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THE

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VOLUME XXXII

PACIFIC OCEAN ISLANDS to ZULOAGA

ALSO SEPARATE INDEX, CLASSIFIED TABLE OF CONTENTS AND LIST OF CONTRIBUTORS COVERING THE NEW VOLUMES XXX, XXXI AND XXXII

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H. Ch.	HUGH CHISHOLM, M.A. Formerly Scholar of Corpus Christi College, Oxford. Editor of the 10th, 11th and 12th editions of the *Encyclopædia Britannica*. Financial Editor of *The Times*, 1913–20. See the biographical article: CHISHOLM, HUGH.	**World War:** *Introductory.*
H. C. P.	HENRY CLEMENS PEARSON, F.R.G.S. Editor and Publisher of the *India Rubber World*, New York. Author of *Crude Rubber Compounding Ingredients*; *Rubber Machinery*; *Pneumatic Tires*; *Rubber Country of the Amazon*; *What I Saw in the Tropics*; etc.	**Rubber.**
H. D. B.	CAPTAIN HENRY DALRYMPLE BRIDGES, D.S.O., R.N.	**Submarine Mines** (*in part*).
H. E. A. C.	HENRY EVAN AUGUSTE COTTON, C.I.E., L.C.C. Formerly Scholar of Jesus College, Oxford, and Advocate of the High Court at Calcutta. Author of *Calcutta Old and New*. Late Editor of *India*.	**Tagore, R.**
H. F. O.	HENRY FAIRFIELD OSBORN, LL.D., D.Sc. Honorary Curator of Vertebrate Palaeontology in the American Museum of Natural History, New York City; and Vertebrate Palaeontologist, United States Geological Survey.	**Palaeontology.**
H. I. P.	HERBERT INGRAM PRIESTLEY, M.A., PH.D. Associate Professor of Mexican History and Librarian of the Bancroft Library, University of California. Author of *José de Gálvez, Visitor-General of New Spain*; etc.	**Panama; Salvador; Villa.**
H. J. G.	SIR HENRY GAUVAIN, M.A., M.D., M.CH. (Cantab.). Medical Superintendent, Lord Mayor Treloar Cripples' Hospital and College, Alton and Hayling Island, Hants. Hon. Consulting Surgeon to the Welsh National Memorial Association. Consultant in Surgical Tuberculosis to the Essex and Hampshire County Councils.	**Tuberculosis** (*in part*).
H. M. M.	HAROLD MEDWAY MARTIN, A.C.G.I. Whitworth Scholar. Member of the Nozzles Research Committee, appointed by the Institute of Mechanical Engineers. Member of the Lubricants and Lubrication Enquiry Committee, appointed by the Department of Scientific and Industrial Research (London).	**Turbines, Steam** (*in part*).
H. O'L.	MAJOR HERBERT O'LEARY. U.S. Army. Chief of Small Army Division, Ordnance Officer, Washington.	**Pistol; Rifles and Light Machine-Guns** (*in part*); **Sights:** (*Rifle* and *Pistol*).
H. P. G.	HARRY PIRIE-GORDON, D.Sc., M.A. Served in the World War. Deputy Governor of Jerusalem, 1918. Editor of *A Brief Account of the Advance of the Egyptian Expeditionary Force*.	Palestine; Syria; **Transjordania**; Turkish **Campaigns:** *Palestine.*
H. P. D.	CAPTAIN HENRY PERCY DOUGLAS, C.M.G., R.N., F.R.A.S., A.M.I.C.E. Assistant Hydrographer of the British Navy, 1919–21.	**Surveying:** *Nautical.*
H. Sa.	HIROSI SAITO, M.A. Secretary of Embassy and Consul in the Japanese Diplomatic and Consular Service. Member of the Japanese Delegation to the Peace Conference in Paris, 1919, and to other Inter-Allied and International Conferences in Europe and America, 1919–21.	**Sakhalin.**
H. S. L. W.	HAROLD ST. JOHN LOYD WINTERBOTHAM, C.M.G., D.S.O. Ordnance Survey, Great Britain. Victoria Medallist of the R.G.S., 1920.	**Surveying** (*in part*).
H. Wf.	HUMBERT WOLFE, C.B.E.	**Trade Boards.**

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H. W. C. D.	HENRY WILLIAM CARLISS DAVIS, M.A., C.B.E. Professor of History at Manchester University. Fellow and formerly Tutor of Balliol College, Oxford. Sometime Fellow of All Souls College, Oxford. Member of Advisory Staff of British delegation to the Peace Conference.	Peace Conference.
H. W. K.	H. W. KAYE, M.D. (Oxon.). Director of Medical Services, Ministry of Pensions. Late Personal Assistant to Chief Commissioner of Medical Services, Ministry of National Service.	United Kingdom: *Medical Examination of the Nation.*
H. W. M.	HENRY WILLIAM MARDON, F.R.G.S. Commander of the Mejidieh. Formerly Lecturer in Geography and Education in the Tewfikieh and Dar el Ulum Colleges, Cairo. Author of *A Geography of Egypt and the Anglo-Egyptian Sudan*; etc.	Ukraine.
H. W. W.	HERBERT WRIGLEY WILSON, M.A. Sometime Scholar of Trinity College, Oxford. Author of *Ironclads in Action*. Contributor to *The Cambridge Modern History*. Assistant Editor of *The Daily Mail*.	Rothermere, Lord.
I. M. T.	IDA MINERVA TARBELL, M.A., LITT.D., LL.D. Former Associate Editor of *The Chautauquan*, *McClure's Magazine*, *American Magazine*. Author of *Life of Abraham Lincoln*; *The History of the Standard Oil Company*; *The Tariff in our Times*; *New Ideals in Business*; etc.	Women's War-Work: *United States.*
I. O. A.	IRENE OSGOOD ANDREWS, A.B. Assistant Secretary, American Association for Labor Legislation. Author of *Working Women in Tanneries*; *Irregular Employment and the Living Wage for Women*; *Economic Effects of the War upon Women and Children in Great Britain*; etc.	Women: *United States*; Women's Employment: *United States*; Women Police: *United States.*
J. A. F.	JOHN AMBROSE FLEMING, M.A., D.Sc., F.R.S., M.INST.E.E. Professor of Electrical Engineering in the University of London. Fellow of University College, London. Sometime Fellow of St. John's College, Cambridge. Author of *The Principles of Electric Wave Telegraphy and Telephony*; *The Propagation of Electric Currents in Telephone and Telegraph Conductors*; *The Thermionic Valve*; *The Wonders of Wireless Telegraphy*; etc.	Wireless Telegraphy and Telephony.
J. A. G.*	JAMES ANDREW GUNN, M.A., M.D., D.Sc., F.R.S. (Edin.). Professor of Pharmacology, University of Oxford. Formerly Assistant in the Department of Pharmacology, Edinburgh University.	Pharmacology.
J. A. K.	J. A. KAY. Editor of the *Railway Gazette*.	Railways: *British.*
J. A. Ro.	JAMES ALEXANDER ROBERTSON, PH.B., L.H.D. Chief of the Near Eastern Division Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D.C. Managing Editor of *The Hispanic American Historical Review*. Co-editor of Blair and Robertson's *The Philippine Islands, 1493–1898* (55 Vols.). Compiler of *Bibliography of the Philippine Islands*; etc.	Philippines.
J. A. T.	JOHN ARTHUR THOMSON, M.A., LL.D. Regius Professor of Natural History in the University of Aberdeen. Author of *The System of Animate Nature*; *The Wonder of Life*; *The Biology of the Seasons*; etc.	Zoology.
J. B. Bi.	JOSEPH BUCKLIN BISHOP. Secretary to the Panama Canal Commission, 1905–14. Author of *The Panama Gateway*.	Panama Canal.
J. C. P.*	JOHN CLAGETT PROCTOR, LL.M. Member of the Bar of the District of Columbia. Author of the *Hines Family*. Historian of the Society of Natives of the District of Columbia.	Washington (D.C.).
J. C. Van D.	JOHN C. VAN DYKE, L.H.D. Professor of the History of Art, Rutgers College. Author of *Art for Art's Sake*; *Meaning of Pictures*; *History of Painting*; etc.	Painting: *United States.*
J. D. P.	JOHN DANVERS POWER, M.V.O. Vice-chairman, British Red Cross Society. Editor of the Report by the British Red Cross Society and the Order of St. John on their joint war work, 1914–9.	Red Cross Work: *British.*
J. E. C.	JANET ELIZABETH COURTNEY, O.B.E., J.P. (MRS. W. L. COURTNEY). Author of *Free Thinkers of the Nineteenth Century*. Joint-author of *Pillars of Empire*. Joint-editor of Index to the 11th edition of the *Encyclopædia Britannica*.	Women: *United Kingdom*; Women Police: *United Kingdom.*
J. E. Ha.	JAMES E. HALE, S.B., M.S.A.E. Technical Development and Sales Engineer, Goodyear Tire and Rubber Company, Akron, Ohio.	Tire.
J. H.	JOHN HILTON.	Strikes and Lockouts; Unemployment: *United Kingdom Statistics.*

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J. H. Ho.	JACOB H. HOLLANDER, PH.D. Professor of Political Economy in Johns Hopkins University. Author of *David Ricardo*; *The Abolition of Poverty*; *War Borrowing*; etc. Treasurer of Porto Rico, 1900–1. Financial Adviser of the Dominican Republic, 1908–10.	**Porto Rico; Santo Domingo.**
J. H. Je.	JAMES HOPWOOD JEANS, M.A., LL.D., F.R.S. Secretary of the Royal Society. Author of *The Dynamical Theory of Gases*; *Problems of Cosmogony and Stellar Dynamics*; etc.	**Relativity.**
J. J. C.	BRIGADIER-GENERAL JOHN JOHNSTON COLLYER, C.B., C.M.G., D.S.O. Late Chief of the General Staff, Union of South Africa.	South Africa: *Defence.*
J. Mo.*	RT. REV. MGR. J. MOYES, D.D. Canon of Westminster Cathedral. Formerly Editor of the *Dublin Review*. Domestic Prelate to His Holiness Pope Benedict XV.	**Pius X.**
J. M. C.*	JAMES MORTON CALLAHAN, A.M., PH.D. Professor of History and Political Science and Dean of West Virginia University. Author of *Neutrality of the American Lakes*; *Cuba and International Relations*; *History of West Virginia*; etc.	**West Virginia.**
J. M. R.	JOHN MORGAN REES, M.A., F.R.ECON.S. Lecturer in Economics and Political Science in the University College of Wales, Aberystwyth. Author of *Wages and Costs in South Africa*; *South Wales Iron, Steel and Tinplate Industries as affected by the War*; etc.	Syndicalism (*in part*).
J. O. P. B.	JOHN OTWAY PERCY BLAND. Author of *China*; *Japan and Korea*; *Houseboat Days in China*. Joint-author of *China under the Empress Dowager*. Served in Chinese Maritime Customs, 1883–96. Shanghai Correspondent for *The Times*, 1897–1910.	**Shanghai; Tibet; Tientsin.**
J. P.*	JOSEPH PROUDMAN, M.A., D.SC. Professor of Applied Mathematics, and Hon. Director of the Tidal Institute, in the University of Liverpool. Fellow of Trinity College, Cambridge.	**Tides.**
J. R. Co.	JOHN ROGERS COMMONS, A.B., A.M., LL.D. Professor of Economics, University of Wisconsin. Author of *Documentary History of American Industrial Society*; *History of Labor in the United States*; *Principles of Labor Legislation*; etc.	Profit-Sharing and Co-Partnership: *United States*; Strikes and Lockouts: *United States*; Trade Unions: *United States*; Unemployment: *United States*; United States: *Labor Movement*; Wages: *United States.*
J. R. R.	RIGHT HON. SIR JAMES RENNELL RODD, G.C.B., G.C.M.G., G.C.V.O. Grand Cross of St. Maurice and St. Lazarus. Commander of the Osmanieh. Grand Cross of Polar Star. Late Ambassador to the Court of Italy. Member of Lord Milner's Mission to Egypt, 1920. Special Envoy to King Menelek II., 1897. Author of *Customs and Lore of Modern Greece*; *Poems in Many Lands*; etc.	Sudan (*in part*).
J. S. F.	JOHN SMITH FLETT, M.A., D.SC., LL.D., F.R.S. Director, and formerly Petrographer, of the Geological Survey of Great Britain. Author or Part-author of many Geological reports and memoirs.	**Petrology.**
J. S. Ha.	MAJOR JULIAN SOMERVILLE HATCHER. Ordnance Department, U.S. Army. Member of the American Institution of Mining and Metallurgical Engineers. Life Member of the National Association of America. Experimental Engineer at the Government Small Arms Plant, Springfield Armory. Formerly Chief of the Machine-Gun and Small Arms Section, Ordnance Department.	**Sights (*in part*).**
J. S. Nc.	JOSEPH SINCLAIR NICHOLSON, M.A.	**Unemployment: *United Kingdom.***
K. H.*	KARL HILDEBRAND, PH.D. Member of the Swedish Debt Board. Chief Editor of the daily paper *Stockholms Dagblad*, 1904–13. Member of the Swedish Parliament, 1907–18.	**Sweden.**
L. A. M.	LIONEL ALFRED MARTIN. Director of Henry Tate & Sons, Limited, Sugar Refiners, London and Liverpool. Vice-president of the London Chamber of Commerce. Member of the Port of London Authority.	**Sugar.**
L. A. W.*	LAURA A. WHITE, PH.D. Professor of History in the University of Wyoming.	**Wyoming.**
L. Br.	LILIAN BRANDT, M.A. Author of *Social Aspects of Tuberculosis*; *Causes of Poverty*; *Deserted Families*; etc.	United States: *Social and Welfare Work (in part).*
L. H. H.	LEWIS HENRY HANEY, B.A., M.A., PH.D. Bureau of Markets, U.S. Department of Agriculture. Formerly Director, New York University, Bureau of Business Research. Member of the Economic Advisory Board of the Federal Trade Commission, 1916–9.	**Prices: *United States*; Profiteering: *United States.***

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L. H. H.*	COLONEL LUCIUS H. HOLT, B.A., M.A., PH.D. (Yale). Professor of English and History at the United States Military Academy, West Point. Author of *Introduction to the Study of Government*. Joint-author (with Major A. W. Chilton) of *History of Europe, 1789–1815*; *History of Europe, 1862–1914*.	**West Point.**
L. J.	MAJOR-GENERAL SIR LOUIS JACKSON, K.B.E., C.B., C.M.G. Commander of the Legion of Honour, Knight of St. Stanislas. Late Royal Engineers. Formerly Director-General of Trench Warfare Supply, and Controller of Chemical Warfare Research, British War Office.	**Poison Gas Warfare.**
L. M. F.	LEONARD M. FANNING. Director of Publicity and Statistics, American Petroleum Institute. Formerly Editor of the *Oil Trade Journal*.	**Petroleum.**
L. Si.	LEON SIMON, B.A. (Oxon.). Author of *Studies in Jewish Nationalism*.	**Zionism.**
L. T.	LORADO TAFT, N.A., L.H.D. National Academy of Arts and Letters. Sculptor, Lecturer, and Professorial Lecturer, University of Chicago. Non-resident Professor of Art, University of Illinois. Author of *History of American Sculpture*; *Modern Tendencies in Sculpture*.	**Sculpture:** *United States.*
L. Wi.	LEONARD WILLIAMS, M.D.	**Vitamines.**
L. Wo.	MAJOR LEONARD WOOD. Chief-of-Staff, United States Army, 1910–4. See the biographical article: WOOD, LEONARD.	**Training Camps:** *United States.*
M. B.*	MARCU BEZA, L. ÈS L. Lecturer at King's College, London. Author of *O Viata*; *Din Anglia*; *Papers on the Rumanian People and Literature*; etc.	**Rumania:** *Literature.*
M. G. F.	MILLICENT GARRETT FAWCETT (MRS. HENRY FAWCETT), J.P., LL.D. (Hon. St. Andrews and Birmingham). See the biographical article: FAWCETT, M. G.	**Woman Suffrage.**
M. H.	LIEUTENANT-FIELD-MARSHAL MAXIMILIAN HOEN. Director of the Austrian Kriegsarchiv, Vienna. Part-author of the Austrian Official History of the First Silesian War. Author of *Der Krieg 1809;* etc.	**Rovno, Battle of.**
M. L. C.	MARGARET ISABEL COLE (MRS. G. D. H. COLE). Correspondence Secretary of the Labour Research Department, London, 1917–20.	**Profit-Sharing and Co-Partnership** (*in part*); **Trade Unions** (*in part*).
N. J.	NICOLAS JORGA, DR. JURIS. Professor at the University of Bucharest. Member of the Académie Roumaine. Correspondent of the Institut de France and of the Académie Serbe. Author of *Die Geschichte des Osmanescher Reiches*; *The Byzantine Empire*; etc.	**Rumania:** *History.*
N. M.*	MAJOR-GENERAL SIR NEILL MALCOLM, K.C.B., D.S.O. General Commanding British Army of Occupation in Germany. Formerly Instructor in Military History at the Staff College, Camberley.	**Tactics.**
N. N. G.	LIEUTENANT-GENERAL N. N. GOLOVINE. Russian Cross of St. George. British Military C.B. French Croix de Guerre. Commander of the Legion of Honour. Formerly Professor in the Russian General Staff College.	**Sukhomlinov.**
O. B. K.	O. B. KENT, B.S., M.S., PH.D. Professor of Poultry Department of New York State College of Agriculture at Cornell University. Managing Editor *Poultry Science*. Secretary Treasurer of American Association of Instructors and Investigators of Poultry Husbandry.	**Poultry:** *United States.*
O. J. R. H.	OSBERT JOHN RADCLIFFE HOWARTH, O.B.E., M.A. Assistant Secretary of the British Association. Sometime of the Geographical Section, Naval Intelligence Department. Editor of the *Oxford Survey of the British Empire*.	**Pacific Ocean, Islands of; Straits Settlements and Dependencies; United Kingdom:** *Statistics.*
P. A. F.	PERCY A. FRANCIS, M.B.E., N.D.A., N.D.D. Technical Head of the Small Livestock Branch, Ministry of Agriculture and Fisheries, London. Late Senior Agricultural Inspector to the Board of Agriculture for Scotland. Superintending Instructor in Poultry-Keeping and Dairying to the Irish Department of Agriculture and Technical Instruction. County Instructor in Poultry-Keeping to the Antrim County Council.	**Poultry** (*in part*).
P. A. Me.	PHILIP AINSWORTH MEANS, M.A. Investigator for the Smithsonian Institution, Washington, D.C. Author of *History of the Spanish Conquest of Yucatan and of the Itzas*; *A Survey of Ancient Peruvian Art*; etc.	**Peru.**
P. A. S.	PERCY ALFRED SCHOLES, B.MUS., A.R.C.M. Music Critic of *The Observer*, London. Editor of *The Music Student*. Author of *The Listener's Guide to Music*; etc.	**Scriabin, A. N.**

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	PETER CHALMERS MITCHELL, C.B.E. (Military Division), F.R.S., D.Sc., LL.D. Secretary, Zoological Society of London. Attached to Directorate of Military Intelligence, War Office, 1916–8. Liaison Officer with British War Mission, 1918. Editorial Staff of *The Times*.	Propaganda.
P. de T.	P. DE THOMASSON. French Delegate to the Saar Commission.	Saar Valley.
P. M. H.	PETER MARTIN HELDT. Engineering Editor of *Automotive Industries*. Author of *The Gasoline Automobile*.	Tractors.
P. M. S.	BRIGADIER-GENERAL SIR PERCY MOLESWORTH SYKES, K.C.I.E., C.B., C.M.G. Formerly British Consul-General, Persia. Late Inspector-General, South Persia Rifles. Author of *History of Persia*; *Manners and Customs*; *Glory of the Shia World*; etc. Gold Medallist, R.G.S., 1902.	Persia.
P. Vi.	SIR PAUL VINOGRADOFF, M.A., D.C.L., LL.D., DR. HIST., DR. JURIS. Corpus Professor of Jurisprudence, Oxford. Author of *Villainage in England*; *The Growth of the Manor*; *Outlines of Historical Jurisprudence*; etc. See the biographical article: VINOGRADOFF, SIR PAUL.	Russia; Trotsky, Lev; Tschaikovsky, N. V.; Wrangel.
R. A. V.	ROLLAND A. VANDERGRIFT, M.A. Assistant in History in the University of California.	San Francisco.
R. B. D. A.	SIR REGINALD BRODIE DUKE ACLAND, M.A., K.C. Judge Advocate of the Fleet. Member of the British Government Committee on the Treatment by the Enemy of Prisoners of War, and of the Committee on the Breaches of the Laws of War.	Prisoners of War.
R. D. O.	RICHARD DIXON OLDHAM, F.R.S., F.G.S., F.R.G.S. Author of numerous papers on various aspects of Geology and kindred subjects.	Seismology.
R. E. G.	COLONEL R. E. GOLIGHTLY.	Volunteers.
R. E. P.	MAJOR R. E. PRIESTLY, M.C., B.A. Author of the *Official History of the Signal Service during the European War, 1914–8*; *Breaking the Hindenburg Line*; *The History of the 46th, North Midland, Division*; etc.	Signal Service, Army (*in part*).
R. H. P.	ROBERT HODSON PARSONS, A.M.I.C.E. Member of the Engineering Institute of Canada.	Turbines, Steam.
R. M. Wi.	R. MCNAIR WILSON, M.B., CH.B. Fellow of the Royal Society of Medicine. Editor, Oxford Medical Publications. Late Research Worker in Cardiology, Medical Research Committee. Consultant to the Ministry of Pensions in Trench Fever.	Tetanus; Trench Fever; Yellow Fever.
R. N. R. B.	ROBERT N. RUDMOSE BROWN, D.Sc. Member of the Scottish National Antarctic Expedition, 1902–4, and of the Scottish Arctic Expeditions, 1909, 1912 and 1914. Lecturer in Geography, University of Sheffield. Author of *Spitsbergen*, etc. Joint-author of *The Voyage of the Scotia*.	Siberia; Spitsbergen.
R. Po.*	ROSCOE POUND, PH.D., LL.D. Carter Professor of Jurisprudence and Dean of the Faculty of Law in Harvard University. Sometime Commissioner of Appeals of the Supreme Court of Nebraska.	Women, Legal Status of: *United States*.
R. S. R.	ROBERT SANGSTER RAIT, C.B.E., M.A., LL.D. Historiographer Royal for Scotland. Professor of Scottish History and Literature in the University of Glasgow. Author of *The Scottish Parliament*; *History of Scotland*; etc.	Scotland.
R. Th.	RALPH THICKNESSE. Barrister-at-Law. Author of *Digest of Law*; *Husband and Wife*; etc.	Women, Legal Status of: *United Kingdom*.
R. van O.	CAPITAINE-COMMANDANT R. VAN OVERSTRAETEN. Aide-de-Camp to H.M. The King of the Belgians. Graduate of the Staff College. Order of Leopold. D.S.O. Legion of Honour.	Ypres and Yser, Battles of: *Part IV*.
R. W. S.-W.	ROBERT WILLIAM SETON-WATSON, D.LITT. (Oxon.), HON. PH.D. (Prague and Zagreb). Lecturer in East European History at King's College, University of London. Author of *Racial Problems in Hungary*; *The Southern Slav Question*; *The Rise of Nationality in the Balkans*; etc. Editor of *The New Europe*.	Serbia; Yugoslavia.
S. B. McC.	SAMUEL BLACK MCCORMICK, A.B., M.A., D.D., LL.D. Chancellor Emeritus, University of Pittsburgh, Pa.	Pittsburgh.
S. de M.	SALVADOR DE MADARIAGA. Author of *Shelley and Calderon, and other Essays on Spanish and English Poetry*; *Romances de Ceigo*; *Manojo de Poesias Inglesas*; etc.	Spanish Literature.
S. H.	SYDNEY HERBERT. Lecturer in International Politics, University College, Aberstwyth. Author of *Modern Europe, 1789–1914*; *Nationality and its Problems*; *Fall of Feudalism in France*.	Syndicalism (*in part*).

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S. L. M.	Susan Langstaff Mitchell. Author of *The Living Chalice*; *Aids to the Immortality of Certain Persons in Ireland*; etc.	**Russell, G. W.**
S. McC. L.	Samuel McCune Lindsay, Ph.D., LL.D. Professor of Social Legislation in Columbia University. President of New York Academy of Political Science. Editor of American Social Progress Series. Author of *Railway Labor in the United States*; *Financial Administration of Great Britain*; etc.	**Prohibition.**
T. C.	Theodore Collier, Ph.D. Professor of European History in Brown University, Providence, R.I.	**Rhode Island.**
T. G. Ch.	Sir Theodore Gervase Chambers, K.B.E., Assoc.R.S.M., F.S.I., F.G.S. Vice-chairman and late Controller of the National (War) Savings Committee, Great Britain.	**Savings Movement.**
T. S. A.	Thomas Sewall Adams, Ph.D. Professor Political Economy in Yale University. Advisor on Taxation, U.S. Treasury Department.	**United States: *Finance*; United States: *Taxation*.**
V. L. C.	Varnum Lansing Collins, A.M. Secretary of Princeton University and Clerk of the University Faculty. Author of *The Continental Congress at Princeton*; *Guide to Princeton*; etc.	**Princeton University.**
V. L. E. C.	General Victor Louis Émilien Cordonnier. See the biographical article: Cordonnier, V. L. E.	**Woevre, Battles in (*in part*).**
V. L. K.	Vernon Lyman Kellog, M.S., LL.D. Permanent Secretary, National Research Council, Washington. Sometime Professor in Leland Stanford Jr. University. Director in Brussels of Commission for Relief in Belgium. Assistant to U.S. Food Administrator. Member of the American Relief Administration.	**Red Cross Work: *United States*; Y.M.C.A.: *United States*.**
W. A. B. C.	Rev. William Augustus Brevoort Coolidge, M.A. (Oxon.), Hon. Ph.D. (Berne). Fellow of Magdalen College, Oxford. Author of *Swiss Travel and Swiss Guide-books*; *Josias Simler et les Origines de l'Alpinisme jusqu'en 1600*; *The Alps in Nature and History*; *Alpine Studies*; etc. Editor of the *Climbers' Guide*.	**Switzerland.**
W. A. N.	William A. Neilson, LL.D. President, Smith College, Northampton, Mass.	**Smith College.**
W. A. P.	Walter Alison Phillips, M.A. (Oxford and Dublin). Lecky Professor of Modern History in the University of Dublin. Member of the Royal Irish Academy. Author of *Modern Europe*; *The Confederation of Europe*; etc.	**Putumayo; Round, John Horace; Self-Determination.**
W. Bn.	William Bateson, M.A., F.R.S. Author of *Materials for the Study of Variation*; *Mendel's Principles of Heredity*; *Problems of Genetics*; etc. See the biographical article: Bateson, William.	**Sex.**
W. B. St.	Walter Barlow Stevens, B.A., M.A., LL.D. President, State Historical Society of Missouri. Author of *History of St. Louis*; *Centennial History of Missouri*; *Missouri's Travail for Statehood*; etc. Director of Exploitation, St. Louis World's Fair of 1904.	**St. Louis.**
W. C. M.	William Clinton Mullendore, A.B., J.D. Attorney-at-Law. Late Assistant Counsel and Liquidator, United States Food Administration. Representative, American Relief Administration, Berlin, Germany, 1920.	**Rationing: *United States*.**
W. E. El.	Walter Elliot Elliot, B.Sc., M.B., Ch.B., M.P. Secretary, Medical Committee, House of Commons.	**Pensions Ministry.**
W. E. P.	W. E. Preston.	**Silver.**
W. F.	Lieutenant-Colonel Wolfgang Foerster. Late General Staff, German Army. Chief Ober-Archivrat of the Reichsarchiv. Formerly member of the Historical Section of the Great General Staff. During the World War, General Staff Officer with troops. Chief of the General Staff of the XI. Corps, 1918. Author of *Prinz Friedrich Karl von Preussen*; *Graf Schlieffen und der Weltkrieg*.	**Western European Front Campaigns (*in part*).**
W. G. C.	William George Constable, M.A. Fellow of St. John's College, Cambridge. Barrister-at-Law. Lecturer at the Wallace Collection.	**Painting (*in part*).**
W. H. B.	Sir William Henry Beveridge, K.C.B., M.A., B.C.L. Director of London School of Economics and Political Science. Formerly Permanent Secretary of the Ministry of Food. Author of *Unemployment: A Problem of Industry*; etc.	**Rationing (*in part*).**
W. H. W.	Sir William Henry Willcox, K.C.I.E., C.B., C.M.G., M.D., F.R.C.P. Consulting Physician to the Mesopotamia Expeditionary Force, 1916–9. Physician to St. Mary's Hospital, London.	**Persia: *Medical Conditions*; Persian Gulf: *Medical Conditions*.**

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W. J. C.	WILLIAM JAMES CUNNINGHAM, A.M. Connected with several American railroads in operating and executive capacities, 1900–16. Professor of Transportation at Harvard. Assistant Director of Operation, U.S. Railroad Administration, 1918–9.	**Railways:** *United States.*
W. J. C.*	W. J. CHILDS. Late of the Intelligence Department of the British Admiralty (Geographical Section).	**Straits** (*Dardanelles and Bosporus*); **Turkey** (*Nationalist*).
W. K. B.	WILLIAM KENNETH BOYD, A.M., PH.D. Professor of History, Trinity College, Durham, N.C. Joint-editor of *The South Atlantic Quarterly*. Author of *A History of North Carolina, 1783–1860*; etc.	**Virginia.**
W. K. M.	WILLIAM KIRKPATRICK MAGEE. Second Librarian, National Library of Ireland. Pseudonym, "John Eglinton." Author of *Anglo-Irish Essays*; etc.	**Synge, J. M.**
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W. L. G.*	WILLIAM L. GRIFFITH. Permanent Secretary, Office of the High Commissioner for Canada, London. Author of *The Dominion of Canada*; article on "Canada," *Oxford Survey of the British Empire.*	**Prince Edward Island;** **Quebec;** **Saskatchewan;** **Yukon Territory.**
W. L. M.	WINTHROP LIPPITT MARVIN, A.B., LITT.D. Vice-president and General Manager, American Steamship Owners' Association. Author of *The American Merchant Marine: Its History and Romance.* Former Secretary of U.S. Merchant Marine Commission.	**Shipping:** *United States.*
W. M. B.	WILLIAM MADDOCK BAYLISS, M.A., D.SC., LL.D., F.R.S. Professor of General Physiology in University College, London. Author of *Principles of General Physiology*; *Nature of Enzyme Action*; etc.	**Physiology;** **Shock.**
W. M.-Lo.	LIEUTENANT-COLONEL WILHELM MÜLLER-LOEBNITZ. Late General Staff, German Army. Ober-Archivrat in the Reichsarchiv. Formerly in the Military History Section of the Great General Staff. During the World War served on the General Staff of XII. Corps and VI. and "A" Armies, and as a Regimental Commander. Author of *Der Wendepunkt des Weltkriegs* and other monographs.	**Somme, Battles of the** (*in part*).
W. M. Le.	WILLIAM MATHER LEWIS, M.A. Formerly Director of the Savings Division U.S. Treasury Department. Author of *The Voices of Our Leaders*; etc.	**Savings Movement:** *United States.*
W. M. M. R.	COMMANDER WILLIAM MALCOLM MARTYN ROBINSON, R.N.	**Torpedo.**
W. No.	SIR WILLIAM NOBLE. Engineer-in-Chief, General Post Office, London. Knight of the Order of the Cross of Belgium.	**Telegraph;** **Telephone.**
W. R. Ma.	WILLIAM R. MANNING, PH.D. Economist, Latin-American Division, U.S. Department of State. Author of *Nootka Sound Controversy* (Justin Winsor Prize Essay of American Historical Association, 1904); *Early Diplomatic Relations Between the United States and Mexico* (Albert Shaw Lectures, Johns Hopkins University, 1913); etc.	**Virgin Islands.**
W. S. L.-B.	WALTER SYDNEY LAZARUS-BARLOW, M.D., F.R.C.P. Professor of Experimental Pathology in the University of London. Director of the Cancer Research Laboratories at the Middlesex Hospital. Author of *General or Experimental Pathology*; *Pathological Anatomy and Histology*; etc.	**Radiotherapy.**
W. S. Ro.	WILLIAM SPENCE ROBERTSON, PH.D. Professor of History in the University of Illinois. Author of *Francisco de Miranda and the Revolutionizing of Spanish America*; *Rise of the Spanish-American Republics*; etc.	**Venezuela.**
W. v. B.	WILHELM VON BLUME, DR. JURIS. Professor of Law in the University of Tübingen. Author of *Familienrecht des Bürgerlichen Gesetzbuchs*; *Erbrecht des Bürgerlichen Gesetzbuchs.* Coöperated in the drafting of the Constitution of Württemberg, 1919.	**Thuringia;** **Württemberg.**
X.	Initial used for anonymous contributors.	

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ENCYCLOPÆDIA BRITANNICA

VOLUME XXXII

THE THIRD OF THE NEW VOLUMES

PACIFIC OCEAN, ISLANDS OF.—For the oceanic islands of the Pacific *see* generally 20.436*, and also the separate articles on the principal groups and islands there referred to. Supplementary information is given below, and also under GUAM, HAWAII, etc.

The so-called Four-Power Treaty was signed Dec. 13 1921, with prospects of early ratification, by France, Great Britain, Japan and the United States, the contracting parties agreeing "as between themselves to respect their rights in relation to their insular possessions and insular dominions in the region of the Pacific Ocean." A map, showing the mandate claims and sovereignties proposed, and zones of restricted fortification, will be found in the article WASHINGTON CONFERENCE.

America Islands.—Christmas I. was leased by a company from the British Government and planted with coco-nuts in 1904–5, but the working lapsed during the World War, and in Oct. 1919 Lord Jellicoe on H.M.S. "New Zealand" found three men who had been confined there for 18 months, ignorant of the cessation of war. The Pacific "all red" cable station on Fanning I. was wrecked by a German landing party from the "Nürnberg" Sept. 7 1914, but communication was restored by the operator. Fanning and Washington Is. belong to a coco-nut company and had in 1920 populations of a few whites and about 120 and 100 native labourers respectively. These islands are administered under the Gilbert and Ellice Is. Colony, of which Ocean I. is the administrative centre.

Auckland Islands.—A depot of provisions and clothes has been established here by New Zealand for shipwrecked sailors.

Caroline and Pelew Islands.—Japan is mandatory for these formerly German islands,[1] having occupied them in Sept.–Oct. 1914. The administration of Yap, which has a pop. of about 8,000 and a cable and wireless station, was at first in dispute between Japan and the United States; but in Dec. 1921 these countries reached an agreement (a formal convention to be drawn up later for signature) whereby the United States secured the same opportunities as Japan or any other nation in all that relates to cable and wireless service on the island. The pop. of the group was in 1919 about 40,000.

Cook Islands.—These islands, which belong to New Zealand, had a pop. of 8,764 in 1916, including 197 whites and half-castes. Eight Government schools were maintained in 1919. Revenue (year 1918–9) £13,847; expenditure £12,344, but this latter figure excludes certain salaries, etc., and about £7,500 has been contributed annually by New Zealand toward the expenditure. In 1919 exports were valued at £142,925 and imports at £127,729. Copra (to United States) and other fruit (to New Zealand) were chief exports.

Easter Island.—Pop. (1915) about 250, all native except an English manager. The island was visited by Mr. and Mrs. Scoresby Routledge in 1914–5 for the investigation of the ancient remains. These and other recent investigators have shown that the islanders, formerly considered to be of Polynesian race, possess an admixture of Melanesian (negroid) characteristics, and their culture reveals the same influence, notably in the bird-cult with its carved figures, partly human and partly of bird form, and in the practice of distending the ear-lobes. A close association with the bird-cult of Easter I. is found in the Solomon Is., far distant in the western Pacific. It is suggested that the Melanesian immigrants who carried this cult to Easter I. were followed by Polynesians, who fought but did not exterminate them, and there remain indications of a division of the island between the two stocks. While it is impossible to assign any date for the Melanesian immigration, it has been suggested that the Polynesian took place about the beginning of the 15th century A.D., but the further evidence collected on Easter I. in 1910–20 has not determined to which group of immigrants the megalithic remains are to be attributed, or cleared up the origin of the ideographic script found on tablets in the island.

Fiji.—The pop. of the Fiji Is. was estimated on Dec. 31 1918 at 163,416, including 87,761 Fijians, 2,100 natives of Rotumah, 2,709 natives of various Polynesian islands, 61,745 Indians, 4,748 Europeans, 2,803 half-castes and 913 Chinese. The revenue in 1918 was £371,189, and the expenditure £342,140. Exports in 1919 amounted in value to £1,871,062, of which £882,574 went to New Zealand and £584,067 to the United States of America. About half the exports (by value) consisted of sugar, most of which went to New Zealand. There has been shortage of labour, the importation of Indian contract labour having been stopped in 1916; but arrangements are made to admit free Indian labour. Prices have ruled low in comparison with expenditure and planters have expressed dissatisfaction with the fixation of the price for one year only, by the controlling exporting company. Copra, bananas, molasses and rubber are the other chief exports. Imports were valued in 1919 at £1,060,314, of which £513,547 came from Australia, but the goods thus indicated were in great part reëxports and largely of British origin.

Down to 1916 the education of the natives was wholly under missionary control, save for the Government high school at Nasinu, Suva, and the native high school at Lakeba. But in that year an Education Act rendered all schools complying with certain conditions eligible for Government aid. Suva has a high-power wireless station, and there are four inter-insular stations.

Gilbert and Ellice Islands.—These became a British colony in 1915–6, having been previously a protectorate. Estimated pop. Gilbert I., 30,000; Ellice I., 3,000. Revenue (year 1918–9) £24,450; expenditure £30,734. In the year 1917–8 copra of the value of £63,465 was exported from the colony, and 82,845 tons of phosphates, valued at £83,000, from Ocean I.; but this latter export was expected to reach 200,000 tons in 1920–1. Ocean I. is the headquarters of the Government, and a wireless station was opened there in 1916. The administration includes the America Is. and the Tokelau (Union) Is. between 8° 30′ and 11° S. lat. and 171° and 172° W. long. The Tokelau Is., total area 7 sq. m., had a pop. of 912 natives and 2 Europeans in 1911. The Gilbert islanders have lost their warlike reputation, and are all, at least nominally, Christian.

Lord Howe Island, belonging to New South Wales, was placed under a board of control with office at Sydney, as the result of the report of a Royal Commission on the trade of the island in Kentia palm-seeds in 1912. A local advisory council assists the board.

The *Lord Howe Group*, also known as Ongtong Java, has a Polynesian pop. estimated at 1,200 (5,000 in 1905), and produces copra.

Loyalty Islands (dependency of New Caledonia), pop. (est., 1919), 11,000.

Macquarie Island is annexed to Tasmania. In connexion with the Mawson Antarctic expedition (*see* 21.968) a meteorological and wireless station was established there.

Manihiki Archipelago.—Of the scattered islands mentioned under this heading, Caroline, Vostok, and Flint are leased from the British Government by a coco-nut company; the rest are dependencies of New Zealand. Suvarov has a fine harbour, though with a shallow

[1] Statistics of the separate ex-German possessions in the Pacific are not available. Exports for them all, excepting Samoa but including New Guinea, were valued in 1913 at £595,000; imports at £450,000.

**These figures indicate the volume and page number of the previous article.*

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W. J.'

horage Islet on the reef is held by the Admiralty. The island is leased to a ucing little owing to destruction by ery has deteriorated. At Manihiki I. l beds were closed when almost worked op. in 1916, 312) production fell off.

ner German islands (excepting Guam [*see* to the U.S.A.) were occupied by the Japa- were given to them under mandate in 1918.

Islands.—The Polynesian pop. has continued to dimin- was estimated in 1920 to be less than 3,500. The French nistration (established at Hivaoa) was stated to neglect the ommercial development of the islands, though in 1913 a German trading company was established there.

Marshall Islands.—These islands, formerly German, were acquired by Japan under mandate in 1918. From 1888 to 1906 they were administered by the Jaluit Trading Co., of Hamburg, under agreement with and subsidized by the German Government. The Government itself subsequently administered them down to 1914. A recent estimate indicates a decreasing pop. numbering 9,200.

Nauru.—This island, in 0° 33′ S. lat., 166° 55′ E. long., was administered along with the Marshall Is. by the Germans, but the phosphate deposits for which it is important were worked by a British company under agreement with the Jaluit company. The island surrendered to a vessel of the Australian navy in Sept. 1914 and came under British mandate in 1918. Pop. (1916), 1,284 natives, 449 Caroline islanders, 278 Chinese, 90 whites. The white settlement is at Yangor, where the phosphate company had its stores and drying plant. The deposits on the high ground (78 to 88% phosphates) are transported by light railways worked by steam, gravity, or electricity, and are shipped by surf-boats from two wharves. Under the Nauru I. agreement, 1919, between the British, Australian and New Zealand Governments, it was enacted that the Australian Government should appoint an administrator for a term of five years, that each of the three Governments should appoint a member of a board of commissioners, that the phosphate company should be bought out by the three Governments and the deposits and their workings should be vested in the board, and that the expenses of the administration, so far as not otherwise met, should be paid out of the sale of the phosphates. The island also yields copra. A wireless station was established by the Germans in 1913.

New Caledonia.—Pop. (census of 1911), 50,608, including 28,075 natives, 19,319 whites, and 3,214 Asiatic immigrants. Nouméa contained 8,961 inhabitants, including 5,207 free whites, 1,245 convicts, 1,999 natives and other coloured people, and 396 troops. Among other centres of population, Thio on the E. coast is the chief nickel-mining centre, and Paagoumene on the W. coast the chief chrome-mining centre. Exports from New Caledonia and dependencies were valued in 1913 at £633,536 (copra, £67,932); imports at £708,316. The guano workings of Walpole I., 150 m. E. by S. of Nouméa, have been recently developed by a company.

New Hebrides.—The pop. has been recently estimated at 65,000 natives and 800 Europeans. Exports in 1919 were valued at £364,000 (copra, £134,300; cocoa, £79,000); imports at £166,847. The Anglo-French condominium is not generally regarded as successful. According to a report of 1918, the confusion between the operations of this tribunal, the French and British courts, and the joint naval commission for native litigation, gave rise to complaints.

French settlers are said to hold the best land as a rule, though in the Banks and Torr Is. British interests are the stronger; trade has been fostered mainly by French interests. The volcano of Ambrym Is. was in eruption on and after Dec. 6 1913, and caused damage.

Niué.—Pop. (1919), 3,664, including 20 whites and 160 half-castes. Exports (about six-sevenths copra) were valued in 1919 at £35,977, and imports at £21,783. The New Zealand Government contributes about £3,000 a year to the administration. A hurricane in 1915 severely damaged the coco-nut plantations, but 15,000 nuts were planted in the course of peace celebrations.

Norfolk Island.—Pop. (Dec. 1918), 815. The executive council now consists of six elected members and six members appointed by the administrator. It was reported in 1919 that the Melanesian Mission established here in 1867 was contemplating the removal of its headquarters. Exports were valued in 1919 at £5,238 (lemons, passion-fruit pulp, fish and whale products); imports at £13,398.

Paumotu or Tuamotu Archipelago (the latter is the proper form, and is used throughout this part of the Pacific).—Pop. (1911), 4,581. Makatea (pop. 866) has become the most important island, owing to the working of phosphates, and is administered separately. It is an elevated coral island, unlike the other coral islands, which are atolls. From these, copra and pearl-shell are the chief exports. The dependent Gambier Is. yield the same commodities, but poorly, and their inhabitants are decreasing in numbers and physique.

Phoenix Islands.—The majority have been leased to the Samoan Shipping and Trading Co., for coco-nut planting.

Rotumah (to Fiji).—Pop. (1918), 2,263.

Samoa.—The former German islands of western Samoa were occupied by a New Zealand expeditionary force on Aug. 30 1914. Although it was stated that there was some feeling in the islands against permanent administration by New Zealand, a mandate for them was given to that Dominion in 1919. The native pop. in 1918 was 30,636 after the epidemic of influenza in that year, which caused over 8,000 deaths. There were also 1,660 white men and half-castes, and 1,166 labourers imported under indenture. The shortage of labour is particularly acute. The Deutsche Handels- und Plantagen-Gesellschaft (German trading and plantation company), which held 8,820 ac. under the German Government, went into liquidation in 1916, and its holdings and other German plantations were taken over by the Government of New Zealand. Exports in 1919 were valued at £532,500, over four-fifths of the total value being in copra, which went chiefly to the United States. In 1918 exports were valued at £306,640; imports (mainly from the United States and New Zealand) at £319,521. Revenue for one year 1919–20 was estimated at £80,215, and expenditure was expected to balance this. Apia has a wireless station. The pop. of the American Samoan islands was estimated in 1920 at 7,550. Copra is practically the only export. There is a high-powered wireless station at Tutuila.

Society Islands.—The pop. of the whole of the French establishments in Oceania in 1911 (including the Society, Tubuai, Tuamotu and Marquesas groups) was 31,477, including 2,656 French, 484 British, 237 Americans and 975 Chinese: there appears to have been a large influx of the last since that date. A later estimate ascribes 11,000 inhabitants to Tahiti alone, but 4,000 lives were lost in this and adjacent islands in the influenza epidemic of 1918. Papeete, the capital (pop. in 1911, 4,099), was bombarded by German cruisers on Sept. 22 1914. Exports were valued in 1917 at 11,997,461 francs (chiefly copra, pearl-shell, and vanilla), and imports at 7,806,294 francs. Papeete has a wireless station.

Solomon Islands.—The native pop. has been recently estimated at 150,000, the whites at 800, and there are a few Chinese. For the year 1918–9 revenue amounted to £29,476; expenditure to £30,205; exports were valued at £170,125; imports at £188,408. The natives are for the most part wild and backward, and the labour question is serious. For the (formerly) German Solomon Is. *see* NEW GUINEA.

Tonga.—Pop. (1919), 22,689 natives, 350 Europeans. The influenza epidemic of 1918 is said to have caused 1,000 deaths. The native government, under the king, consists of 32 nobles and the same number of elected members. The land is vested in the sovereign, but all his subjects hold some of it, and there is no pauperism or public debt. British officials assist the administration. The revenue in 1918 amounted to £58,340, and expenditure to £35,865. The value of exports in 1918 was £169,758, nearly the whole consisting of copra. Imports in 1918 were valued at £177,152. The copra is chiefly exported to America; imports are received mainly from Australia and New Zealand.

Tubuai Islands.—Pop. (1911): Ravaivai, 432; Tubuai, 543; Rurutu, 911; Rimitara, 415; Rapa, 183. Rapa, possessing a fine natural harbour in Ahurei Bay, has been spoken of as a possible trans-oceanic port of call, for which purpose it was used in 1867–9. The island is volcanic, and the bay represents the old crater. The natives are noted sailors and are in demand for the crews of vessels.

Wallis and Horne Islands.—These, formerly a French protectorate, have been declared a colony. When this annexation was proclaimed in 1913, opposition to the proclamation was fomented by Roman Catholic missionaries in Fotuna (Horne Is.), and even in Uvea (Wallis), where the native chiefs had asked for the annexation, a retention of native law was stipulated, and native law could be only gradually replaced by French law. (O. J. R. H.)

PADEREWSKI, IGNACE JAN (1860–), Polish pianist and diplomat (*see* 20.443), after the outbreak of the World War in 1914 gave numerous benefit concerts in America for Polish sufferers and delivered addresses in their behalf. He was appointed plenipotentiary in America for the National Polish Committee, which early had won official recognition by the Allies.

Among the Poles in America—some millions—there was great dissension as to the means of gaining independence for Poland. With rare skill he induced the stubborn factions to accept the authority of the National Polish Committee, of which he was the most influential member in Paris. In the words of Mr. Robert Lansing, who, as a peace delegate, came into constant contact with him there, he was "an able and tactful leader of his countrymen and a sagacious diplomat." He was among the statesmen, who, in Paris, Dec. 1918, formulated the terms of the Peace Treaty. Meanwhile discord had arisen between the Polish Government and the National Committee. At the close of the year Paderewski returned to Poland and was received in triumph. In Jan. 1919 an agreement was reached with Gen. Pilsudski, whereby Paderewski headed a new coalition cabinet as premier and minister for foreign affairs. In this capacity he signed, June 28 1919, the Treaty of Versailles. He resigned as premier in Dec. 1919. It was generally felt that he had been more successful as a diplomat than as an administrator. In an interview given to newspaper reporters after his return to America in Feb. 1921, he asserted that he would never again appear in piano recitals. His last professional appearance as a pianist had been at the Metropolitan Opera House in New York, May 9 1917.

PAGE, THOMAS NELSON (1853–), American author and diplomatist (*see* 20.450), was appointed ambassador to Italy by

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President Wilson in April 1913. In 1914 he announced his discovery of the house, 66 Piazza di Spragna, in which Byron had lived at Rome in 1817. In 1915 he induced the Italian Government to raise the ban on the reëxportation of cotton goods routed by American shippers via Italy to other countries. He earned the gratitude of the Italians by his relief work during the Avezzano earthquake in 1917. After America entered the World War he defended Italy against the charge of backwardness in conducting her campaign by pointing out the obstacles confronting her soldiers in the Alps.

He resigned as ambassador in April 1918 and returned to America. His writings after 1910 included *Robert E. Lee, Man and Soldier* (1912); *The Land of the Spirit* (1913); *Tommaso Jefferson, Apostolo della Libertà* (1918, prepared for an Italian series); *Italy's Relation to the War* (1920) and *Italy and the World War* (1921).

PAGE, WALTER HINES (1855–1918), American editor and diplomatist, was born at Cary, N.C., Aug. 15 1855. After graduating from Randolph-Macon College, Va., in 1876, he was appointed one of the first 20 fellows of the newly established Johns Hopkins University. He taught for a time in Louisville, Ky., and then accepted the editorship of the St. Joseph, Mo., *Daily Gazette*. After two years (1881) he resigned to travel through the South, having arranged to contribute letters on southern sociological conditions to the New York *World*, the *Springfield Republican* and the *Boston Post*. These letters were helpful in educating the North and the South to a fuller understanding of their mutual dependence. In 1882 he joined the editorial staff of the New York *World* and wrote a series of articles on Mormonism, the result of personal investigation in Utah. Later in the same year he went to Raleigh, N.C., where he founded the *State Chronicle*, but returned to New York in 1883 and for four years was on the staff of the *Evening Post*. From 1887 to 1895 he was, first, manager and, after 1890, editor of *The Forum*, a monthly magazine; and from 1895 to 1900 was literary adviser to Houghton, Mifflin & Co., and for most of the same period editor of the *Atlantic Monthly* (1896–99). When the house of Doubleday, Page & Co. was organized in 1899, his duties were divided between editorial and publishing work, for he was not only a partner in the publishing house but also editor of its magazine, the *World's Work*. In March 1913 President Wilson appointed him to succeed Whitelaw Reid as ambassador to England.

Mr. Page was hardly known in England when he was appointed, but during his tenure of office he gradually established himself as one of the great line of American ambassadors. None had ever worked more assiduously than he did for Anglo-American solidarity, and his speeches—though he was no orator—were always marked by absolute sincerity and by well-informed appeals to history. His position was a delicate one after the outbreak of the World War, when German and Austrian interests in England were placed in his hands. He was thoroughly loyal to his country in his conduct, although sympathetic with the Allies. Among the problems with which he had to deal were the British claim of the right to stop and search American ships, including examination of mail pouches; the commercial blockade (1915) and the "blacklist," containing the names of American firms with whom all financial and commercial dealings on the part of the British were forbidden (1916). He had the satisfaction of seeing the United States through its period of neutrality without friction, and then representing it as a partner in the war. In Aug. 1918, finding his strength exhausted, he resigned as ambassador and returned to America in September. He was critically ill on arrival, and after a short rally died at Pinehurst, S.C., Dec. 21 1918. No man ever served his country, or the cause of Anglo-American friendship, more strenuously. While in Great Britain he was honoured with degrees by the universities of Aberdeen, Edinburgh, Sheffield, Cambridge, and Oxford. He was the author of *The Rebuilding of Old Commonwealths* (1902) and *The Southerner, a Novel: Being the Autobiography of Nicholas Worth* (1909).

PAGET, FRANCIS (1851–1911), English divine, was born March 20 1851, the second son of the surgeon Sir James Paget (*see* 20.451). His brothers, Sir John R. Paget, 2nd Bart., the lawyer (b. 1848), the Rt. Rev. Luke Paget (b. 1853), who was Bishop of Stepney, from 1909 to 1919, and was then translated to the see of Chester, and Stephen Paget, the surgeon and author (b. 1855), all became well-known men. Francis Paget was educated at Shrewsbury and Christ Church, Oxford, where he had a distinguished career, taking first classes in classics, winning the Hertford scholarship (1871) and the chancellor's Latin verse prize (1871); he was elected senior student of Christ Church (1873) and tutor (1876), taking holy orders in 1875. In 1885 he was appointed regius professor of pastoral theology, and in 1892 dean of Christ Church. He contributed the essay on the sacraments to *Lux Mundi*. He became Bishop of Oxford in 1901, and was a member of the Royal Commission on Ecclesiastical Discipline 1904–6. He died in London Aug. 2 1911.

PAGET, LOUISA MARGARET LEILA WEMYSS, LADY (1881–), was born in London Oct. 9 1881, the daughter of Sir Arthur Henry Fitzroy Paget (b. 1851), a descendant of the 1st Marquess of Anglesey. She married in 1907 a connexion of her own, Sir Ralph Spencer Paget, who had a distinguished career in the diplomatic service, and was from 1916 to 1918 minister to Denmark and from 1918 to 1920 first ambassador to Brazil. In 1915 Lady Paget organized a Red Cross hospital for service in Serbia, and was stationed at Uskub, having to remain there when the town was occupied by the Bulgarians, Oct. 1915. She was allowed to use her stores for the relief of refugees, and relieved a great deal of suffering. In Feb. 1916 she was transferred to Sofia, and in April returned to England. In 1915 she was invested with the order of St. Sava by the Serbian Government and in 1917 received the G.B.E.

PAINTING (*see* 20.459).—The end of the 19th century saw in painting the triumph of "impressionism" in its widest sense and the reproduction of visual appearance as a whole accepted as the main business of a painter.[1] But with the heterodoxy of the 19th century become the orthodoxy of the 20th, another movement has arisen in revolt against impressionism, giving to painting between 1900 and 1921 its distinctive character: and just as the victory of impressionism was a French victory, so this new movement is mainly French in origin, though its manifestations elsewhere have taken colour from national characteristics. The change in the centre of gravity of art has, however, been greater in appearance than reality. The older academic traditions still survive; and advances by official bodies and the public have been met by concessions to orthodoxy among some followers of 19th-century heretics.

Across these main movements has cut the influence of the World War. At first it threatened to limit artistic output severely, but the check was only temporary. A huge demand arose in the belligerent countries from individuals and public bodies for illustrative, propagandist or commemorative work, which bore fruit in posters and cartoons; in the formation of official collections such as the Canadian War Memorials and a section of the Imperial War Museum; and in decorative paintings for memorial purposes, such as have been commissioned in France by the State and municipalities. The chief interest of this work is that of a document, showing what men did, felt and thought during the war, and of giving a summary of the condition of art at the time in various countries. The aim of the British and Canadian official collection was definitely to preserve a pictorial record of the war in all its aspects, and, consequently, much of the work is only the skilful application of a technique to a set task, and not the expression of a new vision. The same applies to most of the memorial decorations produced in France; only some etchings and lithographs produced independently of official action show any really personal emotion. Similarly, though in all countries the posters were the work of prominent artists, little

[1] Unfortunately for clarity of exposition, the term "impressionist," originally applied to the group of artists round Claude Monet, painters in a high key using a palette limited to white and the spectral colours, has been given a wider meaning, especially in England. To avoid mistake, the term is here used throughout to describe that group and their followers, and does not cover painters such as Monet in his early period, or Whistler, whom the wider signification might include.

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really notable work from an aesthetic point of view appeared. Designed as they were to excite hatred, cupidity, pity and self-sacrifice, their appeal could only in part be aesthetic, and, like the paintings, they showed little more than the application of familiar and matured methods to a special end. Yet by putting the production of the poster into the hands of artists, and by helping to revive and stimulate wood engraving and lithography, the war has had real influence on the graphic arts. Otherwise, its immediate effects have been small. It has quickened a movement towards expression of a national spirit in art, by throwing countries back upon their own resources, and by increasing a desire to assert national superiority. It may also have given a new impulse to the modern search for structure and design, by reducing life so much into terms of machinery and organization; and because of the depth and variety of the emotions it aroused, may have stimulated the tendency to use form and colour for the expression of personal feeling rather than for the reproduction of nature. Probably, too, by making a definite breach with 19th-century ideas, the war has cleared the way for the development of new aesthetic standards. But the most important modern movements in art were in being before the war.

Impressionism.—Of movements which attained full development in the 19th century, impressionism in its purest form was still represented in France in later years by Claude Monet, in Belgium by Emil Claus, and in England by Lucien Pissaro. Of its many developments and adaptations, neo-impressionism—based on the analysis of colour in nature into its constituent elements, which are then placed by means of juxtaposed spots of paint upon the canvas, to be recombined by the eye—survived in 1921 only in modified form. Paul Signac, one of its original exponents, had substituted for spots brick-like rectangles in his oil paintings, and increased use of line in his water-colours; while its conversion into pointillism (simply a method of applying in spots colour already mixed on the palette) was represented by Henri Martin and Henri le Sidaner. Paul Albert Besnard showed impressionism adapted to deal with such complicated problems as a mixture of twilight and artificial light; but with Wilson Steer the expression of subtle tone relations with a limited palette including black had superseded an impressionist technique. In England, indeed, the spectral palette and high key has been only a passing phase with most painters, and it is the impressionism of Whistler and the earlier Manet, with its study of tone and decorative arrangement of silhouette, which has obtained most adherents. This was seen in its purest form in France in the work of Jacques Émile Blanche; but it provided a common basis for the members of the Glasgow school, such as Sir James Guthrie, E. A. Walton, Sir John Lavery and D. Y. Cameron; and brought into relation with them Sir William Orpen, whose use of colour and study of light otherwise connect him with the impressionists. Similarly J. S. Sargent's portraits carried on one side of the Manet tradition, though elsewhere he showed impressionist influence. Of the group of painters who, under the influence of Millet and Bastien-Lepage, carried the realism of Courbet and Manet into the field and workshop, the chief survivors in 1921 were Lucien Simon and Charles Cottet in France, Max Liebermann in Germany, Joaquin Sorolla in Spain and Ettore Tito in Italy. In England the once prominent Newlyn group had fallen by 1921 into obscurity; in Sweden Anders Zorn, best known by his portraits and etchings, was dead; and the Hague School of Holland had no important living representatives.

Transition Painters.—Between these representatives of the 19th-century outlook and those of the modern movement stand many painters combining in varying degrees characteristics of both groups, such as Sir C. J. Holmes (Director of the National Gallery from 1916), whose landscapes are marked by simplification and emphasis on structure. Transition to the modern point of view is also represented by the decorative painters, who have necessarily never fully accepted impressionism and realism. As early as 1892 the *Rose Croix* group had urged that painting should be idealist and monumental in character, with myth and allegory as its subject. These ideas survive, despite impressionist influences, in the balanced and harmonious compositions of René Menard, whose descent is from Puvis de Chavannes, in the mural decorations of Henri Martin, and in the work of Aman-Jean, whose flowing arabesque relates him to the 18th-century decorators. Akin to these painters, but closer to the modern movement and more purely decorative in intent, is the broadly handled work of Jules Flandrin (b.1871). Another group of decorative painters take realism as a starting-point. Among these is Frank Brangwyn (b.1867), one of the few English painters with considerable European influence and reputation. His later work—such as the eight mural paintings, symbolizing the dynamic forms of nature, for the 1915 Panama Pacific Exposition—shows how his dexterous and schematized art combines romantic and allegorical treatment of material drawn from the daily life of commerce and industry with a sensuous materialism. A comparable figure is Ignacio Zuloaga (b.1870), the leader of a group of Basque and Castilian painters, including Ramon and Valentine de Zubiaurre, Gustavo de Maeztu and Federico Beltran-Masses, representing the regionalist and consciously national character of modern Spanish art. Here a romantic conception of subjects drawn from contemporary Spanish life is given decorative form by emphasis on silhouette, simplification of form and broad masses of colour, often combined with a low horizon and a panoramic background; though sometimes the realism degenerates into caricature and the decorative treatment into the production of cardboard figures against a stage drop-scene. Augustus John (b.1879) in England is not romantic, but combines with the realism which finds most complete expression in his portraits a strongly decorative aim in the use of contour to enclose definite areas of colour, and distortions of the human figure in the interests of design. Similarly, the Munich decorative school, still represented in 1921 by its most important product, Franz Stuck (b.1863), inherits from Böcklin the realistic treatment of mythological and allegorical materials. Its once important and widespread influence has waned; but it forms part of the bridge between the archaeological and historical painting which formerly dominated Germany, and more modern movements. Allied thereto is the Swiss, Ferdinand Hodler (1853–1918), by the emphasized contours and calculated distortions of his later work. But in his symbolic mystical outlook he resembles another important forerunner of the modern movement, Hans von Marées (1837–1887), neglected in his lifetime but now the object of much adulation, who turned from Courbet and Manet to Rubens and Delacroix in developing a monumental decorative art based on three-dimensional form.

Another important divergence from the main trend of later 19th-century art is represented in France by H. G. E. Degas (1834–1917) and Pierre Auguste Renoir (1841–1919). Their close association with the impressionists was reflected in the choice of subjects from contemporary daily life and at times in their use of colour; but here the connexion ends. Degas is a descendant of the great classic draughtsmen. A convinced realist, bitterly opposed to the romantic and symbolic, he never sought the ideal beauty of Ingres, but turned to use the more absurd and bizarre attitudes of everyday life. But his realism is synthetic, and represents the building-up, from many sketches and from a retentive memory, the essential character of a form or movement; and his vision is classic in its impersonal, almost ironic, quality. So with his design, which, despite its apparent disregard of the rules of classical composition, yet shows a complete balance of strains and stresses round a pictorial centre, revealing the influence of Chinese and Japanese art. Round Degas centres a group of realistic draughtsmen, such as Henri de Toulouse-Lautrec (1864–1901), whose fevered and excited vision has inspired much modern work, Louis Legrand and J. F. Raffaelli. Jean-Louis Forain (b.1852), chiefly known for his political and social cartoons, has the critical and ironic spirit of Degas, but less power of design and feeling for colour. The later work of T. A. Steinlen (b.1859), likewise well known by his journalistic work, is significant of modern tendencies in the increased emphasis given to the third dimension and the use of simplified forms. In England the realism and irony of Walter Sickert (b.1860) connect him with Degas, though his search for atmospheric

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unity by study of tonal relations, and an incursion into the use of the spectral palette under the influence of Spencer Gore, bring him nearer the impressionists. He has played an important part in English art by transmitting French influence, coloured by his own personality, to a number of younger men. Henry Tonks (b.1862), professor at the Slade School, London, has also played an important part in moulding the younger generation. His realism and draughtsmanship relate him to Degas, his choice of subject at times to Renoir. Renoir, unlike Cézanne, to whom he is most immediately comparable, has inspired no particular group who call him master. He was first and last a painter, not the exponent or founder of an aesthetic creed. Rejecting Monet's principle of unconditional submission to nature, and holding that the work of a painter was not to reproduce a natural effect but to compose and construct, he grafted impressionism on to the tradition based on the Venetians and Rubens and revivified by Delacroix; forming an art in which solid form, simplified to its most expressive elements, and rhythmic flow of contour unite to give his work the plastic quality of a bas-relief. His colour, always daring and exuberant, in his later work becomes less naturalistic, and is dominated by the famous Renoir carnation, which gives his canvases a radiance in accord with his vision.

Etching and Engraving.—In etching and engraving, broadly, the 19th-century tradition originating in Rembrandt and Goya still holds the field, represented by Georges Gôbo in France, Otto Fischer in Germany, Sir Frank Short, Muirhead Bone and D. Y. Cameron in England. Confined as a rule to landscape or architectural work, their work is chiefly notable for technical mastery. Representatives of the modern school, on the other hand, rarely realize the full possibilities of the medium. In Odilon Redon (1840–1916), however, a modern aim is united with the older craftsmanship in his search for a plastic equivalent of his emotion and dreams. He was one of the pioneers of that revival of lithography in which bodies such as the Senefelder Club, whose members include Joseph Pennell and Brangwyn, played a part. A more important revival is that of engraving upon wood, with which Auguste Lepère (1849–1918) was closely associated. His later woodcuts show a return from a technique imitating etching or engraving on metal to the older method of treatment in broad masses, the lights being obtained by cutting away the wood. In Paris and London societies of wood engravers have been formed whose members practise this traditional use of white upon black, which is also much favoured by such modern artists as Derain, Dufy, Friez, and Franz Marc in their book illustrations.

Contemporary Movements.—The modern movement, some of whose characteristics appear in the transition painters already discussed, has been given various labels, such as post-impressionism and expressionism, but its manifestations are so various that no one term can satisfactorily describe it. But these manifestations have a common origin and character, in being a reaction against impressionism, with its aim of representing superficial appearance as a whole at a given time, without reference to shape or appearance as they are known to exist under the conditions; and in proposing to substitute form arranged into a coherent design, so making a new and independent reality and not a reproduction of nature. In this the modern movement claims to be a return to the tradition in painting represented by Raphael, Poussin, David and Ingres, as opposed to the romantics and realists; and to be breaking away from subordination to external and visible things, which are to serve only as a means towards expressing the artist's emotions. From this latter aspect of the movement arises the term " expressionism "; and divergence as to the kind and quality of emotion to be expressed is one cause of the differences between various modern groups. This general character of the movement helps to account for other distinctive features. Colour becomes less naturalistic, and is either used to emphasize the solidity of objects, is purely decorative, or assumes a mystical and symbolic character; and anxiety to avoid a transcript of nature has stimulated return to the subject picture, which calls for constructive effort. But the modern movement owes much to the impressionists. It was they who helped to discredit the formulas and aims of academic art; put powerful weapons in the painter's hands by applying to art scientific discoveries regarding light and colour; and won recognition of the artist's freedom to express his personal vision of things. It was on this basis that the chief initiators of the movement built. These fall into two groups, the one including Cézanne, Seurat and Henri Rousseau, whose emphasis tends to be on structure and organized design; the other including Gauguin, Van Gogh and Gustave Moreau, in whom symbolist and expressionist elements are more marked.

Paul Cézanne (1849–1906) gives the key to understanding of his aims and methods by his own words, that he wished to remake Poussin according to nature, and to make of impressionism something solid and durable like the art of the museums. His sympathies were all with the later Venetians, Rubens, Poussin, and the baroque masters such as the Caracci and El Greco, whose craftsmanship, bravura and well-organized design he admired. These sympathies found expression throughout his life, but are most evident in his earlier work. In this he used little colour; but under the influence of the impressionists, especially Pissarro, he extended his palette considerably (though still retaining black and the earth colours) and turned to a more intimate study of nature. But for him nature was only a starting-point. Contemplation of her, he held, reinforced by reflection and study of underlying causes, creates in the artist's mind a vision of the structure underlying the external, visible world, which to him becomes a series of organic relations between solid forms, which it is his business to realize on canvas. Cézanne's method was to establish the relations between the planes enclosing an object or group of objects by recording all the subtle differences in their colour due to differences in their relation to the light. But it is the form, not the light around it, which interests Cézanne. He worked slowly and painfully; but such was his desire for keeping every element of his work in correct relation that one alteration would often lead to complete repainting. The legend of Cézanne's technical incompetence is partly due to his constant self-depreciation and to the amount of work he left unfinished in despair or disgust. Though his ultimate rank as a painter is still in the balance, his influence underlies much of modern art.

Georges Seurat (1859–1891), like Cézanne, found in the 16th- and 17th-century masters the inspiration to recreate on canvas a world of three dimensions rather than copy that before his eyes. At the same time modern scientific research into colour led him to develop his well-known neo-impressionist technique, which has rather obscured his power of expressing structure and of welding form into balanced and monumental design. But he has exercised much influence, especially on the cubists, whose studio walls often carried reproductions of " Le Chahut," one of his last pictures.

Henri Rousseau (1844–1910), " le douanier," a very different figure was once an octroi official in Paris (whence his nickname). He is the true type of the primitive who tries to paint things as he knows them to be rather than as they appear. He used, for example, to measure his sitters with a footrule, and transfer these measurements to canvas. His work, which includes portraits, views of the suburbs of Paris, exotic landscapes based on recollections of military service in Mexico, and figure compositions, is marked by emphasis on solidity, precision of handling, adjustment of the relative size of objects according to their importance as elements in design, and at times by a symbolic element.

In contrast to Rousseau is Gustave Moreau (1826–1898), a strange figure bred in the strictest academic tradition, whose romantic spirit borrowed fire from Delacroix and Chasseriau, and who fed his imagination upon the myths of Greece and the East. He emerged from many years' retirement to become at the end of his life professor at the École des Beaux Arts, where his influence helped to breed a group of young painters with symbolist tendencies. As a teacher Moreau always encouraged self-expression based on close study of the old masters. In his own work Moreau stood for the use of the plastic arts to express the emotions, and built up a decorative art, combining sombre rich colour and rhythmic linear arabesque.

Paul Gauguin (1848–1903) was more definitely a *chef d'école* than any of the group now under consideration. After an impres-

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sionist phase. He became in Brittany the centre of the famous Pont Aven group, and there developed the theory of synthesis which was to govern all his later work. In 1891 he went to Tahiti and, except for a brief return to France, spent the rest of his life there. Admiration of the primitive was at the base of Gauguin's art. Rejecting impressionism as a mere reproduction of nature not inspired by thought, he held that study of nature awakes emotions in the artist which he has to express by bringing into organized relation symbols, consisting of forms and colours, supplied by nature. Primitive art alone, he considered, proceeds from the spirit, and uses rather than mimics nature; and he justified going to Tahiti on the ground that there only was his imagination sufficiently stirred by nature. Though the colour and forms in his pictures might not actually exist in nature, he claimed them to be the pictorial equivalent of the grandeur, profundity and mystery of Tahiti. His latest work most completely embodies this conception of art in its design based on boldly simplified contours enclosing areas of rich purples, greens, reds and oranges. To the end Gauguin's colour showed impressionist influence. Otherwise his art is primarily decorative, with colours keyed to express the painter's mood, and shows a less passionate search for solidity than Cézanne's. His symbolism, though not primarily literary, towards the end moved somewhat in that direction.

Akin to Gauguin in his outlook and use of colour is Vincent van Gogh (1853–1890). Born in Holland, his early work shows the influence of the Hague School; association with the impressionists in Paris led to his settling down at Arles to the use of heavy masses of vivid colour arranged indefinite patterns, emphasized by black outlines and writhing arabesques of paint. A passionate lover of nature and a mystic and idealist by temperament, Van Gogh believed that the artist's creative power was given to him to make men happy. Vehement personal passion is the note of his work. His colour ultimately became quite non-naturalistic, and was solely directed towards expressing his emotions; and his surface texture was designed to increase the arresting, disquieting quality of his work. The third dimension did not play a dominant part in Van Gogh's work. His design, in which decorative simplification became increasingly marked, shows very strongly the influence of Japanese art.

Symbolism and Fauvism.—The characteristic elements of the preceding group of painters—rejection of naturalistic representation, emphasis on solidity and structure, organized design, and the symbolic use of form and colour—are united in varying degrees in the work of their successors. The influence of Cézanne, which has modified or supplanted that of others, took some time to develop, and the first well-marked group to appear was that round Gauguin at Pont Aven. Among these was Paul Sérusier (b.1864), who was one of the first to formulate a doctrine based on the ideas of Gauguin, Cézanne and Odilon Redon. He drew round him a group of *symbolistes* which included Maurice Denis (b.1870), Pierre Bonnard, K-Xavier Roussel and Edouard Vuillard. This doctrine declares that a work of art must aim at the expression of an idea. Since it uses form for this purpose, it must be symbolic; and since the form has to be organized, it must be synthetic and decorative. At the basis of this is a belief in correspondence between external forms and subjective states—not, however, by association but direct. Sérusier and Denis have given these ideas a mystical and religious application, largely under the influence of the *quattrocento* Italians. In Bonnard (b.1867) and Vuillard (b.1867), however, the purely decorative element is uppermost, in a graceful and refined but over-precious treatment of material drawn from everyday life, influenced by Japanese art, and marked by elusive and delicate harmonies of green, blue, rose and yellow combined with grey. Closely akin to this *symboliste* group is another whose best-known members were pupils of Gustave Moreau. The religious symbolic pictures of Georges Desvallières (b.1861) are characterized by the use of arabesque and rich exotic colour; the more realistic art of Charles Guérin (b.1874) by its decorative aim and search for tonal rather than linear unity. The influence of Moreau, modified only by the pupil's own temperament, is well seen in the fantastic, savagely distorted nudes, and mysterious, sombre landscapes of Georges Rouault. Far better known is his fellow-pupil Henri Matisse (b.1869), who represents the expressionist side of symbolism in its most extreme form. Academic and neo-impressionist phases never obscured his very personal use of line and colour whose decorative quality relates him to the Chinese and Japanese. His arbitrary distortions of the human figure, partly based on the study of negro art, marked a stage towards the abstract, non-representative art of the cubists. These distortions, his apparently anarchic design and his colour earned for Matisse the title of " Chef des Fauves," though he has not formed the centre of a well-marked group, despite his wide influence. It is difficult to acquit him of sometimes painting *pour épater les bourgeois;* but his latest work, while retaining delicacy and sensitiveness, shows increased discipline and restraint. Both in his drawing and painting Matisse is notable for his use of a pure unaccented contour, which nevertheless generates solid form. Somewhat the same power is seen in the Italian painter and sculptor Amédée Modigliani (1884–1920), though he is far more mannered than Matisse and lacks his feeling for colour.

Kees van Dongen (b.1877, in Holland) mingles the influence of Matisse with that of Toulouse-Lautrec, and mainly shows the application of a *fauviste* recipe to the painting of fashionable Parisian society. Different from the *symbolistes* and *fauves*, but equally a reaction against impressionism, are the painters who return to the outlook and methods of the *quattrocento* Italians. Among these are Jean Frélaut (b.1879), notable for his sincere, thoroughly realized interpretations of the country and people round Morbihan in Brittany; and Félix Vallotton (b.1865, at Lausanne), whose angular, precise contours and definite colour pattern relate him to the primitives, and have won him the nickname of the Cabanel of the Salon d'Automne. This Pre-Raphaelite tendency is represented in England by Joseph Southall, head of the Birmingham School of Art, whose work is akin to that of Benozzo Gozzoli; and by Henry Lamb, Stanley Spencer and Gilbert Spencer, who in 1921 were the most prominent of a group of younger men in London of undoubted sincerity but inclined at times to use a rather elementary formula. Their work is also interesting as illustrating a tendency in British art towards decorative design suitable for mural painting. Similar, though more academic in outlook, is Eric Kennington, whose war paintings attracted much attention, their sentimental interest obscuring their mannered draughtsmanship and pretty colour.

Cubism.—To all the manifestations of the modern movement so far considered cubism is a marked contrast. It was a reaction not only against impressionism but against fauvism, and stands for the introduction of order and discipline into painting. So much was this the case that some opponents of the movement professed to see therein a return offensive of the academics. It owes its name and in part its origin to Matisse, from whose association with Picasso and others the movement took shape in 1908. This group coalesced with another working on similar lines, and represented by Albert Gleizes and Jean Metzinger, to win cubism its first public victory in the Salon d'Automne of 1913. To the influence of Cézanne and Seurat, which was mainly behind the movement, was joined that of Negro and Polynesian art, in which the cubists found a simplification of the human form emphasizing its bulk and solidity, and a complete disregard of normal appearance in the effort to express a conception. The central point of cubism is its entire rejection of the reproduction of natural appearance, which, cubists hold, merely serves to awaken in the artist emotions which he expresses by a series of abstract forms, ordered and arrayed by his will. Thus cubism aims at creating a kind of visual music. In its most austere form it avoids curved lines and colour as pretty and sentimental; and even holds that a picture is not a decoration since that term implies dependence upon external objects. From the first, great emphasis was laid on the expression of volume and its arrangement in space. This aroused difficulties, which have separated the cubists into distinct groups. The representation of a third dimension introduced an element of resemblance to nature. Some painters accepted this, so that their pictures are little more than arrangements of realistically painted cubes and cylinders: others rebelled against such

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a restricted art, and made of cubism merely an exercise and discipline in the expression of three-dimensional form. The purists, however, hold that art is not concerned with Euclidean space but with a special pictorial space, which we feel by our whole personality expanding or contracting before a picture; and that it is not the painter's business to create an illusion of a third dimension but to make live on a two-dimensional surface a reality of three dimensions. Further difficulties have been caused by development of a theory of simultaneity which justifies presentation on the same canvas of several aspects of the same object; this often only comes to a mechanical arrangement of a number of separate impressions, whose disentanglement may be a source of interest, so that cubism is descriptive rather than pictorial.

Pablo Picasso (b.1881, at Malaga) has been the dominating force in the movement, but by no means typifies it. With him cubism has been only a phase. To a realistic period, mainly influenced by Toulouse-Lautrec, succeeded a group of reddish nudes, solidly constructed from simplified planes, which ushered in the cubist period. The earlier work in this showed some conformity to natural appearance, and was mainly in *grisaille*. Later the forms became more abstract, the design more arbitrary and the colour brilliant, sand and similar substances being embedded in the paint to give relief and variety of surface. Picasso's latest phase shows the influence of Ingres, especially in his drawings. Some of these show a delicate, unbroken contour, others the use of shading; but all conform closely to natural appearance, with only enough distortion to give flow and rhythm. The chief characteristic of Picasso is his versatility. There is no method he has tried which he has not mastered. But whether he has yet achieved more than a series of exercises in different manners is open to question. The work of other cubists is remarkable for its sameness and impersonal quality. Georges Braque's rigid adherence to abstract forms, straight lines and sombre browns and greys make him the purist of the movement; Gleizes and Metzinger, by their more graceful use of line and colour and by their writings, are its popularizers; while Fernand Leger and Auguste Herbin are mainly makers of attractive patterns in bright colour. The use of colour is, however, pushed furthest by the Orphists, such as R. Delaunay, whose rejection of all rules is really a protest against the formal side of cubism, which he has translated into terms of curves and circles decked with vivid colour.

Between the extremes of cubism and fauvism stands a considerable group of artists who derive something from both, but represent the direct and increasing influence of Cézanne. Of these Albert Marquet (b.1875) is primarily a painter of Paris and of the Seine, whose use of well-defined planes, with their tonal relations very accurately expressed, is apt to degenerate into an ingenious system of notation. Jean Puy (b.1876), in his landscapes of wide-stretching countrysides, brings many scattered elements into harmonious relation by his feeling for subtle variations in colour and tone. With Othon Friez (b.1879) the organizing constructive instinct is uppermost, but he shows considerable power of retaining fresh and unspoiled his original conception. More consciously decorative than Cézanne, his mural paintings sometimes show the influence of Gauguin. Jean Marchand (b.1883) and Dunoyer de Segonzac (b.1884) represent a younger generation to whom cubism has been a gymnastic to develop understanding of form, but who now rely on colour and tone to give solidity and a sense of space. Marchand, taking for his material the most ordinary objects of daily life and the countryside, and using a simple, sober palette, gives his work distinction by his dignified design; Segonzac, with similar constructive power, works in a thick impasto with free use of the palette-knife in colour which has become increasingly sombre. His war paintings express a very personal emotion awakened by experience, and are the colour of the mud which dominated the battlefield. André Derain (b.1880) is one of the most influential of younger painters who, after a period influenced by Van Gogh and the neo-impressionists, produced a series of truculent nudes and landscapes, which showed cubist and fauve influence in their simplified and distorted forms. His recent work is more sober and severe, and reflects a study of Ingres. At times Derain's technical accomplishment threatens to lead him into the mannerism which marks the dramatic landscapes of Maurice Vlaminck (b.1876), with their heavy skies and contrast of sombre greens with vivid reds and pinks.

Futurism.—Modern art in other countries is mainly an extension or adaptation of French ideas and method. Spain, it is true, has produced Picasso; but cubism is entirely Parisian in origin, and so much of the modern spirit as appears in Catalan painters such as Sunyer and Casals is derived from France. Futurism, however, is indigenous to Italy. The term has been loosely used, especially in England, to denote the modern movement as a whole; but it has a definite and limited application to the doctrines of a group of Italian poets, sculptors and painters, first presented to the world in 1909 in a manifesto signed by F. T. Marinetti, the poet and high priest of the movement. These doctrines apply to art a general philosophy of life, with its origin in modern scientific theories which express all matter in terms of energy, and are based on denunciation of all that the past has done (whence the name futurism) and on the worship of movement and conflict as the dominant characteristics of modern life. Cubism, as based on tradition and dealing only with the static aspects of life, it rejects; impressionism it claims to have surpassed, but takes as a starting-point. The futurist's aim is to represent, not the appearance of objects at some particular point in their course, but the sensation of movement and growth itself. One method, which connects futurism with cubism, is to combine on one canvas not only what the artist sees, but what he knows and remembers about an object. Another, peculiar to futurism, is the use of "force lines." Every object, it is argued, is at a given moment the temporary outcome of continuously acting forces, whose character is indicated by the lines and planes enclosing it. Thus an object becomes simply the beginning or prolongation of rhythms conveyed to the artist by contemplation thereof; and these he represents in his picture by lines arranged to clash, harmonize, or interplay in order to express states of mind such as chaotic excitement, happiness or interest. Colour the futurists use arbitrarily to assist in conveying these sensations.

Luigi Russolo is the most logical and orthodox of the futurists. The work of others, such as Carlo Carra, is little more than a catalogue of information about a number of different objects; though Umberto Boccioni, who has applied futurist theories also to sculpture, sometimes redeems his work by an interesting design. The gaily coloured, tapestry-like patterns of Gino Severini are among the most attractive futurist paintings; but his recent work has been modified by cubist and academic influences. His career typifies the fate of futurism, which has found no new recruits, and has had but transient influence.

Modern English Painting.—The English vorticists share some of the futurist doctrines; but the main forces shaping the modern movement in England are French. This movement first took shape in the studio of Walter Sickert, and resulted in the formation of the Camden Town group under the presidency of Spencer Frederick Gore (1878–1914), which developed into the more eclectic London group, whose first president was Harold Gilman (1876–1919). At the same time Roger Fry (b.1866), by his writings and by assisting to organize post-impressionist exhibitions in 1910 and 1912 at the Grafton Galleries, did much to make known the character of the modern movement in France, and to assimilate more closely thereto the English movement. Gore and Gilman represent the movement in its earlier stages. Gore's earlier impressionism was modified under the influence of Cézanne and Van Gogh by increased attention to structure and design, which for a time obscured his charming sense of colour. This reappeared in his latest and most important work, done mainly at Richmond. Gilman emerged from a period influenced by Whistler and painters of the Vuillard type to one which gave increased emphasis to the third dimension and showed the influence of Van Gogh in the use of brilliant, clear colour and the handling of paint. Charles Ginner, whose work is closely akin to Gilman's, describes their art as aiming at "the plastic interpretation of life through intimate research into nature." The emotions aroused by nature in the artist he must express by deliberate and objective transposition of nature on to canvas, so that he reveals the qualities in her

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which have moved him. The variety of line and colour in nature, joined to the artist's personality, will produce a decorative composition. This neo-realism (as Ginner calls it) is based on the attitude of Cézanne and Van Gogh towards nature; but gives an English turn to that attitude by emphasizing the part played by nature as compared with that of the artist. The French point of view is more evident in the work of the London group. Some of its members are still slaves to a French formula; others have based on French teaching a more individual art, notably W. B. Adeney, F. J. Porter, Roger Fry and Duncan Grant, whose sense of colour gives his art characteristic quality. C. R. W. Nevinson, having explored in turn impressionism, futurism and cubism, subsequently abandoned the geometric convention which marked his war paintings, to reveal the academic art masked by his previous experiments.

Vorticism.—Distinct in character is the vorticist movement, with which Nevinson was once associated. This had its origin in 1913 among certain members of the Camden Town group, and had as its leading figures the painters Percy Wyndham Lewis, Cuthbert Hamilton, Frederick Etchells, Edward Wadsworth and William Roberts, the poet Ezra Pound, and the sculptor Henri Gaudier-Brzeska (1891–1915). Like futurism, it holds that modern art must be based on the character of modern industrial civilization, whose features are complexity and dominance of the machine; and since England is preëminently the type of the modern industrial country, this art will be an English art. But it rejects futurism as merely the cinematographic representation of a series of impressions; and joins the modern movement as a whole in basing itself on tradition, and claiming that the artist's work is not to copy nature, but to create new realities. Every phase of emotion has its appropriate means of expression in some particular form of some particular material, whose appeal is direct and not by association or allegory. These forms take shape and proceed out of the artist's "vortex" (hence the name of the movement), which is a general conception of relations in the universe through which ideas pass and take concrete shape, just as the general equation of a circle in analytical geometry becomes one particular circle when definite quantities are substituted for the algebraic symbol. In 1920 the vorticist movement issued in a secession from the London group to form the X group. But though mainly composed of vorticists, its first exhibition showed some modification if not in doctrine, yet in practice. The earlier vorticist work was geometric and abstract, and owed much to cubism. Hamilton still represented this phase in 1921; but others had turned in the direction of expressing the structure and essential character of natural forms in the way exemplified by the work of Wyndham Lewis. Much of the interest of the earlier vorticist painting lies in disentangling in sequence the elements from which it is constructed; and to this extent it is descriptive and literary. Otherwise, though sometimes showing new and interesting combinations of shapes and colours, it presents only a barren world of geometrical forms.

Modern German Painting.—In Germany the modern movement has been mainly inspired by that side of modern French art represented by Matisse and Derain. Cubism has not gained a real footing there; though the Russian Jew, Marc Chagall, shows cubist influence in the sharply defined planes and angular design of his fantastic, vividly coloured, decorations; and Lyonel Feiniger has adopted the cubist method of extension and development of planes. Arbitrary distortion and writhing arabesque are more congenial means of expression in an art always tending towards the romantic and symbolic; native influences, such as Hans von Marées and the Munich decorative school, joined to the study of El Greco and Matthias Grünewald, have paved the way for an expressionist art in the fullest sense of the term—one which gives vent to every kind of emotion with unrestrained and brutal vehemence. A mystical temper and a mass of confused aspirations induced by the war have stimulated this development; but the movement was in being before the war, chiefly under the leadership of Wassily Kandinsky (b.1866, at Moscow), a prominent member of a Munich group of painters, poets and musicians, whose aim was the expression through art of the "*innerer Klang*"—the *soul* of nature and humanity. According to Kandinsky, colour and form have the power of producing spiritual vibrations quite apart from their ordinary meaning and associations; and a picture consists of an arrangement of form and colour whose spiritual values are in harmony, and unite to express the artist's spiritual conceptions. Thus painting ceases to have representation as its purpose, and becomes analogous to music in its rhythmic arrangements of forms and colours. These may be borrowed from nature, but must have no external associations and may be freely adapted and distorted to suit the artist's aim. Thus Kandinsky has points of contact both with the *symbolistes* and cubists; but he criticizes the latter for reducing the construction of a picture to rules and formulas, and for paying over-much attention merely to representing three-dimensional form. Kandinsky's own work has become increasingly abstract in character and consists of some early flat decorations, combining Russian and Munich influences; a group of more or less direct impressions of nature, inspired by Matisse; "improvisations" which represent spontaneous expressions of inner character; and "compositions" which express a slowly formed and mature spiritual feeling. His most important disciple is Franz Marc (1880–1916), whose animal compositions boldly designed in arbitrary colour are his most typical work. Less abstract but more brutal is a group which has come into special prominence during and after the war. Most prominent of these is Oskar Kokoschka (b.1886, in Austria), whose early work showed the free distortion, sharp contrasts of light and shade, bold contours, and thick impasto worked into arabesques, by which he conveys his excited and very personal vision. In his later work emphasis by these means is even more emphatic and merciless. The heads of his figures are balanced on tiny bodies, bizarre monsters are introduced, and the paint is literally thrown on the canvas, with great channels made therein to mark the dominant lines of the design. Painters of similar tendencies are Emil Nolde, Karl Hofer, and Karl Schmidt-Rottluff. The last, under the influence of negro sculpture, has become a coarser Matisse. The influence of an earlier generation of Frenchmen is seen in Max Pechstein, whose work owes much to Gauguin, and in Albert Werszgerber and Carl Caspar, both of whom base their design and use of colour on Cézanne. Edward Munch (b.1862, in Norway) stands somewhat apart in his combination of realism, fantasy and power of monumental design derived from Manet, Toulouse-Lautrec and Seurat, which excited violent controversy in Berlin when first exhibited, and led to the split in the Kunstverein there which marks the rise of the modern movement.

Modern Russian Painting.—In Russia the influence of French art has been no less marked than elsewhere, but has taken peculiar and characteristic shape. Towards the end of the 19th century Western and in particular French influence was represented by the realistic historical painters such as Ilya and Repin and a group of *plein-air* landscape painters. In reaction against their naturalism a decorative school developed, corresponding somewhat to the English Pre-Raphaelites, basing its work on old Russian art, and represented by Vassily Surikov (1848–1916) and Victor Vasnetzov. Of this reaction the modern movement is really a development. One form it has taken is represented by Mikhail Vrubel (d.1910), whose mystical symbolism recalls that of Gustave Moreau in its search to express things of the spirit in pictorial form; while Petroff-Wodkin is nearer to the French fauves in his simplified and distorted nudes and arbitrary use of colour. More important is a Petrograd group, consisting of historical painters whose aim is to reconstruct in decorative form a past epoch, not from living models dressed in costume of the period, but from the close study of every form of contemporary record. Thus, the movement is primarily intellectual and literary and has produced an art which, for all its refinement and delicacy, is inclined to be precious and a mere *réchauffé* of already-used material. Within the movement one group looks to the West. Alexander Benois has concentrated on the age of Louis XIV.; Konstantine Somov, the most charming and individual of all, upon the period of 1830; and Eugéne Lanceray upon the court of Elizabeth and Peter the Great. Stelletsky and Count Koma-

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rovsky, on the other hand, have gone to old Russia for their motives. Stelletsky is the purist of the group, his reconstructions of Russian mediaeval life being based upon minute archaeological study of ikons, service books and similar sources. Nicolas Roerich has departed from strictly documentary methods in seeking to reconstruct primeval and prehistoric Russia in his fantastic flat decorations based on Russian legends, and thereby joins hands with the group represented by Vasnetzov. Rather apart is Boris Anrep (working in 1921 in England), who studied Byzantine art and the ikon, not in an archaeological spirit, but as exemplifying a means for the expression of human emotion. His work is principally in mosaic, submission to whose limitations, he holds, makes for the simplicity and directness which are often lost amid the technical possibilities of oil paint. The close connexion of modern Russian art with the theatre is another important characteristic, which has grown directly out of the decorative reaction against realism. Leon Bakst represents one side of this. Originally associated with the Petrograd historical group, he came into touch with Serge Diaghilev and became one of the chief designers of settings for the Russian Ballet. His use of line and colour relates him to the East; but, like Benois and Somov, his outlook and method are those of the West. Distinct in character is the art of Nathali Gontcharova and M. Larionov. Using the methods of the Petrograd group, they took their material from Russian peasant art, as represented in the decoration of articles in daily use and in the "lubok," the Russian equivalent of the "images d'Épinal," which gives their earlier work notable simplicity and directness. The West was not to be denied, however, and Gontcharova's setting for the 1914 production of the "Coq d'Or" and Larionov's "Les Contes Russes" of 1915 mark the invasion of the theatre by cubist ideas. The colour scheme was still that of Russian peasant art; but the design was based on abstract forms, and aimed at a rhythm in harmony with the music and the dances. To this development the name of *rayonnisme* has been given.

Much of the criticism levelled at the modern movement, like that once directed against impressionism, is merely a violent statement of personal preference. Weightier arguments point out that the emphasis given in the modern movement to the third dimension merely exalts one element in natural appearance, and urge that ultimately design must be based on the play of contour and shapes on the picture plane. Also, it is said, modern methods of simplification and distortion tend to become formulas which prevent sincere and spontaneous expression no less than older conventions. But contention chiefly centres round the question of representation. It is argued that a purely abstract art, which takes no account of the ideas and emotions conveyed by the objects represented, is a limited and empty affair. Rhythm in the plastic arts, no less than in literature, must emphasize some meaning; and form takes on a significance by association, if not with specific objects, yet with general ideas of mass, space and movement.

See also: Maurice Denis, *Theories 1890–1910* (1912); W. H. Wright, *Modern Painting* (1916); R. Fry, *Vision and Design* (1920); A. Salmon, *L'Art Vivant* (1920); G. Coquiot, *Les Indépendants* (1920); P. Westheim, *Die Welt als Vorstellung* (1918); Fritz Bürger, *Cézanne und Hodler* (1913); Ambroise Vollard, *Paul Cézanne* (1914); Charles Morice, *Paul Gauguin* (1919); Vincent van Gogh, *Lettres à Émile Bernard* (1912); Kandinsky, *The Art of Spiritual Harmony*; A. Gleizes, *Du Cubisme* (1920). (W. G. C.)

UNITED STATES.—Between 1910 and 1921 many of the painters mentioned in the earlier article (20.518) had passed away, and some of their younger contemporaries had also laid down their brushes: Ryder, Bunce, Blakelock, Duveneck, Alexander, Smedley, Millet, Cox, Beckwith, Alden Weir. Abbey, who died in 1911, left no followers, but La Farge and Chase wielded great influence over a host of pupils. With the development of American art-schools and the increasing number of capable instructors, the trend towards European art-centres had by 1921 grown less. There was already promise of a school with distinctly American characteristics. This was to be seen most clearly among the painters of landscape. Twachtman and Robinson, among the older men who were trained abroad, brought back some of the light of the so-called Impressionist School, and their example in raising the colour-pitch was of great benefit. Crane, a pupil of Wyant, and such men as Tryon, Murphy and Ben Foster, ably carried on the tradition they received from their American masters. Dewing, Metcalf and Childe Hassam developed individual ways of looking at their subjects. Carlsen, Dougherty and Waugh found the sea an ever-changing theme for their brushes, and they produced canvases not behind those of the landscape men.

With the passing of the Society of American Artists, the men who made this organization a force were merged with the members of the older National Academy and became conservatives in their turn. Thayer, Brush, Blashfield, Tarbell, Mowbray, Melchers and Simmons were still in 1920 painting pictures which showed their sound technical training and their artistic point of view. Some of the later men who developed original ways of doing things were Robert Henri, Jonas Lie, William Glackens, Rockwell Kent, John Sloane, George B. Luks, C. C. Cooper, A. B. Davies, Jerome Myers, George Bellows, Gardner Symons, Everett Shinn, W. E. Schofield and Randall Davey. Abundant manifestations of vorticism and cubism came to be seen in American painting. The followers of Cézanne, Matisse, Gauguin, Van Gogh and Picasso were many, but chiefly the younger men whose work was still in the experimental stage. There was a steady advance in mural painting. Sargent added to the decorations for the Boston Public Library, and the example set there and elsewhere was followed in many of the larger cities, in state capitols, municipal courts, churches and theatres. Pittsburgh, Harrisburg, Baltimore, St. Paul and Minneapolis have important buildings decorated by such mural painters as La Farge, Blashfield, Alexander, and others. There has been remarkable growth at the art museums, especially at the Metropolitan Museum of New York, the Boston Museum of Fine Arts, the Carnegie Institute of Pittsburgh (whose international exhibitions draw many exhibits from overseas), and the Chicago Art Institute. No less remarkable has been the formation of important collections in cities whose size would often afford no reason for expecting their presence. Worcester, Providence, Cleveland and Minneapolis have excellent museums. Washington now possesses three collections of paintings—the Corcoran Gallery, the National Gallery and the Freer Collection. Moreover, private collections of importance have increased in number and quality, and native artists are often given there the high place they deserve. Some of the universities offer courses in the History of Art and in the elements of design. In time this should produce a body of intelligent criticism which should still further stimulate artistic effort in America. (J. C. VAN D.)

PALAEONTOLOGY (*see* 20.579).—During the period 1910–21 the science of extinct forms of life made remarkable progress, especially in North America, where explorations and studies were less interrupted by the World War. The contact of palaeontology with other sciences—even those apparently remote like astronomy, physics and chemistry, less remote like comparative anatomy, or very intimate like geology—was one of the outstanding features of the synthetic work accomplished. Of transcendent interest, however, was the contact between mammalian palaeontology and anthropology, especially through the researches of William K. Gregory of the American Museum of Natural History, and also of G. Elliot Smith of London University to whom is due the article on ANTHROPOLOGY in these New Volumes.

Principal Synthetic Works of 1910–21.—Chief among the synthetic works in pure palaeontology are those of the Austrian palaeontologist Othenio Abel, *Grundzüge der Palaeobiologie der Wirbeltiere* (1912), *Die Stämme der Wirbeltiere* (1919), and *Lehrbuch der Palæozoologie* (1920), which give masterly reviews of the whole fossil history of the vertebrates, especially in analogous and convergent adaptation. In invertebrate palaeontology the reader is referred to Amadeus Grabau's *Principles of Stratigraphy* (1913) and *Textbook of Geology* (1920-1), in which are summed up the principles derived from the teachings of Waagen and Neumayr in Germany, of Hyatt and Beecher in America, in pure palaeontology and in application to geology. A broad synthetic treatment of climate and time in relation to the evolution of life is that of the late Joseph Barrell (1917) in his *Rhythms and the Measurements of Geologic Time*. The best

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synthetic treatment of climate, time and geologic change in relation to the geologic origin and the migration of the different vertebrate groups is William Diller Matthew's *Climate and Evolution* (1915). The subdivisions of geologic time and the successions of faunas and climates are broadly reviewed in the *Textbook of Geology* by Louis V. Pirsson and Charles Schuchert (1915; revised edition, vol. I, 1921). The latest summary of the geology, past physiography and palaeontology of the world is found in the French edition of the great work of Eduard Suess, *Das Antlitz der Erde*, translated and annotated by Emmanuel de Margerie as *La Face de la Terre* (1902, 1918). The comparative evolution of the mammalia of the eastern hemisphere and of North America is broadly treated in Henry Fairfield Osborn's *Age of Mammals* (1910); while the mammals of North and South America are compared in W. B. Scott's *History of Land Mammals in the Western Hemisphere* (1913). A broad treatment of the whole subject of invertebrate and vertebrate evolution is given in Richard S. Lull's *Organic Evolution* (1917) and a synthetic review of the earth's history, from its solar beginnings to the Age of Man, in Osborn's *Origin and Evolution of Life*.

Life Epochs of Geologic Time.—The time scale in the accompanying table is taken from the work of Pirsson and Schuchert of 1915, modified by the substitution of geologic *time units* for *years*. There is a growing indisposition to reckon past time in terms of years, and a growing tendency to substitute a relative term like *time units*, because of the enormously wide discrepancy between the older estimates of geologists, based on sedimentation and the thickness of the various assemblages of rocks, which, taken together, make up the whole geologic time scale, and the estimates of physicists, based on the slow liberation of radium from radioactive minerals. The radium estimates of the age of the earth range as high as 1,400,000,000 years for the oldest known rocks, according to Barrell, who has adopted the calculations of Rutherford and others based on the "rate of disintegration" of radioactive minerals. The contrast between the two methods is exemplified in the following table:

	Walcott (1893) Years	Barrell (1917) Years
Age of Man and of Mammals—Cenozoic	3,000,000	55,000,000– 65,000,000
Age of Reptiles—Mesozoic	9,000,000	140,000,000–180,000,000
Age of Amphibians, Fishes, Invertebrates—Palaeozoic	18,000,000	360,000,000–540,000,000
Precambrian Time—Evolution of Invertebrates and of Unicellular Life	30,000,000	600,000,000–800,000,000
Minimum Total	90,000,000 (Geikie, 1899)	1,200,000,000
Maximum Total	400,000,000 (Geikie, 1899)	1,400,000,000

The most original part of Barrell's contribution was the measurement of time from the base of the Palaeozoic to Recent time by new palaeophysiographic methods, taking into account particularly the rhythms or cycles of dry and moist climates and of elevations and depressions, theories which were originally interpreted by T. C. Chamberlin and popularly treated by Ellsworth Huntington, the physiographer of Yale University.

A few decades ago the physicists and mathematicians, especially Kelvin and Tait, insisted that the earth could not be more than 10,000,000 to 20,000,000 years old; now the physicists are extending the age of the life period to 1,400,000,000 years, as estimated by Barrell (1917). The most recent determination by physicists, as reviewed by Lord Rayleigh (1921), takes into consideration the transmutation of chemical elements, for example, in the bröggerite of the Precambrian rocks at Moss, Norway: "Taking the lead as all produced by uranium at the rate above given, we get an age of 925 million years. Some minerals from other archaean rocks in Norway give a rather longer age. . . The helium method is applicable in some cases to materials found in the younger formations, and proves that the ages even of these are to be reckoned in millions of years. Thus the helium in an Eocene iron ore indicated 30,000,000 years at least. . . The upshot is that radioactive methods of research indicate a moderate multiple of 1,000 million years as the duration of the earth's crust as suitable for the habitation of living beings, and that no other considerations from the side of pure physics or astronomy afford any definite presumption against this estimate." Applying this estimate to the evolution of a familiar mammal like the horse, it might be said that the four-toed horse (*Eohippus*) existed 30,000,000 years ago, a somewhat larger estimate of the life period of the horse than that demanded by palaeontologists. In the same discussion W. J. Sollas comments on the expansion of time estimates proposed by physicists: "The age of the earth was thus increased from a mere score of millions to a thousand millions and more, and the geologist who had before been bankrupt in time now found himself suddenly transformed into a capitalist with more millions in the bank than he knew how to dispose of."

In this connexion we may recall the fact that as early as 1859 Charles Darwin pointed out that the high degree of evolution and specialization seen in the invertebrate fossils at the base of the Palaeozoic, namely, the Cambrian, proved that Precambrian evolution occupied a period as long as, or even longer than, that of Cambrian to Recent time (*see* Table I on p. 11). Poulton, the leading disciple of Darwin in England (1896), declared that 400,000,000 years was none too long for the whole life evolution period; this would allow 200,000,000 years for Precambrian time and another 200,000,000 years from Cambrian to Recent time.

Walcott's Revelation of Precambrian and Cambrian Life.—Charles D. Walcott (1899, 1914) has discovered the remains of life in the Precambrian (Proterozoic) rocks of North America and has been able to give us a fragmentary picture of the fauna and flora of that very ancient period. In Montana at a depth of nearly 10,000 ft. below the earliest Palaeozoic rocks (Cambrian) he found evidence of ancient reef deposits of calcareous algae, which ranged upward through 2,000 ft. of strata. Above these reefs are 3,000 ft. of shales containing worm trails and the fragmentary remains of large crustacean-like organisms. From rocks of approximately the same age in Ontario, Canada, he has described sponge-like forms (*Atikokania*) which are of such generalized structure that it is difficult to decide whether they should be regarded as sponges or as archaic corals. These few plant and animal remains are all that are known from remotely metamorphosed rocks of Precambrian time, but the existence of annelids and possible arthropods marks a break into the hitherto unknown Precambrian. Walcott's most surprising discovery in Precambrian time is a monad or bacterium attributed to *Micrococcus* sp. indet. from the Algonkian of Montana, but probably related rather to the existing *Nitrosomonas*, one of the prototrophic or primitive-feeding bacteria, which derives its nitrogen from ammonium salts.

In 1910 Walcott discovered in the Cambrian (Burgess) shales of Alberta, Canada, a marvellously rich fauna whose preservation is so perfect that the setae of the worms, the jointed appendages of the trilobites, the impressions of soft-bodied medusae and holothurians, and even the alimentary tract and stomach of certain of the crustaceans can be seen on the shale surfaces almost as clearly as in living forms (Plate I.). This discovery fairly revolutionizes our knowledge of the anatomy of the delicately organized as well as the chitinous-armoured forms, like the trilobites. Including the new forms contained within these Albertan shales, the Cambrian marine fauna is now known to be far more abundant than even imagined by Darwin, comprising some 1,500 species, 1,200 of which occur in North America. From Lower as well as Middle Cambrian (Burgess) faunas, it appears that the Precambrian invertebrates had probably become completely adapted to all the life zones of the continental and oceanic waters, excepting possibly the abyssal. All the principal phyla—the jointed arthropoda (including the trilobites among the crustaceans and the merostomes among the arachnids), segmented worms (Annelida), echinoderms, molluscs (including pelecypods, gastropods and primitive cephalopods), brachiopods, medusae and other coelenterates, and sponges—were presumably established in Precambrian times.

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TABLE I.—PROGRESS IN PALAEONTOLOGY.

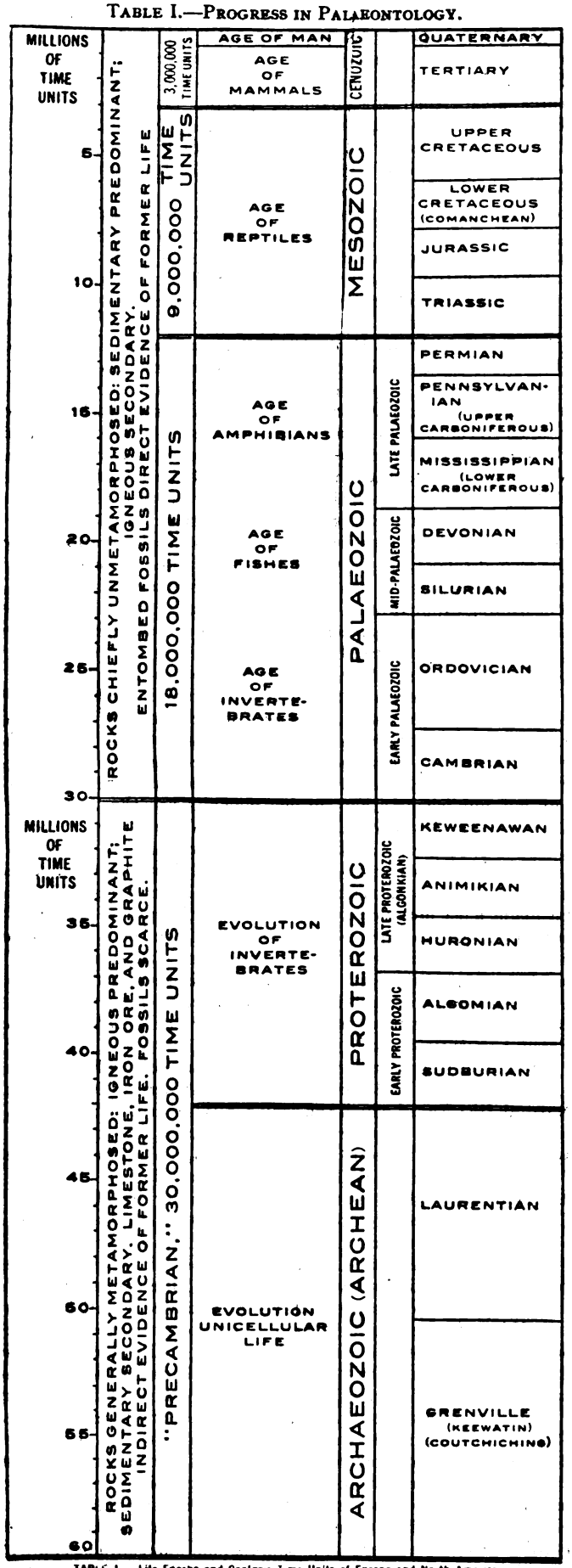

TABLE I. Life Epochs and Geologic Time Units of Europe and North America (After Pirsson and Schuchert, 1915; Issued by Osborn in 1918)

The Cambrian fauna has been made known to us in large measure through the field discoveries and monographic studies of Philip Lake (1906) for Great Britain, of Walcott (1909–21) for North America, and of Cowper Reed (1915) for India. The great variety and high specialization of the Cambrian marine forms, including representatives of all the known marine invertebrate phyla, is in harmony with the trend of discovery among the vertebrates, which is to put the origin of existing families very far back into the Age of Mammals and even into the Age of Reptiles (Mesozoic). In fact, the antiquity and persistence of modern types, as distinguished from modern genera and species, is an illustration of a very far-reaching principle, namely, that the *most stable form of energy in matter known is that of the heredity chromatin* on which this extraordinary preservation of the main features of the ancestral type depends. Next to the stability of the properties of the chemical elements, which are now known to pass into each other by transmutation, the most stable physicochemical properties are those which form the heredity basis of life.

Freshwater and Terrestrial Origins.—The eurypterids appear as contemporaries of the Cambrian trilobites and traces of them are found in Precambrian rocks; they attain to their acme in Silurian time and develop into the eight-foot giants of the fauna of the Devonian of Scotland and eastern North America, suffering extinction at the close of the Palaeozoic. In 1916 appeared Marjorie O'Connell's memoir, entitled *The Habitat of the Eurypterida*, giving as the summation of her studies that throughout their entire phylogenetic history the eurypterids lived in the rivers, a conclusion accepted in the main by Schuchert (1916), with the modification that they also appeared to have lived at times in the brackish waters of more or less large bays and possibly in limited numbers even in the seas. Many other origins formerly traced to the sea have more recently been traced to fresh water. T. C. Chamberlin (1900) proposed the hypothesis of a prevailing freshwater origin both for the ancestral backboned animals known as chordates as well as for the much more ancient arthropods, the eurypterids. His strong influence was needed to overcome the widespread notion that all forms of life originated in the sea; and, one after another, theories of freshwater and terrestrial origin have replaced the theory of marine origin. Early in 1916 Barrell pointed out the influence of Silurian-Devonian climates on the rise of air-breathing vertebrates and freshwater origin in Devonian time under seasonal rainfall.

Schuchert continues that the probable freshwater life of the eurypterids opens a vista into continental life as far back as the Upper Cambrian. Other merostomes related to the eurypterids radiated out from the fluviatile faunas of Cambrian, Ordovician and Silurian time, while in the Devonian rivers dwelt great spider-like eurypterids together with forms so similar to scorpions that they might be called river scorpions, and others that were active swimmers. O'Connell's argument regarding the freshwater eurypterids applies equally to *Limulus*, the horseshoe crab. In brief, the existence of freshwater faunas no less varied than the marine faunas is beginning to be traced back to Lower Cambrian time. O'Connell shows that the entire phylogeny of the eurypterids, which includes about 160 species from the Precambrian to the end of the Palaeozoic, distributed in 78 geologic horizons throughout the world, points to migrations like those of fishes from the headwaters of interlacing river systems, and, taken with other evidence, strongly supports the theory of Predevonian river life as opposed to the general assumption of marine life of all early faunas.

It now appears that beginning in Precambrian time the trilobites, by wide adaptive radiation, reached the acme of their development in the Cambrian, displaying a high degree of articulation and specialization of appendages, suffered a marked decline after the Silurian, and became extinct at the end of the Palaeozoic. James Perrin Smith, who has made a very exhaustive analysis of cephalopod evolution and especially of the Triassic ammonites, observes that the evolution of form continues uninterruptedly even where there is no evidence whatever of environmental change.

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Principal Literature, Cambrian to Pleistocene.—A few of the major contributions to our knowledge of the life of the Palaeozoic are: *Cambrian Geology and Palaeontology* (1910) and *Cambrian Brachiopoda* (1912) by Charles D. Walcott; *Cambrian Fossils of Spiti* (1915) and other papers on the Palaeozoic of India by Cowper Reed; *A Monograph of British Cambrian Trilobites* (1906) by Philip Lake, and *A Monograph of British Graptolites* (1901) by Gertrude Elles and Ethel Wood. The foraminifera have been treated by E. Schellwien, *Monographie der Fusulinen* (1908–12); the bryozoa by R. S. Bassler, *Early Paleozoic Bryozoa of the Baltic Provinces* (1911) and G. W. Lee, *British Carboniferous Trepostomata* (1912); the echinoderms by R. T. Jackson in his memoir on the *Phylogeny of the Echini with a Revision of Palaeozoic Species* (1912), and by Frank Springer in his monograph *Crinoidea Flexibilia* (1920) and in numerous shorter contributions. The ancient arthropods, including, besides the trilobites, merostomes and other arachnids and also insects, have been described by J. M. Clarke and R. Ruedemann in their memoir on *The Eurypterida of New York* (1912), by Alexander Petrunkevitch, *A Monograph of the Terrestrial Palaeozoic Arachnida of North America* (1913), by R. I. Pocock, *A Monograph of the Terrestrial Carboniferous Arachnida of Great Britain* (1911), and by F. Meunier, *Nouvelles recherches sur quelques insectes du terrain houiller de Commentry* (Allier) (1906–12). The literature on the Mesozoic contains more references to ammonites than to other groups, because of their abundance and palaeontological importance. The ammonite faunas of the Triassic have been described by James P. Smith, *The Middle Triassic Marine Invertebrate Faunas of North America* (1914) and by Carl Diener, *The Trias of the Himalayas* (1912), *Japanische Triasfaunen* (1915), and other papers on the Triassic of the Himalayas and southern Europe (1915).

For the Jurassic there are the classic volumes by S. S. Buckman, *Yorkshire Type Ammonites* (1909–19) continued in the *Type Ammonites* (1920) and the memoir by C. Burckhardt, *Faunes Jurassiques et Cretaciques de San Pedro del Gallo* (1912) for Mexico. The studies on Cretaceous ammonites have been more local in character and include: E. Stolley's *Beiträge zur Kenntniss der Cephalopoden der norddeutschen unteren Kreide* (1911–2), D. N. Sokolov's *Zur Ammoniten Fauna des Petschoraschen Jura* (Russian) (1912), H. Yabe and S. Shimizu's, *Notes on Some Cretaceous Ammonites from Japan and California* (1921), and numerous papers by A. de Grossouvre, W. Kilian and E. Haug for France and the Mediterranean region. The silicious sponges which are so well represented in the Mesozoic have received the most careful microscopic study by the students and followers of Zittel. Pioneer work was done in England by the late George Jennings Hinde, *A Monograph of the British Fossil Sponges* (1887–1912), and this work was followed in Germany by A. Schrammen's *Kieselspongien der oberen Kreide von Nordwestdeutschland* (1910) and R. Kolb's *Die Kieselspongien des schwäbischen weissen Jura* (1911). Special works on other groups are: *A Monograph of the Cretaceous Lamellibranchia of England* (1899–1912) by Henry Woods, *Synopsis des Spirobranches (Brachiopodes) Jurassiques Celto-Souabes* (1915–9) by the Swiss palaeontologist Louis Rollier, and Clarke and Twitchell's *The Mesozoic and Cenozoic Echinodermata of the United States* (1915). Among the major contributions to Mesozoic stratigraphy and entire faunas or floras may be mentioned: Victor Uhlig's *The Fauna of the Spiti Shales* (1903), Carl Renz's *Die mesozoischen Faunen Griechenlands* (1911), G. R. Wieland's *American Fossil Cycads* (1906–16), and E. W. Berry's *The Upper Cretaceous Floras of the World* (1916).

For the Tertiary life especial reference should be made to the contributions on different groups made by Thomas Wayland Vaughan (corals), E. W. Berry (plants), J. A. Cushman (foraminifera), R. T. Jackson (echinoderms), Mary Rathbun (crustaceans), A. Pilsbry (cirripedia), and others in *Contributions to the Geology and Paleontology of the Canal Zone, Panama, and Geologically Related Areas in Central America and the West Indies* (1919). The bryozoa have been carefully described and beautifully illustrated by Ferdinand Canu and Ray S. Bassler, *North American Early Tertiary Bryozoa* (1920), while the foraminifera have been described in equal detail by Joseph A. Cushman in numerous contributions, and by H. Yabe (1921) and H. Douvillé (1911). For other groups we may note: J. Lambert's *Description des Echinides des terrains néogènes du bassin du Rhône* (1911–6), F. W. Harmer's *The Pliocene Mollusca* (1914–20), and papers by W. H. Dall on the mollusca. A general résumé of the Pleistocene vertebrate and invertebrate life is embodied in F. C. Baker's *The Life of the Pleistocene or Glacial Period* (1920). Stimulating general reviews of the progress of invertebrate palaeontology are the presidential addresses by F. A. Bather, *Fossils and Life*, British Association (1920), by Ruedemann, *The Palaeontology of Arrested Evolution* (1916), and by Clarke, *The Philosophy of Geology and the Order of the State* (1917).

Progress in Vertebrate Palaeontology

Personnel: Advent of the Fourth Generation.—The principal feature of the decade has been the advent of a new generation of explorers and workers in vertebrate palaeontology who, in a sense, constitute a fourth or " 20th century " group. Beginning with Cuvier (1769–1832) as founder of the science and leader of the first group, the second group embraced the British anatomists Richard Owen (1804–1892) and Thomas Henry Huxley (1825–1895), the French leader Albert Gaudry (1827–1908), the Swiss palaeontologist Ludwig Rütimeyer (1825–1895), and the three great Americans, namely, Joseph Leidy (1823–1891), Edward Drinker Cope (1840–1897), and Othniel C. Marsh (1831–1899). These men marshalled the first positive proofs of vertebrate evolution in Europe and America; they worked more or less independently as pioneers and laid the entire foundation of the modern classification of the Vertebrata. The leader of the third group was the Russian, Waldemar Kovalevsky (1842–1883), who instituted intensive investigation of mechanical adaptation in relation to natural selection. Still productive members of the same period are Arthur Smith Woodward (b. 1864) and Charles W. Andrews (b. 1866) in England, Marcellin Boule (b. 1861) and Charles Depéret (b. 1854) in France, Louis Dollo (b. 1857) in Belgium, Max Schlosser in Germany, Giovanni Capellini (1833–) in Italy, and in America William B. Scott (b. 1858) and Henry Fairfield Osborn (b. 1857). This group includes also Samuel Wendell Williston recently deceased (1852–1918), and Ramsay H. Traquair (1840–1912). Scott treated chiefly mammals, Williston chiefly reptiles and amphibians, Osborn both mammals and reptiles. The principal accomplishment of this third school has been (1) to conduct world-wide exploration, (2) to correct, coordinate and firmly establish the great classifications proposed by the second school and (3) to fill out the details and principles of phylogeny or lines of reptilian, avian and mammalian descent. The leading explorer of this period was John Bell Hatcher (1861–1904), who brought together a large part of the materials for two great monographs of the United States Geological Survey, Osborn's *Titanotheres* and the Hatcher-Lull *Ceratopsia;* he also made the wonderful collection of South American fossils which forms the basis of Scott's monumental memoirs of the Princeton University Expeditions to Patagonia during the years 1896–9. Osborn's monograph *The Titanotheres* (an Eocene-Oligocene family of mammals), twenty-one years in preparation, has been completed but not published; others of his memoirs are the *Equidae of the Oligocene, Miocene, and Pliocene of North America* (1918) and *Camarasaurus, Amphicoelias, and other Sauropods of Cope* (1921). Williston's monographs are chiefly on the Cretaceous mosasaurs and the archaic Reptilia of the Perm-Trias, to which he made most notable contributions. Of this period were Florentino Ameghino (1854–1911), the distinguished vertebrate palaeontologist of Argentina, and Eberhard Fraas (1862–1915) of Stuttgart. Oliver P. Hay (b. 1846) is also of this group, author of the monograph of the *Fossil Turtles of North America* (1908) and of the invaluable *Bibliography and Catalogue of the Fossil Vertebrata of North America* (1902).

To the fourth group of vertebrate palaeontologists belongs the school trained by Professor Osborn in the American Museum of Natural History, of which the senior is William Diller Matthew (b. 1871), Walter Granger (b. 1872), Barnum Brown (b. 1873), William K. Gregory (b. 1876), Richard S. Lull (b. 1867), of Yale University, Lawrence M. Lambe (1863–1919), late of the Canadian Survey, and C. Forster-Cooper, Cambridge University. The chief intensive work of Matthew and Granger has been on the American Eocene mammalian faunas and in aiding Osborn to establish sixteen Eocene-Oligocene life zones of North America very closely coördinated with corresponding life zones of western Europe. Brown's explorations have added greatly to our knowledge of Cretaceous dinosaurs. Of the same group are the pupils of Williston, of whom the leader is Ermine C. Case (b. 1871), who has contributed treatises on Permian life. At the same time John C. Merriam (b. 1869) has led explorations on the Pacific coast of America and inspired a school of younger workers both in vertebrate and invertebrate palaeontology. In Great Britain D. M. S. Watson (b. 1886) has taken up the work of Owen and Huxley in primary groups of fishes, amphibians and reptiles; in Austria Othenio Abel, a pupil of Dollo, is the great exponent of vertebrate evolution; in Germany Friedrich von Huene and Ferdinand Broili are leaders in sauropsidan palaeontology, other notable palaeontologists of recent years being Franz Dre-

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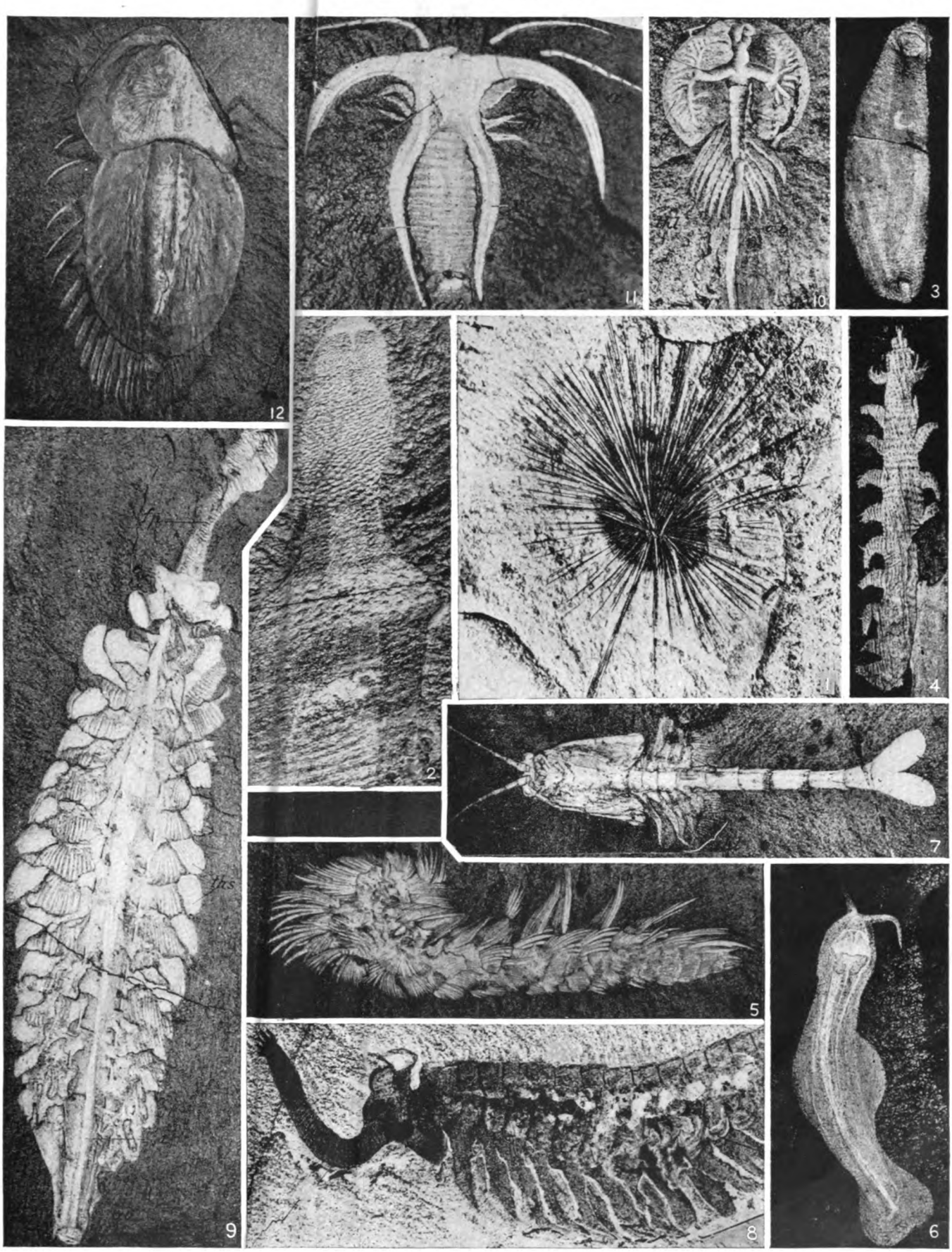

Middle-Cambrian invertebrate fossils, showing the diversity of the animal life of that period and the similarity of many of the types to recent forms. The specimens from which the photographs were taken are in the U.S. National Museum. (Illustrations reproduced by permission of the Secretary of the Smithsonian Institution, Washington, D.C.)

FIG. 1.—*Choia carteri* Walcott, a silicious sponge.
FIG. 2.—*Ottoia prolifica* Walcott, a gephyrean annelid.
FIG. 3.—*Ottoia minor* Walcott, another gephyrean annelid.
FIG. 4.—*Aysheaia pedunculata* Walcott, a *Tomopteris*-like annelid.
FIG. 5.—*Canadia spinosa* Walcott, a polychaete annelid.
FIG. 6.—*Amiskwia sagittiformis* Walcott, a chaetognath.
FIG. 7.—*Waptia fieldensis* Walcott, a *Mysis*-like crustacean.
FIG. 8.—*Opabinia regalis* Walcott, a *Branchipus*-like crustacean.
FIG. 9.—Another specimen of *Opabinia regalis* Walcott.
FIG. 10.—*Burgessia bella* Walcott, an *Apus*-like crustacean.
FIG. 11.—*Marrella splendens* Walcott, a simple trilobite.
FIG. 12.—*Naraoia compacta* Walcott, a curious crustacean.

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PALAEONTOLOGY

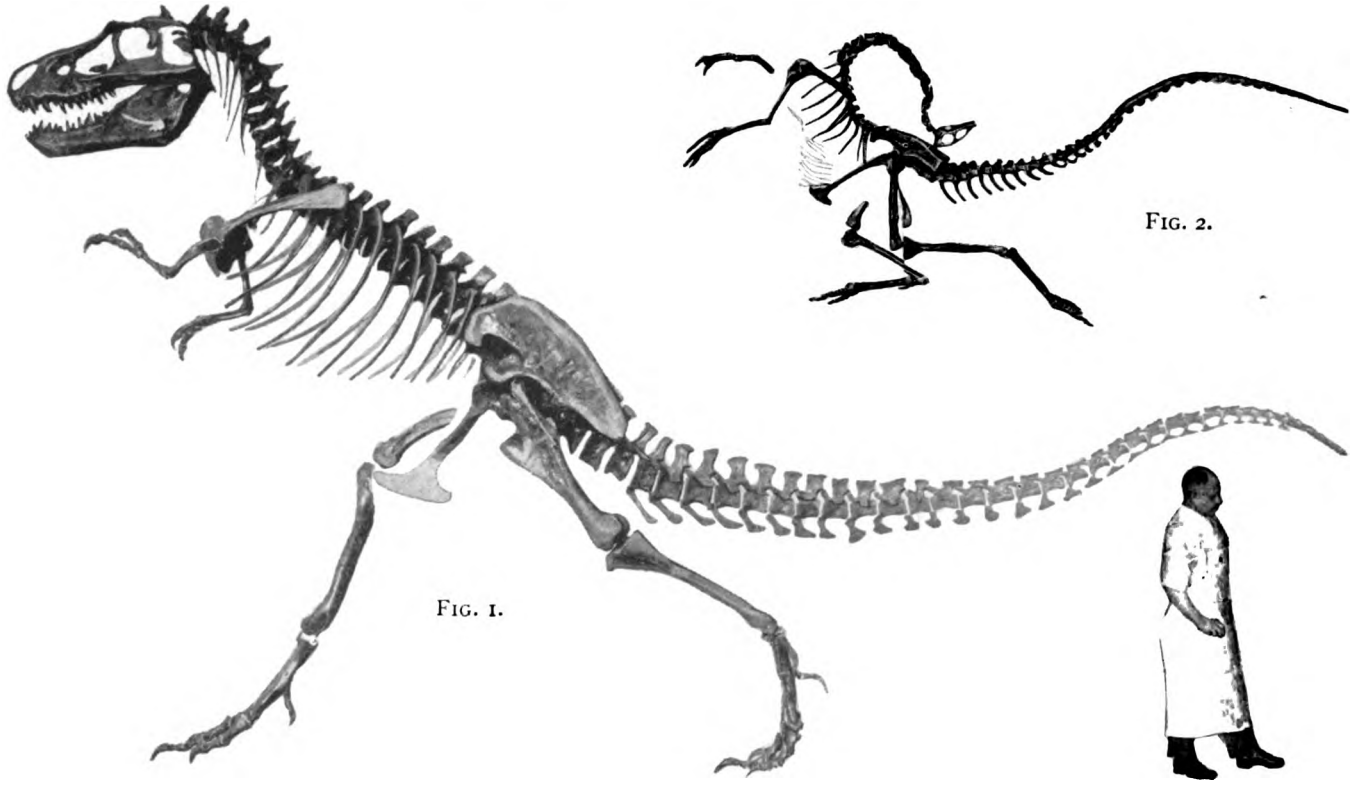


FIG. 1.

FIG. 2.

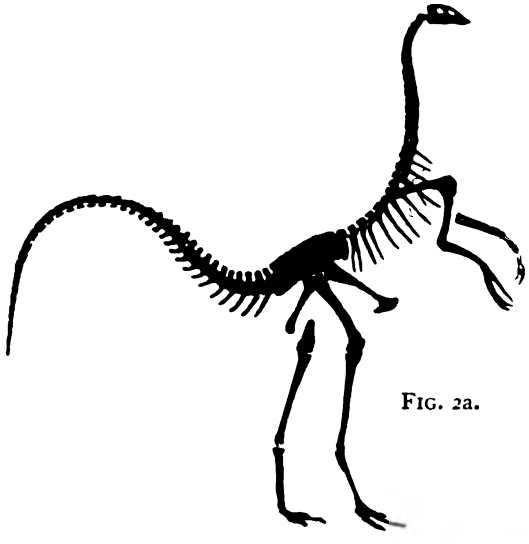


FIG. 2a.

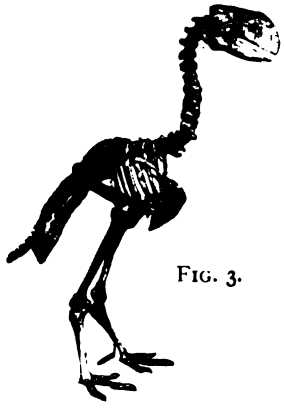
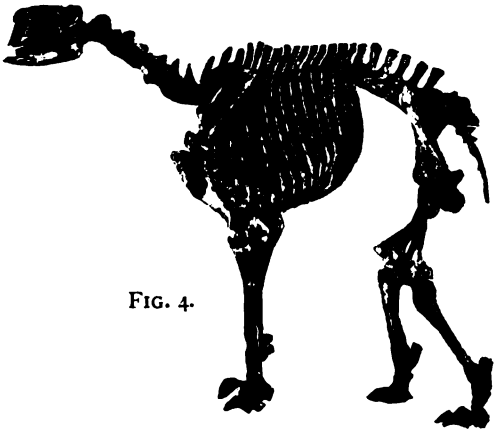


FIG. 3.



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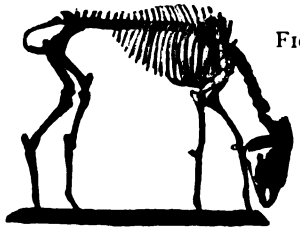

FIG. 5.

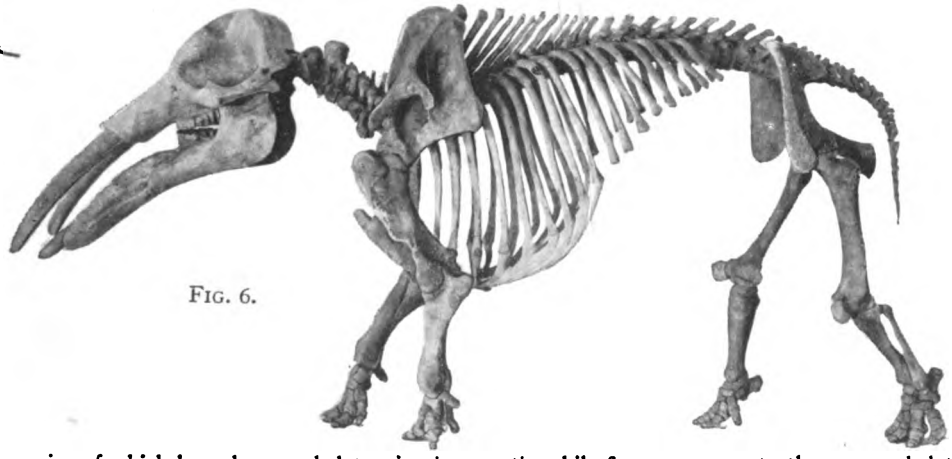

FIG. 6.

Notable vertebrate fossils, complete remains of which have been discovered during the last decade. The mounts from which the photographs were taken are in the American Museum of Natural History, New York. (Illustrations reproduced by permission of the President of the American Museum of Natural History.)

FIG. 1.—*Deinodon* or *Gorgosaurus*, a mid-Cretaceous carnivorous dinosaur from Alberta, Canada, mounted in running position.

FIG. 2, 2a.—*Struthiomimus*, the "ostrich mimic," a mid-Cretaceous browsing dinosaur, from Alberta, Canada, a toothless offshoot from the carnivorous dinosaur stock. Fig. 2 shows the complete skeleton in *rigor mortis*, while fig. 2a represents the same skeleton partly restored from fig. 2.

FIG. 3.—*Diatryma*, a gigantic mollusc-eating bird, from the Lower Eocene of Wyoming.

FIG. 4.—*Moropus*, an okapi-like herbivore, from the Lower Miocene of Dakota, related to the chalicotheres of Europe and Asia.

FIG. 5.—*Pliohippus*, direct one-toed ancestor of the modern horse, from the Lower Pliocene of Nebraska.

FIG. 6.—*Trilophodon*, direct descendant of *Mastodon angustidens* of Europe and North Africa, Lower Pliocene of northern Texas.

All the figures are on the same scale.

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vermann, Ernst Strömer (b. 1871) and Otto Jaekel (b. 1863). At Upsala in Sweden Carl Wiman has inspired a remarkably progressive group of workers, while in Switzerland Hans Georg Stehlin (b. 1870) has continued in the great field of Rütimeyer.

For the principal contributions by palaeontologists of the third and fourth groups above described, the reader is referred to the Memoirs and Bulletins of the American Museum of Natural History, of the university of California, of the Carnegie Institution of Washington, to the Contributions from the Palaeontological Laboratory (Peabody Museum) of Yale University, to the Memoirs and Catalogues of the British Museum (Natural History), to the Palaeontographica, and to the Memoirs of the Société Paléontologique Suisse. It is upon the researches of these workers in field and laboratory that the great synthetic volumes referred to earlier are chiefly founded, and that the following generalizations of modern vertebrate palaeontology are chiefly due.

Origins of the Great Vertebrate Stock and Its Branches

Origin of Chordates.—No discovery has thus far lessened the gap between the modern Protochordates (*Amphioxus*, tunicates, etc.) and any of the known phyla of invertebrates. Some of the cephalaspid ostracoderms have been cited by Patten as favouring the view that the chordates have been derived from certain arthropods, but such resemblances are ascribed to convergence by Dollo and many others. The earliest ostracoderm remnant actually known is a dermal plate of a genus named *Astraspis* from the Upper Ordovician near Canyon City, Colorado; this represents a new family Astraspidae allied to the Psammosteidae of the Silurian and Devonian (C. R. Eastman, 1917). These chordates, heavily shielded and hence known as *ostracoderms*, were dominant in the Upper Silurian, radiating into six families and many genera, abundant in the Lower Devonian, diminishing in the Middle Devonian and becoming extinct in the Upper Devonian.

Origin of Fishes.—The earliest fish remnant actually known is the fin-spined *Onchus* from the Upper Silurian of Scotland, which appears to represent the group of acanthodian sharks, covered with fine quadrate scales like those of ganoids and with a skull structure distinctly elasmobranch. The elasmobranchs (shark and ray types) are still the oldest known gnathostomes or true jaw-bearing vertebrates, constituting (*a*) one of the four primary gnathostome groups, *i.e.* jawed groups, the others being (*b*) the fringe-finned ganoids (Crossopterygii), (*c*) the ray-finned ganoids and teleosts collectively known as Actinopterygii and (*d*) the lungfishes (Dipnoi). The fossil ancestors of the fringe-finned ganoids have not yet been discovered; so these animals are theoretically traced to unknown cartilaginous fishes of Silurian times. The oldest Crossopterygian actually known is the *Osteolepis macrolepidotus* of the Middle Old Red Sandstone of Scotland. There were two principal periods of adaptive radiation among the Crossopterygii, the first in Middle and Upper Devonian times, the second in Mesozoic times which produced the family Coelacanthidae, from which may have sprung the existing fishes *Polypterus* and *Calamoichthys* as degenerate offshoots. From the earlier Devonian radiation of the Crossopterygians is traced the theoretic origin of the Dipnoi or lungfishes, on the one hand, and of the oldest known amphibians on the other. The Devonian Crossopterygian skull and fins appear to be "archetypal," to the lungfish type, on the one hand, and to the amphibian type on the other. Cope's genius in separating the Actinopterygii is sustained, for there is as yet no fossil evidence of the connexion of this group with the Crossopterygii, other than the supposed community of origin in Silurian times. Here the reader should consult the writings of Smith Woodward, Joseph F. Whiteaves, Bashford Dean, William K. Gregory and the synthetic reviews of Osborn (1918) and Lull (1917).

Origin of Amphibians and First Tetrapods.—In this epoch-making transition from the fringe-finned fish type to the tetrapodal amphibian and terrestrial type, the prophecies of Huxley, Cope and Baur and other great anatomists of the second and third groups of palaeontologists appear to be fulfilled. The Silurian period marked the parting of the ways among the great primary groups of fishes and the first steps towards the frame of the terrestrial amphibians. Not until the Upper Devonian of Pennsylvania do we find a footprint (*Thinopus antiquus* Marsh), which may be referred to an amphibian tetrapod. The first known actual skeletons occurred in the Coal Measures (Upper Carboniferous) of Europe and America and represented four widely radiating groups. The structural gap separating the earliest tetrapod amphibians and fishes is perhaps the greatest known in the whole range of vertebrate evolution, but all modern authorities agree that the amphibians were probably derived from a Silurian or early Devonian type of fringe-finned fish. Even as far back as the Upper Carboniferous and even in the Lower Carboniferous the Amphibia were adaptively radiating into several orders and numerous families comprising highly specialized forms. During the Carboniferous we find numerous independent phyla of eel-like or burrowing, and of compressed, swimming, as well as of large-bodied, predatory forms. The latter culminate in the gigantic labyrinthodonts of the Triassic. The exact connexion of any of these forms with the modern Amphibia (urodeles and Anura) is doubtful. The Anura first appear in the Jurassic, and at the present time they retain many characters reminiscent of such Palaeozoic Amphibia as the branchiosaurs and the *Eryops* group. The urodeles are first known in the genus *Hylaeobatrachus* of the Lower Cretaceous of Europe. Both groups, especially the Anura, appear to have gone through a wide adaptive radiation during the Tertiary. The connexion of the modern caecilians with the ancient types is obscure. The reader is referred especially to the contributions of Williston, Case, Watson, Gregory, Broili, and the synthetic reviews of Osborn (1918) and Lull (1917).

Origin of Reptiles.—The oldest-known reptiles, solid-headed *Cotylosauria* of Cope, are regarded as amphibians which had eliminated the aquatic stages in development, the oldest reptile actually known being the genus *Eosauravus* from the Coal Measures of Ohio. In other words, the cotylosaur reptiles are traceable to solid-headed stegocephalian amphibians, which, in turn, are traceable to solid-headed unknown Crossopterygians of Silurian times. The oldest and most primitive reptiles (*Cotylosauria*) occurring in the Upper Carboniferous and Permian, are thus structurally very close to certain contemporary stegocephalian amphibians. The first great adaptive radiation of the reptiles into the two grand divisions, the solid-headed (*Cotylosauria*) and the temporal-arched (*Pelycosauria*), began in the Upper Carboniferous and still more widely diverged in Permian times. As early as the Permian, occurs a mammalian-like series of reptiles which exhibits an extensive adaptive radiation and gives off one branch, the *Cynodontia*, which, in turn, survives into Triassic times and clearly approaches the mammalian grade of organization. From the primary temporal-arched also appear the forerunners of the Mesozoic reptiles, the plesiosaurs, ichthyosaurs, dinosaurs and pterosaurs, widely separated from each other in the Triassic and thus having their branches deep down in the Permian and Carboniferous, each grand division giving rise to an adaptive radiation of its own. These have been traced in detail by such authorities as Andrews, Dollo, Abel, von Huene, Williston and Osborn.

Here the reader is referred to the writings of Williston, Hatcher, Osborn, Merriam, Lambe, Lull, and especially during the past decade to those of Charles W. Gilmore of the United States National Museum, Washington, and of Dr. Robert Broom of South Africa, as well as to the synthetic reviews of Osborn (1918) and Lull (1917).

The two greatest achievements of the decade are the clearing up of the relationships of the primitive South African terrestrial Reptilia of the Perm-Trias, beginning with the solid-headed types (pareiasaurs) and ending in their highest expression, the mammal-like types known as *Cynodonts* and *Theriodonts*. The field explorations of Robert Broom and the profound comparative researches of D. M. S. Watson and of William K. Gregory have given us a clear comprehension of the habits and relationships of this first terrestrial radiation group. Williston and Case have covered the same great period in America.

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Origin of Birds.—Palaeontologists still agree in endorsing Huxley's opinion that birds are "glorified reptiles." The origin of birds, according to recent reviewers such as Osborn and Gregory, brings us close to the two-temporal-arched (*i.e. Diapsida*) reptiles, namely, to the stem which also gave off the dinosaurs, the pterosaurs and the smaller parasuchians (*Euparkeria*). Fossil bird remains are extremely rare. The earliest bird known is the famous *Archaeopteryx* of the Jurassic of Solnhofen, Germany. This is largely a bird, excepting in the tail, the simplicity of the feather arrangement and the possession of teeth. According to the four-winged hypothesis of origin advocated by Beebe, we should some day discover a bird with parachute-like action in both fore and hind limbs. Recent contributions of note on this subject are those of Gerhard Heilmann (1913) and of William Beebe (1915), and the synthetic reviews of Osborn (1918) and Lull (1917).

Origin of Mammals.—Evidence has been accumulating rapidly in favour of the theory that the origin of the mammals should be traced to the more progressive terrestrial mammal-like reptiles (the *Cynodontia*) of the Permian and Triassic of South Africa and Europe, as described in the studies of Broom, Watson, Haughton, Osborn and Gregory. Structurally related to these Cynodonts are the so-called *Protodonts* of Osborn, *e.g. Dromatherium* and *Microconodon* of the Triassic of North Carolina. But of equal antiquity are the multituberculates, *e.g. Plagiaulax* and *Microlestes*, widely spread over Europe and North America. No substantial additions have been made during the decade to our knowledge of this vague period; readers are referred to the reviews of Osborn (1918) and Lull (1917), also to the recent works of Gregory, *The Orders of Mammals* (1910) and *The Origin and Evolution of the Human Dentition* (1921).

Origin of Primates and of Man.—Combined palaeontological and anatomical evidence indicates that the source of the Primates is to be looked for among tree-living insectivorous mammals more or less closely similar to the modern tree shrews (*Tupaiidae*) of Africa. This view advanced with ability by Gregory is in general accord with the opinion that during the phase of arboreal life many of the psychic and anatomical characters of the Primates were acquired. It was not until the Lower Eocene of North America and of Europe that there appeared undisputed Primates of lemuroid affinity, *e.g.* notharctids and tarsioids in America, adapids and tarsioids in Europe. At this time the zoölogical relation of the two continents was close and it would appear that while the primitive horses were acquiring their cursorial characters on the ground, these primitive lemuroids were acquiring their distinctive characteristics in the trees. Actual ancestors of the existing *Tarsius* of Madagascar have been found in France (*Pseudoloris*). The attempt of Ameghino to trace the higher Primates to South American types, *e.g. Homunculus*, appearing in the Lower Miocene of Patagonia, is not supported, because these animals from the first are the true broad-nosed, *i.e.* platyrrhine, type still characteristic of South America. The Old World division of the catarrhines or narrow-nosed true Primates has been traced to the *Parapithecus*, described by Max Schlosser from the Lower Oligocene of Egypt. *Propliopithecus* is possibly ancestral to the true anthropoid apes and thus possibly related to the ancestors of man himself. Darwin's broad conclusion that man was derived from "some ancient member of the anthropomorphous subgroup of Old World Primates" is fully sustained by anatomical evidence, but the precise lines of descent are still in dispute. Some hold that the human line came from Middle Tertiary anthropoid apes allied to *Dryopithecus* of France and *Sivapithecus* of India, while others (including the present writer) regard the Hominidae as a widely distinct family separated especially by its upright walking gait, by the non-divergence of the great toe, and by the retention of its tool-making thumb. A series of masterly reviews of this whole question has appeared in the American Museum publications from Gregory, whose recent memoir *On the Structure and Relations of Notharctus, an American Eocene Primate* (1920) sums up our present knowledge of this whole subject. (*See* ANTHROPOLOGY.)

The Dinosaur Fauna of Alberta, Canada.—The greatest new achievement in exploration is the revelation of the dinosaur fauna of Alberta in the fossil beds extending along the Red Deer river, which were first made known to science by explorers of the Canadian Geological Survey in 1897, 1898, 1901. The first general review of this wonderful fauna was that of Osborn and Lambe, *On Vetebratra of the Mid-Cretaceous of the North West Territory* (1902), based chiefly on the collections in the Ottawa Museum. The American Museum explorations under Barnum Brown, which extended over ten years, have resulted in the discovery of the entire fauna of the middle portion of Upper Cretaceous time, a complete revelation especially of the dinosaur world as it approached the height of its adaptive radiation into herbivorous and carnivorous, armoured and defenceless, swift-moving and slow-moving types, which severally imitate more or less fully the long subsequent adaptive radiation of the mammals. In 1914 the Canadians renewed exploration, so that at present the Ottawa and Toronto Museums have rich collections, part of which has been described by the late Lawrence M. Lambe, while Osborn, Barnum Brown and W. A. Parks have also made known a part of this wonderful fauna. Two of the greatest extremes of adaptation, namely, *Deinodon* or *Gorgosaurus* and *Struthiomimus*, are figured in the accompanying Plate II. In the same plate appear some of the outstanding American discoveries of the decade.

New Discoveries Among Fossil Vertebrates

Fossil Fishes.—Dr. A. Smith Woodward's *Fossil Fishes of the English Wealden and Purbeck* (1915–8) is a beautifully illustrated memoir of the most thorough, systematic type, well sustaining the traditions set by Traquair and by the author himself in earlier works. The period dealt with affords an interesting cross-section of the stream of piscine evolution, at a time when many of the old Mesozoic ganoids were dying out and the teleost fishes were beginning their remarkable expansion. Other important systematic memoirs are those by Stolley on the ganoids of the German Muschelkalk (1920) and by Stensiö (1921) on Triassic fishes from Spitzbergen. The latter memoirs contain a wealth of material of great morphological interest concerning the early stages in the evolution of the skull of the fringe-finned and ray-finned ganoid fishes; this discussion also throws light on the origin of certain elements in the skull of higher vertebrates. In this connexion should be mentioned the brief but highly important paper on *Eusthenopteron* by W. L. Bryant (1919). This fringe-finned ganoid is of particular interest because the construction of its skull and paired limbs approaches the type which may be expected in the piscine ancestors of the land-living vertebrates. The arrangement of the elements on the under side of the skull of this fish raises morphological questions of wide general interest. Papers by Watson and Day (1916) and by Gregory (1915, 1920) deal with the ancestral relations of these fringe-finned ganoids with the land-living vertebrates (tetrapods).

The swarming fauna of Devonian arthrodires, ptyctodonts, cladodonts and other archaic fossil fishes from the vicinity of Buffalo, N.Y., is ably described by Bryant and Hussakof in their *Catalog of the Fossil Fishes in the Museum of the Buffalo Society of Natural Sciences* (1918). A serious difficulty encountered by all students of recent and fossil fishes is the getting in contact with the vast and scattered literature of the subject. The great *Bibliography of Fishes* by Bashford Dean and his associates Eastman and E. W. Gudger (1917) will undoubtedly stimulate research in this field.

Fossil Amphibians.—The outstanding publications in this field are *The Coal Measures Amphibia of North America* by R. L. Moodie (1916) and a memoir on *The Structure, Evolution and Origin of the Amphibia* by D. M. S. Watson (1919). Moodie's memoir is a valuable description and compilation of the extensive and varied fauna of swamp-living amphibians of the American Coal Measures. Watson's memoir is a brilliant and highly original contribution to the classification and phylogeny of the labyrinthodonts. Much detailed work on fossil amphibians appears in papers by von Huene, Broom, Williston, van Hoepen, Haughton and others.

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Stem Reptiles.—In the field of the oldest reptiles, those of the Carboniferous and Permian, perhaps the most important contributions are those by S. W. Williston and D. M. S. Watson. The former, in his paper on *The Phylogeny and Classification of the Reptiles* (1917), traces the rise of the common amphibian-reptilian stock through the "Protopoda," which are so far known only from certain footprints of Upper Devonian age. According to Williston, who built on Osborn's system of 1903–4, the primitive reptilian stock early divided into the following series:—

Anapsida (Cotylosauria and their specialized descendants, the modern tortoises and turtles).
Synapsida (Theromorpha or pelycosaurs, etc.; Therapsida, or mammal-like reptiles, the latter giving rise to the mammals; plesiosaurs).
Diapsida (reptiles with two temporal arches, such as crocodiles, dinosaurs, rhynchocephalians; this stock gave rise to birds).
Parapsida (including the proganosaurs, ichthyosaurs, lizards, mosasaurs, snakes).

Watson (1917), in his *Sketch Classification of the Pre-Jurassic Tetrapod Vertebrates*, assigns a high value in classification to the characters of the brain-case. A general and conservative classification of the early reptiles is given by W. K. Gregory (1920). The most primitive known reptile, *Seymouria*, from the Permo-Carboniferous of Texas, almost bridges the gap between the Amphibia and the Reptilia. Watson (1919) gives a morphological description of this reptile, accompanied by valuable figures and reconstructions of the skull and skeleton.

The habits and environments of the teeming reptilian and amphibian faunas of the Permo-Carboniferous of North America are intensively considered in a memoir by E. C. Case (1919), which also deals with the stratigraphy, climatology and palaeogeography of the late Palaeozoic.

Mammal-like Reptiles.—In no other field of fossil reptiles has the progress of discovery been more satisfactory than in that of the mammal-like reptiles of South Africa, as set forth in numerous papers, especially by Watson (1913–4), Haughton (1918), Broom (1913–4), van Hoepen and others. The relationships of these animals with other reptiles and with the mammals have been reviewed by W. K. Gregory (1920–1).

Marine Reptiles.—These have always been of great interest on account of their secondary adaptations to aquatic life which have been ably discussed by Abel (1912, 1919). One of the outstanding contributions of new material in this field is the *British Museum Catalogue of Marine Reptiles of the Oxford Clay* by C. W. Andrews (1910–3). The origin and relationships of the plesiosaurs and their allies are treated by von Huene (1921).

Dinosaurs.—The Triassic dinosaurs of Europe are of particular interest because some of them tend to connect the very diverse carnivorous and herbivorous saurischian dinosaurs of later ages. Here the leading author is F. von Huene, in a long series of papers and memoirs. *Plateosaurus*, perhaps the most primitive of these reptiles, has been fully described both by von Huene and by Jaekel (1913–6). Primitive dinosaurs from the summit of the Karroo series in South Africa (*Gryponyx*, *Massospondylus*, etc.) are described by Broom and Haughton. During the long ages of the Jurassic the gigantic sauropodous dinosaurs attained their maximum in size and specialization. The leading feature in this field is the description of the strange and monstrous dinosaurs of the Tendaguru fauna of East Africa in the collections of the Berlin Museum, by Janensch (1914). One of the most remarkable of the North American sauropods is the genus *Camarasaurus*, which has been intensively described by Osborn and Mook (1921). *Barosaurus*, a gigantic relative of *Diplodocus*, with a tremendously heavy neck, has been described by R. S. Lull (1919). *Tyrannosaurus*, the greatest carnivorous reptile of all time, and *Struthiomimus*, a contemporaneous ostrich-like dinosaur, have been described by Osborn (1912–9). The highly varied and grotesque armoured dinosaurs, namely, the Ceratopsia and related groups, have been the subject of numerous papers by Gilmore, Brown, Lambe and others.

Pterosaurs.—The pterosaurs, or flying reptiles, have continued to excite the interest of students of flight, such as Abel (1912), Watson and Hankin (1914), Arthaber (1921). The greatest flying reptile, *Pteranodon*, is the subject of a memoir by Eaton (1910) of Yale University.

Chelonians.—An important memoir by O. Jaekel (1913–6) describes the skull, skeleton, carapace and plastron of *Triassochelys dux* from the Upper Triassic of Germany. Although widely differentiated from all other orders this reptile was the most primitive of all known chelonians. Of even greater interest is the *Eunotosaurus* from the Permian of South Africa which Watson (1914) describes as a veritable "Archichelone."

Fossil Birds.—*Diatryma*, a gigantic ground bird from the Lower Eocene of Wyoming, has been described by W. D. Matthew and W. Granger (1917) from a nearly complete skeleton, which is a most rare and valuable fossil. This bird, which has no near relatives, was about seven feet high and of massive proportions, with an enormous head and great compressed beak. The wings were vestigial. This high degree of specialization at such an early epoch indicates that the modernized groups of birds were differentiated during the latter part of the Age of Reptiles.

Monographs on Special Groups of Tertiary Mammals.—The fossil mammals of the basal and Lower Eocene of the western United States are represented in the American Museum of Natural History by collections numbering many thousands of specimens which are being described jointly by Matthew and Granger (1915). Besides describing many new or little known forms these authors also deal with the relationships and morphology of the various groups of early placental mammals. In the paper dealing with the edentates and their relatives, the "palaeanodonts," Matthew (1918) advances the view that the modern Pholidota (Pangolins) are an offshoot of the primitive "palaeanodonts" of the Lower Eocene. Other papers of the same series cover the Creodonts, Insectivores, Primates and Condylarths.

Several mid-Tertiary mammalian groups, such as chalicotheres, entelodonts and the diceratheres, have been revised in the publications of the Carnegie Museum, Pittsburgh, by W. J. Holland and by O. A. Peterson.

Baluchitherium, perhaps the most gigantic land mammal of all time, has been described by C. Forster-Cooper (1913) from a huge atlas, astragalus, cervical vertebrae and limb bones from the Upper Oligocene deposits of the Bugti Hills of Baluchistan.

The evolution of the Sirenia is treated by Abel (1921) and by Depéret (1920); that of the Cetacea by Abel (1919) and by Winge (1918–21). The phylogeny and evolution of the Proboscidea are considered in the researches by Schlesinger (1917), Matsumoto (1915) and Osborn (1918–21). The Eocene and Oligocene titanotheres have been dealt with in numerous papers by Osborn in preparation for his monograph on these extinct animals. The revision of the mid-Tertiary Equidae by Osborn (1918) affords an exceptionally full document on the exact course of evolution in the multitudinous phyla of a typical mammalian family. A most valuable expansion of our knowledge of the anthropoid apes of the mid-Tertiary is found in the work of Pilgrim (1915) on the fossil apes of India of the genera *Dryopithecus* and *Sivapithecus*.

South American Fossil Mammals.—The strange offshoots of the ungulate and edentate orders which swarmed in Patagonia during the mid-Tertiary and Pleistocene times are treated in the excellent memoirs of the Princeton University Patagonian expeditions by W. B. Scott. Herluf Winge has admirably monographed the fossil and recent edentates of Brazil. The mammalian fauna of the Deseado formations is described by F. B. Loomis of Amherst College. These and other investigations are correcting the erroneous correlations by Ameghino, in which the older mammal-bearing horizons of Patagonia were assigned to the Cretaceous. This more modern work indicates that the Pyrotherium beds are not older than Upper Eocene and that the Santa Cruz formation is of Lower Miocene Age.

The Pleistocene fauna of Tarija, Bolivia, is the subject of a beautiful memoir by Boule and Thévenin (1920), in which the anatomy and relationships of "*Mastodon*" *andium* and of the highly specialized horses *Hippidium* and *Onohippidium* are treated.

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Pleistocene Mammalian Faunas (*North America, Europe*).—The Pleistocene represents the climax of the Age of Mammals in point of differentiation and richness of mammalian faunas. In Europe the Pleistocene faunas have been the subject of memoirs by Boule, Schoetensack and many others. In North America we have the teeming fauna of the Rancho La Brea, California, described by Merriam, Stock and their colleagues of the university of California. The correlation of the American Pleistocene faunas has been treated especially by Osborn and by Hay.

In the preparation of this article the writer is especially indebted for the entire invertebrate section to the coöperation of Miss Marjorie O'Connell, who has summarized the chief discoveries in Pre- and Postcambrian time and given a review of the outstanding literature in the invertebrate field. He is also indebted to Charles D. Walcott, chief authority on Cambrian and Precambrian life of the world, for the type figures assembled in Plate I.; to Curators Matthew and Gregory of the American Museum for a revision of the text relating to the evolution of the vertebrates; and to the President and Trustees of the American Museum for permission to reproduce the photographs which are assembled to the same scale on Plate II.

(H. F. O.)

PALESTINE (*see* 20.600).—During the earlier years of the decade 1911–21 little of importance occurred in that country. Afflicted by the economic stagnation and financial strain which affected the whole Ottoman Empire in consequence of the war with Italy (1911–2), and the war with the Balkan States (1912–3), Palestine was unable to develop herself in any way before the outbreak of the World War in 1914. Yet to a section of her population the decision of the Palestinian Jews, in the autumn of 1913, to reject German and insist upon Hebrew as the language of instruction and to secede from the *Hilfsverein* and set up schools of their own, was momentous. The outbreak of the World War, besides leading to a renewed blockade of the coast, and fresh military requisitions, also involved the expulsion or internment of numerous ecclesiastics and laymen of Entente nationalities and the deportation of numbers of Jews. It was followed at the beginning of 1915 by one of the most destructive visitations of locusts recorded for a generation. Thereafter until the arrival of the British army in the autumn of 1917 the prosperity of the whole country slowly withered under the crushing burden of the war.

At the time of the British occupation of Jerusalem in Dec. 1917 the economic situation of southern Palestine was bad. Not only had the Turks requisitioned far and wide without repayment, or against inadequate payment, but they had cut down numbers of olives and revenue-producing trees and carried off the greater part of the agricultural and draught animals. The paper currency had depreciated some 84% and was no longer accepted by the producing classes—mostly outlying Moslem peasants—who would only discover their concealed stores of grain for gold. The civil population of Jerusalem, dependent ordinarily upon the pilgrim traffic or upon the offerings of pious Jews for its livelihood, was emaciated and reduced by starvation. The only products which Jerusalem had to sell were designed for the pilgrim trade and were unmarketable; consequently at the beginning of the occupation many shops were able to offer only cigarettes, picture-postcards and wild radishes for sale.

In view of this it was urgently necessary to provide food for the exhausted inhabitants of Jerusalem and Palestine, to provide work for the purpose of enabling them to earn money with which to pay for the food, and to re-start trade in order that the mercantile community should have something to barter against the gold hoarded by the peasantry and thus make it worth the peasant's while to cultivate and market his produce as he had for some time past realized that his gold was unable to buy the trade goods he required. But there were grave difficulties—the single line of railway by which alone food or trade goods could be brought from Egypt was very fully occupied with the paramount needs of the army. The daily tonnage of supplies alone—not including munitions or transport of men or guns—varied from 800 to 2,300. Ammunition was often 250 tons per day. The civilian population was unaccustomed to the Egyptian currency and more than suspicious of paper money, and Egyptian silver put into circulation was at once hoarded against the proximate return of the Turks, which was confidently predicted by enemy sympathizers who further assured every one that the Egyptian paper pound at par was worth no more than the depreciated Turkish paper lira and offered to prove it by readily exchanging Turkish for Egyptian pounds whenever possible—at a profit to themselves of 17s. 7d. on each deal. Yet without money the civilians could not buy food, without food they could scarcely walk from weakness, and there was every prospect of the establishment of a vicious circle.

Brig.-Gen. G. F. Clayton (afterwards Sir Gilbert Clayton), chief political officer to Gen. Allenby, was appointed chief administrator and began to construct such a form of government as is provided for in "The Laws and Usages of War" laid down by international agreements embodied in the Hague Convention. Transport for a few truck-loads of foodstuffs per week was secured from the military railway, and lorries brought it to Jerusalem until the army was able to reopen the narrow-gauge line from Ludd to the Holy City. Then a small consignment of trade goods came up from Egypt and merchants were permitted to import small quantities from Egypt independently of the over-burthened railway. The labour corps employed numerous civilians, paying them at first daily in Egyptian silver and paper, and then weekly in cash or kind at the choice of the labourer. In this way the new currency came to its own, helped by the stringent measures taken by the military administration to suppress trafficking in or artificial depreciation of Egyptian paper. With the arrival of trade goods in the towns the peasants began to spend their gold and sell their produce so freely that it became unnecessary to import so much food and more accommodation thus became available for other merchandise. But even so, 900 tons of cereals had to be imported monthly for the use of refugees alone. Gen. Clayton took other steps to restore public confidence and reëstablish the amenities of civilization. Bazaar gossip and rumour which for some weeks was hostile to the British was counteracted by the publication of Arabic and Hebrew editions of the newspaper, *The Palestine News*, which had been started by the army in March 1915, and intercourse with the greater part of the world was rendered possible by the restoration of the postal service, for which special stamps for the use of the civilian population began to be issued on Feb. 16 1918. Steps were taken to reassure the Moslems, who were much alarmed at reports sedulously propagated by the enemy, that all land was to be given to the Jews, and resident British officers were appointed to administer the various *kazas* of the old Turkish regime. Thus military governors were established at Gaza, with a deputy at Mejdel; at Jaffa, with a deputy at Ramleh; at Beersheba; at Hebron, with a deputy at Deir Aban; and at Jerusalem, with deputies at Bethlehem, Jericho and Ramalla. At first the Occupied Enemy Territory Administration ("O.E.-T.A.") was at Bir Salem, near Ramleh, the general headquarters of the army, but later when it became impossible for Gen. Clayton any longer to combine O.E.T.A. with the work of the political mission, Maj.-Gen. Sir Arthur W. Money was appointed chief administrator in April 1918, and he removed the administration to the imposing and convenient Empress Victoria Hospice built by the Germans on the Mount of Olives just before the war. In March the country had so far recovered that it became possible to collect taxes once more, in May public confidence was greatly increased by the skilful and tactful handling of the great Moslem religious festival of the Nebi Musa pilgrimage, invented by the Turks as an artificial check on the great Christian gathering at Jerusalem for the Orthodox Easter, with which it always coincides regardless of the Moslem calendar, and by the successful way in which the dangerous, and often fatal, ceremony of the Holy Fire on the Orthodox and Gregorian Easter was conducted by Col. Storrs the military governor of Jerusalem, and Haddad Bey the Syrian chief of police.

During the summer the administration was able to resume the payment of revenues appropriated by international agreement to the service of the Ottoman debt, but the income of the Moslem Waqfs (pious foundations) was used for the benefit of Moslem beneficiaries in Palestine instead of being drained

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away to Constantinople. A local police force was built up, schools and law courts reopened and the country benefited largely not only by the roads and bridges built by the army, but from the wages paid locally by the army for labour and the transport system established by the army for the use of civilians. In the absence of the ordinary pilgrims the army furnished excellent substitutes, and Jerusalem began once more to flourish on the money freely spent by military visitors.

In April 1918 the Royal Engineers undertook a work of permanent utility to Jerusalem by way of compensating the inhabitants for the use made by the army of their carefully stored water supply. At that time the city depended upon an aqueduct yielding 1,650 gal. per hour and upon rain-water storage of about 360,000,000 gal. A new reservoir containing 200,000 gal. was built above the town and fed from the Wadi 'Arrub springs 12 m. S. (used for the same purpose in the days of Herod and Pontius Pilate by the Romans) at the rate of 12,500 gal. per hour. This system, opened on June 18, was subsequently improved by the British administration.

The visit of the Zionist commission under Dr. Chaim Weiszmann and the careful abstention from controversial topics of the only Palestine newspaper did much to abate the alarm of the Moslem population caused by Mr. Balfour's declaration. A further useful function was performed by the army in its sales of young camels and cast army beasts by public auction at Ramleh. According to local standards a "cast" army animal was in more than the prime of life and buyers came from the Hejaz and other parts of Arabia to buy the baby camels which had been born of unusually well-fed and healthy parents and had themselves been nourished on a scale of efficiency entirely unknown to native camel masters.

Later in the year when the Sept. advance had finally driven the Turks out of Palestine the O.E.T.A. was divided into three sectors—South (Jerusalem) East (Damascus) and North (Beirut). A little later, after the Armistice of Nov. 11 1918 and the subsequent occupation of Cilicia, O.E.T.A. North became O.E.T.A. West, and a new north sector was formed at Adana. In O.E.T.A. South, of which Gen. Money continued as chief administrator, British military governors were established at Nablus with a deputy at Hable; Jenin with a deputy at Beisan; Tul Keram; Haifa, with deputies at the Jewish colony of Zimmarin and Acre; and Nazareth with deputies at Tiberias and Safed. On August 15 1920 the system of governorships for Palestine was revised, Hebron was added to Jerusalem, Tul Keram was added to Jaffa, Nazareth and Tiberias were amalgamated to form Galilee, Haifa district became Phoenicia, and Nablus and Jenin were amalgamated to form Samaria. Thus Palestine is now administered by five district governors at £E1,200 a year each, with the help of assistant governors and by two district governors at £E850 each (Gaza and Beersheba).

In the spring of 1919 Sir Arthur Money was succeeded as chief administrator of O.E.T.A. South by Maj.-Gen. Sir Louis Bols, formerly General Allenby's chief of staff, who had to contend with a difficult situation. As no peace settlement had been arrived at, he still had to administer the country on Turkish lines in conformity with the "Laws and Usages of War," while on the one hand eager Zionists complained that nothing was being done to carry out the Balfour declaration as interpreted by its most extreme partisans, and on the other the Moslems protested against what they considered to be Jewish aggression, and various foreign powers sought to establish or revive their influence among the various Christian communities in the country. The Arab tribes beyond Jordan were not under proper control, as the Sherifian government in Damascus was not strong, and parties of desert freebooters revived the time-honoured custom of raiding the settled lands. This combined with the anti-foreign agitation which arose out of the difficulties and delays caused by the contradictory assurances given at one time and another on behalf of the British Government to the French and the Arabs led to serious trouble which was brought to a head soon after the Emir Faisal had been declared King of Syria in Damascus (March 10 1920). In Jerusalem the Moslem procession at the Nebi Musa celebrations was exploited as a manifestation of Arab Nationalist sentiment against the Zionist Jews, many of whom had excited the animosity of the Moslems by unwise and tactless propaganda. Public statements had been made which Moslems could easily misunderstand and represent as threats against their own undisturbed possession of their ancestral properties and sacred sites, and a counter-propaganda directed towards a general agreement of Moslem land-owners to refuse to sell or lease land to non-Moslems had played its part in inflaming the crowd against Jewish immigrants. Riots took place on April 4 and 5, and, as the Moslem police in many cases preferred to yield to religious enthusiasm instead of doing their duty impartially, order had to be restored by British and Indian troops. The casualties were 5 Jews and 4 Moslems killed, 211 Jews, 22 Moslems and 2 Christians wounded. A number of persons were arrested and among the Jews sentenced for "possessing firearms, instigation to disobedience by arming the populace, conspiracy and preparing means to carry out acts of riot" was Mr. Vladimir Jabotinsky who had played a distinguished part in helping to raise a Jewish battalion for the British army. Several Moslems were sentenced to long terms of imprisonment for rape or for possessing firearms. Mr. Jabotinsky's sentence was shortly afterwards reduced and he was released on July 8 under the amnesty which followed the introduction of civil government. Later in April, the Ghazzawiye Arabs raided Beisan on several occasions and carried off 119 head of cattle and 259 sheep and goats, and on April 24, 2,000 Arabs attacked the British garrison at Semakh, but had to retreat leaving 100 casualties behind them. Raids were also made further down the Jordan valley, and in the N. some 2,700 refugees, Christians and Jews, fled into Palestine in May to avoid the Metawali who were massacring in the hills above Tyre.

On July 1 1920 the Rt. Hon. Sir Herbert Samuel became first high commissioner of Palestine under the mandate which was in principle accorded to Great Britain at the San Remo conference in April, although the text of the document was not drafted until 1921 and its precise terms had not yet actually been confirmed by the council of the League of Nations. Civil Government was introduced, and for the first time, the British flag was hoisted over Jerusalem. An amnesty was granted (July 8), the censorship was abolished (July 19), and on August 31 an advisory council composed of seven Moslems and Christians and three Jews was created to sit with the high commissioner. At the same time Hebrew was declared an official language together with English and Arabic, and made obligatory for public notices in areas inhabited by 20% or more of Jews (Jerusalem City, and the kazas of Jaffa, Tiberias, Safed, Ramleh and Haifa). Drinking-bars were suppressed throughout Palestine, and the use of stucco and corrugated iron for new buildings or repairs within the walls of Jerusalem was prohibited.

At the end of 1920 the payments of various dues to the account of Ottoman Regie and the prohibition against the cultivation of tobacco in Palestine came to an end.

Frontier.—On Dec. 23 1920 the frontiers of Palestine towards French Syria were fixed in such a way as to include a small additional area, comprising Kades, Metulla and Dan, in Palestine, but retaining the whole of the Litani-Leontes watershed for Syria. In April 1921 the visit of Mr. Churchill, Secretary of State for the Colonies, to Jerusalem, afforded an opportunity for interview with the Emir 'Abdalla, brother of the Emir Faisal, which resulted in the recognition of Arab authority over the territories to the east of Jordan (*see* TRANSJORDANIA), thus fixing that river as the eastern boundary of Palestine except at Semakh on the Sea of Galilee.

Immigration.—During 1920, as transport became available, a number of expatriated Jews began to return to Palestine, as well as new Jew immigrants, many of whom (*Halutzim*) were employed by the Zionists in the work of opening up and reconstructing waste lands, for additions to which the Jewish National Fund raised £160,000 during the year. On Oct. 22 1920 the deported German colonists, chiefly from the Haifa district, were allowed to return.

Some of the new immigrants seem to have adopted communistic views before leaving Russia, and on May 1 1921 a party of these disturbed a Jewish labour meeting at Tell Aviv ('Ahf), near Jaffa. A struggle ensued in which Moslems became involved, and this developed into a racial riot of so formidable a nature that the local police were unable to suppress it, and British troops had to be called in. Although the riot was stopped that evening, there was further trouble for two or three days. At no time, however, did the troops have to open fire in Jaffa, but the rioters killed 30 Jews and 10 Arabs and injured 170 Jews and 57 Arabs, before order was restored.

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The police arrested 66 rioters, and the leading notables of both religions concerned coöperated with the authorities in calming the population. An inquiry was subsequently held by the Chief Justice of Palestine and two British officials, while Jewish immigration into the Holy Land was suspended for two months (until July 8).

Jewish Agricultural Colonies.—For many years past the piety of Jews all the world over has prompted them to contribute towards the support of the large numbers of Jews resident in or immediately outside Jerusalem on the understanding that the constant prayers and wailings of these—the Jews of the *Haluka*—should benefit also their benefactors. A more modern development of this system led to the foundation of a number of agricultural colonies in other parts of Palestine, which also were for many years dependent upon outside benevolence. With the growth of experience the agricultural colonists, unlike their brethren of the *Haluka*, tended to become more and more self-supporting under the guidance of Baron Hirsch's foundation, the J.C.A. (Jewish Colonization Association), which first began to treat the colonies as a commercial rather than a charitable or sentimental proposition. The earlier colonies had devoted themselves exclusively to viticulture and were embarrassed alike by the attacks of phylloxera and the difficulty of marketing their wine. After the introduction of almonds and oranges and other fruits prospects improved, but until the end of the Turkish period the colonies were much hampered by legal difficulties connected with the purchase and tenure of land, the status of the colonists and the lack of a definite policy. During the war the colonies suffered owing to the deportation of many of the colonists, the requisitions of the military, and the cutting down of large numbers of trees, as well as from the loss of all their foreign markets.

After the war the Zionist Commission greatly improved the prospects of Jewry in Palestine, which, under the Balfour Declaration of 1917, was to become once more a national home for the children of Israel, by organizing a new national life and arranging for the immigration of the *Halutzim*, or Pioneers, young and zealous workers from all parts of Jewry, who began to prepare the country for future arrivals. In 1920 the influx of Jews into Jerusalem was shown by the Immigration Department of the Zionist Commission as follows: Jan. 122, Feb. 139, March 124, April 122, May 98, June 105, July 107, Aug. 178, Sept. 237, Oct. 197, Nov. 218, Dec. 233; total 1,860, of whom 1,251 were men and 609 women, of whom again 1,169 were new immigrants and 696 returning refugees. Jaffa is the principal port of entry, 1,400 Jews having landed there in Sept. 1920. It is estimated that between Dec. 1919 and March 1921 some 11,000 Jews entered Palestine, of whom 3,000 were returning refugees. On the other hand some 3,000 persons emigrated from Palestine during the same period, among whom were many Jews.

The bulk of the new immigrants, up to the end of March 1921, came from Poland, Russia, Morocco, Austria, Syria, Bulgaria, Rumania, Egypt, Hungary, Persia, France, Greece, Germany and England. Each immigrant is provided with a certificate of origin from the Zionist Emigration Office (Palestine Office).

The table shows the area and population of the Jewish colonies founded before the British occupation:—

Land Transfer.—During the whole of the military administration and until Oct. 1920 the sale or transfer of land in Palestine was forbidden, partly because the Turks had removed all official land registers to which appeal could be made for the settlement of disputed titles, and partly to avoid internal trouble which might arise from the transfer of land from a vendor of one religion to a purchaser of another. When this order was rescinded there was no great activity in the estate market in Palestine as a strong movement had been set on foot among Moslems to retain land already owned by Moslems in Moslem hands, and also because the delay in issuing the Mandate and the world-wide financial crisis militated against the economic development of Palestine in general, and land purchase there in particular. Some small parcels of land belonging to Moslems were sold to Jews, but, apart from that, the Jews have acquired no land since the war, with the exception of the university site on Mt. Scopus from the executors of Sir John Grey-Hill.

Ecclesiastical.—In matters ecclesiastical the British authorities were able to steer a careful course between the various conflicting interests, and Col. Storrs, the governor of Jerusalem, was so far able to abate the customary tension between the representatives of the different creeds that the Orthodox at Bethlehem voluntarily removed the unsightly wall which had been built across the nave of the Church of the Nativity chiefly for the purpose of causing annoyance to the Latins; and the Gregorians invited the Anglican bishop, Dr. MacInnes, who had succeeded as bishop in Jersualem after the resignation of Dr. Blyth in Oct. 1914, to take an important part in their Easter ceremonies in 1918. After the final defeat of the Turks the Orthodox and Latin patriarchs who had been held prisoners in Damascus returned to Jersualem, when Mgr. Damianos, who had had difficulties with his Holy Synod, was reinstated by the chief administrator. Mgr. Camassei, the Latin patriarch, however, withdrew soon afterwards to Rome, where he became a cardinal, and in April 1920 Mgr. Louis Barlassina was appointed to succeed him in Jerusalem, while on Oct. 9 1920 Father Paschal Robinson was sent to Palestine as apostolic visitor. On March 20 1921 His Eminence the Grand Mufti of Jerusalem, Kamil Huseini Effendi, died, and after some delay his brother, Hajj Amin, was appointed (May 1921) to succeed him.

Population.—On March 31 1919 the pop. of O.E.T.A. South was 647,850, of whom 515,000 were Moslems, 65,300 Jews and 62,500 Christians. There were 150 Samaritans and 4,900 others. The present area of Palestine is larger than O.E.T.A. South.

The 1919 census figures for the pop. of various towns, showing Ruppin's 1914 estimate in each case in brackets, are as follow:—

	1914 Estimate of Ruppin	Census of 1919
Jerusalem	(80,000?)	60,000
Jaffa	(40,000?)	40,000
Nablus	(30,000)	28,000
Haifa	(20,000)	20,000
Hebron	(20,000)	18,000
Gaza	(30,000)	—
Nazareth	(12,000)	15,000
Safed	(24,000)	12,500
Acre	(12,000)	10,000
Tiberias	(8,000)	8,000
Bethlehem	(12,000)	15,000

Gaza, credited with 30,000 inhabitants in 1914, was entirely depopulated during the war as a military measure by the Turks. The inhabitants were beginning to return slowly to the completely ruined town in 1921.

Of the three divisions of the pop. of Palestine 69% of the Moslems, 46% of the Christians and 19% of the Jews were engaged in agriculture in 1919. In 1918 taxes were paid on 139,000 domestic animals (Southern Palestine only), in 1919 on 531,000 animals (Northern Palestine as well) and in 1920 on 543,000.

Finance.—The budget for Palestine for the first year under British occupation, ending Oct. 1918, showed a revenue from direct taxes £E160,000, from customs and excise £E122,000 and from other normal sources £E54,000. The artificial revenue of £E324,000 drawn from the operation of the services of relief for refugees failed to balance their cost, £E331,000, thus the revenue for purposes of ordinary expenditure amounted to £E337,000 and the expenditure to £E407,000, which included £E141,000 of revenues mortgaged by the Turks for the services of the Ottoman Debt and to meet the kilometric guarantee on railways in other parts of the Empire. It should also be remembered that, while the cost of administering northern Palestine for six weeks is contained in the budget, no revenue at all was collected in that area, as the taxes had all been exacted in advance by the Turks. On the other side, however, it must be noted that the private charity of the American Red Cross and other funds contributed more than £E40,000 *per mensem* towards the maintenance of refugees and destitute civilians, which would otherwise have been a charge upon the Treasury.

In 1918–9 the actual receipts were £E748,000 from all sources and the estimated expenditure £E738,000. For 1919–20 the estimated figures were £E735,000 for both, exclusive of £E284,000 of revenue and £E162,000 of expenditure in the "Excluded Funds" assigned to municipalities, Waqf administration, the Ottoman Debt and railway guarantee outside Palestine. For the first nine months of civil administration ending March 31 1921 the total revenue, excluding that from railways and post-office, was estimated at £E776,000 and the expenditure at £E731,000, while the railways and post-office were expected to yield a net profit of £E30,000, thus showing a surplus of £E75,000. For the first complete financial year under civil administration, 1921–2, the total revenue—including railways and post-office—was estimated at £E2,214,000, and the expenditure at £E2,286,000.

The following table shows the detailed revenue from direct taxation and State domains for the two financial years 1919–20 and 1920–1:—

		House and Land Tax £E	Animal Tax £E	Tithe £E	State Domains £E	Stamp Duty £E	Total £E
Jerusalem	1919–20	29,089	7,399	28,173	1,437	2,743	68,841
	1920–21	29,500	8,000	36,000	2,000	4,000	79,500
Jaffa	1919–20	27,261	2,150	57,733	499	3,134	90,777
	1920–21	26,000	1,200	60,000	600	4,700	92,500
Gaza	1919–20	15,781	3,348	52,401	848	361	72,739
	1920–21	16,000	1,900	60,000	2,000	500	80,400
Beersheba	1919–20	338	5,020	1,556	171	187	7,272
	1920–21	370	6,700	39,000	500	400	46,970
Samaria	1919–20	15,190	4,214	28,158	6,837	633	55,031
	1920–21	14,500	4,300	40,000	2,000	1,200	62,000
Phoenicia	1919–20	26,499	6,975	39,753	452	1,517	75,196
	1920–21	22,000	7,700	80,000	1,600	3,200	114,500
Galilee	1919–20	12,643	3,680	36,555	4,160	534	57,572
	1920–21	11,630	4,200	60,000	15,300	1,000	92,130
Totals	1919–20	126,801	32,786	244,329	14,404	9,109	427,428
	1920–21	120,000	34,000	375,000	24,000	15,000	568,000

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Names		Area in 1913			Population	
Hebrew	Arabic	Dunams*	Acres	Hectares	1913	1921
(1) JAFFA DISTRICT:—						
Pethah Tiqwah	Mulebbis	35,036	8,091	3,276	2,722	2,555
Divisions:—						
(a) Yehud	El Yehudiye					..
(b) Kefar Saba	Kefr Saba					96
(c) 'Ein Hai	Bir 'Adas					30
(d) 'Ein Gannim	El Fejja					194
(e) Mahane Yehudah						..
Rishon Le-Siyon	'Ayun Qara	12,342	2,771	1,122	1,200(?)	1,068
Divisions:—						
(a) Nahalath Yehudah						..
(b) Be'er Ya'aqob	Bir Ya'qub					145
Nahalath Re'uben or Nes Le-Siyonah	Wadi Hanin	2,794	627	254	199	199
Rehoboth	Khirbet Deiran	14,190	3,186	1,290	731	348
(a) Ezra						..
'Ekron or Mazkereth Bath-yah	'Aqir	12,716	2,855	1,156	316	960
(a) Na'amah	Na'ane					..
(b)	Mansura					..
Gederah	Qatra	5,632	1,244	512	167	182
(a) Sukkoth						..
Be'er Tobiyah	Qastine	5,621	1,242	511	150(?)	170
Ruhamah	Jemmame	5,500	1,235	500		34
Ben Shamen		2,343	526	213	120(?)	120
	Abu Shushe	6,996	1,570	636		..
Khuldah	El Khulde	1,969	442	179		30
Qiryath Moshe	Kefr Urye	4,785	1,197	435		30
Miqweh Israel		2,612	590	237	150	153
Agricultural School (near Jaffa)						
(2) JERUSALEM DISTRICT:—						
Har Tob	'Artuf	4,664	1,037	424	124	149
Mosa	Qaloniye	1,078	242	98	40(?)	40
Dilb	'Ain ed Dilbe					200
(3) PHOENICIA:—						
Zikeron Ya'aqob	Zimmarin	30,668	6,886	2,788	1,034	..
(a)	Shefeya					50
(b)	Umm el Tut					..
(c) Bath Shelomoh	Umm el Jemal					80
(d)	Khirbet Menshiye					..
(e)	El Burj					..
(f)	El Marah					..
Dor	Tantura	297	66	27	16	..
	Athlit	7,293	1,637	663	50	108
	Kerkur and Beidus	11,396	2,558	1,036		20
Khederah	El Khudheira	39,556	8,882	3,596	459	300
(a) Hefsi-bah						..
(b) Nahli-el						..
(c)	Khudheira Zeita					..
(4) GALILEE:—						
Rosh Pinnah	Ja'une	41,987	9,427	3,817	501	501
(a) Mahanayim						30
Mishmar Hay-Yarden and Gesher Hay-Yarden		7,590	1,704	690	93	93
Yesud Ham-ma'alah	Khirbet Zubeid	12,221	2,744	1,111	198	200
(a)	'Ain el-Mellaha					..
'Ein Haz-zeithim	'Ain Zeitun	5,599	1,257	509	30(?)	30
Metullah	El Mutalle	16,907	3,796	1,537	241	241
Shezerah	Shejera	17,710	3,976	1,610	192	235
Kefar Tabor	Mesha	16,016	3,596	1,456	235	289
Yabni-el	Yemma	32,505	7,298	2,955	330(?)	1,125
(a) Poriyah						80
(b) Beth Gan	Beit Jan					87
(c) 'Atshi-yah						128
Meliamiyeh		9,471	2,126	861	86	40
Degan-yah	Umm Junye	3,069	689	279	130(?)	100
Kinnereth		9,273	2,082	843	70(?)	38
Mispai	'Ain Kateb	3,421	768	311	37	..
(a) Tiberias	Tabariye					50
Magdala	Mejdel	4,950	1,111	450		..
Merhabyah	El Fule	9,416	2,114	856		50
Tel Ado						11
Sharona						

*Dunam = 1,075·2 sq. yd.

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The customs revenue collected at various ports of entry and railway and caravan centres for the same two years was as follows:—

	1919–20 £E	1920–1 £E
Acre	214	534
Beersheba	463	314
Gaza	10,092	6,695
Haifa	164,391	169,031
Jaffa	146,204	186,336
Jerusalem	93,779	71,161
Khan Yunis	645	586
Ludd	1,893	5,255
Tul Keram	5,094	5,642
Qantara	5,375	3,446
Total	428,150	449,000

Municipalities.—There are 22 municipalities in Palestine: Jerusalem, Ramalla, Beit Jala, Bethlehem, Hebron, Jaffa, Ramleh, Ludd, Gaza, Khan Yunis, Mejdel, Feluje, Beersheba, Nablus, Tul Keram and Jenin in Samaria; Nazareth, Tiberias and Safed in Galilee; and Haifa, Acre and Shefa 'Amr in Phoenicia. In 1919–20 their total revenue amounted to £E89,000 (Jerusalem £E29,500, Jaffa £E14,700) and their ordinary expenditure to £E89,000. They had a balance of £E9,000 from the previous year and obtained loans and grants from Government amounting to £E10,000, repaying debt to the amount of £E11,000.

Education.—Palestine before the British occupation contained numerous schools supported by religious bodies and charitable organizations abroad, some of which were undoubtedly supported more in the political interests of the countries concerned than for strictly religious or educational purposes, and it is possible that in the future certain institutions may suffer financially from the decay of that political driving-force. For the year 1919–20 the Military Administration granted £E46,000 for Moslem education, and for 1921–2 the Civil Administration has allotted £E103,000, and employs 443 teachers. In addition to this the Zionist Organization in 1920–1 provided for 135 educational institutions with 523 teachers and 12,830 Jewish pupils at a cost of about £E110,000. Christian schools in 1919–20, generally open to pupils of all denominations, provided for some 7,000 children, but many of these institutions had been adversely affected by Turkish requisitions during the war and had not recovered.

Defence.—Under the final rearrangement of the Ottoman army before the World War Palestine formed part of the recruitment area of the VIII. (Damascus) Army Corps, and after the war was held by a considerable army of occupation composed of British and Indian troops. This, consisting of three Army Corps with a ration strength of over 460,000 men and some 163,000 beasts at the time of the Armistice, was reduced to 23,000 men on April 1 1920, and to 7,700 men on April 1 1921. The scheme of local defence provides for the formation of two battalions of troops to be recruited in Palestine, and a police force has already been raised consisting on April 1 1921 of 78 officers and 1,392 other ranks, divided into four categories:—

	Mounted	Foot	Railway	Prisons
N.C.O.s	47	72	4	16
Men	397	712	50	85 and 8 wardresses
Total	444	784	54	109

Railways.—Although several schemes for railway construction in Palestine were proposed during the period 1910–4, nothing was done. On Oct. 14 1913 a Franco-Turkish agreement provided for an extension of the standard-gauge line from Rayak in Syria to Ludd in Palestine, where it would join the then existing narrow-gauge line from Jaffa to Jerusalem. By the same agreement a French firm was to obtain concessions for building harbours at Haifa and Jaffa, and a little later a concession was granted to the Perrier Bank to run a tramway from Jerusalem to Bethlehem. None of these proposals was carried out, but during the war the Turkish Government built an extension of the Hejaz railway from Jenin on the plain of Esdraelon through Messudiye (56 km.) to Nablus (15 km.) on the one hand, and on the other to Tul Keram (20·5 km.) and thence to Ludd (42·5 km.), and from Junction Station to Beersheba (83 km.), whence the line was taken on to El 'Auja (66 km.) for the attack on Egypt. A narrow-gauge branch line was run from Tine on the Junction Station–Beersheba railway to Beit Hanun (39 km.), near Gaza, with a branch from Deir Sineid to Huj (12 km.), and another from Tul Keram to the forest near Caesarea (24 km.), which was cut down for fuel. Owing to the shortage of railway material the lines between Damascus and Mezeirib (63 km.), Haifa and Acre (18 km.) and Jaffa and Ludd (20 km.) were stripped and the rails sent south to be used for the new extensions. Later the Beersheba–El 'Auja extension was stripped in its turn and the Tine–Beit Hanun–Huj branch was removed after the arrival of the British.

The British-built standard-gauge line laid across northern Sinai, Qantara–Romani (41 km.), opened July 1916; Romani–El 'Arish (114 km.) Jan. 1917, El 'Arish–Rafa (45 km.) Mar. 1917, reached Deir el Belah (219 km.) from Qantara in June 1917, and a branch from Rafa to Karm (34·5 km.) was opened Oct. 28 1918. This was later continued to Beersheba (24·5 km.) and opened May 3 1918. The metre-gauge railway from Ludd to Jerusalem, much damaged during the military operations in the autumn of 1917, was restored and reopened Jan. 27 1918. Meanwhile, the standard-gauge from Belah had been opened to Deir Sineid (28 km.) Nov. 28 1917, and to Deiran (43 km.) Jan. 8 1918. On Feb. 4 1918 it was opened to Ludd (15 km. or 305 km. from Qantara) and carried on to Rantie (9 km.) a little later in readiness for the next forward move. While waiting for this, the standard-gauge was opened to 'Artuf (31 km.) on March 31 and to Jerusalem (29 km.) June 15. This last section was laid by day, while the narrow-gauge which it superseded continued to work by night. The Turkish narrow-gauge between Junction Station and Irgeig (72 km.) on the Rafa–Beersheba line was converted to standard gauge between May 18 and July 8; thus Gen. Allenby was able to dispose of a double line of standard gauge from his advanced base at Ludd to Rafa, to which point the railway from Qantara had been double-tracked by April 17 1918. Later, in 1919–20, the sector Junction Station–Irgeig was dismantled. A number of narrow-gauge lines were laid behind the front between Dec. 1917 and Sept. 1918: Ludd to Jaffa (20 km.), Ludd to Ras el 'Ain (22 km.), Sarona (on the Jaffa line) to near Jelil (14 km.), Kefr Jinnis on the Ras el 'Ain line to Lubban (18 km.), Sheikh Muannis on the Sarona line to Carrick Hill (3 km.), and from Jerusalem to Bire (28 km.). The standard-gauge started north once more on the heels of the Sept. advance, and was superimposed on the Turkish line from Ras el 'Ain to Tul Keram (32 km. from Rantie) which was reached on Oct. 15. The extension to Haifa (66 km.; 413 km. from Qantara) was opened early in Jan. 1919 and soon afterwards the narrow-gauge Acre branch (18 km.) was restored. On Oct. 5 1920 the standard-gauge was opened between Ludd and Jaffa (20 km.).

Agriculture.—The crop returns for 1920–1 show the following figures in kilogrammes:—

	Kgm.
Wheat	62,897,017
Barley	27,233,948
Beans	2,061,306
Peas	3,441,525
Lentils	2,724,635
Kersenneh (Jilbaneh)	4,599,944
Durra	30,352,916
Sesame	2,488,229
Olive Oil	6,706,059
Grapes	5,490,306
Figs	5,419,878
Melons	16,351,022
Almonds	238,090
Total	Kgm. 170,004,875
Oranges, Lemons, etc.	537,043 boxes

Of this total of 170,004,875 kilogrammes the production according to districts was as follows:—

	Kgm.
Jerusalem	27,589,480
Jaffa	40,866,228
Gaza	11,170,179
Phoenicia	35,852,954
Beersheba	9,005,058
Samaria	17,686,452
Galilee	27,834,524

Of the 537,000 boxes of oranges and lemons the Jaffa district produced 498,000, Phoenicia being second with 36,000.

Trade.—The bulk of the sea-borne commerce of Palestine passes through its three chief ports of Gaza, Jaffa and Haifa. Of these Haifa, before the war, had begun to supplant Beirut to a certain degree as the port of Damascus, the Hauran and Gilead and, in virtue of its connexion by rail with Medina, handled goods in transit for that area as well; consequently its trade was Syrian rather than Palestinian and recovered sharply after the end of the Italo-Turkish War in 1912. Gaza was concerned almost entirely with an export trade of barley, chiefly used for making beer in England, while Jaffa, with all its drawbacks, served as the chief port for exports and imports of purely Palestinian origin and destination. The standard-gauge railway leading to Egypt is also a great trade route, more particularly for passengers and those classes of goods which suffer from the delays still inevitable in bad weather at Jaffa.

The total trade of Palestine for the first complete year during which the whole country was under British administration and at peace, April 1919–March 1920, was:—

	Imports	Exports
April–June 1919	£E1,098,938	£E130,463
July–Sept. "	861,869	179,719
Oct.–Dec. "	984,926	196,552
Jan.–March 1920	1,296,334	186,968
	£E4,242,067	£E693,702

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Of this the respective shares of Jaffa and Haifa as compared with the last complete year before the war—both calculated in £E—were:—

	Imports	Exports
Jaffa	£E	£E
1913	1,279,785	726,775
1919–20	1,408,238	169,308
1920–21 (first 7 months)	1,186,079	127,360
Haifa		
1913	516,750	338,033 (1912)
1919–20	1,627,381	270,057
1920–21 (first 7 months)	950,155	116,795

From this it is apparent that while Palestine had to buy largely and at enhanced prices of those goods of which she was unable to procure adequate supplies during the war, she had not yet recovered her capacity for production after the dislocation of trade and ruin of agriculture caused by the war, with the consequence that the balance of trade was against her. It has been pointed out, however, that her exports are bulkier than her imports, and that had tonnage been available the exports would have been greater.

The deficiency of available tonnage is well shown in the following shipping figures for ports of Palestine:—

Flag	Number of Ships 1913	Number of Ships 1919–20	Tonnage 1913	Tonnage 1919–20
British	307	97	464,674	123,116
Russian	237	55	405,987	27,244
French	101	41	262,512	71,904
Italian	97	99	170,227	176,504
Austrian[1] and Other	496	65	658,302	67,946
	1,238	357	1,961,702	466,714

Currency.—The currency in Palestine, formerly Turkish, became Egyptian at the time of the occupation as the accounts of the Egyptian Expeditionary Force were kept in that medium. A vast quantity of British, Australian and Indian silver, however, came into circulation at fixed rates to supply the deficiency of Egyptian silver—of which a large consignment sent from the London mint for use in Palestine was sunk by enemy action at sea—and a good deal of gold, chiefly British, came into the country from Arabia where a large amount of the gold coin paid as subsidy to the king of the Hejaz passed into circulation. French silver, generally taken at full value in the larger towns before the war, is now seldom seen, and Turkish silver and billon money has also nearly disappeared, although legal tender at fixed rates. Turkish paper was never legal tender after the occupation.

Weights and measures still vary locally according to immemorial custom, but the civil administration is taking steps to introduce a standard system on European lines in order to facilitate trade.

Archaeology.—On Aug. 9 1920 the British School of Archaeology in Jerusalem was opened and participated in the excavations which were being conducted at Ascalon, with happy results, by the Palestine Exploration Fund. Important discoveries were made also in the Garden of Gethsemane, where the complete foundations of a 4th-century church were brought to light, and near Tiberias.

The duty of maintaining historical buildings in the Holy City has been entrusted to the Pro-Jerusalem Society—a pan-denominational body founded by the governor, Mr. Ronald Storrs. At Acre mediaeval crypts have been cleared of débris, the Tower of Ramleh has been strengthened and arrangements have been made for a resumption of the excavations at Tell Hum (Capernaum) by the Franciscans. Three universities in the United States have agreed to undertake important archaeological researches, that of Pennsylvania at Beisan (Beth Shan), that of Harvard at Samaria and that of Chicago at Megiddo (for which Mr. John D. Rockefeller, Jr., gave $60,000). Unauthorized excavations by persons unqualified as archaeologists are forbidden. In the Budget for 1921–2 a grant of £E1,000 was made for the conservation of historical monuments, and £E750 provided for the redemption of antiquities out of a total estimate for the Department of Antiquities of £E6,500.

(H. P.-G.)

PALGRAVE, SIR ROBERT HARRY INGLIS (1827–1919), English banker and economist, was born at Westminster June 11 1827, the son of Sir Francis Palgrave, the historian (*see* 20.629). He was educated at Charterhouse and entered Barclay's Bank at Yarmouth. There he rose to a position of such importance that in 1875 he was one of three representatives of the English issuing country bankers chosen to give evidence before the select committee of the House of Commons on Banks of Issue. He edited the *Economist* from 1877 to 1883, and published many works on banking, as well as *The Local Taxation of Great Britain and Ireland* (1871). He also edited the *Dictionary of Political Economy* (1894–1906). He was knighted in 1909. He died at Bournemouth Jan. 25 1919.

[1] Much tonnage formerly Austrian was in 1921 Italian.

PALLES, CHRISTOPHER (1831–1920), Irish lawyer, last chief baron of the Irish Court of Exchequer, was born Dec. 25 1831. He was educated at Clongowes Wood school, and Trinity College, Dublin, where he graduated in 1852. He was called to the Irish bar in 1853, and became a Q.C. in 1865. In 1872 he became a solicitor-general for Ireland, and from 1872 was attorney-general. In 1874 he was made chief baron of the Court of Exchequer. The Exchequer division was in 1898 merged in the Queen's Bench division of the Irish High Court of Justice, and the chief baron from that time sat as one of the judges of the Queen's Bench division, and also as a judge of appeal. Palles retired from the bench at an advanced age in 1916. He was a great lawyer, of remarkably wide learning and power of argument. He died in Dublin Feb. 14 1920.

PALMER, ALEXANDER MITCHELL (1872–), American politician, was born of Quaker parentage at Moosehead, Pa., May 4 1872. After graduating from Swarthmore College in 1891 and admission to the bar in 1893 he practised law at Stroudsburg, Pa. He was a member of Congress from 1909 to 1915, was then appointed judge of the U.S. Court of Claims, but resigned four months later. In 1912 and 1916 he was a delegate-at-large from Pennsylvania to the Democratic National Convention, and from 1912 a member of the executive committee of the Democratic National Committee. At the convention of 1912 he was "floor leader" of the Wilson supporters, and the next year declined the post of Secretary of War in President Wilson's Cabinet. In 1917 he was appointed alien property custodian under the "Trading with the Enemy Act," and within 18 months was administering 32,000 trusts, valued at $503,000,000. In March 1919 he was appointed to the President's Cabinet as Attorney-General. The Senate refused to confirm the appointment until his record as alien property custodian had been investigated, on the ground that he had made his office a "political machine." It was furthermore charged that he was in contempt of the Senate in having failed to submit on request a complete report of the management of his office. A filibuster at the end of the 65th Congress caused the Senate to adjourn without confirming the appointment, but the President made him a "recess" appointee. Not until Aug. 30 1919 did the Senate Judiciary Committee hand in its report recommending the appointment. This was followed by confirmation. His career as Attorney-General was widely, and it was generally felt justly, criticized by the public at large and by competent legal authorities as being both arbitrary and inefficient. At the Democratic National Convention in 1920 he had strong support for the presidential nomination, standing second on the first six ballots. After a prolonged deadlock, extending through 38 ballots, he released his delegates, who swung to James M. Cox, nominated on the 44th ballot.

PALMER, SIR WALTER, 1ST BART. (1858–1910), English manufacturer, was born at Reading Feb. 4 1858. He was the son of George Palmer (*see* 20.644), founder of the firm of Huntley & Palmer, biscuit manufacturers, of Reading, and was educated at University College, London, and also at the Sorbonne, Paris. He became a director of the firm and was also the first chairman of University College, Reading. He sat in the House of Commons for Salisbury during 1900–6. In 1904 he was created a baronet, and he died at Newbury April 16 1910. His elder brother, GEORGE WILLIAM PALMER (1851–1913), was chairman of the firm and sat in the House of Commons for Reading from 1892 to 1895 and from 1898 to 1904. He was made a privy councillor in 1906. He died near Newbury Oct. 8 1913.

PANAMA (*see* 20.664).—The pop. of the South American republic of Panama at the end of 1911 was estimated at 336,742 for the area exclusive of the Canal Zone. The latter contained in that year 71,682 persons, the number decreasing to 31,048 in 1916 and to 21,707 in 1918. In the estimate made in 1911, whites and *mestizos*, those of mixed blood, numbered 238,200, and negroes and Indians 96,600. Foreigners included 3,500 Chinese

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and 55,000 British subjects from Caribbean islands. The cities of Panama and Colon in 1917 contained 61,369 and 26,076 inhabitants respectively; the estimated total pop. then being 401,554. A general census taken in 1920 gave a total pop. of 434,015.

Vital statistics for 1916, 1917 and 1918 showed respectively 11,593, 10,898, and 11,283 births, of which in each year respectively 7,827, 7,511 and 7,700 were illegitimate. Deaths in the same years numbered 6,218, 6,107 and 5,649 respectively. There are eight provinces, Herrera having been added in 1915. The area as determined by the White boundary award is 87,480 sq. km. (33,776 sq. miles).

In 1917 there were 398 Government-supported schools with an enrolment of 22,000, besides 1,721 pupils in Canal Zone schools. The Instituto Nacional, dedicated in 1911 with handsome buildings at Panama costing $1,500,000, gives instruction in high-school subjects, commerce and languages. A school of Law and Political Science offers a three-year course to graduates of the Instituto. Travelling scholarships to Europe and the United States are provided by the Government.

Finance and Economics.—Panama receives all the import duties collected, but the United States imports all canal materials and supplies for Government use duty free. Panama's revenues and expenditures 1915–20 were as follows:—

	Revenues	Expenditures
1915	£ 675,057	£ 635,820
1916	729,802	1,164,600
1917	793,882	732,171
1918	646,752	707,464
1919–20	1,490,385	1,490,385 (estimated)

Public finance is managed by a fiscal agent appointed with the approval of the United States. For nine months ending in March 1921, revenues received were $4,012,023, and expenditures $2,767,146; balance $1,244,877; of this sum $739,349 was set aside for road construction. The debt, begun early in 1915 with a loan of $3,000,000 from the United States, chiefly for railway construction, amounted in 1919 to $7,101,000.

Commerce is chiefly with the United States; but that with the United Kingdom, France, and Spain is important.

The totals for the years 1910–20 were:—

	Imports		Exports	
	Kgm.	Balboas *	Kgm.	Balboas *
1910	128,647,313	10,043,395.11	126,333,609	1,769,330.15
1911	128,331,874	9,896,987.85	165,180,189	2,863,425.30
1912	115,822,532	9,871,653.73	166,232,433	2,064,647.55
1913	153,057,605	11,060,088.24	187,330,063	5,101,960.45
1914	140,472,718	9,891,552.78	182,625,216	3,800,517.18
1915	126,244,629	9,032,977.17	152,594,343	3,422,455.10
1916	107,191,027	9,397,596.27	137,438,898	5,706,724.38
1917	82,798,113	9,223,170.00	177,484,046	5,624,176.00
1918	45,085,659	7,821,660.00	150,497,870	2,909,557.00
1919	48,960,768	11,406,880.15	162,476,039	3,757,028.24
1920	59,678,802	17,092,270.35	150,370,225	3,640,453.15

*A balboa is worth a dollar.

About 80% of the exports go to the United States. The chief articles are bananas, coconuts, hides, tortoise shell, cacao and *tagua* (vegetable ivory). All international commerce moves through Cristobal and Balboa, Bocas del Toro being reserved for local business. The Panama railway across the Isthmus, 47 m. long, is U.S. property. The United Fruit Co. has 150 m. of banana railway in Bocas del Toro province, running to Limón in Costa Rica. Only a small part of the territory is occupied, and little is under cultivation. The only highly organized industry is the banana business of the United Fruit Co., which exports over $2,000,000 worth of bananas yearly. In 1906 cattle numbered 65,000; in 1916, 200,000; there were then also 15,000 horses, 2,000 mules, 30,000 hogs, and 5,000 goats. Coffee grows in Chiriqui province, and in Cocle province a concern of German origin has raised cacao, coffee and rubber since 1895. Tobacco and sugar are increasing; the first sugar exported to the United States was in 1920. Other crops are corn, rice, yams and ivory nuts. The tropical woods of the forests are exported, as are medicinal plants. The pearl fisheries are famous. Metals are scantily represented. The Sinclair Oil Corp. of New York has concessions on Columbus I., and has drilled wells at Bocas del Toro.

History.—The successful candidate of 1908 for the four-year presidential term, Domingo de Obaldia, died in 1910, and Pablo Arosemena completed his term. In 1912 Belisario Porras, a Liberal, was elected. Ramon M. Valdez was elected in June 1916 amid riots and intervention by the United States. He died in 1918, and Ciro L. Urriola completed his term. Ernesto Lefevre was inaugurated Jan. 30 1920, but Belisario Porras soon succeeded him, being elected in Aug. of the same year, and inaugurated Nov. 1 for a four-year term. There are three vice-presidents (*designados*), and a Cabinet of five members. The constitution was amended Dec. 26 1918 so as to provide for a Chamber of 33 members, one for each 10,000 inhabitants. The president is chosen by direct vote, and is ineligible to succeed himself. Beginning in 1924 deputies of the Chamber are to be chosen by direct vote. Provincial governors became elective in 1920. Capital punishment is prohibited. Foreigners may not mingle in politics, and may be ejected for criticizing public officers or institutions. The independence of the republic was recognized by Colombia April 6 1914 by a treaty between the latter and the United States, ratified by Colombia in the same year and by the U.S. Senate April 20 1921. Panama ratified the Treaty of Versailles Jan. 8 1920, and is an original member of the League of Nations.

Boundary Dispute.—The constitution of Colombia of 1886 declared that its boundary with Costa Rica should be that which had existed between the viceroyalty of Nueva Granada and the captaincy-general of Guatemala in 1810, but that boundary lines might be located by treaties which might be negotiated without reference to the *uti possidetis* of that year. Colombia and Costa Rica endeavoured, by treaties negotiated in 1825, 1856, 1865 and 1876, to fix the line without success. In 1876 arbitration was agreed on, and Alfonso XII., King of Spain, was asked in 1880 to make an award, but he died before doing so. It was agreed in a treaty of Dec. 25 1880 that the arbitral award must lie within the specified limits of the conflicting claims. This provision was included in a treaty made at Paris dated Jan. 20 1886, and in another made at Bogotá on Nov. 4 1896. Under the last-named instrument, President Loubet of France rendered on Sept. 11 1900 an arbitral award which was accepted by Colombia and Costa Rica as final. Its demarcations were in general terms.

The state of Panama, which had been created by Nueva Granada in 1855 and made a department of Colombia in 1886, became independent on Nov. 3 1904, at which time it inherited the boundary controversy with Costa Rica. The Loubet line had not been made effective because of Colombian revolutions. On March 7 1905 Costa Rica and Panama by convention adopted a line interpretative of the Loubet award, but Costa Rica still considered the award unfair to her in respect of the valleys of the tributaries of the Sixaola river above the Yorquín. In fact, the treaty gave to each republic *de facto* right over territory belonging *de jure* to the other. Costa Rica considered, because of interpretations of the Loubet award by Panama, that the treaty of 1905 had lapsed, Panama not having ratified it. Through the good offices of the United States, which was interested in American land claims in the Sixaola region, the two republics agreed in 1910 to submit the Loubet award, which both had accepted, to the interpretation of Chief Justice White of the U.S. Supreme Court. In 1914 he rendered a decision adverse to Panama, and the latter refused to accept it, claiming that it went beyond interpretation, and gave territory not asked for to Costa Rica.

On Feb. 21 1921 Costa Rica forces seized Coto, in Chiriqui province, for the purpose of enforcing the White award, which favoured her there. Panama forces composed of volunteers and police at once moved to recover the territory invaded. Panama on Feb. 24 asked the good offices of the United States to prevent bloodshed. During late Feb. and early March the invasion, moving toward Bocas del Toro, was marked by light engagements and there were anti-American disorders in Panama. On March 5 President Harding requested both nations to cease hostilities and provide for an agreement based on the White award. They acceded, and on March 9 an armistice was announced. Panama had reiterated her dissatisfaction with the White award, and had made representations to the League of Nations denouncing the invasion of her territory by a fellow-member of the League. While withdrawing her military forces from Coto, as Costa Rica had done, Panama announced that she was leaving civil and police forces, and would demand reparation from Costa Rica. The U.S. Government insisted that Panama should acquiesce to the terms of the White award.

(H. I. P.)

PANAMA CANAL (*see* 20.666).—The construction period of the Panama Canal covered about 10 years, but the actual work of

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construction was accomplished in about seven years. The first three years were devoted mainly to the task of getting ready to work. During that time the thorough sanitation of the Canal Zone was accomplished, yellow fever was permanently banished, an operating plant was assembled, a working force gathered, living quarters erected and a food supply provided. Reservoirs were built which furnished an ample supply of pure water to the canal force, and to the cities of Colon and Panama, in which water and sewer-systems were built. An out-of-date railway-system was converted into an adequate one with a thoroughly modern equipment of rails, locomotives and cars. The first commission was in office only a year (1904–5) and accomplished little beyond formulating plans and ordering necessary supplies. The second, under the expert direction of John F. Stevens as chief engineer and afterwards as chairman also, reconstructed the railway-system, assembled the operating plant, collected an efficient working force and provided for it quarters, food and all necessary supplies. It also constructed wharves and docks at both terminals, and machine-shops in which the locomotives, cars, steam-shovels and other elements of the operating plant, which were shipped in parts from the United States, were put together. President Roosevelt paid a visit of three days to the Isthmus in Nov. 1906, inspecting the canal works at all points. His visit was notable as the first instance in which an American president had passed out of the U.S. territory while in office. Col. Goethals, of the Engineer Corps of the U.S. army, was appointed chairman and chief engineer of the third commission on the resignation of Mr. Stevens, and entered upon his duties April 1 1907. This commission was composed of four army engineers, one navy engineer and two civilians. It had been in office only a few months when President Roosevelt, who had from the outset of the work been convinced that the best results could not be attained through an executive body of seven members, issued an executive order placing supreme power in the hands of Col. Goethals, abolishing the commission as an executive body, and making its members, who were heads of departments, subordinate to him. By this order Col. Goethals became the absolute autocrat of the Canal Zone, holding in his hands all civil, military and other powers. For issuing the order President Roosevelt was sharply criticized in Congress, on the ground that he had exceeded the authority conferred upon him by law, but his course was subsequently approved in the Act of 1912 for the government and operation of the canal after its completion.

Excavation and "Slides."—Through the power thus given him, Col. Goethals pressed the work of construction forward with such vigour during the five years following the issue of the order that during that period nearly 75% of the entire excavation of the canal was accomplished. The original plans of the canal contemplated a channel with a bottom-width of 200 ft. through the nine m. of the Culebra (afterwards called Gaillard) Cut section and estimated the excavation in the Cut at 54,000,000 cub. yd., and that of the entire canal at 95,000,000 cub. yards. The entire cost of construction, exclusive of $40,000,000 paid to the French Canal Co., $10,000,000 paid to the Panama Republic, and the cost of sanitation and civil administration, was placed at about $190,000,000. The original plans also provided for locks 900 ft. long and 100 ft. wide. In 1906 President Roosevelt increased the length to 1,000 ft. and in 1908 the Canal Commission recommended and President Roosevelt approved changes in the plans which increased the bottom-width of the Cut channel to 300 ft. and the width of the locks to 110 feet. These and other changes increased the estimate of total excavation to nearly 175,000,000 cub. yd. and the estimate of total cost, including payments to the French Canal Co. and to the republic of Panama, to $375,210,000. In this estimated excavation there was included an allowance of about 8,000,000 cub. yd. for "slides" or breaks in the walls of the Cut. These had been active during the French operations, and had begun to be troublesome to the Americans in the wet season of 1905. In Oct. 1907 a movement occurred which carried about 500,000 cub. yd. into the canal prism, completely filling it and stopping the movement of dirt trains for a month. In Jan. 1913 another movement occurred carrying about 2,500,000 cub. yd. into the prism. One in Feb. 1920 carried in about 2,000,000 cub. yd. more. During the period of construction and subsequently there were about 30 slides of different kinds, covering an area aggregating 220 ac., and compelling an additional excavation of about 30,000,000 cub. yards. Because of this and other developments, revised estimates of the total excavation were made in 1912, 1913 and 1914, the last one placing it at nearly 240,000,000 cub. yd., or about 65,000,000 more than the amount on which the estimated cost of $375,000,000 had been based. When the canal was thrown open to commercial traffic on Aug. 14 1914, a total of 224,000,000 cub. yd. had been excavated, and when it was declared formally completed and opened by President Wilson July 12 1920, a total of about 240,000,000 cub. yd. had been excavated and yet the total cost of the canal up to that date was only $366,650,000, exclusive of expenditures for its military and naval defence. The excavation of slides alone cost about $10,000,000.

Gatun Dam.—The Panama Canal is a huge water bridge rather than a canal, for its surface for the greater part of its length is 85 ft. above sea-level and is held in place by dams at either end. Of these dams the largest and most important is that at Gatun on the Atlantic side. It spans the northern and lower end of a deep valley through which the Chagres river formerly flowed to the sea. It is nearly 1½ m. long measured on its crest, nearly half a mile wide at the base, about 400 ft. wide at the water surface, about 100 ft. wide at the top; and its crest is at an elevation of 105 ft. above sea-level. It is really two dams in one, for in its centre there is a natural hill of rock about 110 ft. in height. In this the spillway of the dam is constructed, and against its two sides rest the two sections of the great dam. The dam itself contains about 21,000,000 cub. yd. of material. Its outer portions are composed of rock and earth, mainly from the Cut, and its centre or core of material drawn by hydraulic process from pits above and below the dam. This material is a natural mixture of sand and clay which in a watery condition flowed into the interstices of the rock and clay of the structure, making the whole at the centre a rubble-wall firmly cemented together and thoroughly impervious to water. Of the entire length of the dam only 500 ft. are exposed to the maximum waterhead of the lake, which is 85 to 87 feet. In 1919, after an exceptionally light rainfall, the maximum level of the lake was 87·16 ft. in Dec.; and in May 1920, 81·65 feet. The spillway is a concrete-lined channel, 1,200 ft. long and 285 ft. wide, the bottom being 10 ft. above sea-level, sloping to sea-level at the lower end. Across the lake-opening of the channel is a concrete dam in the form of an arc of a circle, making its length 805 ft., although it closes a channel with a width of only 285 feet. The crest of this dam is 69 ft. above sea-level, or 16 ft. below the normal level of the lake. On the crest are 13 concrete piers with their tops 115·5 ft. above sea-level and between these are regulating gates of the Stoney type which move up and down on roller trains in niches in the piers. The gates permit a discharge of water greater than the maximum known discharge of the Chagres river during a flood. Near the N. wall of the spillway is a hydro-electric station capable of generating, through turbines which are supplied with water from the lake through a forebay, sufficient electricity to meet all demands, including the lighting of the canal and all Canal Zone towns and buildings; the machinery of the locks, the machine shops, dry-dock and coal-handling plant; and the telephone and telegraph systems. There is an emergency electric plant at Pedro Miguel, operated by steam.

Dams on the Pacific Side.—Dams much smaller than that at Gatun were erected on the Pacific side, one with one lock at Pedro Miguel and one with two locks at Miraflores. In both instances the lock structures themselves form the main portion of the dam. That at Pedro Miguel maintains the level of the water in Gatun Lake and in Culebra Cut, and is placed at the lower or southern end of the channel through the Cut. That at Miraflores holds back the water of a small lake which furnishes the supply of the locks at that point. The Pacific dams are constructed in part like that at Gatun and in part of concrete. That at Miraflores has a small spillway in it.

The Locks.—All locks of the canal are in duplicate, are constructed in the same manner, and their chambers, with walls and floors of concrete, have the same usable dimensions—1,000 ft. long and 110 ft. wide. There are six pairs, making 12 in all. The side walls are from 45 to 50 ft. wide at the surface of the floor, are vertical on the chamber side, and narrowed on the outside from a point 24½ ft. from the floor, by means of a series of steps each 6 ft. long, to a width of 8 ft. at the top. A culvert 254 sq. ft. in area of cross-section, about the area of the Hudson river tunnels of the Pennsylvania railway, extends the entire length of each middle and side wall, and from each of these large culverts, smaller culverts, 33 to 44 sq. ft. in area, extend under the holes in the floors. Fifteen ft. above the top of the culvert in the middle wall there is a space much like the letter U in shape, 19 ft. in width at the bottom and 44 ft. at the top. This space is divided into three storeys or galleries: the lowest for drainage; the middle for wires that carry the electric current to operate the gates and valve machinery installed in the centre wall; and the upper a passage-way for the operators. All lock walls are approximately 81 ft. high, except in the lower pair of locks at Miraflores, where they are 82 ft. to meet the requirements of the extreme tidal oscillation of about 21 ft. in the Bay of Panama. In the walls at Gatun there are about 2,000,000 cub. yd. of concrete, and in those on the Pacific side about 2,400,000 cub. yards. All lock walls rest on rock foundations. The approach wall at the N. entrance at Gatun, 1,031 ft. long, rests upon piles driven from 35 to 70 ft. into the earth; that at the S. or lake entrance, 1,009 ft. long, rests on piles reaching to rock, in some places over 100 ft. below sea-level. Cellular form of reinforced concrete is used in all approach walls except those of the lower locks at Gatun and Miraflores where mass concrete is used because of the effect of salt water on steel reinforcement.

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Lock Gates.—The lock gates, each composed of two leaves, are 65 ft. wide, from 47 to 82 ft. high, 7 ft. thick and weigh from 390 to 730 tons. There are 92 leaves in all and their combined weight is 60,000 tons. They were carried in parts to the Isthmus and put together there. They are constructed to float like a ship. Each is a huge webbed steel box, the girders of which are covered with a steel sheathing. All portions of the interior are accessible, with watertight compartments providing for the adjustment of the buoyancy so as to control within limits the dead load on the bearings, making the leaf practically float in the water. This watertight compartment is subdivided vertically into three sections, each independently watertight, so that if the shell should be broken in any way, or begin to leak, probably only one section would be affected. An air-shaft, 26 in. in diameter, runs from the bottom compartment up to the top of the gate, and this also is watertight where it passes through the upper half of the leaf. The girders are made with manholes through the webs, providing communication from the top to the bottom of the leaf, and are connected by several sets of vertical transverse diaphragms of solid plates, running from top to bottom of the leaf, thus making a cellular construction, and dividing the spaces between the horizontal girders into small pockets, all of which are accessible through manholes. Each leaf rests at the bottom of its heel-post upon a hemispherical pivot of forged nickel steel, and is hinged at the top to the masonry of the lock wall. It swings free on the pivot like a door, without wheels or other support beneath it. Intermediate gates are used in all except one pair of locks, and are so placed as to divide the space into two chambers, one 600 and the other 400 ft. in length. This makes possible a saving of water and time in locking small vessels through, for about 95% of the vessels navigating the high seas are less than 600 ft. in length. The highest gates and the highest lock walls on the canal are those of the lower locks at Miraflores, and these locks are the only ones which have no intermediate gates. The total lift from mean sea-level to the level of Miraflores lake, 54⅔ ft., is divided equally between the upper and lower locks. The depth of water on the mitre sills is 40 feet. The locks are filled and emptied through the large and smaller culverts. The large culverts are controlled at points near the gates by large valves, and each of the small culverts feeds in both directions through the laterals, thus permitting the passage of water from one twin lock to another, effecting a saving of water if desired. The average time in filling and emptying a lock is about 15 minutes. The time to pass a vessel through all the locks is about two hours, one hour at each end of the canal. The time of passage of a vessel from ocean to ocean is from 8 to 10 hours, according to the ship's size and speed.

Passage of Locks.—No vessel is permitted to enter or pass through the locks under its own power. On arrival at Gatun or Miraflores, it is tied up to the approach wall and turned over to the absolute control of the canal authorities. These place a representative of their own on the bridge and another in the engine-room. They then connect the towing locomotives, or "electric mules," with the ship. These locomotives operate on cog tracks on the lock walls, and proceed at the rate of 2 m. an hour. The number of locomotives varies with the size of the vessel. The usual number required is four: two ahead, one on each wall, imparting motion to the vessel; and two astern, one on each wall, to aid in keeping the vessel in a central position and to bring it to rest when entirely within the lock chamber. They are equipped with a slip drum, towing windlass and hawser, which permit the towing-line to be taken in or paid out without actual motion of the locomotive on the track. The locomotives run on a level, except when in passing from one lock to another they climb heavy grades. Before a lock can be entered, a fender chain, stretched across the walls of the approach, must be passed. If all is proceeding properly, this chain is dropped into its groove to the bottom of the channel. If by any chance the ship is moving too rapidly for safety, the chain remains stretched and the vessel runs against it. The chain, which is operated by hydraulic machinery in the walls, then pays out slowly by automatic release until the vessel is brought to a stop. The chain, which weighs 24,098 lb., and is stronger than any previously made, is capable of stopping a 10,000-ton ship running at 4 m. an hour within 73 ft., or less than the distance between the chain and the first gate. If the vessel by a remote possibility gets away from the towing locomotives and, breaking through the chain, rams the first gate, there is a second gate 50 ft. away, protecting the lock, which is certain to arrest further advance. When the leaves of this gate swing open, the vessel is towed in, and the gate is closed behind it. Then, from openings placed at regular intervals in the lock floor, water pours in, lifting the vessel to the level of the lock above. This inflow, coming equally from all points, does not move the ship from a stable position. The gates are never opened or closed with a head of water on either side of them. The process of lifting is repeated until the vessel reaches the lake level. At all times the vessel is in full view of the men who are controlling it and as safe as if tied to a wharf. The gates are opened and closed by a powerful machine invented by Edward Schildhauer, an electrical engineer in the employ of the Goethals Canal Commission. It consists of a crank gear or wheel moving through an arc of 197°, placed horizontally in the lock wall. To the outer rim of the wheel is attached a strut or connecting-rod which is fastened to the top of a lock gate 17 ft. from the pintle or hinge. When the wheel turns in either direction the gate leaf is opened or shut, the operation taking two minutes. The crank gear, constructed of cast steel, is 19 ft. 2 in. in diameter and weighs approximately 35,000 pounds. It is connected with an electric motor, and a small electric switch sets it in motion. Every operation in the passage of a vessel through the lock, except the movements of the towing locomotives, is controlled by a single man so placed in a building at the top of the centre wall as to command an unobstructed view of every part of the locks. He has before him a control board table about 64 ft. long and 5½ ft. wide which is a complete model of the locks in duplicate with switches and indicators in the same relative positions the machines they control occupy in the lock walls. Standing by this board the operator throws the electric switches, and in response to his action he sees in the model the fender chains rise and fall, the gates open and close, the water rise and fall in the locks, and knows the exact position of the vessel at every stage of its progress. Each gate, each valve for letting in the water to the culverts, each fender chain, is operated by a separate motor mounted near the machinery in chambers in the lock wall. In each machinery chamber there is a starting panel containing contractors by which current is applied to the motor, and these panels in turn are controlled from a main unit in the central control-house. Some of the machinery chambers at Gatun are 2,700 ft. distant from the point of control, 90% of them are within 2,000 ft., and 50% within 1,200 feet.

The Canal Voyage.—The length of the canal from shore-line to shore-line is about 40 m. and from deep water in the Atlantic to deep water in the Pacific about 50 miles. The canal does not, as is generally supposed, cross the Isthmus from E. to W. It runs due S. from its entrance in Limon Bay, through the Gatun locks to a point in the widest portion of Gatun lake, a distance of about 11½ m.; it then turns sharply toward the E. and follows a course generally southeastern till it reaches the Bay of Panama. Its terminus near Panama is about 22½ m. E. of its terminus near Colon. In passing from the Atlantic to the Pacific a vessel enters the approach channel in Limon Bay, which has a bottom width of 500 ft. and extends to Gatun a distance of seven miles. At Gatun it enters a series of three locks in flight which lift it 85 feet. It then enters upon Gatun lake, the waterbridge of the Isthmus. The lake covers an area of 164 sq. m. with a depth varying from 45 to 87 ft., and contains 183,000,000,000 cub. ft. of water. It has a channel varying from 500 to 1,000 ft. in width, for a distance of about 24 m. to Bas Obispo, where the Cut passage begins. Through the lake a vessel may steam at full speed. The channel through the Cut, a distance of about nine m., has a bottom width of 300 ft. and a depth of 45 ft., and extends to the locks at Pedro Miguel, the Pacific end of the water-bridge. At Pedro Miguel the vessel is lowered in the single lock 30⅓ ft. to a small lake, at an elevation of 54⅔ ft. above sea-level, through which the vessel passes, 1½ m. to the two locks at Miraflores. These drop it to sea-level, and through an approach passage 8½ m. long, with a bottom width of 500 ft., it passes into the Pacific. The Cut has eight angles and at these the channel is widened sufficiently to allow a 1,000-ft. vessel to make the turn. The smallest angle is 70° 36′ and the largest 30°. In the whole canal there are 22 angles, the total curvature being 600° 51′. The sharpest curve is 67° 10′. The canal is lighted from end to end by electricity and gas. There are concrete lighthouses for range lights on the hillsides, and beacons in the Cut, in which electricity is used. The channel through Gatun lake is marked with floating buoys lighted with compressed acetylene dissolved in acetone. The most powerful electric lights are those of the approach channels which are visible for from 12 to 18 nautical miles. The beacons and gas-buoy lights have about 850 candle-power. White lights are used throughout; and in order to eliminate the possibility of confusing the lights with one another, and with the lights on shore, all range-lights, beacons and buoys have individual characteristics, formed by flashes and combinations of flashes of light and dark intervals. The electric lights on the locks are suspended from brackets on concrete columns about 34 ft. high and are clustered under concrete hoods in such a way as to light the lock chambers and not penetrate along the axis of the canal.

Breakwaters.—Long breakwaters have been constructed near the approach channels in both oceans. One in Limon Bay, or Colon harbour, called the West Breakwater, extends into the bay from Toro Point at an angle of 42° 53′ northward from a base-line drawn from Toro Point to Colon light, and is 11,526 ft. in length, 15 ft. wide at the top and 10 ft. above mean sea-level. A second, also in Limon Bay, known as the East Breakwater, is without land connexion, is about one m. in length and runs in an easterly direction at nearly a right-angle with the canal channel. It has a lighthouse on the channel end. The purpose of the West Breakwater is to protect the harbour against "northers," very severe gales which are likely to blow from Oct. to January. The purpose of the East Breakwater is to prevent silting in the canal channel. The breakwater at the Pacific entrance extends from Balboa to Naos Is., a distance of about 17,000 ft., or a little more than three miles. It lies from 900 to 2,700 ft. E. of, and for the greater part of the distance nearly parallel to, the axis of the canal prism, varies from 20 to 40 ft. in height above mean sea-level, and is from 50 to 3,000 ft. wide at the top. It was constructed for a twofold purpose; first, to divert cross-currents that would carry soft material from the shallow harbour of Panama into the canal channel; second, to furnish rail connexion between the islands and the mainland.

Permanent Canal Buildings.—All permanent canal buildings, for civil or military use, are of concrete, replacing the temporary struc-

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tures which were of wood. The headquarters of the canal force are in the large three-storey administration building, situated on a bluff about 75 ft. above sea-level and overlooking the Pacific entrance to the canal. Near this are the governor's residence and the dwellings of the other officials. On the plain below, which was formerly a swamp and was raised to an elevation of 20 ft. above sea-level by material from the Cut and hydraulic fill from excavation for terminal structures at Balboa, there is a town composed of concrete buildings erected after the canal had been completed. The buildings are arranged on either side of a central avenue. They include dwellings for different types of employees, a police station, post-office, fire station, chief sanitary office, dispensary, telephone building, clubhouse, hotel, lodge hall, schoolhouse and playground, church and commissary. All are of concrete blocks with roofs of red tiles, and of the same general style of architecture, and are connected with one another by a continuous arcade as protection against sun and rain.

Terminal Facilities.—In both oceans have been constructed terminal facilities adequate for the naval, military and commercial needs of the United States and attractive to the shipping of the world. Systems of concrete piers 1,000 ft. in length, with docks and wharves and sheds of concrete, have been built. On the Pacific side is a concrete dry-dock on a rock foundation, with a usable length of 1,000 ft. and an entrance width of 110 ft., and a subsidiary dock for vessels of a smaller type with a usable length of 350 ft. and an entrance width of 80 feet. There are also large repair shops of ample capacity to meet all demands. Dry-docks and machine shops are situated behind Sosa Hill and thus protected against naval bombardment. Basins of concrete for the storage of coal have been constructed below the water-line on both oceans, some of which are available for leasing to private coaling companies, all handling to be done by the U.S. Government plant. A fixed supply of coal for the United States naval use is maintained. From a single plant supplies of oil, food and other necessities are furnished to all vessels desiring them, as well as to the canal forces. A high-power wireless telegraph station is situated midway of the Isthmus, under the jurisdiction of the Navy Department, but open to the public under Government regulations.

Fortifications and Military Occupation.—The Canal Zone is a military reservation by Act of Congress. Fortifications have been built in the oceans at both ends of the canal, and a military force of about 10,000 men is maintained. Concrete barracks have been erected at both terminals, and adjoining the locks.

Canal Administration.—Under an Act of Congress, approved Aug. 24 1912, the Panama Canal is governed and operated and the Canal Zone is governed through a governor of the Panama Canal, appointed by the president, with the advice and consent of the Senate, for a term of four years, and until his successor shall be appointed and qualified, at a salary of $10,000 a year. In addition to the operation of the canal, the governor has official control and jurisdiction over the Canal Zone and performs all duties in connexion with its civil government, it being held, treated and governed as an adjunct to the canal. There is one U.S. District Court in the Canal Zone, with the same jurisdiction and procedure as the same courts in the United States, the judge of which is appointed by the president. Appeals are made to the Circuit Court of Appeals of the Fifth Circuit of the United States. In each town there is a magistrate's court, the judges being appointed by the governor. They have jurisdiction only within their towns and over minor cases. General Goethals was the first governor and served till Jan. 11 1917, when he resigned and was succeeded by Col. Chester Harding, U.S.A., who held the office till Jan. 11 1921, when he was succeeded by Col. Jay J. Morrow, U.S.A.

Canal Zone Population.—A census of the Canal Zone, taken in 1920, showed a total pop. of about 30,000 of which 21,650 were civilians and the remainder military. There were 3,434 male and 360 female American citizens; 5,652 male and 74 female aliens; the remaining 12,000 were mainly natives and transient West Indians.

Canal Force.—The average working force of the canal was in 1920 about 21,000, of which about 3,500 were Americans, chiefly in official and clerical positions, and the others alien labourers, mainly West Indian negroes. The apparent discrepancy between these figures and those of the Canal Zone census is due to the fact that many of the labourers live in the cities of Panama and Colon, which are not within the Canal Zone.

Tolls.—The Hay-Pauncefote treaty between Great Britain and the United States, abrogating and succeeding the Clayton-Bulwer treaty, was ratified on Dec. 16 1901. It contained this clause:—

"The canal shall be free and open to the vessels of commerce and of war of all nations observing these rules, on terms of entire equality, so that there shall be no discrimination against any such nation, or its citizens or subjects, in respect of the conditions or charges of traffic or otherwise. Such conditions and charges of traffic shall be just and equitable."

In 1912 Congress passed an Act for the operation and government of the Panama Canal, which was approved by President Taft on Aug. 24 of that year, and which contained the provision that "no tolls shall be levied upon vessels engaged in the coastwise trade of the United States." A formal protest against this exemption was made by Great Britain on the ground that it was a violation of the Hay-Pauncefote treaty. In June 1914, under a special appeal from President Wilson, Congress passed a bill which repealed the Exemption Act of 1912. This was approved by President Wilson on June 15 1914. Under authority given to him by the Panama Canal Act of Aug. 24 1912, President Wilson issued a proclamation on Nov. 21 1913, fixing the canal tolls at $1.20 per net ton of net capacity as determined by the United States national rules of measurement. On Feb. 15 1915 President Wilson issued supplementary instructions that where application of the $1.20-per-net-ton rate produced a sum in excess of the sum produced by the application of the $1.25 rate on net registered tonnage as determined by the United States rules of measurement, the excess amount should be uncollectable. The effect of this ruling was to reduce by approximately 14% the revenue from tolls paid by ships of all nationalities using the canal. During the first six years of operation there was a marked increase in traffic through the canal notwithstanding the fact that the World War everywhere prevented the normal development of ocean-going commerce. After the entry of the United States into the war there was a decrease in commercial traffic, due to the diversion of certain lines of ships to trans-Atlantic service, which was more than offset by the increase in traffic growing out of the war, chiefly on account of the development of the nitrate trade with the Pacific coast of South America.

Canal Traffic.—The number of commercial transits, the amount received from tolls and other collections, and the current expenses of maintenance and operation for the fiscal years ending June 30 1915–20 are shown in the following table:—

Fiscal Year	Number of commercial transits	Tolls and other revenues	Current expenses of operation and maintenance
1915 . . .	1,072	$4,343,383.69	$4,123,128.09
1916 . . .	760	2,558,542.38	6,909,750.15
1917 . . .	1,806	5,808,398.70	6,788,047.60
1918 . . .	2,068	6,411,843.28	5,920,342.94
1919 . . .	2,028	6,354,016.98	6,112,194.77
1920 . . .	2,478	8,935,871.57	6,548,272.43

For the same period the number of canal transits by government vessels exempted from tolls and the total tonnage of cargo carried were as follows for each fiscal year:—

Fiscal Year	Number of Vessels	Cargo Tons	Fiscal Year	Number of Vessels	Cargo Tons
1915	16	43,647	1918	112	36,746
1916	43	76,675	1919	179	93,641
1917	100	147,405	1920	267	351,332

Over 25% of the cargo handled through the canal, from its opening to the end of the fiscal year 1920, was in transit between the United States and South America, and 14½% was between the Atlantic coast of the United States and the Orient. Among nations the chief users of the canal were the United States and Great Britain. The number of vessels passed each year for these nations and for all other nations was as follows:—

Fiscal Year	United States	Great Britain	All other nations
1915 . . .	470	465	153
1916 . . .	238	358	191
1917 . . .	464	780	632
1918 . . .	628	699	803
1919 . . .	786	602	637
1920 . . .	1,129	753	596

The following is the saving, in nautical miles, effected by the Panama Canal from European ports to ports on the W. coast of America, to Hawaii and to New Zealand.

To	From				
	Liverpool	Hamburg	Antwerp	Bordeaux	Gibraltar
Sitka, Alaska . . .	5,666	5,528	5,528	5,376	4,950
Port Townsend, Wash. .	5,666	5,528	5,528	5,376	4,950
Portland, Ore. . .	5,666	5,528	5,528	5,376	4,950
San Francisco, Cal. . .	5,666	5,528	5,528	5,376	4,950
San Diego, Cal. . .	5,676	5,538	5,538	5,386	4,960
Acapulco, Mexico . .	5,874	5,736	5,736	5,584	5,158
San Jose, Guatemala .	6,128	5,990	5,990	5,838	5,412
Honolulu, Hawaii . .	4,403	4,265	4,265	4,113	3,687
Guayaquil, Ecuador .	5,198	5,060	5,060	4,908	4,482
Callao, Peru . . .	4,043	3,905	3,905	3,753	3,327
Valparaiso, Chile . .	1,540	1,402	1,402	1,250	824
Wellington, N.Z. . .	1,564	1,409	1,409	1,257	489

The following is the saving, in nautical miles, effected by the Panama Canal in length of all-water routes between ports of the Atlantic–Gulf U.S. seaboard and various Pacific ports.

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To	From				
	Boston	New York	Norfolk	New Orleans	Galveston
Sitka, Alaska	7,676	7,873	8,020	8,868	8,940
Portland, Ore.	7,676	7,873	8,020	8,868	8,940
San Francisco, Cal.	7,676	7,873	8,020	8,868	8,940
San Diego, Cal.	7,686	7,883	8,030	8,878	8,950
Acapulco, Mexico	7,884	8,081	8,228	9,076	9,148
San Jose, Guatemala	8,138	8,335	8,482	9,330	9,402
Honolulu, Hawaii	6,413	6,610	6,757	7,605	7,677
Guayaquil, Ecuador	7,208	7,405	7,552	8,400	8,472
Callao, Peru	6,053	6,250	6,397	7,245	7,317
Valparaiso, Chile	3,550	3,747	3,894	4,742	4,814
Yokohama, Japan	3,435	3,768	4,116	5,705	5,777
Shanghai, China	1,543	1,876	2,224	3,813	3,885
Hong-Kong, China	351	18	330	1,919	1,991
Manila, P. I.	292	41	389	1,978	2,050
Adelaide, Australia	1,483	1,746	2,000	3,258	3,330
Melbourne, Australia	2,507	2,770	3,024	4,282	4,354
Sydney, Australia	3,669	3,932	4,186	5,444	5,516
Wellington, N. Z.	2,296	2,493	2,640	3,488	3,560

See Joseph Bucklin Bishop, *The Panama Gateway* (1913, revised edition 1915); George W. Goethals, *Government of the Canal Zone* (1915); W. L. Sibert and John W. Stevens, *The Construction of the Panama Canal* (1915); W. C. Gorgas, *Sanitation in Panama* (1915); Joseph A. Le Prince and A. J. Orenstein, *Mosquito Control in Panama* (1916); *Annual Reports of the Governor of the Panama Canal.*

(J. B. Bi.)

PAN-AMERICAN CONFERENCES (*see* 20.671).—The fourth Pan-American Conference was held July 12–Aug. 30 1910 in Buenos Aires. Many questions involving the common interests of all the American republics were discussed, including steamship service, sanitation, copyright, patents and trade marks. It was decided that the International Bureau of the American Republics should henceforth be called the Pan-American Union. The same year the Pan-American Union building in Washington was dedicated; it had been erected through a gift of $750,000 from Andrew Carnegie and additional funds provided by the various republics. During the three weeks following Dec. 25 1915 the second Pan-American Scientific Congress met in Washington. Eduardo Suarez, Chilean ambassador to the United States, presided. Among the speakers was President Wilson, who urged friendly settlement of international disputes by arbitration. The Congress appointed an International High Commission, which met at Buenos Aires in April 1916. Improvement and extension of cable, telegraph and railway service between the countries was urged. A permanent International High Commission was established to promote uniform commercial laws throughout Pan-America. In Nov. 1918 a Pan-American Federation of Labor Conference met at Laredo, Tex. Delegates were present from the United States, Mexico and Central America. An influenza epidemic interfered with South American attendance, Colombia alone being represented. A permanent federation was organized. Pan-American Child Welfare Congresses met at Montevideo, Uruguay, in Dec. 1918 and in May 1919; at the second meeting provisions were made for establishing at Montevideo an International Bureau of Child Welfare. In June 1919 a Pan-American Commercial Congress was held in Washington, and in the same city in Jan. 1920 a Pan-American Financial Congress.

PAN-ISLAMISM.—One of the results of the World War was to bring into new prominence, in connexion with Turkey and the Middle East, the movement known as Pan-Islamism, for uniting the peoples who profess the Mahommedan religion under one banner. The history of Pan-Islamism from 1910 onwards is analyzed below.

1. *Before the Italian War.*—The proclamation of the Ottoman Constitution in 1908 seemed to cut at the root of Pan-Islamism, since the idea of the former was to substitute for preëxisting religious and national divisions an Ottoman nationality, wherein the different communities of the empire should equally share. Writers of the year 1909 show many reasons why the "Young Turks" could never favour Pan-Islamism, which indeed they had officially repudiated. It was pointed out that the more conservative Moslem nations of Africa would never approve a Sultan in whose eyes all creeds were to be equal. By 1910 it was realized that this prospect was chimerical; Tal'at Bey, Minister of the Interior, in a speech delivered at Salonika on Aug. 6 of that year at a private meeting of the Committee of Union and Progress, asserted that, though according to the Constitution all Ottoman subjects were equal before the law, such an order of things was clearly impossible; this equality was in defiance of the *Shari'ah* (religious code), and the Christians themselves had no desire to become Ottomans. At the Salonika Congress of 1911 a definite scheme of Pan-Islamic propaganda was adopted, and it was resolved that a congress of delegates from all the Moslem countries of the world ought to meet annually in Constantinople to discuss questions of interest to all Moslems. Emissaries appear to have been actually sent out during these years to win or to confirm adherents to the Ottoman Caliph wherever Moslems were subject to Europeans, even to remote parts of Africa, including Morocco; others worked among the Moslems of China. These missions seem to have been fairly effective, as a Pan-Islamic writer asserts that the *khutbah* (Friday sermon) continued to be pronounced in the name of the Ottoman Caliph in Tunis in spite of French objection; and that when, in 1912, a republic was proclaimed in China the Chinese Moslems signified their adhesion on condition that the rights of the Ottoman Caliph were not infringed thereby.

Attempts were also made to deal with the old difficulty which had confronted Pan-Islamism, the schism between Sunnah and Shi'ah. Early in 1911 a letter was published by a number of Ottoman and Persian jurists assembled at Nejef, asserting that there was no difference of principle between the two sects and urging coöperation between the two empires, Persia being at that time, it was supposed, menaced by England and Russia. The Agha Khan, head of a sect so heretical that 'Abdul Hamid II. had declined to admit him to an audience, made a tour in India to advocate the claims of a Moslem university. Articles advocating union appeared in various Sunni and Shi'i journals; indeed, the Moslem press as a whole was Pan-Islamic.

Nevertheless, as early as 1910 prominence had been given to a new antithesis, which may be said to have ultimately wrecked the schemes for reunion of the Moslem communities. In that year the Constantinople journal *Iqdam*, an organ of the Committee, adopted a tone unfriendly to the Arabs, whom it charged with readiness to sell their honour for gold—an accusation vehemently resented in the Arabic-speaking countries. But in fact the seeds of dissension between the Turkish and Arab elements in the Ottoman Empire had been sown in the Constitution, in Art. 68, par. 10 of which it is enacted that after the expiration of a period of four years a condition of eligibility to the Chamber of Deputies shall be ability to read and write Turkish. This rule definitely aimed at making Turkish the language of the empire; and in the resolutions in favour of Pan-Islamic propaganda the encouragement of the study of Turkish was recommended. The true Pan-Islamic view was that Arabic should be the common language of Islam; some, indeed, suggested that the empire should be bilingual, with Turkish for its secular and Arabic for its religious language; in any case, that every Moslem should learn Arabic in addition to any idiom which happened to be his mother tongue. Journals were started in the Turkish and Arabic interests respectively; the latter were represented in Constantinople by one called at first *Sirat Mustaqim*, afterwards *Sabil al-Rashad*. The Committee of Union and Progress more and more inclined to the Turkish side and to the substitution of Pan-Turanianism for the Ottoman nationality. In the races subject to the Russian Empire and speaking different varieties of Turkish they found their natural allies; and for these the Ottoman literature could count as classical, being in any case far superior to anything of their own. This policy of Turkification involved the Committee in wars in Albania, the Hauran and S. Arabia; they planned treating the Arab parts of the empire as colonies, to be ruled from Constantinople without the right of sending deputies to the Chamber; and they were charged with the design of disarming all Moslems in the empire except the Turks, and with advocating neglect of the ritual of Islam. Where military exercises interfered with religious the latter were to give way; devout officers were, it is said, dismissed and replaced by free-thinkers.

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2. *The Italian War.*—To some extent this split was retarded by European aggression, which may be said to have culminated in 1911. The interference of Great Britain and Russia in Persia and the French scheme for governing Morocco as a protectorate had made it clear that Turkey was the only Islamic state which could compete with the European Powers on anything like equal terms. The Italian attack on Tripoli in Sept. of that year evoked widespread sympathy with Turkey among the Islamic communities. The Javanese press, *e.g.*, made no secret of its desire to see Turkey triumph, and the Mahommedan press of Egypt warmly espoused the side of Turkey. At a meeting held in Kabul the Amir of Afghanistan took part in a demonstration in favour of the Turks, and in India money was collected for their assistance.[•] Care, indeed, had been taken by Italy to avoid all appearance of an attack on Islam itself, and the Pope himself warned Christian soldiers against considering the campaign as a crusade; but to the Moslem, Christian and European are not very clearly distinguished, and it was plausibly argued that Europe was not now satisfied with protecting Christians within the Ottoman Empire, but had resolved on partitioning that empire among non-Moslem Powers. In proclamations issued in Constantinople the Sultan whose dominions were thus attacked was described as the legitimate ruler of 300 million Moslems (swelled by some journalist to 400 million), and a demand was raised for the restoration of his arbitrary powers.

Islam was not united on this occasion in the defence of the Ottoman Caliph, for while the Iman of San'a ceased hostilities, the Idrisi chieftain in Asir favoured the Italians. On the other hand, the Turks had the coöperation of the Senussis, who in the preceding century had kept aloof from their quarrels. The Committee of Union and Progress is said to have been astonished at the amount of sympathy which the cause of Turkey had evoked, having expected, *e.g.*, that the Tripolitans would be indifferent to the change of rule, whereas they in fact stubbornly resisted the invaders. The Committee in consequence proceeded to make certain concessions to Arab sentiment, without, it is said, actually altering their policy. A beneficent Islamic society was founded in Constantinople, under the patronage of the heir apparent, chiefly with Egyptian money; and an attempt was made to found a Moslem university in Medina. Schemes were started for promoting the study of Arabic under efficient instructors; and there were authoritative pronouncements that racial differences in the Ottoman Empire need not be suppressed.

3. *The Balkan War and its Consequences.*—This war, which broke out in Oct. 1912, demonstrated the military weakness of Turkey, though the recovery of Adrianople after the Armistice was greeted with telegrams of congratulation from all parts of the Moslem world. Clearly, however, up to this point Pan-Islamism had failed in its original design, that of arresting the progress of European aggression and eventually restoring Islamic rule in Asia and Africa. It had, however, aroused fairly general sympathy with Turkey and perhaps brought home to many Moslems the idea that someone claiming to be their Caliph existed. Subscriptions to the national defence fund of the Ottoman Empire flowed in from various quarters; owing to the efforts of a deputy of the Duma, Tas-pula 'Abdul Jalil Oghlu, the Moslems of Samarkand sent a handsome subscription in Aug. 1913; and in Bosnia, which had quite lately formed part of the empire, the opinion was said to be general that the ruin of Turkey would be an immense disaster from the religious point of view. From this region, too, sums of money were sent to the Red Crescent and the national defence fund. In May the Moslems of Delhi sent the sum of £1,600 to the Ottoman Minister of Finance for the housing of immigrants who had lost their homes in the recent war. Subscriptions were also promised from Java and the Malay States. The talk about the need for union between Moslems was renewed in the Moslem press throughout the world; notably in the *Habl al-Matin*, a Pan-Islamic journal in the Persian language published in Calcutta; and societies with the object of either spreading Islam or producing unity among Moslems were founded in different regions; *e.g.* a *jam'iyyat al-ittifaq*, "Society of Concord," founded in Muscat, a *khariji* state. An *anjuman-i-himaya-i-Islam*, "Society for the Defence of Islam," of Auckland, California, is also mentioned.

The language used by journalists caused some apprehension to the European governments responsible for great numbers of Moslems, and complaints were made that in the Islamic territories of Russia the charge of Pan-Islamism was easily leveled and resulted in frustrating the efforts that were being made for spreading education. The Islamic reactionaries, who dreaded the modern learning, obtained the imprisonment of modernist teachers by informing the authorities that the latter were engaged in Pan-Islamic propaganda. Any Moslem who took in the journals of Cairo or Constantinople, or had studied in either of those cities, was suspected of pursuing these schemes. On the other hand, the plan pursued by the imperial government in its scheme for enforced education was the Russification of all its subjects. One member of the Duma, Sadr ad Din Maqsudoff, had some years before defended his co-religionists from the charge of Pan-Islamism which the Moslem schemes for education had incurred; while claiming that the Russian Moslems were loyal to the Government, he maintained that their nationality was Islam.

In Syria and Mesopotamia nationalism at this time was developing, and Pan-Islamism making little way.

Two works issued in Constantinople in the year 1913 illustrate the ideas of Moslem publicists on the phase which the question had now assumed.

One of these is the *Ittihad al-Islam* ("Unity of Islam" or "Pan-Islamism") of Jalal Nuri Bey, of sufficient importance to be translated into Arabic in 1920, seven years after its first appearance. In the face of the weakness displayed by Turkey in her last wars it was no longer advisable to demand a general uprising of Islamic peoples to free themselves from European oppression; hence the author, while anticipating yet further defeats and losses, substitutes for a plan of coöperation a vague hope, to which Moslems should cling. This hope is not confined to proceedings in Islamic areas.

He hopes that China and Japan will become cordial friends and so prevent the further spread of European domination in Asia; and thinks that the republican Government of China will be better for the Moslems there than the imperial Government had been. He thinks that the Arabic-speaking people of Africa and Asia will one day form a single state, without indicating what the relation of that state to the Ottoman Empire is to be; the older Pan-Islamism had on the whole favoured "decentralization," *i.e.*, a confederation of Moslem countries under Ottoman hegemony. He advises the English to bestow on their Asiatic possessions the status of Canada or Australia, as in that case the inhabitants will coöperate cordially against their enemies.

In the matter of the sectarian divisions of Islam, which from the first have rendered Pan-Islamism impracticable, this writer's method is to some extent drastic: the minor sects in the Ottoman Empire (*i.e.* probably the Zeidis, Isma'ilis, Nuseiris, etc.) should be wiped out. In the case of the more important Shi'ah sect his advice is that the Moslem should forget that he is a Sunni or a Shi'i and remember only that he is a Moslem. This probably means that the Shi'is, who are in a minority, should abandon their system in favour of the other.

While asserting the superiority of Islam morally to Christianity as practised in Europe, he is anxious that European science should be adopted and its methods assimilated; and he advises the adoption of the distinction between the civil and the religious code, to the unification of which he attributes the decadence of Islam. Education should, he holds, be taken out of the hands of religious authorities and be secularized; thus mediaeval scholasticism will be abolished. What concerns the conscience should be left to religion, whereas commercial affairs should be regulated by codes which admit of improvement. These doctrines are so unorthodox that his Arabic translator has occasionally to register a protest. They look like Pan-Islamism with the Islam omitted.

This writer repeatedly speaks of the Moslems as a nation of 300 million individuals attached to each other by a bond of unique strength; indeed, the phrase *Union of Islam* is, he thinks, tautologous, as the word Islam of itself implies union. Whatever

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may be the truth of this as a theory, it is confirmed neither by ancient nor by modern practice. Some writers, in general favourable to Islam, speak of dissension and civil war as unavoidable in Moslem communities; and doubtless this has led to that loss of political power which gave rise to the Pan-Islamic movement.

The work called *Qaum Jadid* ("The New Nation"), by Ubaid-alla Efendi, formerly member for Aidin, and at one time editor of an anti-Arabian journal in Arabic, which appeared about the same time, perhaps in the main advocated the same ideas, only it was far more outspoken. It demanded that every Moslem should give half his wealth to the Ottoman treasury in order to enable it to muster forces capable of recovering its lost provinces; anyone who declined to make this sacrifice was to be considered an apostate. Its idea of Islam was somewhat loose—there was no occasion to study Arabic, as the Friday sermon might be delivered in Turkish, and the Qur'an and other sacred books might be translated. The Sacred War was a duty incumbent on all Moslems, and such of them as lived contentedly under non-Moslem rulers were apostates, for by pleasing unbelievers they offended God. All Moslems in Ottoman countries who failed to enlist under the banner of the party of Union and Progress were to be regarded as apostates; as such the Albanians were to be branded. To follow the ritual prescribed in the books of the orthodox jurists was unlawful, for the new school had deduced five principles from the Qur'an. These were: 1, reason; 2, the Moslem formula of faith; 3, good character; 4, the duty of fighting with person and wealth; 5, that of striving to furnish the requisites of war by uniting under the banner of the Caliph.

Little could in fact be hoped from attempts to rouse men to make great sacrifices in the cause of Islam when all which constitutes Islam to the ordinary believer is abandoned; and Mr. Wyman Bury, in his acute analysis of the causes which militate against Pan-Islamism, gives the first place to the contempt shown by the Turks for the ordinances which Islam holds sacred. "Even before the war," he says, "Yemen Arabs talked of Turks and Moslems, a distinctly damning discrimination." The Turkish proclivity towards European dress and civilization, which he regards as another source of weakness, is scarcely to be distinguished from this, though the antithesis between civilization and its absence is to be found in other Moslem countries; and the Pan-Islamic encouragement of education as Europeans understand it, while in appearance rendering the movement formidable, has also rendered it suspect to large multitudes who would gladly emulate the ancient Islamic heroes. For the Islamic cult, which is thus so altered as to be unrecognizable, the Pan-Turanians endeavour to substitute a national ideal with a set of heroes, largely pagan, who are to displace the Prophet's family and the Four Pious Caliphs as objects of general reverence. This disrespect is naturally resented by Arab and other non-Turkish Moslems.

The former of the works described is far more characteristic than the latter of the general tone of Pan-Islamic journalism. It is full of accusations against the European Powers in control of Islamic territories, charging them with oppressing the Moslems, depriving them of elementary human rights, sowing dissension among them, and the like; yet rarely able to bring evidence justifying these charges, and compelled to ignore the fact that the Moslems prosper far more in countries protected by Europeans than where they are left to themselves. Its great hero is the Ottoman Sultan Selim I., whose chief title to fame is that he fought against and overthrew another Islamic sultanate, that of Egypt, and forcibly incorporated various Islamic countries in the Ottoman Empire. In places it is asserted that the unity of Islam is an undeniable fact wherewith Europe is confronted; in others, that the troubles of Islam are all due to its divisions. Hence the vagueness of both aim and method which characterized the earlier Pan-Islamism is conspicuous in this statement; and many a prophecy is uttered with regard to the future of European states which the years following its publication have falsified. To the latter work the term Pan-Islamism can scarcely be applied. Its programme is indeed clear enough—a general revolt of all Moslems against their European rulers in order to swell the armies of the Ottomans, the Ottomans meanwhile practically abandoning Islam. The summing-up of the situation in Arabia by Mr. Wyman Bury in 1914 would hold good of many other Islamic lands: "The Arab still acknowledges the Sultan as Caliph, but repudiates the Ottoman Government and all its works." Some Moslems of Java threatened to abandon the *khutbah* to the Sultan if the ideas of the Turkish extremists materialized. And indeed Pan-Islamism at this stage contained no practical formula which any but Turks would adopt.

4. *Pan-Islamism during the World War (1914–1918).*—Shortly after the Turkish Empire entered the war on the side of the German alliance the Grand Mufti declared a *jihad*, summoning all Moslems to arms in defence of their faith. General Liman von Sanders asserts that this call was absolutely without response; the reason, he holds, being that the pretext was obviously false, inasmuch as Turkey was itself in alliance with non-Moslem Powers and, indeed, fighting for their benefit and under their command. He quotes an Italian minister for the statement that the call was absolutely neglected by the Moslems of Tripoli. Further, the French Government issued a counterblast in a collection of expressions of loyalty from Moslem authorities of the French African Empire (*Collection de la Revue du Monde Musulman*, 1915, 1916, called *Le Salut au Drapeau*, in the English edition *Honour to the Flag*), wherein all Moslems are called upon to fight for France. The call seems to have been issued half-heartedly, even within the Ottoman dominions. When the official at the Mosque of Damascus had to proclaim the Sacred War from its pulpit, seeing a group of German officers among the congregation he said: "I am ordered to proclaim *jihad*. A *jihad* is, as you know, a Holy War to protect our Holy Places against infidels. This being so, what are those infidel pigs doing in our mosque?" This story is told by Mr. Wyman Bury (*Pan-Islam*, 1919, p. 81), who adds: "Those who forged the blade of this counterfeit *jihad* could not temper it in the flame of religious fervour, and it shattered against the shield of religious tolerance and good faith."

Doubtless the most serious blow which the unity of Islam received during the war was the entry into it of the Sherif of Mecca on the British side in 1916. The Sherif in his proclamations (published in his organ, the *Qibla*, and reprinted in the *Manar*, vol. xix.) made it clear that his quarrel was not with the Ottoman Empire, but only with the Party of Union and Progress, who had reproduced the worst atrocities of the *Umayyads* by firing at the House of God and slaughtering worshippers. As, however, this party represented the Ottoman Government, this act produced a definite division in Islam which is unlikely ever to be repaired. Uncertain as the sense to be attached to the title Caliph has ordinarily been, the idea has on the whole prevailed that he should have control of the sanctuaries and the access to them; there seems no means of devising a formula which should combine a Turkish Caliphate with an independent Hejaz. On the other hand, the removal of Turkish rule from Arabia, to which the events which followed the secession of the Hejaz led, has done little or nothing to realize the dream of Jalal Nuri of an empire embracing all the speakers of Arabic. The establishment of the Hejaz kingdom probably on the whole accentuated the sectarian differences which were already rife in the peninsula. A mission was indeed sent by the Emperor of Morocco to the Sherif of Mecca to congratulate him on his assertion of independence; but the legal authority who accompanied it gave it as his opinion that where Islamic countries were at a great distance from each other there was no objection to their being subject to different *Imams;* Morocco had at no time recognized the Eastern Caliphate, in whosesoever possession it happened to be; the independence of the Sherif therefore in no way affected the Moroccan Caliphate. Moreover, the history of Islam attested the frequent coexistence of numerous Caliphs (*Revue du Monde Musulman*, xxxiv., 1917–8, p. 140). The rise of this new power in the sanctuaries was not therefore to furnish a new principle of unity for Islam; it only helped to get rid of that round which the old Pan-Islamic ideas had been grouped.

In lieu of this there is some Pan-Arabian agitation; such at least is the purpose of a violent diatribe reprinted in the *Manar*

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for August 1919 from an Arabic newspaper appearing in Brazil called *Suriyyah al-Jadidah* (" New Syria "), for the preceding May, wherein the author urges the Arabs to unite and emulate the exploits of the early heroes of Islam. Apparently he contemplates an Arab federation, to be governed by an assembly which is to meet at one of " the great Arabian cities," with home rule for the separate states. This orator names the Turks with the English and the French among the oppressors of the Arabs, whence his proposed confederation is evidently not intended to include any who are not Arabs by race or adoption; and indeed he traces the servitude of the Arabs to the practice of the Abbasid Caliphs, who relied on Persian and Turkish retainers in lieu of depending on Arab forces exclusively. In addition to this he traces their downfall to the personal ambition of the Arabs, each one of whom aspires to be chief. Probably this is in the main intended as anti-French propaganda; but it would seem that quite early in the war some persons had aimed at establishing a union between the various states in Arabia itself, to be extended into the neighbouring countries with a view to resist the enforced Turkification with which they were threatened. It failed to materialize because the Sherif of Mecca had reasons for refusing to join it, and the course of the war by no means tended to allay divisions between the states of Arabia; indeed, in July 1918 the King of the Hejaz issued a proclamation declaring the Wahabis infidels and urging his subjects to resist them with force. This conflict " wounded the heart of every Arab who desired the unity of his race and every Moslem who disliked discord between his co-religionists."

The attempts that have been made during these years in other Islamic countries to propagate the idea of a Moslem union seem to have been ordinarily similar to those which preceded the Ottoman Constitution. They consist largely in the encouragement of education, and the founding of societies and journals whose purpose is to keep the Moslems together, and to maintain some sort of relations with their co-religionists in other parts of the world. Certain countries, indeed, appear to have been outside the reach of such efforts; and there are some wherein if attempted they have been unsuccessful. The general result of the war would seem to be to show that the Pan-Islamic idea was doomed to disappointment from the first. The European Powers against whom it was directed—England, France, Russia and afterwards Italy—received during the course of it great proofs of loyalty and attachment from their Moslem subjects; and even if we do not take every protestation at its face value, it seems clear that there was little sense of unity with the Turks on the ground of common religion on the part of these populations, in which, on the contrary, the sense of patriotism to the empires within which they are incorporated had been developed. The proclamation of a *jihad* with no response shows that the time for the employment of that instrument has passed, if indeed it was ever effective; the insertion of the Ottoman Sultan's name in the *khutbah* of so many peoples, to whom he was unknown, no more made him their real ruler in this century than that of an Abbasid in the 10th or 15th century secured for the Caliph any real power. Possibly the call attracted attention to the nature of and qualifications for the Caliphate, a subject which the Ottomans were imprudent in bringing to the forefront.

This is not, indeed, the view of some Moslems in India, who have established an *All-India Caliphate Committee*, with a series of publications on the *Question of the Caliphate*. The first of this series contains the presidential address of " Maulana Abul-Kalam," purporting to have been delivered at the provincial Caliphate Conference held in Calcutta Feb. 28 and 29, 1920. This treatise presents the most bellicose aspect of Pan-Islamism, and differs little from the *Qaum Jadid* described above. The *jihad*, according to it, is the primary duty of the Moslem; if the Turks are apt to be lax in their ritual, it must be remembered that for centuries they alone maintained the *jihad*, at a time when the Indian Moslems were enjoying peace and security. An endeavour is made to show that ever since the time of Sultan Selim I. the Caliphate of the Ottoman Sultan has been generally recognized. It is argued that there can be only one Caliph, and that it is the duty of every Moslem to be his obedient subject; and in particular to aid him in repelling invasions by unbelievers of Islamic territory and expelling them where they are already in possession; Islamic territory would appear to include the whole inhabited world. At the least the author claims that Arabia, Palestine and Iraq are the property of the Ottoman Sultan, which must be restored to him if the sentiments of the Moslems are not to be wounded. The Indian Caliphate Delegation sent to London went so far as to demand the cession of all the European lands which the Ottomans had ever occupied.

Ideas of this sort—not always carried to these lengths—are expressed by various authors and journalists in India, few of whose names are known in Europe. The best known of those who are claimed as advocates of them is probably the poet and philosopher Mohammed Iqbal, M.A., Ph.D. See this writer's *Secrets of the Self*, transl. R. A. Nicholson, London, 1920.

5. *After the War.* To what extent we can speak of Pan-Islamism since the Armistice is not clear. On the one hand it is evident that the occupation of Constantinople by foreign forces and the reduction of the Ottoman Empire to a comparatively small area have produced a feeling of depression among the Islamic peoples, who can no longer look with confidence to a great Islamic Power as the natural leader in some scheme for the recovery of hegemony in Asia and Africa; on the other hand, the feud between Sunnah and Shi'ah shows no signs of healing, and though an Arabian Caliphate may not yet have been formally proclaimed, the severance of the Arabs from the Turks appears to have been definitely concluded. Even within the Ottoman system there is at this moment a schism, since the authority in power at Angora acts independently of the Caliph of Constantinople, and appears to rely on Turanian support, so far as it obtains any from Islamic peoples; while its endeavour to obtain support from Bolshevism is calculated to wound the sentiment of orthodox Islam, which is far removed from the principles of that system. Further, it would appear that the tendency of recent events has been to emphasize nationalism, and create a desire in the various Arabic-speaking countries for complete independence rather than for absorption in an Islamic empire, even on the condition of decentralization, which was the catchword of the old Pan-Islamism. A Pan-Islamic tendency may perhaps be found in the Indian Caliphate agitation, but, even if it be taken at its face value, it is clear that it is making demands for the Ottoman Caliph which his former subjects do not back, and many who have made sacrifices for this idea have found no encouragement from Islamic rulers who at one time were supposed to recognize this title.

Conjectures are indeed at times put forward concerning the existence of agencies organizing simultaneous outbreaks in different Islamic countries against their European protectors; such may certainly exist, but the results hitherto achieved indicate little in the way of coöperation or clearness of aim; and indeed 'Abdul Hamid II., who gave some encouragement to the Pan-Islamic idea, which was that Turkey should lead a *jihad* against the European possessors of Islamic countries, does not appear himself to have entertained such a project, though he thought the fear of it might help him in checking European interference with his internal government. The governments which have followed have probably hoped for greater results, but have obtained very much less, being unable either to maintain the independence of Moslem states outside their empire or to preserve the integrity of that empire itself. It would seem then that Pan-Islamism, should it again acquire importance, must seek some other *point d'appui* than the Ottoman Empire; but only the future can tell whether such a *point d'appui* will be found.

AUTHORITIES.—*Revue du Monde Musulman* (1911–1919); *al-Manar* (Cairene monthly) (1328–1338 A.H.); G. Wyman Bury, *Arabia Infelix* (London, 1915) and *Pan-Islam* (1919); R. Pinon, *L'Europe et la Jeune Turquie* (Paris, 1911). (D. S. M.*)

PAN-TURANIANISM.—Only a few years before the outbreak of the World War in 1914, a new political movement came into prominence in Constantinople. The awakening of a Turkish national consciousness began to aim at the purification of the

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with Central Asia, which was closed by Tsarist Russia, is now open for the union of the Turks. This road to the East is of great importance both on political and economic grounds.

If the spirit of independence among the Turks of Central Asia, the Caucasus, and Azerbäijän could be overcome by the unifying power of common language, race, religion, and culture, Turkey might become a formidable political power based on the combined moral force of the Caliphate and of Turkish nationalism.

Pan-Turanianism, however, if pushed to extremes, is an artificial and a retrograde movement, and would then come into irreconcilable conflict with Pan-Islamism. Thus the attempt to carry out the proposal of some of the Turks of Constantinople to renounce the religion of Mahomet, or even to substitute Turkish for the sacred language of the Koran, would incense the fanatical Moslem. Again, the Turkish peoples outside the Ottoman Empire do not form coherent populations, containing as they do large nomadic elements. On the other hand, the Ottoman Turks, indolent by nature, have never displayed any ability or energy in state-building. It is therefore not likely that they will develop enough statecraft and driving-power to succeed in welding together the different Turkish peoples into a single strong united empire containing perhaps 25,000,000 of the Turkish race. The extension of Pan-Turanianism so as to include other branches of the Turanians can only be pronounced to be a purely visionary idea. The only connecting link between them and the Turks at the present day is the descent of their various languages from a single parent speech that existed in remote antiquity: but Lapp and Manchu are to-day farther apart than English and Sanskrit. The other four branches now differ from the Turks in religion and civilization, besides being separated from them by great and often immense distances. The Samoyeds are nominally Christians, but really Shamanists. The Tunguses, who inhabit a vast tract of north-eastern Asia as Shamanists and reindeer nomads, are slowly dying-out in Siberia while their most prominent tribe, the Manchus, are being entirely absorbed by Chinese civilization. The Mongols, who are the eastern neighbours of Turkish tribes, and were many centuries ago politically associated with the Turks as warlike invaders of the West, are nomads and for the most part adherents of Buddhism, which has transformed them into a peaceful and unenterprising people that at the present day has hardly anything in common with the Turks. The Finno-Ugrian branch, for the most part separated by long distances from the Turks, have with very slight exceptions been thoroughly Europeanized and Christianized for many centuries. The Magyars, conquered by the Turks in the 16th and 17th centuries, fought on the side of the Turks during the World War owing to the pressure of the German alliance; but there seems to be no permanent prospect of political association between these two racially and linguistically related races. It thus seems clear that at least 20,000,000 Turanians will never have the slightest inherent tendency to be drawn into union with the Islamic religion and civilization of the Turkish Empire.

AUTHORITIES.—Sarron, *La Jeune Turquie et la Revolution* (1912); Tekin Alp, *The Turkish and Pan-Turkish Ideal* (1916); *La Turquie et la Guerre* (1916); "Islam and the War," *Quarterly Review* (April 1918); Macdonell, *Turanians and Pan-Turanianism* (1918); *Eurasian Routes* (1920); *Berliner Tageblatt* (Jan. 24 and 28 1920).

(A. A. M.)

PARAGUAY (*see* 20.756).—The pop. of Paraguay in 1920 was supposed to be about 800,000. At least 60% of the inhabitants were illiterate, though President Franco during 1916–9 made an attempt toward educational progress. The school registration for 1916 was 80,142.

Of the imports of Paraguay 81%, and of the exports 40%, pass through the Asunción custom-house. The total foreign trade of Paraguay varied little between 1907 and 1918 though the proportion of imports to exports differed, as will be seen from the following table, showing the official customs values in Paraguayan gold pesos, equal to 4s. or $0.96 each:—

	Imports	Exports	Total
1907	7,512,502	3,236,110	10,748,612
1917	5,098,581	6,494,802	11,593,383
1918	5,201,726	7,171,319	12,373,045

The United Kingdom had first place in imports until 1908, when Germany passed her, supplying 29% of the total imports as against Great Britain's 21 per cent. A close competition followed. In 1913 the United Kingdom supplied 28·6% of Paraguay's imports as compared with 27·6% from Germany, but in 1914 the situation was reversed, Germany supplying 27% to the United Kingdom's 22·7 per cent. In 1915 and 1916 the proportion of imports from the United Kingdom rose to 33% and 38·5% respectively. There was in 1921 only one strictly British mercantile house, and only one American, as compared with five German houses.

History.—Manuel Gondra became President on Jan. 18 1911 but was overthrown by a revolution headed by Col. Albino Jara in July of that year. Jara was succeeded in turn by Liberato Rojos, who was overthrown Jan. 14 1912 by another "alteration of the legal order," as a consequence of which Pedro Pena was placed in the presidential chair Feb. 29. Considerable bloodshed accompanied these changes, which cost the country at least £400,000. On March 25 Emiliano Gonzalez Navero became President, retaining office until Aug. 15, when Eduardo Scherer succeeded him. Scherer actually completed his term of office, the first time this had occurred in Paraguay since 1870. His firmness prevented several outbreaks and disturbances, especially one at the beginning of 1915, which might have been most serious under a weaker executive. Scherer's successor was fortunately another able man, Manuel Franco, who retained his position from Aug. 15 1916 until his death on June 3 1919. Franco not merely forestalled revolutions, but brought Paraguayan finance to the best condition it had reached for years. During his administration the meat-packing industry became fully established in Paraguay. This was the greatest step forward that had occurred since 1870. By encouraging an industry which more than almost any other improves the lot of the individual farmer in a rather isolated agricultural country, the three United States packing-houses that established themselves in Paraguay during President Franco's administration were of great service. They caused a thorough survey of Paraguay's cattle-raising possibilities to be made and also studied the different grasses and areas of pasturage and their suitability for different breeds of cattle. In 1918 37% of the total exports of Paraguay consisted of the products of stock-raising and meat-packing as against 32·4% for the products of the forest industries (lumber, quebracho, etc.) and 30·2% for agricultural products.

José P. Montero filled the remainder of Franco's presidential term, from June 3 1919 to Aug. 15 1920, when Manuel Gondra again became President, having been elected while minister to the United States. The lessened demand from Europe and the United States for the chief exports of Paraguay at the close of the World War caused a decided setback to Paraguay's prosperity. On Jan. 1 1921 Paraguay was unable to meet the payments due on her foreign debts, and the largest banks in the country became seriously involved, further aggravating the commercial crisis. An American financial adviser was assisting the Paraguayan Government in 1921. On Nov. 17 1913 through rail communication was inaugurated between Asunción and Buenos Aires. This has done much to lessen the isolation of the country, for under normal conditions the journey between the two cities is made in 50 hours. Paraguay renewed direct diplomatic relations with the United States in 1913, sending a minister to Washington for the first time in eight years, while the United States created a separate mission for Paraguay in the same year, accrediting a minister to Paraguay alone, instead of to Uruguay and Paraguay jointly as formerly. Great Britain in 1921 still accredited one minister to both countries. The United States and Paraguay signed an extradition treaty on July 30 1913. In Nov. 1921, Pres. Gondra was ejected from office as the result of a revolution.

The Government remained neutral during the World War, though Congress adopted a resolution of sympathy with the Allies and of approval of the action of the United States in declaring war on Germany. The Government dismissed some of its German employees, and maintained a pro-Ally attitude.

The best recent book on Paraguay is: W. L. Schurz, *Paraguay, a Commercial Handbook*, published by the Government Printing Office at Washington, D.C., 1920.

(C. L. C.)

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PARAVANE, a naval device used in the World War first for attacking submerged submarines and subsequently for protecting vessels against mines and for cutting up hostile minefields. The name of Acting-Comm. C. D. Burney is especially associated with its design and development.

The explosive paravane in its final form consisted of a torpedo-shaped body carrying near its head a large steel plane which was set at a small angle to the centre-line of the body, and was in an approximately vertical position when the paravane was being towed. The thrust of the water on the plane carried the paravane away from the towing vessel, and with two paravanes, one on each side, a spread of sweep of about 200 ft. was obtained, *i.e.* the two paravanes were that distance apart. Horizontal and vertical fins near the tail increased the stability, and in the tail was fitted a depth-keeping mechanism consisting of a horizontal rudder actuated by a hydrostatic valve which responded to any difference in the water-pressure caused by a change of depth. The paravane carried a heavy charge of high explosive which could be detonated, by means of an electric current passing through the core of the towing-wire, in any one of three ways. If the paravane hit the hull of a submarine, striking-gear on its nose operated a switch which closed the firing circuit. This impact method would not become operative should the towing-line become entangled in the external fittings of a submarine, but in that case an extra load would be put on the line; apparatus was therefore provided such that when the load on the line exceeded a predetermined value a switch was tripped and the circuit closed. Finally a hand-switch on the bridge of the towing vessel enabled the charge to be detonated at will should the presence of a submarine be suspected.

It was soon seen that the explosive paravane could be adapted to protect vessels against moored mines. For this purpose the towing-lines were attached, not at the stern as with the explosive paravanes, but at a point as far forward and as low down as possible. Their outboard ends being kept about 100 ft. away from the central fore and aft line of the ship by the paravanes to which they were attached, they swept a wedge-shaped track in a horizontal plane at the level of the keel or slightly below it, and fouled the mooring-wires of any anchored mines lying in or near the course of the vessel. When this happened the mooring-wire was deflected along the towing-line until it reached the head of the paravane, where it was guided into the jaws of shears or scissors made of special high-grade steel, by which it was severed. The mine then floated to the surface and was exploded by rifle-fire. It was found that with a pull of about 7 cwt. the shears would cut a 1½ in. mooring-wire. The normal length of the towing-lines was 56 yd.; three-strand wire ropes were used, each consisting of 37 galvanized wires, 0·049 in. in diameter, with an ultimate breaking strength of between 100 and 120 tons per sq. in. There were three types of protector paravanes: (1) The merchant-vessel type, known as "otters," for ships with speeds below 16 knots; (2) the fast-liner type; and (3) the battleship type.

The mine-sweeping paravanes were towed from the stern of high-speed destroyers. As the point of attachment had to be on deck, an arrangement called a "depressor" was used to bring the virtual point of tow down to the required depth at the stern. Wide paths could be swept at speeds of 26 to 30 knots.

PARDO BAZAN, EMILIA (1851–1921), Spanish author (*see* 20.800), died in May 1921.

PARIS (*see* 20.804).—The population of the French capital, —2,847,229 at the census of 1911,—was 2,906,472 at the census of 1921. In view of the rapid German advance on Paris after the outbreak of war in August 1914, steps were quietly taken to evacuate as many as possible of the civilian population; and on the night of Sept. 2 the President and ministers left the city for Bordeaux, where the Government was temporarily transferred. But the victory of the Marne removed the peril from Paris, and in December the Government returned there.

Paris during the World War was bombarded by aeroplane, Zeppelin, and artillery; 746 bombs were dropped from the air, killing 266 persons and wounding 603; German long-range artillery fired 303 shells into Paris, killing 256 persons and wounding 620. The first air raid was made on Aug. 30 1914, by aeroplane and in daylight. The first Zeppelin raid took place by night on March 21 1915. The worst air raid was made on the night of Jan. 30–31 1918, when 91 bombs fell upon the city itself and 178 on the suburbs. The long-range bombardment began on March 23 1918, and continued until Aug. 9, with many intervals of calm, there being only 44 days upon which the Berthas were active. The existence of such long-range artillery being unknown when the first shells fell at an early hour of the morning, it was imagined that German aircraft, hidden high behind the clouds, must be engaged. All work in the city was at a standstill until noon, when the regularity with which the projectiles exploded at intervals of about 20 minutes, and an examination of some of their fragments, showed that a new engine of war was at work. The first two days of bombardment were the heaviest from the point of view of the number of shells fired, but from the number of casualties caused, March 29, when only one shell fell in Paris, was the most costly. That one shell fell during Good Friday service on the church of St. Gervais, bringing down with it a large portion of the roof; 88 people were killed and 68 wounded.

The air defences of Paris were not properly organized until March 1918. In fact organization had not been necessary, as German air services concentrated all their bombing raids upon England during the years 1916–8. The results obtained by the Paris system of air defences were as follows: on 13 different occasions, on which 107 aeroplanes all-told were employed, no single raider was able to reach Paris; of the 483 planes sent by the enemy to Paris in 1918, only 37 reached the city, and 13 were brought down; and only 11,680 kgm. of bombs were thrown upon the city.

The war being over, the work of demolishing the fortifications encircling the city was begun in 1919, in accordance with a grandiose scheme which would give Paris another ring of boulevards nearly 30 m. in length. It was intended that some of the ground thus made available should be used for building purposes, in the hope of solving the acute housing problem. It was proposed to keep much of it as garden, and to build numbers of well-equipped playing-grounds, and air stations round the city. One portion of the available space, S. of the city, was to be set apart for "University City," where accommodation would be provided for students of all nationalities; to include recreation and sports grounds, swimming-baths, etc. The site chosen is near the Parc Montsouris.

PARKER, ALTON BROOKS (1852–), American lawyer, was born at Cortland, N.Y., May 14 1852. He studied at the local academy and normal school, taught for a short time, read law in an office, and in 1873 graduated from the Albany Law School. He was admitted to the bar and began to practise law at Kingston, N.Y. In 1877 he was elected surrogate of Ulster co., and was reëlected in 1883. He resigned in 1885 on being appointed by the governor justice of the N.Y. Supreme Court to fill a vacancy, and the following year was regularly elected. He was a delegate to the Democratic National Convention in 1884 and in 1885 declined President Cleveland's offer of the first assistant postmaster-generalship. He was appointed a member of the second division of the N.Y. Court of Appeals in 1889 and a member of the general term in 1893. In 1898 he was elected chief justice of the N.Y. Court of Appeals. In 1904 he resigned on being nominated by the Democrats for president, but he was defeated by Theodore Roosevelt, the electoral vote being 336 for Roosevelt to 140 for Parker, the popular vote 7,623,486 for Roosevelt to 5,077,971 for Parker. He then resumed the practice of law in New York City. He was a delegate-at-large from New York to the National Democratic Convention in 1912. In 1913 he was counsel for the managers of the trial leading to the impeachment of Governor Sulzer of New York.

PARKER, SIR GILBERT, BART. (1862–), English novelist and politician (*see* 20.827), was created a baronet in 1915 and a privy councillor in 1916. During the first two and a half years of the World War he was engaged on the work of publicity in

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British interests in the United States, and he published *The World in the Crucible* (1915) and *The World for Sale* (1916). Amongst his later works of fiction are *The Judgment House* (1913); *The Money Master* (1915); *Wild Youth and Another* (1919) and *No Defence* (1920). He retired from Parliament in 1918 and did not seek reelection.

PARKER, HORATIO WILLIAM (1863–1919), American composer and musician, was born at Auburndale, Mass., Sept. 15 1863. His talent for composition manifested itself early; before he was 15, for example, in less than two days he set to music the verses in Kate Greenaway's *Under the Window*. He studied first in Boston, but later attended for three years the Royal Conservatory in Munich. After his return to America in 1885 he was for two years professor of music in the Cathedral School of St. Paul in Garden City, Long Island. From 1888 to 1893 he was organist of Trinity church, New York City, and from 1893 to 1901 organist of Trinity church, Boston. In 1894 he was appointed professor of the theory of music at Yale. Cambridge University bestowed on him the degree of Mus. Doc. in 1902. Before leaving New York City he had completed his oratorio, *Hora Novissima*, which was widely performed in America. It was also given in England in 1899 at Chester and at the "Three Choirs" festival at Worcester, the latter an honour never before paid an American composer. While carrying out the duties of his position at Yale he composed much. His opera *Mona* (libretto by Brian Hooker) won the Metropolitan Opera Company's $10,000 prize in 1911, and in 1914 his opera *Fairyland* (also with Hooker) was awarded another prize of the same amount offered by the National Federation of Women's Clubs. His cantata *Morven and the Grail* was written in 1915 for the centenary celebration of the Handel and Haydn Society of Boston. His other works include the cantatas *King Trojan* and *The Kobolds*, the oratorios *St. Christopher* and *A Wanderer's Psalm*, besides numerous sacred and secular pieces. He died at Cedarhurst, Long Island, Dec. 18 1919.

PARKER OF WADDINGTON, ROBERT JOHN PARKER, BARON (1857–1918), English lawyer and lord of appeal, was born at Claxby Rectory, Alford, Lincs., Feb. 25 1857. He was educated at Eton and King's College, Cambridge, where he took his degree in 1880. In 1883 he was called to the bar and built up a large and important connexion, largely dealing with Government work. In 1900 he was appointed junior counsel to the Treasury, and was raised to the bench in 1906. As a judge he earned a high reputation for great shrewdness and learning, and in 1913 was made a lord of appeal in ordinary, being at the same time given a life peerage over the heads of the five sitting lords justices. In 1916 a special second division of the Judicial Committee of the Privy Council was constituted for dealing with Prize Court appeals, and over this Lord Parker presided until within a short time of his death at Haslemere July 12 1918.

PARKIN, SIR GEORGE ROBERT (1846–), British educationalist (*see* 20.831), published in 1912 *The Rhodes Scholarships*, an account of his work as organizing representative of the Rhodes Trust (*see* 23.257). He was knighted in 1920. He retired from the secretaryship of the Rhodes Trust in 1921, being succeeded first by Sir Edward Grigg, and then, on the appointment of the latter to be private secretary to Mr. Lloyd George, by Mr. Geoffrey Dawson, formerly (1912–9) editor of *The Times*.

PARMOOR, CHARLES ALFRED CRIPPS, 1ST BARON (1852–), English lawyer, was born at West Ilsley, Berks., Oct. 3 1852, the son of Henry William Cripps, Q.C. He was educated at Winchester and New College, Oxford, where he had a distinguished career. He was called to the bar of the Middle Temple in 1877, in 1890 became a Q.C. and in 1893 a bencher. In 1895 he was appointed attorney-general to the Prince of Wales (being reappointed in 1901 and 1912). He sat as Conservative member for the Stroud division of Glos. 1895–1900, for the Stretford division of Lancs. 1901–6 and for the Wycombe division of Bucks. 1910–4. In 1908 he was made K.C.V.O. Sir Alfred Cripps was well known as a strong High-churchman. He was appointed chancellor and vicar-general to the province of York in 1900 and vicar-general to the province of Canterbury in 1902. He was chairman of the Canterbury House of Laymen and a member of its committee in 1910, and chairman of the House of Laity in the National Church Assembly of 1920. In 1914 he was appointed a member of the Judicial Committee of the Privy Council and raised to the peerage, and in 1917 he became treasurer of the Middle Temple. He was the author of two important works, *Law of Compensation* (1881, 5th ed., 1905), and *Law Relating to the Church* (6th ed., 1886).

PARRATT, SIR WALTER (1841–), English organist, was born at Huddersfield Feb. 10 1841. He was educated privately and at College School, Huddersfield. After some years as organist and choirmaster to various churches, he became in 1872 organist of Magdalen College, Oxford, and in 1882 organist of St. George's Chapel, Windsor. From 1908 to 1918 he was professor of music at Oxford, and in 1916 was appointed dean of the faculty of music in London University. He was knighted in 1892, was created M.V.O. in 1901, and C.V.O. in 1917. He wrote various important articles on musical subjects for Grove's *Dictionary of Music*, and other works.

PARRY, SIR CHARLES HUBERT HASTINGS, BART. (1848–1918), English composer (*see* 20.865), retired from his professorship at Oxford in 1908. He acted during the World War as chairman of the Music in Wartime Committee, and did much to relieve the prevailing distress among poorer musicians. He died at Rustington Oct. 7 1918, and was buried in St. Paul's cathedral.

PARSONS, ALFRED (1847–1920), English painter, was born at Beckington, Som., Dec. 2 1847. He was educated privately, and in 1865 entered the General Post-Office as a clerk, but after two years his taste for painting decided him to adopt an artistic career. He was preëminently a painter of flowers and gardens. He was also interested in the designing of gardens, and was a judge at the Chelsea flower show. His picture of an orchard, "When Nature Painted All Things Gay," was purchased by the Chantrey fund in 1887, and he was a frequent exhibitor not only at the Royal Academy but at the Grosvenor and New Gallery exhibitions. Among the various special exhibitions held of his work was one of scenes from the Warwickshire Avon (1885). As an illustrator Parsons took a very high place, much of his work appearing in *Harper's Magazine*, while among the books he illustrated are *She Stoops to Conquer*, Herrick's *Poems* (with E. A. Abbey), and *The Danube, from the Black Forest to the Black Sea* (with F. D. Millet). He died at Broadway, Worcs., Jan. 16 1920.

PARSONS, SIR CHARLES ALGERNON (1854–), British engineer, was born in London June 13 1854, the fourth son of the 3rd Earl of Rosse. He was educated privately and at St. John's College, Cambridge, graduating 11th wrangler in 1876, and being elected in later life (1904) an hon. fellow of the college. In 1877 he entered the Armstrong Works at Elswick, having previously worked as a boy in his father's workshops at Birr Castle, King's co., Ireland, where the Rosse telescope was constructed (*see* 23.745). In 1883 he served for a year on the experimental staff of Messrs. Kitson of Leeds, and in 1884 entered into partnership with Messrs. Clarke Chapman & Co. of Gateshead. The partnership was dissolved in 1889, and Charles Parsons, whose invention of the Parsons steam-turbine was bringing him into continually greater prominence in connexion with the progress of shipbuilding, then built his own works at Heaton, Newcastle-upon-Tyne, for the making of steam-turbines, dynamos, searchlight reflectors and other electrical apparatus (*see* 25.845 *seq.*). Besides his chairmanship of C. A. Parsons & Co., he became managing director of several electric supply companies, notably at Newcastle, Scarborough and Cambridge, and also of the Marine Steam Turbine Co. which became the Parsons Marine Steam Turbine Co. of Wallsend-on-Tyne, owners of the turbine patents, with ramifications throughout the engineering world. He was elected F.R.S. in 1898, won the Royal Society's Rumford Medal in 1902, was president of the Institute of Marine Engineers 1905–6 and of the British Association 1919–20. In 1911 he was created K.C.B. During the World War Sir Charles

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Parsons served on many Government committees connected with scientific research, electric power, aircraft, fuel research and the construction of tanks.

PASCAL, JEAN LOUIS (1837–1920), French architect, was born in Paris June 4 1837, and his architectural education was begun at the age of 16 when he became a pupil of Gilbert. Later, when in the studio of Questel, he entered the École des Beaux-Arts, where, amongst other distinctions gained, in 1866 he won the *Grand Prix de Rome*. On his return to Paris in 1870, after his four years at the Villa Medici, he was appointed inspector of works at the Louvre and the Tuileries. In 1872 he became patron of his *atelier*, and thereafter was appointed assessor in public competitions, and subsequently received many distinctions. Amongst these was his election to the council of the Beaux-Arts and president of the jury, and to membership of the Institut de France, and finally he became *commandeur de la Légion d'Honneur*. In his long career the private, as apart from official, work of Pascal was of a very diversified nature, and covered a wide area of ground, domestic and civil, and particularly a long series of artistic memorial monuments such as those commemorating Col. d'Argy at Rome, Henri Regnault at the École des Beaux-Arts, and President Carnot at Bordeaux. Among his buildings are the Château du Doux, Corrèze, that for the Faculté de Médecine, Bordeaux—a design with much dignity and calm—the painter Perrault's house and studio, Paris, and several villas and châteaux in the provinces—at Pau, Beaulieu, Avignon and elsewhere. He lived long enough to see, at the close of his busy career of over 50 years, the completion of the Bibliothèque Nationale, Paris, a fine building characteristic of his learning and ingenuity, but speaking none of the modern note of a too conscious individuality. A man of untiring energy, Pascal's application to his *atelier* work and his many professional calls did not prevent his finding time for the literary side of architecture and he, with M. Gaudet, is responsible for the splendid edition of Blondel's *Architecture Française*, published under the auspices of the French Government. The celebrated *atelier* of which he was for so many years the greatly respected patron, was responsible in his time for the training of many architects to be found later on in every country in Europe, in the United States and in Canada. Among them were Sir John Burnet, Thomas Hastings of New York, Signor Beltrani of Milan and Henri Nénot of Paris. In 1914 he was awarded the gold medal of the Royal Institute of British Architects but his great age and state of health prevented his receiving this in person. He died in Paris in 1920.

PASCOLI, GIOVANNI (1855–1912), Italian poet, was born at San Mauro, Romagna, Dec. 31 1855. His first volume of verse, entitled *Myricae*, appeared in 1891, and his *Primi Poemetti* in 1897. His other volumes include *Odi ed inni* (1906); *Le Canzoni di Re Enzio* (1908) and *Nuovi Poemetti* (1909). He wrote also much elegant Latin verse, and was well known both as a prose essayist and for his Dante studies, which led to his appointment as professor of Italian literature at the university of Bologna. He died at Barga April 6 1912.

PASSY, FRÉDÉRIC (1822–1912), French economist and pacifist, was born in 1822 and was a nephew of the economist Hippolyte Passy, finance minister to Louis Philippe and to Louis Napoleon's Republican Government. Under his uncle's influence Frédéric devoted himself to economic studies, and to that end gave up the appointment as auditor of the Conseil de Droit, which he had held during 1846–49. In 1860 he began to teach political economy both in Paris and in the provinces. His first work on the subject, *Mélanges économiques*, appeared in 1857. True to his republican principles, he refused to be reconciled to the Second Empire, and remained, therefore, ineligible for any Government post. He was an ardent free-trader and an admirer of Cobden. In 1867 he founded the Ligue Internationale de la Paix, afterwards known as the Société Française pour l'Arbitrage entre Nations, and for the rest of his life he devoted himself to the promotion of international peace. From 1881 to 1899 he was deputy for the Seine department. In 1901 he received the Nobel Prize, sharing it with M. Dunant. His published works include *De la Propriété Intellectuelle* (1859); *Leçons d'économie politique* (1860–61); *La Démocratie et l'Instruction* (1864); *L'Histoire du Travail* (1873); *Malthus et sa Doctrine* (1868); *La Solidarité du Travail et du Capital* (1875) and *Le Petit Pouce du 19ième Siècle: George Stephenson* (1881). He died in Paris June 12 1912.

PATIALA, SIR BHUPINDAR SINGH, MAHARAJA OF (1891–), head of the Sikh community in India, was born Oct. 12 1891, to the soldier-sportsman Maharaja Sir Rajendra Singh, whose death in Nov. 1900, at the age of 28, brought him to the *gadi*. He was carefully trained, and on receiving full ruling powers at the close of 1910 maintained and greatly developed the progressive policy of the council of regency, applying himself with great assiduity to the moral and material welfare of his people. Inheriting sporting and soldierly qualities, he was a skilful polo-player and batsman, becoming well known to British crowds when he captained the Indian cricket eleven in 1911. He also inherited the conspicuous loyalty of his house to the paramount Power. In the autumn of 1914 he set out with the Indian Expeditionary Force to France, but serious ill-health compelled his return to India after reaching Aden. The contribution of Patiala to the Indian army, including Imperial Service troops, was increased from about 4,000 men to 28,000, and as the recognized head of the Sikh race the Maharaja exercised an enormous influence in promoting recruitment from other parts of the Punjab. His subjects saw active service in nearly all the theatres of war, and won 125 battle distinctions. His gifts in material and money were constant and generous. He visited his troops in France, Palestine and elsewhere when deputed to England in the summer of 1918 with Sir S. P. (Lord) Sinha on selection as a member of the Imperial War Cabinet, being the second Indian prince to be called to Empire councils. In the Punjab disturbances in the spring of 1919 important responsibilities were assigned to him by the British authorities, and tranquillity was maintained throughout his state and adjacent British districts. In the third Afghan War which immediately followed he volunteered his personal services as well as the loan of his troops, and held a staff appointment in a trying hot-weather campaign, not returning from the frontier until an armistice was granted the Amir Amanulla. He took a prominent part in promoting the inauguration of the Chamber of Princes in 1921 and was elected to the small standing committee. He was raised to the rank of major-general, his permanent local salute was raised from 17 to 19 guns, and he held the grand crosses of the Star of India, the Indian Empire and the British Empire.

PATON, FREDERICK NOEL (1861–1914), British explorer and Anglo-Indian official (*see* 20.930*), died July 1 1914.

PATON, JOHN BROWN (1830–1911), British Nonconformist divine (*see* 20.930), died at Nottingham Jan. 26 1911.

PATTI, ADELINA JUAÑA MARIA [BARONESS CEDERSTRÖM] (1843–1919), English singer (*see* 20.937), died at Craig-y-Nos Castle, Wales, Sept. 27 1919.

PAYNE, JOHN BARTON (1855–), American public official, was born at Pruntytown, Va., Jan. 26 1855. He was educated at Orleans, Va., read law, and was admitted to the bar in 1876. He moved to West Virginia and practised law at Kingwood from 1877 to 1882, during the same period serving as chairman of the county Democratic committee. In 1882 he was elected mayor of Kingwood, and the following year went to Chicago, where he was engaged in law practice until 1893. Then he was appointed judge of the Superior Court of Cook Co., Ill., but resigned after five years to resume the practice of law. In Nov. 1917 he was appointed counsel of the Emergency Fleet Corporation and also legal adviser to the Commissioner of Internal Revenue. In 1918 he was appointed counsel of the Director-General of Railroads and in 1919 chairman of the U. S. Shipping Board. In Feb. 1920 he was appointed Secretary of the Interior, to succeed Franklin K. Lane, and he served to the end of President Wilson's term.

PEACE CONFERENCE (1919).—The first plenary session of the Conference of the Powers assembled in Paris to settle the terms of peace after the World War was held on Jan. 18 1919, more than two months after the conclusion of the Armistice with Germany; and the Conference remained in being from

** These figures indicate the volume and page number of the previous article.*

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that date until Jan. 21 1920, when the Supreme Council met for the last time. Even then the work of the peace settlement was incomplete. What remained to be done was partly delegated to a council of ambassadors at Paris, partly left to the Premiers of the principal Powers, who continued to meet in consultation at irregular intervals during 1920 and 1921. The Conference separated before the Hungarians had decided to sign their treaty, and before the terms of the partition of the Ottoman Empire were finally agreed upon. It left the Adriatic question in such a state that 10 months elapsed before Italy and Yugoslavia could compose their differences. The total sum to be demanded from Germany in the name of reparation had not yet been settled, nor had the principal Powers finally agreed in what proportions this sum should be divided between them. But the events of 1920 showed that most, if not all, of these questions could be arranged without the cumbrous mechanism of a conference. An even more momentous uncertainty, the problem of the future attitude of the United States towards the treaties, would obviously be solved at Washington and not at Paris. But the most urgent difficulties of the transition from war to peace had been met, so far as diplomacy could meet them, before the Conference was six months old; and, after the German treaty had been signed, the doings of the statesmen at Paris no longer excited the same interest as before. The most important of these statesmen, except the French Premier, M. Georges Clemenceau, soon made their exit. In the last days of June 1919 Mr. Wilson returned to the United States, Mr. Lloyd George to London. Sig. Orlando had fallen from power before the signing of the treaty, and his successor, Signor Nitti, abstained from visiting Paris. In July Mr. Lansing, the American Secretary of State, withdrew, leaving Mr. Polk, his under-secretary, to act for him. In Sept., after the signing of the Austrian treaty, Mr. Balfour departed and Sir Eyre Crowe became the chief British plenipotentiary. By June 28 the main outlines of the new map of Europe were drawn; the principles which were to govern all the treaties had been laid down; Germany had been rendered powerless for evil, and the Austro-Hungarian Monarchy had ceased to exist.

The Secret Treaties and the Pre-Armistice Terms.—The Allied and Associated Powers entered the Conference with a load of previous commitments.[1] The three chief European Allies had to consider many secret undertakings given at critical periods of the war. In April 1915 France and Great Britain had purchased Italy's coöperation by the Treaty of London, which gave very definite pledges regarding Istria, Dalmatia, Cisalpine Tyrol, the Dodecanese and Adalia. In May 1916 France and Great Britain had mapped out their future spheres of influence in the Ottoman Empire; and in 1917 there had been consequential arrangements with Italy. In Aug. 1916 all three Powers had given pledges to Rumania regarding her claims on Hungarian territory, pledges which Rumania at least did not regard as invalidated by her subsequent Treaty (of Bucharest, May 1918) with the Central Powers. In Feb. 1917 all three had agreed with Japan to uphold her claims on Shantung. Finally there were agreements of a less definite character with Serbia and with Greece. It remained to be seen how far these compacts could be reconciled with each other and with the views of the United States, who had not endorsed any of them and was officially unaware of them up to the opening of the Conference. There remained the pre-Armistice terms which were binding on all the parties to the Conference, and which indisputably must prevail wherever they came into conflict with treaties of prior date. Drafted at Washington, on the basis of a separate correspondence between Mr. Wilson and the German Government, they had nevertheless been considered and adopted (with certain amendments) by the Supreme War Council of the Allies as the foundation of the future peace. This meant that (with the exceptions which they or Mr. Wilson had specified in Oct. and Nov. 1918) the Allies were bound to impose no terms which clashed with Mr. Wilson's Fourteen Points (of Jan. 8 1918), his Four Principles (of Feb. 11), his Four Ends (of July 4) and his Five Particulars (of Sept. 27).

This peculiar obligation was the outcome of an offer, made by Germany on Oct. 4 1918, "to accept the programme set forth by the President of the United States in his message to Congress of Jan. 8 1918, and his later pronouncements, especially his speech of Sept. 27," as a basis for peace negotiations. A similar offer was made by the Austro-Hungarian Government on Oct. 7. From Germany the President required, as a condition precedent to negotiations, that "the military masters and monarchical autocrats of Germany" should be irrevocably deposed. To Austria-Hungary he intimated that in one particular he could no longer stand by the Fourteen Points. It was no longer sufficient that the Czechoslovaks and the Yugoslavs should be guaranteed autonomy within the Austro-Hungarian state. These peoples must now decide what action on the part of Austria-Hungary would satisfy their aspirations. A republican Germany and a partition of Austria-Hungary were thus indicated as fundamental conditions of the peace. The Central Empires accepted the fiat; and the European Allies then agreed to make peace with Germany "on the terms of peace laid down in the President's Address to Congress and the principles enunciated in his subsequent addresses," with two qualifications. They reserved judgment on the second of the Fourteen Points "relating to what is commonly known as the freedom of the seas." They pointed out that, in their opinion, the President's demand for the "restoration" of territories invaded by Germany should be understood to include "compensation for all damage done to the civilian population of the Allies and their property by the aggression of Germany by land, by sea and from the air." The President accepted explicitly this meaning of "restoration," and accepted *ex silentio* the demurrer as to the "freedom of the seas." After the Conference had begun, he stated to some American journalists (Feb. 14 1919) that the freedom of the seas was no longer needed, as in future (with a League of Nations in existence) there would be no neutrals. It will be noted that the reply of the Allies to the President only committed them with regard to the German treaty. The armistices signed by Austria (Nov. 3 1918) and Hungary (Nov. 13) were unconditional, and the Italian Government afterwards held that neither of these countries was entitled to the benefit of the Wilsonian terms. But the legal point was not pressed by the Allies in general, even against Bulgaria and Turkey with whom Mr. Wilson had not negotiated at all. The general view was that Germany had negotiated on behalf of both herself and her Allies; and indeed the Wilsonian terms which Germany accepted made explicit references both to Austria-Hungary and to Turkey.

Purport of the Wilsonian Terms.—The general principles contained in Mr. Wilson's manifestoes were not all of the kind that a Peace Conference could enforce or promote. Some were principles of international morality; others could hardly be realized in a world which was still convulsed by national and racial animosities, by the sense of intolerable wrongs and of crushing disillusionments. The time was not yet ripe for insisting that the victors, equally with the vanquished, should abstain from "private international understandings of any kind," should throw down all "economic barriers" and should guarantee "equality of trade conditions" (most favoured nation treatment) to their former enemies. Still less could the Allies agree at that date to give "adequate guarantees" that their armaments should be "reduced to the lowest point consistent with domestic safety" within any definite period of time. It was easier for the Allies to accept some other principles which made a strong appeal to the moral sense of mankind: as, for instance, that nations ought to be governed in their foreign policy by the rules of private honour and by respect for the common law of civilized society; that "every part of the final settlement must be based upon the essential justice of that particular case, and upon such adjustments as are most likely to bring a peace that will be permanent"; and that "no

[1] For the preliminaries leading to the Armistice of Nov. 11 1918, *see* under WORLD WAR. *See* also, for points unsettled at the Peace Conference, SILESIA and other appropriate headings.

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special or separate interest of any single nation, or any group of nations, can be made the basis of any part of the settlement which is not consistent with the common interest of all." These, and other similar rules, were valuable as a statement of the spirit in which the wiser heads of the Conference would approach their work. But the Conference could hardly do more for the propagation of Mr. Wilson's ideals than it did in approving the Anglo-American scheme of a League of Nations "formed under specific covenants" to ensure that "the combined power of free nations will check every invasion of right." When it provided that the Covenant of the League should form an integral part of each of the new treaties, and when it made the League responsible for supervising and revising many parts of the peace settlement, the Conference loyally accepted the conception of the League which Mr. Wilson had explained in his address of Sept. 27 and in several speeches of his European tour (Dec. 1918–Jan. 1919). The League was planned to be, as he had said at the Guildhall in London on Dec. 28, a permanent concert of Powers for the maintenance of the peace terms. It is easy now to blame the Allies for assuming that the Covenant, drafted by Lord Robert Cecil and Gen. Smuts in consultation with Mr. Wilson and Col. House, would be accepted without demur by the U.S. Senate. But their attitude towards the project of the League, when it was under discussion at the Conference, at least proves them honestly desirous of realizing Mr. Wilson's aspirations.

The territorial terms which Mr. Wilson had formulated were comparatively simple, though not always easy to reconcile with his principle of self-determination, which required that "every question whether of territory or of sovereignty, of economic arrangement or of political relationship" should be settled on the basis of "the free acceptance of that settlement by the people immediately concerned." Mr. Wilson himself subsequently confessed that, when he put self-determination on his programme (in spite of Mr. Lansing's fruitless objections, since revealed), he did so in ignorance of the very existence of some of the nationalities which afterwards invoked his aid. Literally and unconditionally applied, the principle of self-determination would have reduced eastern Europe to a chaos of privileged enclaves and economically helpless states; nor was it easy to see how it could be applied with any useful results to the German colonies or to the non-Turkish portions of the Ottoman Empire. The first of these two difficult cases was hardly met by Mr. Wilson's demand (in the Fourteen Points) that colonial questions should be settled with equal regard to the interests of the populations concerned and to the equitable claims of the Government whose title was to be determined. The solution eventually applied to both cases was that of mandates, a device first suggested by Gen. Smuts in Dec. 1918, and readily endorsed by Mr. Wilson when it was brought to his notice. As for the minor European nationalities, Mr. Wilson himself had already, before the Conference, indicated that their aspirations could not in every case be satisfied "without introducing new or perpetuating old elements of discord and antagonism that would be likely in time to break the peace of Europe and consequently of the world." This at least made it clear that a plebiscite would not be assumed to be in every case the one unfailing criterion of the justice of national claims.

The following is a brief summary of the territorial terms to which the Allied and Associated Powers were committed by the pre-Armistice negotiations: (1) Germany was to evacuate all Russian territory, and (2) to recognize the independence of all territories inhabited by indisputably Polish populations. (3) Belgium and the occupied territories of France, Rumania, Serbia and Montenegro were to be evacuated. (4) Belgium was to be left in the position of a sovereign state. (5) Alsace and Lorraine were to be returned to France. (6) Poland and Serbia were to be given free and secure access to the sea. (7) The independence and territorial integrity of Poland and the Balkan states were to be assured by international guarantees. (8) The Turkish portions of the Ottoman Empire were to be allowed to form a sovereign state; but the Straits were to be placed under international control, and the non-Turkish nationalities were to be allowed "an absolutely unmolested opportunity of autonomous development." (9) The Czechoslovaks and the Yugoslavs within the Austro-Hungarian Monarchy were to determine their own political destiny. We may further mention Mr. Wilson's Ninth Point, demanding a readjustment of the frontiers of Italy along "clearly recognizable lines of nationality." To this limitation of Italy's ambitions Sig. Orlando had never agreed. But his protest was not, unluckily, made public till May 1919.

Opening of the Conference.—The invitations to the Conference were issued by the five principal and associated Powers, whose chief plenipotentiaries held consultations in Dec. and the early days of Jan. 1919, before they formally assembled at Paris. Mr. Wilson was in Paris from Dec. 13 to Dec. 25, in England from Dec. 26 to Dec. 31, in Italy from Jan. 3 to Jan. 6. M. Clemenceau, Sig. Orlando and Baron Sonnino visited London early in December. Finally, on Jan. 12, there took place at the Quai d'Orsai a meeting of the Supreme War Council (a body constituted in Nov. 1917) which was attended by Mr. Wilson and Mr. Lansing, M. Clemenceau and M. Pichon, Mr. Lloyd George and Mr. Balfour, Sig. Orlando and Baron Sonnino. On this occasion it was decided that only the representatives of the five chief Allied and Associated Powers (the fifth being Japan) should be entitled to attend all meetings of the Conference, and that other members should be summoned only when their special interests were involved in the discussion. The decision was taken without the other Allied and Associated Powers being consulted, but was in harmony with the practice of the Congress of Vienna (1815), and was defended on the ground that the five were "Powers with general interests." Membership of the Conference was accorded to 32 Powers in all. Enemy Powers were not admitted, and neutral Powers were only to attend, when specially summoned by the five, at sessions specially appropriated to the discussion of their claims. But all belligerents, and all Powers who had severed diplomatic relations with Germany, were entitled to appear at every plenary session. It had been originally proposed to put all "new states in process of formation" on the same footing as the neutrals with special interests. But the right of Poland and of Czechoslovakia to be represented in the Conference was conceded before the first plenary session. Croatians and Slovenians were in fact represented by the Serbians, but the enlarged kingdom of Serbia, owing to the opposition of Italy, was not officially recognized until the end of May. The five principal Powers settled the number of plenipotentiaries by whom each state might be represented, with special regard to the military importance of each Power and to the part which it had played in the war. The number of plenipotentiaries was a question of sentiment only, since no Power exercised more than one vote; but the question was not settled without some bickering. Finally five plenipotentiaries were assigned to each of the principal Powers; three apiece to Belgium, Brazil and Serbia; two apiece to Canada, Australia, South Africa, India, China, Czechoslovakia, Greece, the Hejaz, Poland, Portugal, Rumania, Siam; one apiece to New Zealand, Bolivia, Cuba, Ecuador, Guatemala, Haiti, Honduras, Liberia, Nicaragua, Panama, Peru, Uruguay. All the Powers were allowed to make use of the panel system in choosing their plenipotentiaries, and the representatives of the British Dominions did important work on more than one occasion by virtue of their position on the panel of the British Empire. These arrangements were complete before the first plenary session (Jan. 18), which was merely asked to transact some formal business, on lines settled in advance by the Five. It elected M. Clemenceau as president of the Conference; it sanctioned the appointment of a secretariat, and also of a drafting committee on which the Five alone were represented. At the second plenary session (Jan. 25) certain of the minor Powers, Belgium and Canada amongst them, protested against the degree of control which the Five had assumed over the proceedings of the Conference. These protests were

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bluntly answered by M. Clemenceau; but they could not be altogether ignored. The smaller Allies were by degrees allowed a larger representation on some of the commissions and committees; and in this way a use was found for the abilities and experience of some highly distinguished statesmen, such as M. Venizelos.

Organization and Procedure.—The original rules of procedure, drafted by M. Berthelot, do not throw much light on the methods of transacting business which were actually employed, and in some points they were quickly modified.[1] The conduct of affairs, until March 25, was in the hands of the Council of Ten, a body composed of two plenipotentiaries for each of the five Powers; it was simply the Supreme War Council adapted to new purposes. The plenipotentiaries were allowed to bring their expert advisers with them, and made free use of this permission; but the Council from the first availed itself of the power, accorded under rule 13, to refer technical questions to committees of experts. The proceedings of the Ten were secret; rule 8 provided for the publication of official *communiqués*, but these were usually so worded as to convey the minimum of information. Owing to the large numbers present at each session, the secrecy of the proceedings was seldom respected; and, while the unofficial reports published in the French press were severely censored, the correspondents of English and (more particularly) American papers were often successful in acquiring and transmitting important information. On Jan. 17 the Ten promised, in answering a protest from the correspondents, that the plenary sessions should be open to them, except in special cases. But these sessions were infrequent and, when they were open to the press, only transacted formal business. Those of May 6 and May 31, at which important differences of opinion became manifest, were held behind closed doors. The secrecy of the deliberations grew more complete after March 25, when the Council of Ten was superseded by the Council of Four (Mr. Wilson, M. Clemenceau, Mr. Lloyd George, Sig. Orlando). Thenceforward experts were merely summoned to answer questions; for over three weeks the only official continuously present was the interpreter (M. Mantoux); but in April Sir Maurice Hankey was admitted as secretary. The Four delegated certain questions to a council of five foreign ministers (Mr. Lansing, M. Pichon, Mr. Balfour, Baron Sonnino, Baron Makino), but this body did not become prominent until the end of June when the Four dispersed and left all current business to be transacted by the Five.

Each of the principal Powers, except France, provided its plenipotentiaries with a large staff of officials and other experts. These "delegations" served as panels from which was drawn the personnel of the innumerable commissions and committees appointed from time to time by the plenary sessions or by the Supreme Council.[2] Most of the earlier commissions were large and imposing bodies; each of the principal Powers contributed two or three representatives to each commission, while the other Powers were allowed to send, between them, five or ten. This was the constitution of the commissions on Reparations, on the Responsibility for the War, on the League of Nations, on International Labour Legislation, on Ports, Waterways and Railways, all of which were sanctioned by the second plenary conference (Jan 25). In Feb. and March five territorial commissions were constituted. On these only the principal Powers were represented. The subjects referred to them were the territorial claims of: (1) the Czechoslovaks, (2) the Poles, (3) Rumania and the Yugoslavs, (4) Greece and Albania, (5) Belgium and Denmark. On Jan. 27 the Supreme Council appointed a large economic commission to draft the articles of the German treaty which related to such subjects as commercial relations, shipping, industrial property, pre-war contracts, and the liquidation of enemy debts. On Feb. 12 a naval and military committee, under Marshal Foch, was created to draft the terms relating to disarmament and the surrender of naval and military material. The Council of Four, like the Council of Ten, constantly employed expert committees, but showed a preference for comparatively small bodies which could be trusted to work with expedition.

For business not immediately connected with the making of treaties the Supreme Council made considerable use of the Armistice Commission at Spa, of the military staff of the old Supreme War Council at Versailles, and of the Supreme Economic Council at Paris. The last named of these bodies was instituted, at the instance of Mr. Wilson (Feb. 8) to advise the Conference on any economic measures of a temporary character which might be necessary to ensure: (*a*) that the devastated areas were duly supplied with the raw materials and other commodities required for purposes of reconstruction; (*b*) that the economic life of other countries which had suffered from the war was promptly revived; (*c*) that the pressing wants of neutral and ex-enemy countries were satisfied without detriment to the Allied and Associated Powers. The Supreme Economic Council absorbed many of the functions of those inter-Allied councils which, during the later stages of the war, had been charged with special problems of food supply and relief work, finance, shipping and blockade. It also formed special sub-sections to advise on the reorganizing of inland communications by rail and water, and on the control of the raw materials required for reconstruction. Lord Robert Cecil, representing Great Britain, usually presided at meetings of the Supreme Economic Council. Mr. Hoover, who was one of the American representatives, made himself responsible for the Food and Relief section, which had to deal with the most urgent of all the duties referred to the Council. From Feb. 17 to the end of June the activity of the Supreme Council was unremitting. It was expected to see to the revictualling of Germany under the terms of the Armistice Convention. It organized relief work among the starving populations of eastern Europe. It reorganized the derelict transport systems of Austria-Hungary and Poland. Its German duties involved negotiations with a German finance commission, and the arranging of the Brussels agreement (March 14) under which Germany was supplied with foodstuffs up to the end of Aug. 1919. It was by successive recommendations of this council that the commercial blockade of Germany was partially relaxed in Feb., March and April; the most striking of these recommendations was that subjects of Allied countries should be free to trade with Germany, subject to any restrictions which their respective Governments might desire to maintain (April 24). In April the Council undertook to supervise the economic life of the left bank of the Rhine, during the period of occupation. After the German treaty had been signed the Supreme Economic Council was still utilized by the European Allies as an agent for the purchasing of foodstuffs in America and supplying Austria with coal. The last meeting was at Rome in Nov. 1919.

The Council of Ten, Jan. 18–March 25 1919.—The first section of the German treaty to be drafted in something like its final form was the Covenant of the League of Nations, which Mr. Wilson consistently regarded as "in a sense the most essential part of the peace settlement." By the end of Jan. the American and British delegates had agreed upon a draft. This was carefully discussed in the first fortnight of Feb. by the League of Nations Commission, on which were represented not only the five Great Powers, but also Belgium, Brazil, China, Portugal, Serbia, Greece, Rumania, Poland and Czechoslovakia. The most prominent personages who served on the commission, after Mr. Wilson who was its president, were Col. House (U.S.A.), Lord Robert Cecil and Gen. Smuts (British Empire), M. Bourgeois (France), Sig. Orlando (Italy) and M. Venizelos

[1] English was recognized at the Conference as of full equality with French as the official language, so that all the proceedings were bilingual. The British Dominions were recognized not only as an integral part of the British Empire delegation (being, for instance, part of the panel from which British representations on the Supreme Council were chosen), but also as states on an equality with other small independent states. Thus Gen. Botha and Gen. Smuts sometimes sat in the Supreme Council in one capacity and sometimes in the other.

[2] "Supreme Council" was the generic name applied to whatever body—the Ten, the Four or the Five—happened to be in control of the proceedings.

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(Greece). The Covenant passed its first reading at the third plenary session (Feb. 14), but was amended in details before it was finally approved by the fifth plenary session (April 28). The amendments were chiefly inspired by the wish to meet American criticism. One provided that members of the League might withdraw on giving two years' notice; another expressly guarded the Monroe Doctrine from attack. Among amendments which were considered but rejected it is enough to mention: (*a*) a Japanese proposal that there should be a clause declaring all members of the League, without respect of race or colour, to be equal; (*b*) an American proposal to forbid any discrimination "in fiscal and economic regulations" between one nation and another (which would have put an end to *Zollvereins* and to imperial preference); (*c*) a French proposal to endow the League with a general staff and with powers to supervise the process of disarmament. (*See* LEAGUE OF NATIONS.)

To the same period belongs the main work of the Labour Commission, which began to draft the Labour Convention on Feb. 1. The Convention was intended to convince the world that the interests of labour would be better served by supporting the Allies at Paris than by helping German Socialists to draft their Labour charter in the International Conference which sat at Berne in Jan. and February. The Commission, first proposed by M. Clemenceau, had an American chairman (Mr. Gompers); among the other prominent members were Mr. Barnes (Great Britain) and M. Vandervelde (Belgium). It contained no elected representatives of labour, but conferred with a number of labour leaders who were specially invited to Paris for the purpose. Its work proceeded smoothly and swiftly. The Convention enumerates nine fundamental principles, for drafting which Mr. Gompers was responsible; but otherwise it refrains from any attempt at remedial legislation. It is mainly concerned with outlining the organization, powers and procedure of a Labour Conference (an international labour parliament) and a Labour Office (a bureau of experts). The Convention links up the Labour Conference with the League of Nations, and provides that the original members of the League shall also be the original members of the Conference. The German delegates proposed (in May 1919) that the Convention should be revised by a conference of trade unions, in the light of the German Labour charter and of the Berne resolutions. This proposal was however rejected; the Convention in its final form owes nothing to German amendments. It forms section 13 of the Treaty of Versailles, and appears in all the other treaties with enemy powers. The Labour Conference met for the first time at Washington in the autumn of 1919, but was attended by no American delegates, owing to the fact that the U.S. Senate had not yet ratified the Treaty of Versailles. (*See* INTERNATIONAL LABOUR.)

The Labour Convention was not presented to the Conference until April 1, and for some weeks after the third plenary session (Feb. 14) it seemed as though the Ten and their satellitic commissions were making little progress. This impression was strengthened by the temporary absence of Mr. Lloyd George (Feb. 7–March 5) and of Mr. Wilson (Feb. 14–March 14), who departed on urgent business of different kinds to London and to Washington respectively. For a time the Supreme Council was also robbed of M. Clemenceau; he was wounded on Feb. 19 by a French anarchist and was not seen again in public until March 10. But in any case the Supreme Council was at this stage burdened with a mass of formal duties which could not be avoided or postponed. It was necessary, under the rules of procedure, to hear the views of the "members with special interests." Late in Jan. audiences were given to the claimants for the German colonies, among whom the British Dominions were conspicuous. Then came the turn of the minor Powers and the oppressed nationalities: Rumania, Greece, Czecho-slovakia, the Hejaz, Belgium, the Syrians, the Druses, the Zionists, the Yugoslavs, Denmark, the Albanians, the Armenians and the Montenegrins. The ceremonial interviews rarely added anything to the case which had been already presented in writing; and all the claims, except those involving considerations of high policy, were referred, as the interviews concluded, to the five territorial commissions, and to a central commission which was appointed (Feb. 27) to coördinate the conclusions of the territorial experts. On a few questions there was substantial progress. A provisional agreement was reached as to the future of the German colonies. A Financial Drafting Commission defined the questions of finance and reparation which must be settled by the experts. Between Feb. 12 and March 3 the Military and Naval Drafting Committee prepared the first draft of the naval and military terms, and early in March Mr. Lloyd George persuaded the Supreme Council to accept the principle that all the enemy Powers should be obliged to abolish compulsory military service. By March 10 the naval, military and air terms were practically complete and on March 17, when Mr. Lloyd George was contemplating another visit to London, Mr. Wilson, M. Clemenceau and Sig. Orlando sent him a joint letter, begging that he would remain in Paris for the fortnight which, in their opinion, was the time required for completing the German treaty. Mr. Lloyd George agreed, but on condition that a more expeditious and more secret procedure than that of the Ten was adopted. He carried his point; on March 25 an official notice was issued that informal discussions by the delegates of the principal Powers would be substituted for the methods hitherto adopted. With this announcement began the period of the Council of Four. The Marquis Saonji, who might have claimed a seat in this conclave, abstained from doing so, except when Japanese interests were involved, on the ground of his ignorance of European languages.

Council of Four, March 25–May 7.—The Four worked at high pressure to complete the German treaty. They met two or three times a day; they confined their discussions to matters of principle and high policy; they left questions of detail and all technical subjects to the experts. But there were delicate and urgent problems, not all vitally connected with the treaty, which came up at many sessions, and some of these were never finally settled at Paris. The Four could never concentrate on one subject, to the exclusion of all others, until a definite agreement was reached; for each stage in a particular discussion involved a further reference to the experts, and a longer or shorter delay until the experts were ready with their report. Hence a chronological record of their debates, if such were available, would be a bewildering document. But it is known what were the more contentious topics debated in these six weeks, and what were the main issues in each case.

(*a*) The *guarantees* for Germany's compliance with the treaty were a special anxiety to France. She asked that there should be a prolonged occupation of the left bank of the Rhine by French, British and American forces; that the Rhine bridge-heads (Cologne, Coblenz and Mainz) should be included in the zone of occupation; that the left bank should be permanently detached from Germany to form a neutral and autonomous state ("Rhineland Republic"). Great Britain and America had offered France defensive treaties (the "Three Power Treaty") in lieu of these cumbrous precautions (March 14). M. Clemenceau accepted the treaties, but also pressed for the adoption of the French scheme. His colleagues would not hear of a Rhineland Republic; but they agreed that the left bank, and a deep belt on the right bank, should be denuded of fortifications (Art. 180); and, more reluctantly, that there should be joint occupation for 15 years. Still another concession was extracted from them—the last clause of Art. 429, which provides that, even at the end of 15 years, the occupation may be continued if in the opinion of the Allies France is insufficiently guaranteed against an unprovoked attack. This clause was intended to provide for the contingency of the British or the American defensive treaty being still unratified at that date.

(*b*) The *Saar valley* was claimed by France in compensation for her ruined mines. At first she had asked for complete political sovereignty on historical grounds; but this solution, which involved the subjection of 650,000 Germans to French rule, was rejected by her Allies, who would not even restore the French frontier of 1814 in this region. But they conceded to her the Saar coal-mines in full ownership, and, not without some

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hesitation, agreed that for 15 years the Saar valley should be withdrawn from the control of Germany and placed under the League of Nations. At the end of that time the inhabitants were to decide between three alternatives—the *status quo*, union with France, union with Germany. If they voted for Germany, then France was to receive the price of the mines from Germany or from the Reparations Commission.

(*c*) The *Reparations Clauses* were also of special interest to France. Her representatives insisted passionately on "integral reparation," the assessment of the damage actually done by Germany and by her allies, and the exaction of the utmost farthing. How otherwise, they asked, could France escape bankruptcy? Many English and American experts were impressed by the exhaustion of Germany, the danger of driving her to desperation, the unwisdom of leaving her liability indeterminate for the many months which would pass before a complete bill for damages could be presented; and they pressed for taking in final quittance whatever sum (20 or 40 milliards of marks at most) Germany could be compelled to pay at once. The French view prevailed, but there was another battle over the categories of damage, and Mr. Wilson was persuaded only with great difficulty to admit that pensions and allowances to combatants and to their families came within the terms of his pre-Armistice conditions. There were further debates on the capacity of Germany to pay and on the sum for which she might conceivably be liable. In the end the extent both of her legal liability and of the sum to be actually paid was left for future definition. Germany was to pay 20 milliards of gold marks in cash and kind by May 1 1921; and out of this sum the Allies would pay for any foodstuffs or raw materials which they considered indispensable to Germany. Two further sums, each of 40 milliards, were to be exacted later, bringing the total to 100 milliards; but this, in the words of the treaty, was only "a first instalment." The final account would be presented by the Reparations Commission before May 1 1921, and would be paid off by degrees over a period of 30 years, with interest at 5 per cent. On Sept. 5 1919 the French Minister of Finance encouraged the Chamber to expect that 300 milliards might be extracted from Germany. In Jan. 1921 the European Allies agreed to exact one-third of this sum, payable with interest over 40 years, and supplemented by a tax of 12 per cent *ad valorem* on German exports. This was rejected by Germany, but at the end of April the Allies presented an ultimatum which was accepted.

(*d*) The delimitation of the western frontier of *Poland* was not effected without serious debates. France desired to treat Poland liberally. Great Britain was impressed with the risk of creating a new *Germania irredenta* to trouble the peace of eastern Europe. The experts were anxious that due weight should be given to Mr. Wilson's Thirteenth Point, which stipulated that Poland should have a free and secure access to the sea. Poland (supported by France) asked for full sovereignty over Danzig and the approaches to that city. But the population of Danzig was almost wholly German, and the frontier demanded by Poland would have left 2,000,000 Germans under Polish rule—a solution which Mr. Lloyd George considered inadmissible. Thanks to Mr. Lloyd George a compromise was at last arranged which left Danzig a free city under the protection of the League of Nations with a very exiguous degree of freedom. The Polish frontier, in this compromise, was still drawn with more regard to the economic interests of Poland than to the rights of nationalities. But, before the German treaty was signed, the frontier was again modified, and other changes were introduced, in deference to the expostulations of the German delegates; in particular it was determined that in Upper Silesia a plebiscite should be held.

(*e*) *Shantung* was demanded by the Japanese plenipotentiaries under the treaties which China had concluded with Japan in 1915, but which, according to the Chinese plenipotentiaries, had been extorted by *force majeure;* also under a secret agreement of 1917 with the European Allies, to which the United States had never adhered. For a long time Mr. Wilson resisted the Japanese claim, but he finally accepted (April 30 1919) a compromise which the Chinese regarded with so much disfavour that they declined to sign the German treaty. The Japanese were allowed to keep the town of Kiaochow with the adjacent district, and the right of exploiting the mines and the railways in the Shantung peninsula; but they gave an oral understanding that they would restore the sovereignty of the peninsula to China "as soon as possible." Mr. Wilson subsequently (Aug. 19) told a committee of the American Senate that he would have preferred a different solution. But the Japanese claim was pressed at a time when Italy seemed on the point of seceding from the Conference; and a second secession would have made it difficult to conclude any treaty with the Germans.

(*f*) The *Italian claims* to Austro-Hungarian territories were continually under discussion during April. They were primarily founded on the Treaty of London; but Sig. Orlando claimed Fiume also, taking his stand in this case on the right of self-determination which he otherwise repudiated. Mr. Wilson at first argued that the Treaty of London was incompatible with the principle, enunciated in the Fourteen Points, that "a readjustment of the frontiers of Italy should be effected along clearly recognizable lines of nationality" (Point Nine). But Sig. Orlando objected that Italy was not bound by this principle, against which he himself had twice protested in the Supreme War Council, when the terms of the German Armistice were under discussion. His protests had been overruled at that time, on the ground that they were irrelevant to the discussions with Germany; but he had reserved the right to dispute Point Nine, and he asserted this right to the fullest extent in April. On April 14 Mr. Wilson gave way to the extent of intimating that he would accept the northern (Brenner) frontier assigned to Italy by the Treaty of London, and would admit Italy's claim (based on the same treaty) to Lissa and Valona; but he required that Fiume, as the natural outlet for the trade of Yugoslavia and Austria, should be made a free city within the Yugoslav customs area, and he held that, as regarded Dalmatia, Italy ought to be content with guarantees for the rights of the Italian minorities living in that province. Subsequently he rejected a proposal, made by M. Clemenceau and Mr. Lloyd George, that Italy should be awarded Fiume in exchange for a renunciation of her treaty claims upon Dalmatia; on April 20 he declined to discuss the Adriatic problem any further; and on the 23rd he created a sensation by publishing a statement of the grounds on which he resisted the Italian pretensions. Next day Sig. Orlando left the Conference, and Baron Sonnino followed him within 24 hours. On April 29 the Italian Chamber, after hearing Orlando's account of the negotiations, reaffirmed his definition of the Italian claims by an overwhelming majority. On April 30 the German delegates arrived at Versailles and the Council of Four (now reduced to three) had to face the possibility that Italy would not sign the treaty; at this time was drafted the ratification clause which stipulates that the treaty shall come into force as soon as ratified by Germany and any *three* of the principal Powers. But on May 4 Orlando relented. He and his colleagues reached Paris on May 7, a day too late for the sixth plenary session which approved the draft treaty, but a few hours before the draft was handed to the Germans at Versailles. The Council had not surrendered to Italy on the Adriatic question, but it was left open for future discussion.

The Draft Treaty and the German Delegates.—Two considerable sections of the treaty, the Covenant of the League and the Labour Convention, had been finally approved on April 28 by the fifth plenary session without much debate; the chief feature of the proceedings was that Baron Makino and M. Bourgeois expressed regret that the commission had not seen fit to accept the Japanese and French amendments. The sixth plenary session (May 6), which was held in secret to approve the treaty as a whole, revealed more serious differences. The Chinese protested against the Shantung clauses, the Portuguese against the African settlement, and Marshal Foch argued that the military guarantees for the submission of Germany were inadequate. His objection was met, to a certain extent, by the announcement,

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on May 7, that the United States and Great Britain were prepared to sign treaties with France, guaranteeing her against German aggression. But the session of May 6 was remarkable for the strong undercurrent of dissatisfaction among the minor Powers "with special interests" (including the British Dominions) who felt that their views had not been sufficiently considered. On May 7 at the Trianon the Conference saw the draft treaty handed to Count Brockdorff-Rantzau, the principal German delegate, and heard him deliver, without rising from his chair, a sharp attack upon their dilatory methods. He stated that, in the past six months, the blockade had been responsible for hundreds of thousands of deaths in Germany. "Think of that when you speak of guilt and punishment." He and his countrymen accepted the liabilities to which they were committed by the Armistice and Mr. Wilson's terms. They were prepared to play their part in restoring Belgium and the devastated areas of France. But he intimated that Germany did not hope for a just peace. "We are under no illusions as to the extent of our defeat and the degree of our helplessness; . . . we know the power of the hatred that we encounter here."

Fifteen days were allowed the Germans for preparing their reply, but the term of grace was eventually extended to May 29. The German delegates, to expedite the negotiations, transmitted their criticisms by instalments, each dealing with one topic (League of Nations, Labour Charter, Saar Valley, etc.); in some cases they tendered several notes successively on the same subject. The Supreme Council had arranged that these notes should be considered by 13 committees, each of which was specially responsible for one section of the treaty, and interim replies were returned to the Germans very promptly. Consequently much of the disputed ground had been covered in preliminary correspondence before the German counter-proposals were presented as a whole; and M. Clemenceau was able to dispatch the reply of the Allies on June 16. Both documents were polemical in character. The Germans, besides criticising many particular articles of the draft treaty, argued that its general tenor was inconsistent with the terms of the pre-Armistice agreement; and the Allies repudiated this imputation with some heat. The main criticisms of the Germans are noted below. Their counter-proposals were numerous, and only the more striking can be given here: (*a*) *Reparation.*—They offered to pay a sum not exceeding 100 milliards of gold marks, partly in gold but mainly in commodities and services; but they claimed the right of appeal from the assessment of the Reparations Committee to a neutral arbitrator. They would pay the first 20 milliards by May 1 1926; but they claimed credit for all war material surrendered under the Armistice conditions, for state railways and state property ceded along with Alsace-Lorraine and the colonies, and for the share of the German public debts which, as they maintained, these territories ought to bear. No definite period was fixed for the payment of the remaining 80 milliards, though it was stated that Germany would allocate to this purpose annually a sum equal to the average *net* peace budget of the empire before the war and it was stipulated that no interest should be paid. (*b*) *Territorial.*—They demanded a plebiscite in Alsace-Lorraine which should give the inhabitants an option between union with France, union with Germany and complete independence. In lieu of the Saar valley they offered to France fixed annual supplies of coal, pending the reconstruction of the French mines. In lieu of ceding West Poland, Danzig and Memel they offered to make Danzig, Königsberg and Memel free ports (under German sovereignty). They demanded that Germany's claim to keep her colonies should be referred to arbitration. (*c*) *Commercial.*—They offered to the Allies "most favoured nation" treatment in German markets for a restricted number of years, upon condition of complete reciprocity; and "national" treatment to Allied goods passing over German railways (without a time limit) on the same condition. (*d*) *League of Nations.*—They offered to negotiate on this subject, taking the Allies' draft covenant as a basis. But, as conditions precedent to negotiation, they demanded that Germany should be admitted immediately to the League; that members of the League should be pledged to abstain from waging economic war; that the Allied Powers should, within two years, abolish compulsory military service and themselves disarm. (*e*) *Occupied Territory.*—They proposed that the armies of occupation should be withdrawn within six months after the signing of the treaty.

These proposals constituted a manifesto addressed to the public outside the Conference; but in some particulars they agreed with proposals which had been forcibly argued in the inmost circles of the plenipotentiaries. M. Tardieu and Mr. Wilson Harris have both stated, apparently on good authority, that the idea of mitigating the treaty in essential details was before the Supreme Council at various dates from May 23 to June 13, and that one reason for these discussions was a doubt whether the treaty, as it stood, could be enforced on a recalcitrant Germany. Mr. Lloyd George was now the spokesman of the critics; among these were counted the leading members of his Ministry, who, together with Dominion representatives, had been summoned to a special meeting at Paris on June 1. He protested against the idea of maintaining a large army of occupation for a considerable time. He was now (for a short while at least) in favour of a fixed indemnity; he advocated revision of the Polish frontier and the early admission of Germany to the League of Nations. But it was hardly possible to rewrite the treaty at this stage; the dangers of further delay were too serious to be lightly accepted. On June 13 the movement for revision came to an end. Its only consequences were some concessions on secondary points. On Reparation and Military Occupation the Allies stood by their original draft. They conceded some slight changes in the Polish frontier with the object of bringing it "into closer harmony with the ethnographic division." They agreed to a plebiscite in Upper Silesia. They intimated that they were opening negotiations at once for an eventual reduction of their own armaments. They withdrew a provision for internationalizing the Kiel canal. They promised that Germany, if she complied with the terms of the treaty, should be admitted to the League of Nations "in the early future." They invited Germany to offer, within four months of the signing of the treaty, a lump sum in settlement of the whole bill for reparation, but this suggestion was not accepted.

Signing of the Treaties of Versailles, June 28.—All arrangements had been made for a general advance of the Armies of Occupation in case the German Government refused to sign the treaty, and there were a few days of suspense while Count Brockdorff-Rantzau was conferring with his colleagues at Weimar. On June 20 the Scheidemann Cabinet resigned, ostensibly because it would not consent to sign, but actually from a well-founded consciousness that it no longer commanded the confidence of the German Labour party. On June 21 a new Premier, Herr Bauer, offered to sign on conditions; he stated that the articles requiring the surrender of war criminals and those declaring Germany to be the sole author of the war must be omitted. He was told that conditions could not be accepted, and on June 22 obtained the leave of the Weimar National Assembly to sign unconditionally. Formal assurances to this effect were given on June 23 at Versailles, through Herr Haimhausen who, on the previous day, had succeeded Brockdorff-Rantzau as head of the German delegation. During the last days of suspense the German warships interned at Scapa Flow were sunk by their commanders, acting, it was stated, on orders from the German Admiralty (June 21).

The new German Minister for Foreign Affairs, Herr Hermann Müller, and his colleague Dr. Bell signed the treaty on June 28 in the Salle des Glaces at Versailles in the presence of all the plenipotentiaries, except those of China, who absented themselves to emphasize their protest of May 6 against the Shantung articles. Before and after this ceremony several subsidiary treaties were signed: (*a*) Defensive treaties with France, by Great Britain and the United States, undertaking to defend France against unprovoked aggression. The British treaty was ratified by Great Britain on Nov. 20 1919, but it was not to become binding until the American treaty should be ratified;

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and since American ratification was subsequently refused (*see* UNITED STATES: *History*), the British treaty became a dead letter. (*b*) A protocol defining certain ambiguous conditions in the German treaty. (*c*) An agreement between the United States, Belgium, the British Empire, France and Germany, which defines the nature of the military occupation of the Rhineland. (*d*) The Polish minorities treaty by which Poland contracts with the Allies and with Germany to respect the civil and political rights of racial and religious minorities within her jurisdiction. The idea of imposing such a treaty was first laid before the Conference by Jewish associations, whose fears were excited by the reports of Polish pogroms in the winter of 1918–9; but it was also of great importance for the protection of German and other non-Polish minorities. Similar treaties were afterwards concluded by the principal Powers with Czechoslovakia, with Rumania and with Yugoslavia. The main Treaty of Versailles was ratified by President Ebert, on behalf of Germany, on July 10; by the King of Italy, by King George V. and by President Poincaré in Oct. 1919. But it was not till Jan. 10 1920, when Germany at last signed a protocol agreeing to give compensation for the ships which had been scuttled at Scapa Flow, that the final exchange of ratifications took place at Paris, and the state of war between the European Allies (but not the United States) and Germany was formally terminated.

Treaty of Versailles—Territorial Terms.—Germany surrenders Alsace and Lorraine to France, free and quit of all public debts (Arts. 51, 55), and accepts the arrangements regarding the Saar basin which have been described above (Art. 45–50). Luxemburg ceases to form part of the German *Zollverein*, and Germany renounces all rights over the railways in Luxemburg (Art. 40). Belgium receives Moresnet *neutre* and part of Prussian Moresnet (Arts. 32, 33); also Eupen and Malmedy (Art. 34) subject to the result of a plebiscite, which was held in Sept. 1920 and resulted in the final reunion of these districts to Belgium, by whom they had been continuously claimed since 1815. These acquisitions give Belgium some valuable forests and railway stations and a population of about 70,000 souls. The frontier between Germany and Denmark is to be settled in accordance with the wishes of the population (Art. 109); these were ascertained by plebiscites held in North Schleswig (Feb. 10 1920) and in Central Schleswig (March 14 1920) when the former district voted for reunion with Denmark and the latter voted for Germany. Under Art. 87 Germany recognizes the complete independence of Poland and surrenders Danzig together with the territories received by Prussia under the partitions of Poland (Posnania, W. Prussia) and part of Middle Silesia; in 1910 these districts had a population of 2,931,000 souls of whom 1,087,000 were Germans. Article 88 provides for the plebiscite in Upper Silesia which had been conceded on June 16 1919; the voting (March 21 1921) seemed to prove that this clause was a concession of substance, and the subsequent award of the League of Nations (Oct. 1921), in favour of Poland, was correspondingly disappointing to Germany. By Arts. 94 and 96 plebiscites are ordered for the Masurenland region of East Prussia, and the West Prussian *Kreise* of Stuhm, Marienburg, Marienwerder and Rosenberg; in July 1920 both plebiscites produced substantial majorities for Germany. By Art. 99 Memel with the adjacent territory (total pop. 122,000 souls) is detached from East Prussia and put at the disposal of the principal Powers, who intended that Memel should be the port of Lithuania but had not, up to May 1921, given effect to that intention. Article 100 similarly assigns Danzig (pop. 200,000) to the principal Powers, who (in accordance with this Article) have recognized Danzig as a free city with an elected legislature under a high commissioner appointed by the League of Nations. But Poland will control the Vistula and the main railways within the territory of Danzig, and will be responsible for the foreign relations of the city, which is also to be brought within the Polish customs area (Art. 104).

Under Art. 156 Germany abandons to Japan her rights in the Shantung peninsula; she also renounces her concessions in Hankow and Tientsin (Art. 132), her privileges in Egypt under the Capitulations (Art. 147) and all her treaty rights in Morocco (Art. 141). By Art. 119 she renounces in favour of the principal Powers all her overseas possessions. These, in accordance with Art. 22 of the Covenant of the League of Nations, will be administered by mandatories of the League. The Supreme Council made, on May 6 1919, a provisional distribution of mandates for the German colonies. German E. Africa was allotted to Great Britain, by whom it was renamed Kenya Colony (July 8 1920); but on May 30 1919, Great Britain resigned the districts of Urundi and Ruanda, which border on the Belgian Congo, to be held by Belgium under a separate mandate. German S.W. Africa went to the Dominion of South Africa. France and Great Britain received a joint mandate for Togoland and Cameroon, with permission to delimit their respective jurisdictions by mutual agreement. German New Guinea was entrusted to Australia, German Samoa to New Zealand, the island of Nauru (a rich source of phosphates) to Great Britain, the German islands in the North Pacific to Japan. But the United States subsequently announced (Feb. 21 1921) that Mr. Wilson did not agree to the island of Yap, an important cable station, being included in the Japanese mandate, and this question was one of the matters considered at the Washington Conference. (*See* WASHINGTON CONFERENCE.)

Treaty of Versailles—Reparations and Financial and Commercial Terms.—The articles of the treaty which define the sums to be paid by Germany have been epitomized above. The annexes to the Reparations section specify some of the payments in kind which Germany is to make immediately on account of reparation: (*a*) She is to surrender all her merchant ships of 1,600 tons gross and upward; one-half of her merchant ships between 1,600 and 1,000 tons gross; also one-quarter of her fishing fleet and a proportion not exceeding one-fifth of her river craft. By Feb. 10 1920 she had surrendered vessels of over 1,000 tons amounting to 1,824,888 tons gross. (*b*) She is to furnish live stock, machinery, equipment, tools and building materials for the reconstruction of devastated areas. (*c*) During the next 10 years she is to find annually 7,000,000 tons of coal for France, 8,000,000 tons for Belgium, and for Italy deliveries amounting on the average to 8,000,000 tons per annum. Also she is to make good the difference between the actual output of the French pits in the Nord and Pas de Calais and their pre-war average output. But, since May 1920, her total liability for coal has been reduced to 2,000,000 tons a month. According to the Conference note of June 16 1919, the Germans might terminate this system of payment in kind as soon as they pleased after May 1 1921. "If Germany raises the money required in her own way, the Reparations Commission cannot order that it shall be raised in some other way."

The Reparations Commission is a body appointed, under Art. 233, with the duties of estimating Germany's liabilities and her capacity to pay, of insisting on the due performance of her obligations to pay in gold and in kind, and of seeing that the German scheme of taxation "is fully as heavy proportionately as that of any of the Powers represented on the Commission." The Commission is to consist of seven delegates representing the principal Powers, Belgium and Yugoslavia; but no more than five of these may vote at any meeting. The United States, Great Britain, France and Italy have a vote on every occasion; Japan and Yugoslavia only vote when their special interests are concerned; Belgium votes when neither Japan nor Yugoslavia is entitled to do so. On certain questions the unanimous vote of the meeting is required to make the decision valid; as, for instance, on the question of cancelling the whole or any part of the debt or obligations of Germany. The powers assigned to the Commission were severely criticised at the Conference by the German delegates, who said that they were greater than those which any German emperor had ever possessed in Germany. It remained, however, to be seen how those powers would be utilized afterwards. The Commission has considerable powers under the other treaties, being made responsible, directly or indirectly, for the execution of the Reparations

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clauses in each; and it was conceivable that it might remain in existence for the next 42 years, or even longer.

The financial clauses provide that Germany shall pay the costs of the armies of occupation (Art. 249). They safeguard the right of the Allied and Associated Powers to dispose of enemy assets and property within their respective jurisdictions (Art. 252)—a clause of great importance since the German assets held by Great Britain exceeded £120,000,000 sterling, and those held by the United States exceeded $500,000,000. On the other hand, ceded German territories, other than Alsace-Lorraine and the German colonies, are to be burdened with a due proportion of the German pre-war debt (Arts. 254, 255, 257). Germany transfers to the Allies any claims she may have to payment or repayment by Austria, Hungary, Bulgaria and Turkey (Art. 261).

The most striking feature of the commercial terms is that they impose on Germany a number of unilateral obligations for limited periods of time. For five years she must grant "most favoured nation" treatment to the Allies, in respect of both her imports and her exports (Arts. 264–7). For five years goods imported into Germany from Alsace-Lorraine, up to the average quantities of the years 1911–3, are to be free from German import duties; and imports from the ex-German provinces of Poland are similarly privileged for three years (Art. 268). The Allies may impose a special customs regime on the occupied territories "to safeguard the economic interests of the population" (Art. 270). For three years Germany may not raise the import duties on certain commodities (chiefly produced by Belgium and Italy) above the lowest rates to which these commodities were liable before July 31 1914 (Art. 269).

Treaty of Versailles—Military, Naval and Air Clauses.—Germany is required to abolish universal compulsory military service (Art. 173); her army is to be reduced, by a fixed date—which was originally March 31 1920, but subsequently altered to Jan. 1 1921—to a maximum total of 100,000 officers and men (Art. 160). The great general staff and all similar organizations are to be dissolved (*ib.*), and associations of all kinds are forbidden to instruct or exercise their members in the use of arms (Art. 177). The standing army is to be composed of volunteers recruited on a long-service system (Arts. 173–5). The stock of arms, munitions and military equipment which Germany may provide for this army is strictly limited; and the manufacture of such materials may only be carried out in factories approved by the Allies (Art. 168). All such materials in excess of Germany's legitimate requirements are to be surrendered within two months after the treaty comes into force (Art. 169). Germany is required to destroy all fortifications on the right bank of the Rhine within a distance of 50 km. from the river, and in the whole of her territory on the left bank (Art. 180). The size of her navy is defined; she may not keep more than 6 battleships, 6 light cruisers, 12 destroyers and 12 torpedo-boats; no submarines are allowed (Art. 181). She is to surrender 8 battleships, 8 light cruisers, 42 destroyers and 50 torpedo-boats (Art. 185), all her submarines (Art. 188), all military and naval aeroplanes and dirigibles (Art. 202). Warships and submarines still under construction are to be broken up. Germany's air forces are to be entirely disbanded by Oct. 1 1919 (Art. 199). The personnel of her navy, including officers, is not to exceed 15,000, and is to be recruited on a long-service system (Arts. 183, 194). The execution of these terms will be supervised by inter-Allied Commissions of Control armed with full powers of inspection and investigation (Arts. 203–210).

Criticisms of the Treaty.—One of the earliest critics was Gen. Smuts, who signed the treaty on behalf of South Africa, and on the same day issued a statement in which he spoke of "territorial settlements that will need revision" and "indemnities stipulated which cannot be exacted without grave injury to the industrial revival of Europe." He said that he had signed "because the real work of making peace will only begin after this Treaty has been signed." Mr. J. M. Keynes, till June 10 the chief finance expert of the British delegation, has argued (in his book on *Economic Consequences of the Peace*, published in Nov. 1919) that the claims of the Allies to reparation have been unjustifiably inflated by claims for separation allowances and pensions to the families of combatants, and for pensions and for compensation money paid to the wounded and disabled; and that the demands made on Germany are out of all relation to her capacity to pay. These points are naturally taken in the German counter-proposals of May 29, which accuse the Allies of desiring to fasten "a system of slave labour" upon Germany. "If," says this document, "they impose upon Germany a debt which robs her of every possibility of a future; if as a consequence every improvement of Germany's economic condition, which the German people might achieve by tireless diligence and Spartan thrift, would lead simply to this, that even greater payments for the discharge of this debt would be imposed upon us, then any delight in creative work, any spirit of initiative, would perish for all time in Germany." The experience of 1920 and 1921 showed that this prophecy was overdrawn, but it has suggested to more recent critics the reflection that the Allies might have obtained more, if they had demanded less. Experience has also shown the unreality of the terrifying picture which the Germans, and also Mr. Keynes, presented of the Reparations Commission as a despotic tribunal created "to exploit the labour of the German people for the benefit of the creditor states." Another subject which frequently recurs in the German note is that of the treatment accorded to German private property in the dominions of the Allies, in Alsace-Lorraine and in the German colonies. They objected to the general policy of liquidation and of referring the expropriated persons to the German Government for compensation. They argued that, by international law, private property ought to have been respected even during the war. They complained that the Allies reserved the right to liquidate German property in their own territories for an indefinite period after the war. They pointed out that Germany could only compensate the sufferers by printing more and more paper money, in which case "Germany with her currency constantly depreciating would be forced to flood the world market with goods at ridiculously low prices." But the greatest emphasis of all is laid on the complaint that the Allies, by the terms of their treaty, are violating the "innate rights of nation." The right of sovereignty is said to be infringed by the powers of the Reparations Commission and of the International Commission appointed to control the navigation of the Elbe, the Oder, the Niemen, the Rhine and the Upper Danube. The seizure of her colonies is represented as meaning that Germany is denied "the right and the duty to coöperate in the joint task which devolves upon civilized mankind of exploring the world scientifically and of educating the backward races." It is further alleged that the right of self-determination has been consistently overridden in the territorial settlement, inasmuch as the fate of the Saar valley (for 15 years), of Alsace-Lorraine, of Danzig and Memel, has been settled without a plebiscite, and Austria is virtually forbidden to throw in her lot with Germany, however greatly the populations concerned desire this union. On the topic of self-determination the Allies showed themselves particularly sensitive in their reply of June 16 1919. This principle, as we have seen, had already caused them some embarrassment; they had not all interpreted it alike; and Mr. Wilson himself had reluctantly waived its application in certain cases which were complicated by economic or strategical considerations. On the other hand the Allies absolutely declined to discuss the categories of damage for which they were demanding reparation, and merely asserted that this part of the treaty had been drafted "with scrupulous regard to the correspondence leading up to the Armistice of Nov. 11 1918."

The Austrian Treaty Negotiations.—The drafting of the Austrian treaty was begun some time before the German treaty had been signed, and the Austrian delegates arrived at St Germain-en-Laye on May 14 1919. But there were unexpected delays in completing the first draft, which could not be submitted to the seventh plenary session until May 29. Even then the military, financial and reparation terms and part of the

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political terms were reserved; and in this incomplete form the draft was handed (on June 2) to Dr. Renner, the principal Austrian delegate. On the same day the Serb-Croat-Slovene state (Yugoslavia) was formally recognized by France and Great Britain, who thus at length followed the example set by Mr. Wilson nearly four months before (Feb. 5). Even in its incomplete state the draft showed the great concessions which had been made, at Austria's expense, to Italy and to Czechoslovakia. By May 29 Mr. Wilson had withdrawn his opposition to the Italian claim (under the secret Treaty of London) for a frontier which touched the crest of the Brenner Pass and gave Italy 200,000 German subjects. The draft showed this frontier. It also showed that the 3,000,000 Germans living within the historic boundaries of Bohemia, Moravia and Slovakia were to be included in the Czechoslovak state. Against these arrangements the Austrian delegates protested in vain. They were more successful when they claimed the German districts of western Hungary as being not only German in sentiment but also economically indispensable to Austria ("the kitchen garden of Vienna") and her natural bulwark against unprovoked attacks from the side of Hungary. This claim was granted on July 20, perhaps the more readily because of the defiant attitude of Bela Kun, the leader of the Hungarian Bolsheviks, who was still in possession of Budapest. The Austrian delegates asked the permission of the Conference for a plebiscite in western Hungary, but were told that this formality was needless, the sympathies of the population being unmistakable. Nevertheless western Hungary was still in the hands of the Hungarian Government till the autumn of 1921. A smaller, but still valuable concession, was that which restored to Austria the important railway junction of Radkersburg, originally assigned to Yugoslavia. The draft ordered a plebiscite to be taken in the Klagenfurt basin, which was claimed on ethnological grounds by the Yugoslavs and had been forcibly occupied by Yugoslav troops. Though the administration of the basin was provisionally assigned to Austria, the Austrians appear to have assumed that the plebiscite would be so managed as to ensure the victory of their rivals at the polls; and they lodged some protests on this assumption, which in fact was falsified. When at last the plebiscite was held (Oct. 10 1920), it was found that the whole of the disputed area preferred to remain under Austrian rule.

In the course of the negotiations with the Austrian delegates it became clear that the principal Powers as a whole were far more leniently disposed to Austria than the form of the Austrian draft treaty appeared to suggest. The draft had been constructed on the same lines as the German treaty, and the effect of the Austrian reparation clauses was to convey an impression of greater severity than was in fact intended. As in the German treaty, so in the Austrian, the total sum to be demanded was left uncertain. Austria was required to pay, by May 1 1921, "a reasonable sum" which would be assessed by the Reparations Commission (Art. 181); and her remaining liability was to be defined by that body after that of Germany had been fixed (Art. 179). But, out of the "reasonable sum" to be paid in the first instance, the commission were to pay for any supplies of food and raw material which it deemed essential to Austria; and the Conference soon discovered that Austria was quite incapable of paying, either in gold or in kind, for the relief that she required and received. Austria was obliged to resign all claims to the merchant shipping owned by her nationals. She was required to find a quantity of live stock for the devastated areas of Italy, Yugoslavia and Rumania. But, in 1921, the Allies decided to waive all their outstanding claims against her on account of reparation. This act of grace makes it unnecessary to dwell upon the insistence with which the Supreme Council in 1919 emphasized their right to treat the new Austria—a state of 7,000,000 souls—as the legal heir to the liabilities of the Austrian Monarchy. The chief advantage which the principal Powers derived from this attitude was that of a legal title to dispose of the severed lands of the Austrian Monarchy. These lands the new Austria renounces (under Arts. 36, 47, 53, 59, 89 of the treaty) in favour of the beneficiaries appointed by the Conference. Similarly she renounces the interests of the old Austria outside Europe (Arts. 95–117).

Several concessions, other than those enumerated above, were notified to the Austrian delegates between June 2 and the date of signature. (1) The Supreme Council promised to support Austria's claim to membership of the League of Nations as soon as she possessed a responsible Government which had both the will and the power to fulfil its international obligations. This promise was fulfilled, and Austria was admitted to the League late in 1920 at a session held in Geneva. (2) The Council also conceded that the property of Austrian nationals in the former territories of the Dual Monarchy should not be liable to detention or confiscation by the Governments of those territories (Art. 267). (3) They sanctioned a temporary system (to last for five years) of preferential customs duties between Austria on the one side and Hungary and Czechoslovakia on the other (Art. 222). (4) They reduced from five to three years the period during which the new states could claim "most favoured nation" treatment in Austria without reciprocity (Art. 232).

The second draft of the treaty was handed to the Austrian delegates on July 20 and was practically complete. The Austrians presented their final observations on Aug. 6; the Supreme Council gave its final reply on Sept. 2. On Sept. 8 the Austrian National Assembly, while protesting against the terms, authorized its delegates to sign; and this ceremony took place at St. Germain-en-Laye on Sept. 10. But Rumania and Yugoslavia refused to sign because by doing so they would have pledged themselves to accept Minorities Treaties, similar in character and intention to that which Poland had signed at Versailles on June 28, under the terms of the German treaty. The argument which the principal Powers stated in defence of the Minorities Treaties was forcibly put by Mr. Wilson at the eighth plenary session (May 31). These Powers could not be expected to guarantee the independence and integrity of the new states, unless the latter would on their side guarantee equality of rights to the minorities, racial or religious, which, under the terms of the peace settlement, were being transferred from the allegiance of ex-enemy Governments. But this argument did not fit the case of Rumania or of Yugoslavia so completely as that of Poland or of Czechoslovakia. Rumania and Yugoslavia were old states, and (though greatly enlarged by the peace settlement) denied the right of the Conference to limit their sovereignty by special stipulations. They might have accepted minority treaties applying exclusively to new territories acquired under the peace settlement; but the Minorities Treaties presented for their signature applied indifferently to old and new territories alike. Eventually they were obliged to give way; but they did not sign the Austrian treaty and the Minorities Treaties until Dec. 10 1919, after receiving an ultimatum from the Conference. The final ratification of the Austrian treaty took place on July 16 1920.

Summary of Austrian Treaty.—The new Austria includes the provinces of N. Tirol and Vorarlberg, Salzburg, Carinthia, Styria (N. of the Drave), a strip of western Hungary and Upper and Lower Austria. The treaty reserves for future determination considerable sectors of the frontier on the E. and S.E., but the Klagenfurt plebiscite has settled the most important of the doubtful points in Austria's favour. Unlike Germany, Austria has been obliged to give explicit guarantees of the rights of her minorities; these guarantees may, however, be modified with the assent of a majority of the Council of the League of Nations (Arts. 62–9). Under the military clauses the Austrian army may not exceed a total of 30,000 officers and men, and is to be constituted and recruited by voluntary enlistment (Arts. 119, 120). Stocks of guns, munitions and equipment are restricted as in the German treaty, and surplus stocks are to be surrendered, and no air forces may be maintained. A special section of the Reparations Commission is constituted to assess and to collect the payments due from Austria (Art. 179); it is to include representatives of the United States, Great Britain, France, Italy, Greece, Poland, Rumania, Yugoslavia and Czechoslovakia; but the four first named Powers have two votes apiece,

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and thus constitute a majority. Besides the " reasonable sum " to be paid before May 1 1921 (Art. 181), Austria is required to hand over all merchant ships and fishing-boats owned by nationals of the former Austrian Monarchy, and up to 20% of her river fleet; also animals, machinery and equipment, up to the limits of her capacity, for the restoration of devastated territories. Immediate delivery is required of specified quantities of live stock for Serbia, Rumania and Italy. Austria is made liable for so much of the Austrian war debt as is held outside the boundaries of the Austro-Hungarian Monarchy; but she is not liable for war debt bonds which are held by other states, or by their nationals, within those boundaries (Art. 205). All transferred territories of the monarchy are to be liable for their fair share of the pre-war Austrian debt (Art. 203). Austria renounces all claims to the state property, including royal property, lying within the transferred territories; but the states acquiring such property will be debited, and Austria will be credited, with its value by the Reparations Commission (Art. 208). The commercial clauses are similar to those of the German treaty. In the clauses relating to ports, railways and rivers, it is provided that the old Danube commission shall be revived, and that the Upper Danube (from Ulm downwards) shall be controlled by a new commission on which Great Britain, France, Italy, Rumania and the riparian states will be represented (Arts. 301, 302). Austria is guaranteed free access by railway to the Adriatic through the territories and the ports which have been severed from the monarchy (Art. 311).

The Austrian treaty is supplemented by two special agreements which were signed at St. Germain-en-Laye on Sept. 10 1919. By the first of these Poland, Rumania, Yugoslavia and Czechoslovakia agree with the other Allied and Associated Powers to make separate payments, not exceeding in the aggregate 1,500,000,000 gold francs, as a contribution to the costs of liberating the territories which have been transferred to them from the monarchy. By the second Italy agrees to make a similar payment, in consideration of the provinces assigned to her. None of these payments was to be made before 1926.

The Bulgarian Treaty, Nov. 24 1919.—The Bulgarian delegates, headed by M. Theodoroff, the Prime Minister, arrived in Paris on July 26, but did not receive the draft treaty until Sept. 19. The terms were not altogether unexpected, for M. Theodoroff had lodged objections against some of them on Sept. 2. But five weeks elapsed before the formal observations of the delegates were presented to the Supreme Council (Oct. 24). The Bulgarians demurred to the terms of the territorial settlement, which were thought by critics on the side of the Allies to be too lenient; they also complained that Bulgaria was harshly treated in not being immediately admitted to the League of Nations. They protested that Bulgaria could not afford to abolish conscription and maintain an army of volunteers, even on the small scale prescribed by the draft treaty. The Supreme Council in their reply (Nov. 3) promised speedy admission to the League, but made no other concession of substance. Further remonstrances from the Bulgarians merely led M. Clemenceau to intimate (Nov. 5) that the treaty as it stood must be either accepted or rejected within ten days. By this time M. Theodoroff had resigned office. His party had been severely defeated at a general election held in Aug., and he shrank from the invidious responsibility of signing the treaty. A new Government was formed by the leader of the Agrarian party, M. Stambolisky; and, on Nov. 13, Bulgaria's acceptance of the inevitable was notified to the Supreme Council. The treaty was signed at Neuilly-sur-Seine on Nov. 27, M. Stambolisky acting as the sole signatory for Bulgaria.

The general principle of the territorial terms is to restore the frontiers of 1914; but Bulgaria cedes to the principal Powers the share of Thrace which had been left to her by the Treaty of Bucharest; the Powers undertake to provide (by arrangement with Greece) outlets for Bulgarian trade on the Aegean. Certain districts are transferred (for strategic reasons) from Bulgaria to Yugoslavia; the most important of these districts contains the town of Strumitza. It is stated that further transferences of territory to Yugoslavia were considered at the Conference, but were rejected on ethnological grounds as they would have affected districts in which the Bulgarian nationality preponderates. The reparation terms are more definite than those of the German and Austrian treaties. Bulgaria is required to pay 2,250,000,000 gold francs by half-yearly instalments extending over a period of 37 years. An inter-Allied commission of three members (representing France, Great Britain and Italy) will remain in Bulgaria to see that the reparation terms are duly honoured. This body will decide how the half-yearly payments are to be raised. It will prepare a list of the taxes and other revenues which are to be appropriated to reparation. If Bulgaria makes default in respect of any instalment, the commission may assume the duty of collecting the appropriated revenues. The commission may also recommend the Central Reparations Commission to give a time of grace for any particular instalment, or to reduce Bulgaria's liability. Such a recommendation will take effect if it is endorsed by a majority of the Reparations Commission. Bulgaria must provide, by way of restitution, specified quantities of live stock for the devastated areas in Greece, Rumania and Yugoslavia. She must also supply Yugoslavia with 50,000 tons of coal annually for five years. The maximum size of the Bulgarian army is fixed at 20,000 officers and men, raised by voluntary enlistment; but Bulgaria may maintain gendarmes, customs officials, forest guards and some other kinds of police and frontier guards (all armed with rifles) up to the number of 13,000. All Bulgarian war-vessels (including submarines) are to be surrendered or broken up, except four torpedo-boats and six motor-boats. No air forces may be maintained, no submarines may be built or otherwise acquired. The importation of arms and munitions is prohibited; only one munitions factory is permitted. No new fortifications may be constructed in Bulgaria.

The Hungarian Treaty, June 4 1920.—The Hungarian delegates did not appear in Paris until Jan. 7 1920, and over six months elapsed before the Treaty of the Trianon was signed. But the main features of this treaty had been settled long before the Peace Conference dissolved. Except in the territorial terms it was closely parallel to the Austrian treaty. The Supreme Council had informed Bela Kun on June 13 1919 what territories would be transferred to Czechoslovakia and Rumania; and on July 20 1919 the German districts of western Hungary were promised to Austria. But some time elapsed before Hungary acquired a Government which commanded the confidence of the Allies. Late in July 1919 Bela Kun was overthrown by the Rumanians, whom he had attacked on the line of the river Theiss. The Rumanians then occupied Budapest, and permitted the Archduke Joseph to assume the title of Administrator, with the support of a number of ex-officers (Aug. 6). The Archduke applied to the Supreme Council for recognition; but the Council insisted that he should resign, and that steps should be taken to form a coalition Government (Aug. 22). The Archduke then effaced himself, but his Premier, M. Friedrich, remained in office until the Rumanians evacuated Budapest in November. At last on Nov. 24 a coalition Government was formed under M. Huszar, and M. Friedrich joined the new Cabinet as Minister for War. M. Huszar was promptly recognized by the Supreme Council (Dec. 1), in spite of the fact that the strength of his position had not yet been tested by a general election. This, however, took place early in 1920 and produced a National Assembly whose sentiments were comparatively reasonable. The draft treaty was handed to the Hungarian delegates on Jan. 15 1920, a week before the termination of the Conference; the negotiations were left to be conducted by the Council of Ambassadors. On Feb. 12 the Hungarians presented counter-proposals and observations which were the reverse of conciliatory. They argued that the position of the Magyars in Hungary was an exact parallel to that of the Czechoslovaks in Bohemia, and asked why the principle of self-determination had been differently applied to the two cases. They asked that the Szeklers of E. Transylvania should be left under Hungarian rule; that all the territories which Hungary was required to

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surrender should remain within the Hungarian customs régime for a period of years; that no territories should be transferred without a plebiscite, or, alternatively, that better safeguards should be provided for the rights of Magyar minorities. These requests came too late for serious consideration. All the ambassadors would promise was that the League of Nations should be free to consider any minor rectifications of boundaries which the frontier commissions might recommend on ethnological or economic grounds. It is remarkable that this reply, which only involved small alterations in the draft treaty, was not transmitted until May 6. There was one Hungarian pretension with which the Allies dealt more promptly. The Huszar Government claimed that Hungary was still a monarchy, though the royal dignity was in suspense; it was no secret that many Hungarians still desired a Habsburg dynasty. But on Feb. 2 1920 Great Britain, France and Italy declared that a Habsburg restoration in Hungary would violate the fundamental principles of the peace settlement. The Hungarian royalists did not even then abandon all hope; the monarchical character of the constitution was reaffirmed by the Government on March 23. But since the signature of the Treaty of the Trianon the three states of Czechoslovakia, Yugoslavia and Rumania have combined in a "Little Entente" which avowedly exists to defeat any Hungarian project for a Habsburg restoration.

The only parts of the Hungarian treaty which call for comment are those which fix the future boundaries of Hungary and the allocation of the transferred provinces. On the N. the new frontier gives to Czechoslovakia the southern slopes of the Carpathians, mainly though not entirely populated by Slovaks. To provide Czechoslovakia with a frontage on the Danube and to secure the economic unity of the Carpathian territories, the frontier line has been so drawn as to place large Magyar populations under Czechoslovak rule. Similarly Rumania receives not only Transylvania, in the E. of which there is a compact Magyar (Szekler) minority, but also a broad strip of the Hungarian plain to the W., in which the chief towns are Magyar, in order that Transylvania's railway communications with the Danube may be adequately secured. The Banat, which is divided between Rumania and Yugoslavia, has a mixed population, predominantly Slav in the western and predominantly Rumanian in the eastern half of the province. The German element in the eastern Banat is considerable and would no doubt have preferred to remain under Hungarian rule. But the chief difficulty which the Conference experienced in dealing with the Banat was the adjustment of the conflicting claims of Yugoslavia and Rumania. For the Allies, in their secret treaty of Aug. 1916 with Rumania, had promised her the whole of the Banat, without regard to the historic claims of Serbia. At the Conference M. Bratianu pressed for the fulfilment of the secret treaty. He was met with the reply that Rumania herself had cancelled it by making peace with the Central Powers in May 1918; but he continued to reiterate his demands until the terms of the partition of the Banat were irrevocably settled by the Conference and announced to the world (June 13 1919). To this incident were due the Rumanian occupation of Budapest, the intrigue with the Archduke Joseph (which seems to have included a plan for the union of the Rumanian and Hungarian crowns) and the delay of Rumania in signing her Minorities Treaty.

Like Austria, Hungary is precluded from alienating her independence, except with the consent of the Council of the League of Nations (Art. 73). She is required to pay a reasonable sum, fixed by the Reparations Commission, before May 1 1921; her total liability will be fixed by the same body (Arts. 163, 165) and the balance is to be paid in half-yearly instalments over a period of 30 years, unless payment is respited or remitted by the Allies. She is to surrender all her merchant shipping, up to 20% of her river fleet, and an indefinite quantity of live stock (at the discretion of the Reparations Commission) for devastated countries.

The Adriatic Question.—When the Italian plenipotentiaries reappeared at Paris in May 1919 they were offered by the American delegation the so-called Tardieu Compromise, under which Fiume and its hinterland would have constituted an independent state for 15 years, and a plebiscite would afterwards have been taken to ascertain the views of the inhabitants. To this compromise, it is alleged, Sig. Orlando gave his consent; but the Yugoslav delegates insisted on unacceptable amendments, and the American attempt at mediation was dropped at that time. Subsequently the Italian poet D'Annunzio, at the head of a band of volunteers, occupied Fiume (Sept. 12) while fresh negotiations were in progress (at Washington) between Mr. Wilson and the Italian Government. In spite of this *coup d'état*, which was disavowed by Italy, the American negotiations continued; by Oct. 27 Italy had agreed that Fiume should be a free state under the protection of the League of Nations and had resigned her claims on Dalmatia, while Mr. Wilson was prepared to recognize Italy's sovereignty over the Pelagosa group, Lissa, Lussin, Unie and the port of Valona. The Adriatic position was then examined more minutely at Paris by M. Clemenceau, Sir Eyre Crowe and Mr. Polk. These three proposed that Italy should be offered a protectorate over the Dalmatian city of Zara, but that she should be asked to abandon her demands upon the isle of Lagosta and the eastern part of Istria, and also her proposal that the city of Fiume should be made independent of the free state of Fiume. The offer did not satisfy Sig. Nitti, who intimated that Italy, in default of a more acceptable scheme for a compromise, would take her stand on the secret Treaty of London. To this Mr. Lloyd George and M. Clemenceau replied that they too were willing in the last resort to abide by that treaty, but on Jan. 14 1920 they offered new terms which were distinctly more favourable to Italy than those of Dec. 9 1919. The new terms were drafted after Mr. Polk had left Paris for Washington, and were presented to Sig. Nitti before the U.S. Government had been consulted regarding them. Accordingly Mr. Lansing intimated, on Jan. 20, that Mr. Wilson could not admit the right of France and England to modify, on their own responsibility, the only terms of compromise to which an American representative had subscribed. The French and British Prime Ministers argued, in reply, that their new proposals were actually more favourable to Yugoslavia than those of Dec. 9, and were intended to save France and England from the necessity of honouring the Treaty of London, to which, as was notorious, Mr. Wilson had always objected. But on Feb. 10 Mr. Wilson stated precisely his objections to the terms of Jan. 14. They gave to Italy the whole of Istria and the prospect of a future protectorate over Fiume. They also provided for the partition of Albania between Yugoslavia, Italy and Greece. Mr. Wilson stated that he could not coöperate with the European Allies if they allowed the admitted principles of justice to be overborne "by the country possessing most endurance in pressing its demands." The upshot of the controversy was that Italy and Yugoslavia were left to settle their differences, if they could, by separate negotiations, with the proviso that they must not come to terms at the expense of Albania. It took some time to reach this consummation. But on Nov. 12 1920 Italy and Yugoslavia concluded the Treaty of Rapallo, and on Jan. 2 1921 D'Annunzio's garrison at Fiume surrendered to the Italian Government. Albania, thanks to Mr. Wilson's intervention, has established an independent Government and has been admitted (Dec. 17 1920) as a member of the League of Nations. The Adriatic question was thus provisionally settled, nearly a year after the close of the Conference, but still on lines which the Conference had suggested.

The Turkish Treaty.—The Turkish question was discussed at Paris in May and June 1919, but the drafting of the Turkish treaty was not seriously taken in hand until the London Conference of Feb. 1920. This delay was due partly to the hope (unhappily falsified) that the United States would join in the treaty; but also to difficulties arising out of the allocation of mandates for the non-Turkish portions of the Ottoman Empire. The twelfth of the Fourteen Points provided that these territories should receive "unmolested opportunity of autonomous development." Article 22 of the Treaty of Versailles indicated

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that some at least of them would be recognized as independent nations, under such mandatories as they were willing to accept. The principal claimants for these mandates were France and Great Britain, who in May 1916 had come to an understanding about their future spheres of influence (the Sykes-Picot agreement), on the basis that the French sphere should include Cilicia, Southern Armenia and Syria (with autonomy under French protection for Damascus, Aleppo, 'Urfa, Deir and Mosul); that Palestine should be an international territory; and that Haifa and Mesopotamia should be in the British sphere. But Greece claimed the whole of Turkish Thrace, Smyrna (which she occupied with the approval of the Supreme Council in May 1919) and the Aegean Is.; while Italy claimed the Dodecanese (of which she had retained possession at the end of the Libyan war in 1912) and a sphere of influence on the adjacent mainland. There were difficulties connected with all these claims. The most notorious conflict of interests was that between France and the Hejaz (over the Arab districts of Syria), which came to a head in March 1920 with the proclamation by a "Syrian National Congress" of an independent Syria (to include the Lebanon, Palestine and Mesopotamia) and of Faisal, the heir apparent of the Hejaz, as the king of this state; but there were also doubts as to the wisdom of allowing Greece to assume responsibility for Smyrna, and as to the possibility of reconciling the French and Italian claims with Mr. Wilson's promise to respect the political unity of the Turkish race. The future of Constantinople was long in doubt. At last on Feb. 16 1920 the Conference of London announced that it would remain the Turkish capital; but, a month later, the Allies informed the Turkish Nationalists that this concession was conditional on their good behaviour, and Constantinople was temporarily occupied by Allied troops under the command of Gen. Milne. On April 24 the Conference of San Remo gave mandates to France for Syria, Cilicia and the Lebanon; to Great Britain for Palestine and Mesopotamia; a mandate for Armenia was declined first by the League of Nations (April 27) and afterwards by the United States Senate (May 27). At last on May 11 the draft treaty was handed to the Turkish delegates at Sèvres. Its terms produced considerable excitement among the Nationalists, and it was necessary for the Allies to call upon the Greeks to make armed demonstrations both in Asia Minor and in Thrace. But at the Conference of Spa (July) the last touches were put to the treaty and on Aug. 10 it was duly signed by the Turkish delegates.

Under the treaty Constantinople is left to the Sultan, with the proviso that it may be forfeited if Turkey violates the terms of settlement, especially those by which she guarantees the rights of minorities in her territory. In accordance with the Fourteen Points the Straits are neutralized and placed under the control of an international commission. Smyrna, with about half its *vilayet*, is left under Turkish sovereignty, but this sovereignty will be exercised by the Greek Government, and Smyrna may be incorporated in the Greek customs area. There is to be a local legislature, which may, if it so desires, petition the League of Nations (within five years) for the incorporation of Smyrna in the Greek kingdom. Greece also receives, in full sovereignty, Thrace outside the zone of the Straits, Imbros, Tenedos, Lemnos, Samothrace, Mytilene, Chios, Samos and Nikaria. But she may not fortify the first five of these islands (owing to their proximity to the Straits); and she engages to sign a minorities treaty. Armenia is declared a free and independent state; the boundary between Turkey and Armenia is to be referred to the arbitration of the President of the United States. Syria, Mesopotamia and Palestine are recognized as independent states; their boundaries will be fixed by the principal Powers, and they are to be administered by mandatories, on terms formulated by the principal Powers and submitted to the Council of the League of Nations for approval. The Hejaz is recognized as a free and independent state. Turkey cedes to Italy the islands of Astropalia, Casso, Scarpanto, Rhodes, the Dodecanese and Castellorizo. The British protectorate over Egypt and the British annexation of Cyprus are confirmed. The chief feature of the military clauses is the proviso that Turkey may maintain no military forces except the Sultan's bodyguard, and gendarmes and frontier guards not exceeding 50,000 in number. The Allies waive their claims for reparation. But Turkey is to pay the costs of the armies of occupation since the Armistice of Oct. 30 1918, and to compensate civilian nationals of the Allies for loss or damage suffered in the war through the action or negligence of the Turkish authorities.

BIBLIOGRAPHY.—All the treaties have been published by the Stationery Office. Supplementary documents are printed in the *History of the Peace Conference*, vols. i.–iii., ed. H. W. V. Temperley (1920–1), which also comments exhaustively on the German treaty, and gives an account of proceedings up to June 28 1919. Three more volumes are in preparation; these will deal with the remaining treaties. A few more documents will be found in the *American Journal of International Law* (and supplements) for 1919 and 1920. The German *Comments on the Conditions of Peace* of May 29 1919 is published (in English) by the Amer. Assoc. for International Conciliation (Oct. 1919); the *Reply of the Allied and Associated Powers*, of June 16 1919, is published by the Stationery Office: Cmd. 258 (1919). For the question of Fiume see documents published by "Adriaticus" in *La Question Adriatique* (1920), and the Stationery Office paper: *Correspondence relating to the Adriatic Question*, Cmd. 586 (1920). Of books describing or criticizing the Conference the following are useful: Sir M. Hankey, "Diplomacy by Conference" (*Proc. Brit. Inst. of International Affairs*, 1921); H. Wilson Harris, *The Peace in the Making* (1920); J. M. Keynes, *Economic Consequences of the Peace* (1919); C. H. Thompson, *The Peace Conference Day by Day* (1920). Of capital importance is the series of articles by M. André Tardieu in *L'Illustration* for 1920, reprinted in his book *La Paix* (1921). See also R. Lansing, *The Peace Negotiations* (1921) and *The Big Four and Others* (1921). (H. W. C. D.)

PEARCE, CHARLES SPRAGUE (1851–1914), American painter (*see* 21.24), died in Paris, France, May 18 1914.

PEARS, SIR EDWIN (1835–1919), British lawyer and man of letters, was born at York March 18 1835, and educated privately and at the London University where he took first-class honours in Roman law and jurisprudence. He was called to the bar at Middle Temple in 1870 and for a time was private secretary to Frederick Temple, afterwards archbishop of Canterbury, and secretary to various associations connected with social work in London. In 1873 he settled in Constantinople, practising in the consular courts and becoming president of the European bar there. He acquired in this way an intimate knowledge of the East which he turned to account in 1876 when, as correspondent of *The Daily News*, he sent letters home describing Moslem atrocities in Bulgaria which aroused popular demonstrations in England led by W. E. Gladstone (*see* 12.71). He was knighted in 1909. His works include *The Fall of Constantinople, a Story of the Fourth Crusade* (1885); *The Destruction of the Greek Empire* (1903) and, his most distinguished book, *Turkey and its People* (1911) in which he displayed his expert knowledge of Byzantine Constantinople. He died Nov. 27 1919 at Malta as the result of an accident on his journey home from Constantinople.

PEARSE, PATRICK HENRY (1879–1916), Irish educationist, author, and Sinn Fein leader, was born in Dublin on Nov. 10 1879. His father was an Englishman, a sculptor and worker in stone, who was himself the author of a pamphlet on *England's Duty to Ireland as it appears to an Englishman*. It is likely that it was from his father Pearse derived his love of liberty; and from his mother, whose people came from county Meath, he drank in memories of '98 and of the Fenians. He was educated at the Christian Brothers schools and graduated before he was 24 at the Royal University of Ireland as a B.A. and B.L. His first serious work was when he became editor of the *Claidheamh Soluis*, the weekly organ of the Gaelic League. When engaged on this work he made a tour through Belgium to study bilingual methods, and edited several *Fiana* tales from Irish manuscripts. He was a hard worker on the *Coisde Gnotha* or Executive of the League, and secretary to its publication committee. He was more interested in education than in any other subject, and it is remarkable that he was in favour of accepting Mr. Birrell's Irish Council bill (*see* 14.788) in 1907, because it gave the Irish control over their own education. In this attitude he stood almost alone. His first book was a slender volume containing *Three Lectures on*

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Gaelic Topics, published when he was only 19, dedicated to the New Ireland Literary Society (an ephemeral body which he himself had founded) by its President. This little book contained the germs of much later and better work, including a plea for enthusiasm, and a prophecy that the Gael would "become the saviour of idealism in modern intellectual and social life." In order to carry out his educational schemes he founded a school at Cullenswood, in Dublin, which prospered. The idea was to give an Irish education such as he assumed would be given in a free Ireland. Much stress was laid on the Irish language and on religion. In 1910 he removed this school to the Hermitage, Rathfarnham, a few miles out of Dublin, and continued to run it until his death. He travelled in America collecting money for his schemes, and on his return threw himself into the Irish Volunteer movement. He was high up in its councils, and led in the revolution of 1916, of which he was commander-in-chief. At the same time he proclaimed an Irish Republic. After a week's fighting in Dublin he saw that further resistance was useless, and ordered the Volunteers to lay down their arms. He and Thomas MacDonagh, who had formerly been one of his assistant masters at the Hermitage, and other leaders were tried by court-martial and shot soon after their surrender. Pearse was an excellent orator, with a fine resonant voice. He was a pious Catholic, of irreproachable life, a great lover of children and of nature.

After his death appeared *The Collected Works of Padraic H. Pearse* (3 vols. 1917), containing plays, poems and stories in Irish, and one volume of English writing. (D. Hy.)

PEARSON, SIR (CYRIL) ARTHUR (1866–1921), English newspaper proprietor and philanthropist, was born at Wookey, near Wells, Feb. 24 1866, and was educated at Winchester. He early founded the business of C. Arthur Pearson, Ltd., newspaper proprietors and publishers; and after having made large profits with *Pearson's Weekly* and other periodicals he founded in 1900 the *Daily Express*, a halfpenny rival to the *Daily Mail*, and in 1904 purchased the *Standard* (*see* 19.560, 561). He was a strong supporter of Mr. Chamberlain's tariff-reform movement. In 1910 increasing—later complete—failure of sight obliged him to retire from the active direction of newspapers. Henceforth he devoted himself and his fortune with whole-hearted industry to efforts to ameliorate the condition of the blind. During the World War he established at his house, St. Dunstan's, in Regent's Park, London, a hospital for blinded soldiers, and became chairman of the Blinded Soldiers and Sailors Care Committee (1914). He also became president of the National Institution for the Blind. He was created a baronet in 1916 and G.B.E. in the first gazette of the new Order of the British Empire in 1917. He died in London Dec. 9 1921. Having been eager to encourage those among the blind who cannot command attendance, he had made it his practice to have his bath unaided, but on this occasion he accidently slipped, was stunned by striking his head on a tap and suffocated while unconscious, his face under water.

PEARY, ROBERT EDWIN (1856–1920), American Arctic explorer (*see* 21.30), died in Washington, D.C., Feb. 20 1920. Because of his discovery of the North Pole (1909) he was promoted rear-admiral in 1911 and received by special Act the thanks of Congress. The same year he was U.S. delegate to the International Polar Commission in Rome. During his later years he was much interested in aerial navigation and delivered many addresses in which he urged coast patrol by aeroplanes. In 1913 he was made Grand Officer of the Legion of Honour (France). He was the author of *The North Pole* (1910) and *Secrets of Polar Travel* (1917).

PEEL, ARTHUR WELLESLEY PEEL, 1ST VISCOUNT (1829–1912), English statesman (*see* 21.39), died at Sandy, Beds., Oct. 24 1912.

He was succeeded by his son, WILLIAM ROBERT WELLESLEY PEEL, who in 1916 was chairman of the Committee on Detention of Neutral Vessels, in 1919 became Under-Secretary for War, and in 1921 Chancellor of the Duchy of Lancaster.

PEKING, China (*see* 21.61).—During the first decade of the new Chinese Republic, great improvements were made in the matter of the maintenance, lighting and sanitation of the principal thoroughfares of the capital; the police were reorganized on western lines, and instructed in traffic control; and, as the result of the introduction of metalled roads, the old-type mule cart was rapidly replaced by carriages, motor-cars and jinrikishas. Many of these changes were due to the initiative of Chu Chi-chien, Minister of the Interior in 1913.

The conditions of railway traffic between the city and the outside world were also greatly improved by the location of the *termini* of the Peking-Moukden and Peking-Hankow lines at the Chien Mên, the great southern gate of the Tatar city, which lies between the palace and the Temple of Heaven. The wall adjoining this gate has been pierced with new passages for general traffic and broad thoroughfares thrown open to the public in the Forbidden City.

A large number of buildings in foreign style have been erected for Government offices, banks and business premises. In spite of these changes, however, chiefly conspicuous in the official and business quarters in the vicinity of the legations, the general features of the scene which the traveller sees from the walls remain much the same as in former times, a vast enclosure within which the yellow-tiled roofs of palaces and temples emerge here and there above the trees; and in the less frequented parts of the city, notably the Manchu quarter, there is but little outward evidence of change. The poverty-stricken appearance which the Chien Mên district and other business centres presented as the result of the destruction wrought by the Boxers in 1900 has gradually disappeared.

The trade of the city remains local as of old, and generally unconcerned with industrial enterprise, but during the first ten years of the Republic the citizens of the capital were able to recover a considerable measure of comfortable prosperity, because of the freedom with which money was circulated by the various political and military parties.

New macadamized roads running from the city in several directions (to the western hills, to Tongshan and to Tungchow) are amongst the most conspicuous manifestations of the Peking municipal council's activities. The number of foreigners resident at the capital has increased considerably in recent years, and, although the city has not been opened by treaty to foreign trade, a number of business houses have been established with the tacit consent of the Chinese authorities.

See E. Backhouse and J. O. P. Bland, *Annals and Memoirs of the Court of Peking* (1913); D. Mennie and P. Weale, *The Pageant of Peking* (1921); P. H. Kent, *The Passing of the Manchus* (1912); J. O. P. Bland, *China, Japan and Korea* (1921).

PÉLISSIER, HARRY GABRIEL (1874–1913), English comedian, was born at Finchley in 1874. His father was a Frenchman living in England—a descendant of Marshal Pélissier—and his mother was English. In 1911 he married Fay Compton, the daughter of Edward Compton, the actor. He became an "entertainer" and author of musical sketches and organized a troupe known as "The Follies," who gained a very great success in a special *genre* of musical entertainment, half song, half witty parody, at the Apollo theatre, London. He died in London Sept. 25 1913.

PELLETAN, CHARLES CAMILLE (1846–1915), French politician and journalist (*see* 21.69), died June 4 1915.

PENLEY, WILLIAM SYDNEY (1852–1912), English actor (*see* 21.99), died at St. Leonards-on-Sea Nov. 11 1912.

PENNSYLVANIA (*see* 21.105).—During 1910–20 there was a great increase in the industrial developments of Pennsylvania, largely as a result of the World War. From 1914 until American participation in 1917, the Allied Governments expended many millions of dollars among the steel, ammunition and other establishments, bringing to the state a period of prosperity the extent of which was apparent when the Liberty Loans and war taxes disclosed the accumulated wealth. The state maintained its rank as the second state in population and in industry.

The pop. of the state in 1920 was 8,720,017, an increase of 1,054,906 over 1910. The rate of increase, 13·8%, was considerably lower than that of the preceding decade, 21·6%. In 1920 the pop. of the 15 largest cities of the state was: Philadelphia, 1,823,158; Pittsburgh, 588,193; Scranton, 137,783; Reading, 107,784; Erie, 93,372; Harrisburg, 75,917; Wilkes-Barre, 73,833; Allentown, 73,502; Johnstown, 67,327; Altoona, 60,331; Chester, 58,030; Lancaster, 53,150; Bethlehem, 50,358; York, 47,512; and McKeesport, 46,781.

Agriculture.—A decrease of nearly $100,000,000 in the value of crops from 1919 to 1920 was reported by the state department of agriculture, but the state's farms showed an improvement in

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production during the preceding decade. The contrast is shown in the following table:—

	1909	1920
Wheat	26,265,000 bus.	26,774,760 bus.
Indian Corn	48,800,000 "	65,755,660 "
Oats	25,948,000 "	44,858,325 "
Buckwheat	5,665,000 "	4,952,860 "

The depreciation in the value of crops from 1919 to 1920 was due in part to reduced acreage, but chiefly to the heavy decline in prices. The average farmer in 1920 lost $434.20 as a result of depreciation. The price of the average dairy cow during the year dropped from $96.75 to $75.50, the dairy industry alone depreciating $20,890,774. Sheep depreciated $3.75 a head, falling from $10.25 to $6.50, and the total loss to sheep-raisers was $4,000,000. Hogs declined from $30.90 to $16.15 and farm horses from $111 to $102. The potato production for the entire state for 1920 was 29,158,435 bushels. The state department of agriculture valued the total fruit production of 1920 (20,825,000 bus.) at $18,742,500.

Mineral Production.—The following table shows the figures of the coal and coke industry during 1910–8, in tons:—

	Bituminous	Anthracite	Coke
1910	148,770,858	83,683,994	23,722,944
1911	142,189,329	90,917,176	19,984,320
1912	160,830,492	84,426,869	24,682,474
1913	172,965,659	91,626,964	24,718,238
1914	145,884,530	91,189,641	17,164,124
1915	157,420,068	89,377,706	22,012,945
1916	169,123,814	87,680,198	26,428,926
1917	171,074,411	100,445,299	23,240,777
1918	177,217,294	99,445,794	27,157,373

During these years an average of 190,000 persons were engaged in mining bituminous coal and 170,000 in mining anthracite.

Manufactures.—In the absence of final industrial figures for the U.S. census of 1920, not yet available in Dec. 1921, comparisons between the industries of 1909, 1914 and 1919 must be drawn from U.S. census figures for the first two periods and the survey made by the state department of internal affairs for the latter. In 1914 Pennsylvania became the foremost state in the value of silk production, displacing New Jersey. Her 1914 production was valued at more than one-third of the total for the United States, and the state had more than two-fifths of all the employees in the industry. In 1909 226 silk-producing establishments, with 36,469 employees, had a production valued at $62,061,000. In 1914 284 establishments, with an average of 44,755 wage-earners, produced material valued at $86,938,554. In 1919 347 establishments, with 57,079 employees, produced material valued at $238,422,600. Pennsylvania was the leading state in 1914 in hosiery manufacture, reporting 39·7% of the national quantity and 41·2% of the national value. In 1909 464 establishments manufacturing hosiery, employing 38,206 hands, produced a value of $49,658,000; in 1914 498 establishments, with 41,130 employees, produced a value of $64,163,449; in 1919 328 establishments, with 35,400 employees, $130,167,800. In the iron and steel industry in 1909 66 blast furnaces, with 14,521 employees, yielded $168,578,000, and in 1914, 52 with 11,518 employees a product valued at $135,806,067. Notwithstanding the decrease the state in 1914 employed 39·2% of all the wage-earners and produced 42·8% of the total product of the country. Steel works and rolling mills in 1914 also showed a decrease from 1909. In 1909 189 establishments, with 126,911 employees, produced $500,344,000, and in 1914 178 establishments, with 131,955 employees, produced $488,106,324. In the manufacture of tin-plate, Pennsylvania in 1914 led the nation. Comparative figures show:—

	Establishments	Employees	Product
1909	17	2,346	$25,234,066
1914	13	2,368	36,795,990
1919	8	12,311	115,642,300

The state census of 1919, for all industries, shows a total of 20,888 establishments in the state divided as follows:—buildings and contracting, 2,895; chemicals and allied products, 768; clay, glass and stone, 583; clothing, 1,398; food and kindred products, 2,404; leather and rubber goods, 395; liquors and beverages, 453; lumber and its remanufacture, 1,114; paper and printing, 1,740; textiles, 1,024; laundries, 273; metals and metal products, 3,432; mines and quarries, 1,564; public service, 1,005; tobacco and its products, 709; and miscellaneous 1,131. The total average number of employees was 1,691,171 (167,562 salaried employees, 1,523,609 wage-earners); the total wages, $2,176,449,100, and the total value of products, $8,853,047,600. The highest valuation was placed on metals and metal products, $3,675,971,500, more than 40% of the whole value of production. Employees in this industry numbered 508,311. Next was a product of $722,515,300 from the mining industries, which employed on an average 329,179 men in 1919. The textile industry maintained third place with 125,291 employees and a production valuation of $646,683,000. The figures from 1915–9 are as shown in the following table.

	Establishments	Average No. Wage-Earners	Value of Production
1915	22,359	1,503,188	$4,180,790,500
1916	20,961	1,735,543	6,419,410,000
1917	22,101	1,802,813	8,336,984,800
1918	21,158	1,827,101	9,403,306,600
1919	20,888	1,523,609	8,853,047,600

Education.—Two progressive steps a decade apart mark the development of the public schools. The first was the adoption of the School Code of May 18 1911; the second the enactment of what is known as the Finegan programme (named after the State Superintendent of Public Instruction) by the Legislature of 1921. The School Code of 1911 was virtually a codification of all the laws governing the public-school system and a general unification, with many new features, of administrative measures. Its most important sections provided for independent control of taxation and borrowing by school boards with minimum and maximum tax rates varying according to the size of the school district; reduction of the number of members in school boards so as to simplify official business; establishment of a State Board of Education; establishment of a state school fund, and general provisions for the better selection of text-books and for the development of higher education. The measures of 1921 (the Finegan programme) are as follows: (1) Providing that after Sept. 1 1927 those persons who enter the teaching service must show evidence of graduation from a state normal school or an equivalent education and training; (2) requiring fourth-class districts to maintain schools for 150 days in 1921–2 and 160 days in 1922–3; (3) increasing the qualifications of county superintendents by providing that no one except college-trained persons or normal-school graduates with certain school experience shall be qualified for the position; (4) increasing the salaries of all assistant county superintendents from $1,800 to $2,500 per year and giving most of the county superintendents an increase in salary of $500 or $1,000; (5) establishing a state-wide salary schedule for teachers, fixing the minimum at $1,200. In cities annual increments are required, and proportionately higher salaries are provided for high-school teachers; (6) increasing the state aid to schools for each biennial period from $24,000,000 to $36,000,000 and establishing a new basis of apportionment; (7) encouraging consolidation by providing that for each school closed the district shall be entitled to receive an annual allotment of $200; (8) making sufficient appropriations for normal schools so that they may be supported without tuition fees and providing a salary schedule for the faculties; (9) creating a State Council of Education to consist of nine business and professional men and women, replacing the State Board of Education and the college and university council; (10) standardizing the elementary courses in public and private schools and requiring that they be taught in the English language and from texts written in English; (11) strengthening the compulsory attendance laws.

Finance.—The revenues of the state more than doubled from 1909 to the end of 1920. The receipts in 1909 were $28,945,210; in 1920, $62,071,293.97. This does not include $11,800,000 derived from the sale of state road bonds, a fund kept separate from the regular state moneys. Governor Sproul recommended to the 1921 session of the state Legislature an increase of about 10% in the tax on manufactures and a small tax on mined coal, a combination which would add more than $30,000,000 to the treasury annually. The treasury disbursements in the fiscal year 1920 were $74,960,112.20, the highest ever known. The total was $18,000,000 higher than in 1919, the increase being due to road construction. During the 1920 season approximately 410 m. of concrete state road were built, and 350 m. were under construction in 1921. In two years, 660 m. of 18-ft. concrete roadway, some of which had a brick wearing surface and some asphalt, were constructed by the state. In 1920 a total of 337 m. of macadam highway were resurfaced and 1,400 m. of highway had surface treatment. The maintenance force of the State Highway Department in March 1921 was keeping up 9,503 m. of roadway, of which 463 m. were in boroughs and on state-aid roads. The total resources in 1919 of all the banking institutions within the state, whether organized under national or state laws, were $4,529,919,000. Of these the state banks had resources in 1920 of $3,615,244,850, divided as follows: savings banks, $314,256,637; banks of deposit, $331,759,257; trust companies: banking resources, $1,380,919,028; trust funds, $1,578,424,021; trust funds in banks, $9,885,906.

Constitutional Changes.—The first two constitutional amendments of the decade ending 1920, adopted in 1911 and 1913 respectively, had to do with the courts, the one of 1911 increasing the number in Philadelphia county and merging those in Allegheny county, the one of 1913 altering the judicial and municipal terms to conform with an amendment of 1909 which changed the date of the elections from Feb. to November. Another amendment of 1913 enabled municipalities, except Philadelphia, to embark upon the construction or acquisition of waterworks, subways, etc., even though their cost brought the indebtedness above the limit allowed, and permitted arrangement whereby the interest and sinking-fund charges were paid from the principal until the properties should have been completed and in operation for one year. A limit of 10% of the assessed valuation of taxable property in a municipality was fixed for such indebted-

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ness, three-fifths of the electors of the municipality having first to give their assent to the increase. On Nov. 2 1915 the people voted on four proposed amendments and adopted three of them. The first and the most important prepared the way for workmen's compensation. The second enabled Philadelphia to increase its borrowing capacity under conditions similar to those set forth in the amendment of 1913. The third enabled the general assembly to enact laws providing a system of registering, transferring, insuring and guaranteeing land titles by the state or the counties. Amendments passed by the Legislature in 1915 and 1917 were approved by the voters in 1918, one enabling the state to issue bonds to the amount of $50,000,000 for the improvement of highways, and the other enlarging Philadelphia's borrowing capacity by removing the previous restrictions which confined its increased indebtedness to the construction or acquisition of waterworks, subways, etc. An amendment approved at the general election in 1920 enabled the assembly to levy "graded or progressive taxes." The result of these numerous amendments was manifest in the session of 1919, when a bill was passed authorizing the governor to appoint a commission to study the constitution with an eye either to general revision or to amendment by sections. This commission held public hearings during 1920 and prepared a report to be placed before the session of 1921.

Legislation.—The number of boards, commissions, etc., functioning under the state government was greatly increased between 1919 and 1920. The Legislature in 1911 created a Bureau of Professional Education under the State Department of Public Instruction, its purpose being to regulate the education of physicians, dentists and pharmacists. The same year a State Board of Education was created, composed of six members, to report and recommend legislation needed to increase the efficiency and usefulness of the public-school system, to equalize educational advantages in all sections of the state, to inspect schools supported in part or in whole by the state, to encourage vocational training, to improve sanitary conditions and to promote physical and moral welfare. A Bureau of Medical Education and Licensure, under the Department of Public Instruction, was also created by Act of 1911, to examine into conditions in the medical schools and conduct the examination of students applying for state licences. In 1911 the office of state fire marshal was created, with general powers of investigation over all fires in the state and means of fire prevention. Another important change of 1911 was the reorganization by legislative enactment of the State Highway Department and the undertaking of an extensive system of highways to be built and maintained entirely from state funds.

In 1913 the Department of Labor and Industry was created, with the power to enforce the "laws relating to the safety, health and prosperity of employees and the industries." Under it were formed the bureaus of Inspection, Hygiene and Engineering, Statistics and Information, Mediation and Arbitration, Employment, and also an Industrial Board. A Workmen's Compensation Board was created, the state was divided into districts and the administration of compensation carried on through referees and members of the board. A State Workmen's Insurance Board was created the same year for the purpose of administering the insurance fund provided in the Workmen's Compensation Act. In the meanwhile the Legislature in 1913 did away with the old State Railway Commission and substituted a Public Service Commission, with powers far greater than those of its predecessor, and having jurisdiction over "all railroad, canal, street railway, stage line, express, pipe line, ferry, common carriers," etc., companies "doing business within the state."

The year 1915 saw the reorganization of the Department of Agriculture with the creation of a Commission on Agriculture to appoint all officers and employees of the department and prepare the budgets of the department and of the State Live Stock Sanitary Board. Other new boards of that year were the one on vocational training under the Department of Public Instruction; the Board of Censors, upon all motion pictures; the Prison Labor Commission, to supervise the manufacturing industries of inmates of penal institutions; and the Veterinary Medical Examining Board. The Bureau of Municipalities under the Department of Labor and Industry was a development of 1917 intended to classify and make available statistics and other information tending to improve the government of municipalities. Five boards were created the same year: the State Military Board which has the power to grant pensions not exceeding $12 per month to widows or minor children of national guardsmen killed on active duty while under the direction of the governor; the Board of Pharmacy; the Board of Optometrical Education, Examination and Licensure; the Board of Commissioners on Uniform State Laws and the Public School Employees' Retirement Board. The Legislature of 1917 also created a Commission on Public Safety and Defense, to which was appropriated $2,000,000 and which functioned during the two years of American participation in the World War, partly independently and partly through the State Committee of Public Safety and Council of National Defense. The Commission on Public Safety and Defense was succeeded in 1919 by the Commission on Public Welfare, which received an appropriation of $500,000 to carry on the work of reconstruction, Americanization, and collection of the records of the state's part in the World War. The session of 1919 also created a Bureau of Statistics and Information under the State Department of Internal Affairs, transferred the Bureau of Municipalities from the Department of Labor and Industry to the Department of Internal Affairs, and created a Bureau of Rehabilitation under the Department of Labor and Industry. The year 1919 witnessed the adoption of two Federal amendments, Pennsylvania ratifying the prohibition amendment, as the forty-fifth state, on Feb. 25, and the woman suffrage amendment, as the seventh state, on June 24.

More recent governors were John K. Tener, Republican, 1911–5; Martin G. Brumbaugh, Republican, 1915–9; William C. Sproul, Republican, 1919– .

War Period.—Pennsylvania sent 297,891 men into the U.S. army, of whom 53,419 were regulars, 21,350 national guardsmen, and 223,122 drafted. There were 31,063 Pennsylvanians in the navy, 16,872 of whom enlisted in the naval reserve, 13,772 in the regular navy, and 419 in the national naval volunteers. The state was represented by 5,422 men in the marine corps, making a total of 334,376 men and women in the national armed forces. In addition it had 1,600 Y.M.C.A. workers, 147 Knights of Columbus secretaries, and 129 welfare workers under the Society of Friends. In the army Pennsylvania suffered 35,042 casualties, of which 7,898 were deaths. Financially, 559,936 Pennsylvanians subscribed $315,834,950 to the First Liberty Loan; 881,207 subscribed $549,963,700 to the Second Loan; 2,026,973 subscribed $467,758,550 to the Third Loan; 2,349,252 subscribed $812,217,400 to the Fourth Loan; and 1,289,764 subscribed $564,173,200 to the Victory Loan, making a total of $2,709,947,800 for the five loans, a per capita of $312.92 as compared with the per capita throughout the United States of $232.31. The war taxes of the state were: 1917, $589,056,143.20; 1918, $446,811,191. The American Red Cross in its two campaigns in Pennsylvania raised $27,283,990.90 or 10% of the total for the whole country. The Red Cross membership in the state at the close of 1918 was 1,669,758 adults and 1,451,057 juniors, the latter being 86·12% of the school population. Pennsylvania gave approximately $3,000,000 to the war welfare work of the Knights of Columbus. The two Y.M.C.A. drives in the state netted $6,562,516.23.

More than 85,000 men and women were employed in the six Pennsylvania shipyards on the Delaware river in 1918. The Hog I. plant near Philadelphia built 110 cargo vessels of 7,500 dead-weight tons apiece and 12 transports of 8,000 tons. The Harriman yard at Bristol, of the Merchants' Shipbuilding Corp., built 32 cargo vessels of 9,000 tons apiece; William Cramp & Sons at Philadelphia built four tankers of 10,000 tons apiece and nine steel ships, all but one of which were of more than 9,000 tons. Likewise it launched 35 destroyers during the war period and 13 subsequently. The Chester yard of the Merchants' Shipbuilding Corp. built 28 cargo ships and tankers averaging 8,000 tons apiece and several small naval vessels. The Sun Shipbuilding Co. at Chester built 14 ships averaging 11,000 tons apiece and four cargo ships of 10,000 tons apiece. It also constructed nine minesweepers for the navy. The yard for wooden ships of the Traylor plant at Cornwells Heights built eight vessels of 3,500 tons each. The Federal Government spent $46,396,266.80 in housing war workers in the state, $23,021,000 being spent by the Emergency Fleet Corp. for shipbuilders, and $23,375,266.80 by the U.S. Housing Commission.

The Remington Arms Co. at Eddystone manufactured 1,181,908 rifles up to two days before the Armistice, or 47% of the American rifles supplied to troops at home and abroad. The Baldwin Locomotive Works at Philadelphia and Eddystone contracted for 470 steam locomotives for the U.S. Railroad Administration and nearly 4,000 steam locomotives for the A.E.F. and the Allies. The Aluminum Co. of America, at Pittsburgh, manufactured 3,385,955 meat cans for mess kits, or two-fifths of the total made in America. The Edward G. Budd Co., Philadelphia, pressed and stamped 1,150,775 steel helmets, while a total of 2,707,237 helmets were painted and assembled in the Ford Motor Co. plant in Philadelphia. The entire cannon-forging output of the country during the war was 8,440 before Armistice Day, and Pennsylvania's contribution was 2,960, or almost two-fifths. One of the three American powderbag loading plants was located at Tullytown, Pa.; it employed 7,000 persons and had reached a capacity of 40,000 bags a day at the date of the Armistice. The Pittsburgh Plate Glass Co. at Pittsburgh had a total output of 81,845 optical lenses when the end of the war caused a general cancellation of contracts. (A. E. McK.)

PENNSYLVANIA, UNIVERSITY OF (*see* 21.114).—In 1910 the Henry Phipps Institute for the study, treatment and preven-

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tion of tuberculosis was transferred to the university. In 1912 the college was divided into three separate departments—the college, the Towne scientific school, and the Wharton school of finance and commerce. In 1914 the school of education was established, with a four-year course leading to the degree of Bachelor of Science in Education; since then there has been held every spring at the university "Schoolmen's week," and teachers from all over the state assemble to take part in conferences and discussions. By a merger in 1916 the Medico-Chirurgical College of Philadelphia became an integral part of the university as its graduate school of medicine, and in 1918 another merger was effected with the Philadelphia Polyclinic and College for Graduates in Medicine. In 1917 a course in military science was established to qualify students for commissions as reserve officers. In 1920 the laboratory of hygiene and public health became the school of hygiene and public health.

During the decade 1910–20 there were many developments in the widening of the university's usefulness to the community through the establishment of extension schools. In 1920–1 the university had 964 officers of instruction, of whom 302 were in the college, and 213 in the department of medicine. The enrolment was 11,182 students, including 2,652 women, of whom 753 were in the college (arts and science); 29 in biology; 780 in the college course for teachers; 1,281 in the summer school; 638 in the Towne scientific school; 2,277 in the Wharton school of finance and commerce; 1,439 in the evening school of accounts and finance; 996 in the extension schools; 760 in the school of education; 218 in the school of fine arts; 657 in the graduate school; 191 in the law school; 433 in the medical school; 101 in the graduate school of medicine; 735 in the school of dentistry; 30 in the school of veterinary medicine, and 6 in the school of hygiene and public health (duplications, 142).

Beginning with 1920 the tuition fees were raised from $200 to $250 in the college, the Towne school, the Wharton school, in education, law, dentistry, and hygiene; from $200 to $300 in medicine; and from $100 to $150 in veterinary medicine. In 1920–1 the income from tuition fees was $1,425,000; the payment for "educational salaries" amounted to $1,425,000, and for other salaries and wages $678,000. In June 1920 the excess of the university's assets over its liabilities was $26,000,000, and the donations for the year were $278,000. The total value of real estate (including the university's buildings) was $11,486,000; and libraries, museums, apparatus and furniture were valued at $3,645,000. The university library, including numerous special collections, contained about 500,000 bound volumes and 50,000 pamphlets. A question of paramount importance concerning the future policy of the university was settled in 1921, when the trustees, in accordance with the overwhelming sentiment of the alumni, resolved that the university should continue as a private institution and not surrender its independence, as had been proposed, by becoming a state university with consequent supervision by the official representatives of the state Government.

In 1921 Gen. Leonard Wood (*q.v.*) was elected "head of the university under such appropriate title as may be hereafter agreed upon." Later in the year Gen. Wood was appointed governor-general of the Philippines, and was granted a year's leave of absence before assuming his duties at the university. During the World War 9,204 students and alumni of the university saw service, of whom 7,411 were in the army, 856 in the navy, 827 in auxiliary service, and 110 in the armies of America's Allies. Of these 212 died for their country's cause. (E. F. S.*)

PENSION (*see* 21.118).—The following summary shows the chief pension legislation in the United States during 1908–20. Legislation in Great Britain regarding pensions is described in the article following this: PENSIONS MINISTRY. An Act of March 4 1909 provided that under direction of the Commissioner of Pensions the expenses of last sickness and burial of deceased pensioners should be reimbursed. An Act of May 11 1912 granted $30 per month to honourably discharged men who had served 60 days or more in military or naval service during the Mexican War. An Act of Feb. 19 1913 granted $20 per month thereafter to survivors of Indian wars named in earlier Acts. An Act of March 3 1915 provided double pension in case of death of an officer or enlisted man of the navy or marine corps, or for disability of an enlisted man, resulting from an aviation accident. An Act of April 27 1916 granted a special pension of $10 per month for life to persons whose names are entered on the "Army or Navy Medal of Honor Roll." An Act of Aug. 29 1916 granted double pension for disability or death of a student-flyer of the navy or marine corps due to an aviation accident. This Act also repealed Section 4716 of the Revised Statutes, which made disloyalty in the Civil War a bar to a pension. An Act of Sept. 8 1916 granted $20 per month to the widow of a Civil War veteran who was his lawful wife during the period of his service, and the same rate to the widow of a veteran of the Civil War, Mexican War, and War of 1812, on reaching the age of 70 years. An Act of Oct. 6 1917 provided a payment of $25 per month thereafter for widows of officers or enlisted men of army, navy, or marine corps, who served in the Civil War, in the Spanish-American War or in the Philippine insurrection; this Act was amended June 25 1918 making existing pension laws inapplicable to persons in active service on Oct. 6 1917, or entering it thereafter, except in so far as rights under any such law had theretofore accrued. An Act of July 16 1918 granted widows of officers or enlisted men, volunteers and regulars, who served 90 days or more in the Spanish-American War, Philippine insurrection, or Chinese Boxer rebellion, if without means of support other than daily labour and an actual net income not exceeding $250 per year, $12 per month and $2 per month additional for each child under sixteen. In case of death or remarriage of the widow, the whole pension goes to any child or children under 16 years of age. An Act of Dec. 24 1919 provided that no one should draw both pension and compensation under war risk insurance (*see* below). The War Risk Insurance Act was made effective as of April 6 1917. An Act of May 1 1920 granted $50 per month from that date to persons on the roll because of Mexican War or Civil War service; and $72 to those so nearly blind or helpless as to require personal aid and attendance; also increasing rates of pension for certain permanent specific disabilities. This Act granted $30 per month to widows of men who served in the War of 1812 or the Mexican War, also to widows, married prior to June 27 1905, of men who served in the Civil War and to certain remarried widows, with $6 per month additional for each child under 16 years. In case of death or remarriage of widow, the whole pension goes to any child or children under 16 years. This Act also increased the pension to army nurses of the Civil War, and dependent parents of Civil War soldiers, to $30 per month. An Act of June 5 1920 granted pensions ranging from $12 to $30 to soldiers and sailors who served 90 days or more in the Spanish-American War, Philippine insurrection, or China Relief Expedition, under certain conditions as to service, the rate depending upon degree of disability or age attained; this Act also increased rates of pension for certain permanent specific disabilities.

The following table, furnished by the Commissioner of Pensions, shows the number of pensioners on the roll at the close of the fiscal year, June 30 1921, together with disbursements of pensions for that year:—

	Soldiers	Widows, etc.	Total	Disbursements
Civil War	218,775	281,327	500,102	$246,584,639.64
Spanish-American War	31,066	8,216	39,282	6,171,569.82
War of 1812		64	64	24,160.21
Mexican War	109	2,135	2,244	888,024.64
Indian Wars	3,784	2,569	6,353	1,565,862.41
Regular Establishment	13,832	4,081	17,913	3,456,191.45
World War	63	32	95	25,394.37
Total	267,629	298,424	566,053	$258,715,842.54

By an Act of May 22 1920 provision was made for the retirement of Civil Service employees and for payment to them of certain annuities based on amount of salary, length of service and age or disability. The annuity fund is created in part by the deduction of 2½% from the salaries of employees. The minimum annuity is $180 per year, the maximum $720. This law is administered by the Commissioner of Pensions. On June 30 1921 there were 6,471 annuitants on the roll, to whom had been paid $2,913,547.

War Risk Insurance.—Soon after the outbreak of the World War, at the request of the Secretary of the Treasury, there was created, Sept. 2 1914, a bureau of marine insurance, under the Treasury Department, for protecting American vessels and cargoes against loss or damage. After America entered the war further legislation, enacted June 12 1917, enlarged the scope of the marine bureau to make provision for insuring against loss of life or injury masters, officers, and crews of American vessels. Under date of Jan. 4 1919, seven weeks after the signing of the Armistice, right to application was withdrawn and no further insurance issued to seamen. From

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June 12 1917 to June 30 1919, the end of a fiscal year, the number of policies issued was 6,150; net insurance written, $322,429,408; net premiums received, $842,348; losses paid, $124,724.

By Act of Oct. 6 1917 further amendment made provision for granting allowances by the Government to the families and dependents of all enlisted men. To secure this allowance the enlisted man was required to make an allotment from his pay. Two classes of allotment were established: A. compulsory allotment to a wife, child, or divorced wife awarded alimony; B. voluntary allotment to parent, sister, brother, grandchild, or grandparent. To these allotments the Government added allowances, not exceeding $50 per month, as follows. Under Class A. $15 per month was deducted from the enlisted man's pay and addition made by the Government to bring the monthly payment up to $30 for a wife; $40 for a wife and one child; $47.50 for a wife and two children; and $5 for each additional child. Under Class B. the Government added monthly $10 for one parent, $20 for two parents, and $5 for each dependent sister, brother, grandchild or grandparent. If a man, in addition to the compulsory allotment, desired an allowance under Class B. he was required to make an additional allotment of $5 per month. In case of no compulsory allotment, the voluntary allotment under Class B. was $15. Class A. took precedence, and, if the entire Government allowance of $50 was required for this, no payment was made under Class B. From Oct. 6 1917 to June 30 1920 requests for allotments and allowances numbered 1,666,607; during the same period 2,807,093 application blanks were returned without such requests. For the fiscal year ending June 30 1920 allotments paid beneficiaries amounted to $20,748,709; Government allowances, $32,819,927.

The Act of Oct. 6 1917 also provided compensation for death or disability of all persons in service, including women in the army and navy nursing corps, in line of duty. The recognized beneficiaries include a widow until remarriage, dependent widower, children under 18 years, and dependent mother or father. Death compensation allowed was as follows: widow, $25 per month; widow and one child, $35; widow and two children, $42.50; widow and three children, $47.50; widow and four children, $52.50, with no further allowance for additional children. If the deceased were a woman, $20 per month was granted for the first fatherless child, $10 in addition for the second, $10 in addition for the third, $5 in addition for the fourth, and $5 in addition for the fifth, with no further allowance for others. A mother or father was allowed $20 per month, and, if both were dependent, $15 each. The maximum death compensation was $75 per month. Compensation for disability depended upon its seriousness and duration. For a man totally disabled it was as follows: unencumbered, $30 per month; if he had a wife, $45; if he had a wife and one child, $55; $10 additional each for a second and third child, with no further allowance; and $10 additional for each dependent father or mother. At the close of the fiscal year, June 30 1920, compensation was being allowed on 42,945 death claims, and on 134,408 disability claims, the latter involving a monthly payment of $5,036,103. In the case of disabled persons provision was also made that the Government furnish free medical service and supplies, including artificial limbs so far as "reasonably necessary."

A novel feature of the Act of Oct. 6 1917 was the provision for granting insurance at peace-time rates to any person, man or woman, in active military or naval service. Such insurance was wholly voluntary, and could be taken out, in multiples of $500, for any amount from $1,000 to $10,000 inclusive, at a monthly premium rate varying from 63 cents per $1,000 at the age of 15 to $3.35 at the age of 65. All persons in service Dec. 14 1917 were given until April 12 1918 to apply for policies, and those entering later were given 120 days. Among the beneficiaries allowed were wife, husband, child, grandchild, sister, brother, stepbrother, stepsister, adopted brother or sister, parent, grandparent, and step-parent. A man's fiancée could not be named as beneficiary. This insurance was issued on the yearly renewal basis, to be continued as term insurance for five years after the proclamation of peace, when it would automatically expire. Privilege, however, was granted for converting this temporary insurance, in whole or in part, into one of the permanent forms of Government insurance, including ordinary life, 20-payment life, 30-payment life, 20-year endowment, 30-year endowment, and endowment maturing at the age of 62. Premiums on converted policies may be paid monthly, quarterly, semi-annually, or annually. In the case of monthly premiums, 31 days of grace are provided. If term insurance is allowed to lapse, reinstatement may be secured within 18 months after discharge from service or 12 months after lapse, but health of the applicant must be as good as it was at the time when the premium was first withheld. Never before was insurance on such a large scale undertaken. The cost of administration was assumed by the Government and not included in the computation of the premiums for term insurance. The hazards of war were ignored and peace-time terms offered, such as no commercial company could have undertaken. The inevitable loss to the Government was regarded as part of the cost of the war. All converted insurance was to be administered by the Government and not handled through commercial companies. At the time of the Armistice, Nov. 11 1918, there were on file 4,152,787 applications for insurance. Between Oct. 6 1917 and June 30 1920 there were filed 4,631,993 applications for term insurance, requesting a total insurance of $40,284,892,500, an average of about $8,697. On the last-mentioned date there had been issued 4,610,185 certificates for term insurance. The amount involved exceeded that in all commercial life insurance companies and fraternal organizations of the United States combined. About 98% of the enlisted personnel had taken advantage of this unprecedented opportunity. Every effort was made to induce policy-holders to convert their war-risk insurance into some form of permanent Government insurance, but by far the greater number allowed their policies to lapse. In 1921 all the activities concerning the welfare of ex-service men were consolidated in the Veterans' Bureau.

PENSIONS MINISTRY (Great Britain).—Before the World War the Admiralty and the War Office were responsible in the United Kingdom for the award and payment of service and disability pensions. The commissioners of the Royal Hospital, Chelsea, acted for the War Office in respect of pensions to warrant officers, N.C.O.'s and men. Pensions to privates and N.C.O.'s were paid quarterly by the regimental paymaster, those to officers and warrant officers by the paymaster-general. In the financial year 1913–4 there were in round numbers 60,000 service and 25,000 disability pensions for the army (men), and for the navy 33,000 and 7,700 respectively. The total annual cost to the State was £3,695,000. In the subsequent changes the disability pensioners were transferred to the new organizations, the service pensions remaining unaffected.

The first war alteration was made in Sept. 1914. A Central Army Pension Issue Office was set up and weekly instead of quarterly payment of pensions was authorized. Next, by the War Pensions Act 1915, the local war pensions committees were set up, under a statutory central committee "for the purpose of administering supplementary assistance in case of hardship and providing for the after-care of disabled officers and men." These committees were appointed under schemes of local authorities, more than half the membership being nominated by these authorities. The Ministry of Pensions was subsequently set up by the Act of Dec. 1916. This transferred to a minister responsible to Parliament the powers and duties of the Admiralty, the War Office, and the Chelsea Commissioners "in respect of the administration and payment of pensions and grants to officers and men, to their widows, children and dependents and to persons in the nursing service of the Naval and Military forces," the administration of service pensions being left with the service departments. It was provided that the powers and duties of the statutory committee above referred to should be continued under the control of the minister, who should communicate through it with the local committee. This arrangement proved unworkable, and in 1917 a new War Pensions Act dissolved the statutory committee and transferred its powers to the minister. A pensions appeal tribunal was set up. In 1919 a further Act conferred a statutory title to pension, subject to the conditions of the royal warrant. Previously it had been, in theory, only an act of grace. Independent statutory appeal tribunals were also appointed.

In the Ministry of Health Act (1919) provision was made for the transfer by order in council of "all or any of the powers and duties of the Ministry of Pensions with respect to the health of disabled officers and men after they have left the service" to the Minister of Health, at a date "not earlier than one year or later than three years after the termination of the present war." A further addition to the series of the Pension Acts was made in 1920, when an Act was passed providing that after the termination of the present war fresh cases were not to be transferred to the Ministry of Pensions, but were to remain, as in pre-war days, under the care of the War Office and Admiralty respectively, to whom the Air Ministry must now be added. Finally under the War Pensions bill of 1921, it was proposed that the large proportion of temporary awards should be converted into permanent awards, a right of appeal being granted to the pensioner. The period was to be within four years of his discharge from the service or after the first award of a pension to him. The administrative functions of the local war pensions committees were also to be limited and the numbers of these bodies reduced.

Award of Pensions.—Pension finance, generously revised at the outbreak of the World War, was reorganized from time to time in

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accordance with the changing type of recruits and the rise in the cost of living. The scales of 1917 and 1918 were again considered in 1919 by a select committee of the newly elected House of Commons, which settled the rates governing payments till 1923. The principle of payment is that of compensation for disablement attributable to or aggravated by war service. "Disablement" is assessed by purely medical opinion, in terms of a percentage reduction from the standard of a normal healthy man. The pension is on a flat rate graded from 20% to 100%; below 20% only a lump sum is awarded payable usually in weekly allowances. Pensions are in the first instance awarded temporarily—usually for 12 months—and remain temporary till the disability has reached its final and stationary condition, when they are made permanent. The patient is subject to periodical medical examination during this time, and at each "board" his disability is reassessed for the next period. In addition the principle was laid down in 1917 that no account was to be taken of the earnings of disabled men. The "alternative pension" was also provided whereby a man might obtain a pension (within certain limits) running up to his full pre-war earnings, which by the Warrant of 1919 were further loaded up by 60% on account of the increased cost of living. Widows, also, may choose alternative pensions (husband's earnings plus 60%), and this right has been exercised in a large number of cases. The new pension scales were not to be subject to revision before April 1923.

The following figures may be quoted from the Warrant of 1919:—

(1)	Totally disabled (privates):	
	Man	40s.
	(+ attendance allowance up to 20s. if helpless)	
	Man and wife	50s.
	Man, wife and one child	57s. 6d.
	Man, wife and two children	63s. 6d.
	For each additional child	6s.
(2)	Widows:	
	Childless	20s.
	(+ 6s. 8d. if aged 40).	
	With one child	36s. 8d.
	With two children	44s. 2d.
	For each additional child	6s.

Although the assessment of disablement is a purely medical matter, the question of entitlement (*i.e.* whether due to war service) is decided by medical and lay opinion combined. The claimant has an appeal against the assessment of a medical board to a medical appeal tribunal; he may similarly appeal against refusal of entitlement to one of eleven statutory pensions appeal tribunals set up under the 1919 Act. These are appointed by the Lord Chancellor and are independent of the Ministry of Pensions.

Constitution.—In 1918 the Ministry consisted of the following branches: (1) Finance (including pensions issue office); (2) awards (men); (3) awards (men's widows and dependents); (4) awards (officers and officers' widows and dependents, and medical treatment and training of officers); (5) local administration; (6) medical services; (7) vocational training; (8) artificial limbs; (9) surgical appliances; (10) chief inspector; (11) special grants committee. The only important change in these divisions has been in the case of vocational training, which in 1919 was transferred to the Ministry of Labour (save for convalescent centres associated with medical treatment).

In April 1919 a scheme of regional decentralization was begun, and during the following 12 months 11 regions were set up. Each is governed by a director, assisted by a commissioner of medical services, a regional administration officer, an awards officer, a finance officer, a registrar, and staff. These regional offices carry on (1) medical examination; (2) awards of pensions; (3) control of Ministry hospitals; (4) supervision of the local war pensions committees. The Ministry itself, whose staff had numbered at its inception in 1917 2,296, expanded with its work to 5,754 in its first year, and in 1921 had reached 26,000, which included 8,000 hospital staff. (Of the male staff at this date 94% were ex-service men.) The local war pensions committees then numbered 349, with nearly 1,000 sub-committees. They had 27,500 members and a paid staff of 6,200 in addition to many voluntary workers. Space precludes more than a mention of the special grants committee, the chief function of which is to make supplementary and special grants where need exists, under regulations approved by the Ministry of Pensions.

Duties.—The machinery was great, but the burden was gigantic. By 1917 (when the Ministry came into being) 262,000 pensions in all had been granted. The number was doubled in the following 12 months. The increase continued rapidly; at one time as many as 35,000 new awards were made in a week. The pressure was greatest in the first six months of 1919, when demobilization was at its height. It was estimated at the beginning of 1921 that the crest of the curve had been reached; cessation or reduction of temporary pensions had begun to balance new awards, and medical treatment to be commensurate with the demand.

The subjoined figures have been taken as exemplifying the business of State pensioning at its maximum. (The figures are approximate and are taken from the estimates for 1920–1.)

Cost of administration 1920–1, including medical services, and local war pensions committees	£5,000,000
Cost of local war pensions committees (administration)	£1,150,000
Money disbursed through local war pensions committees 1920–1 (recoverable advances, treatment allowances, etc.)	£20,000,000
Estimated total cost of pensions including medical services and administration expenses	£123,000,000

From these sums were treated or maintained, partially or wholly, both the World War and pre-war disability pensioners (the awards of these last by the Royal Warrant of 1917 had been levelled up to the corresponding war scale). The total number of awards had increased from 262,000 in 1917 to 1,849,000 at Dec. 31 1920, made up as follows:—

Disabled men	1,216,000
Widows	226,000
Dependents	384,000
Children	23,000

The pensions, temporary and permanent, actually in payment on Dec. 31 1920 were:—

Disabled men	1,180,000
Widows	169,000
Dependents	362,000
Children	16,900

In addition the following first awards of disability retired pay or pension had been made:—

Officers	56,487
Officers' widows	10,408
Officers' children	11,302
Officers' other dependents	7,077
Nurses	2,045
Nurses' dependents	22

In payment on Dec. 31 1920 (approx.):—

Officers	38,850
Officers' widows	9,700
Officers' children	9,100
Officers' other dependents	6,500
Nurses	1,458
Nurses' dependents	22

Including wives' allowances, and children's allowances the total number of beneficiaries was nearly 3,500,000.

Medical treatment was being carried on in 84 hospitals and convalescent centres and 150 clinics. The Ministry controlled 14,000 beds in its own institutions and 10,000 in civil institutions (*cf.* the whole voluntary hospital system of the country, which has not more than 40–50,000 beds). There were under treatment at any given time 158,000 cases. The cost of this, including allowances to men under treatment, in excess of pension, amounted to £16,000,000 per annum. The doctors directly employed were 464, the hospital staff numbered 7,600; in addition, for assessment purposes, there were 450 medical boards, each of three members, examining over a considerable period from 21,000 to 25,000 men every week.

Special Features.—In addition to the mere mass of the task, many most baffling problems demanded solution. The Ministry, in addition to pensions work and medical treatment, had for example to undertake the supply and repair of artificial limbs and surgical appliances (a special division of the Ministry was organized to deal with this). There were in Dec. 1920 23,932 officers and men pensioned on account of amputations of the leg, and some 64,000 cases of wounds of the upper extremity involving amputation of arm or part of the hand. There were 8,000 cases of epilepsy, 114,000 cases of "heart disease" and 69,000 cases of nervous disease (under which are included both "shell shock" and "neurasthenia").

There was no medical staff in existence to cope with such numbers. In the case of the "nervous diseases" a special training school for psycho-therapy and other forms of treatment was established in London, where a four months' course was given. The problem of "heart disease" demanded specialist attention; a system of special cardiological boards and clinics for examination and diagnosis was started in London, and extended throughout the country.

For the concurrent treatment and training of the broken men six large centres had been opened by Jan. 1921, and it was intended to open two more, giving accommodation in all to between 3,000 and 4,000. The effects of concurrent treatment and training upon the health and prospects of the patients were extremely beneficial. Difficulties were experienced in their absorption in industry, and efforts were made to overcome this by the institution of a national Roll of Honour by which firms pledged themselves to employ a certain proportion of disabled men, while special treatment for the permanently unfit was being considered. (W. E. EL.)

PERCIN, ALEXANDRE (1846–), French general, was born at Nancy (Meurthe) on July 4 1846. He entered the École Polytechnique on Nov. 1 1865, and two years later was appointed a sub-lieutenant of artillery. He was promoted lieutenant in 1869 and captain in 1870. He took part in the Franco-German

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War and the commune fighting and was twice wounded—in Dec. 1870, at the battle of Patay, and again in April 1871 before Paris. He was made a major (*chef d'escadron*) in Jan. 1883, lieutenant-colonel in 1890, colonel in 1895, general of brigade in 1900, and general of division in 1903. In the period between 1900 and his retirement, Gen. Percin was a very active reformer and innovator in the tactics of the artillery arm. The typical field-artillery tactics of 1914, based on time shrapnel covering fire, and on the intimate liaison of infantry and artillery, were largely due to his work, and after his retirement he continued a very active student and critic of artillery operations. His marked personality, and his political opinions as a radical, however, made him many enemies. At the outbreak of the World War he was recalled to service, but only as commander of the Lille region, and he was involved in the controversies connected with the evacuation of Lille. Later he was employed for a short period as inspector-general of artillery units. In Jan. 1915 he was placed in the reserves. He was given the Grand Cross of the Legion of Honour in June 1917.

Amongst his more important works are *La Manœuvre de Lorlanges*, *L'Artillerie aux Manœuvres de Picardie* (English translation, War Office, 1912) and a psychological study of battle under the title *Le Combat* (1914).

PERCIVAL, JOHN (1834–1918), English divine, was born in Westmorland Sept. 27 1834, the son of William Percival, of a yeoman family. He was educated at Appleby and Queen's College, Oxford, where he took his degree in 1858. In 1860 he was ordained, and went to Rugby as an assistant master. In 1863 he went to Clifton College as first headmaster, remaining there for 15 years. He was elected president of Trinity College, Oxford, in 1878, and while in this position took much interest in the foundation of Somerville College for women. In 1887 he became headmaster of Rugby, and in 1895 was appointed to the bishopric of Hereford. His broad churchmanship placed him in opposition to the dominant tendency in the Church of England, and he was also a strong and militant Liberal in politics, being an ardent advocate of the disestablishment of the Church in Wales. He died at Oxford Dec. 3 1918.

PÉREZ GALDÓS, BENITO (1843–1920), Spanish novelist (*see* 21.139), died Jan. 4 1920. The final series of his *Episodios Nacionales* contained *España sin rey* (1908); *España Trágica* (1909); *Amadeo I.* (1910); *La Primera República* and *De Cartago á Sagunto* (1911); and *Canovas* (1912). He also published various plays and novels, including *El Caballero encantado* (1909), and *Santa Juana de Castilla* (1918).

See L. Olmet and A. Carraffa, *Los Grandes Españoles*, vol. i., *Galdos* (1912).

PERIODICALS: *see* NEWSPAPERS.

PERISCOPE.—An optical instrument used in land warfare and in submarine navigation, enabling an observer to see in all directions while remaining under cover or submerged. Essentially it consists in an optical system of lenses and mirrors, or mirrors alone, the upper part of which projects from cover, or from the deck of a submarine, while the observer looks into the lower end, receiving an image of the surrounding country or sea by reflection down a tube.

The use of reflecting mirrors for the purpose of observing from cover is no novelty, and during the trench warfare of the Crimean War 1854–5 a device was patented which scarcely differs from the simple mirror periscope of the World War. From the beginning of the 20th century, however, the practical introduction of submarine navigation brought about the development of new elaborate periscopes of great length and provided with an optical system of lenses, which were built into the structure of the submarine. At the same time, on land, the new necessities imposed on field artillery by the growing use of covered positions led to the development of scissors-telescopes (*see* RANGEFINDERS) and panorama-telescopic sights (*see* SIGHTS), in which the optical system was arranged with the tube of the telescope vertical and the object-glass and eyepiece systems at right angles to the axis of the tube. And in the World War, while optical instruments of this kind were elaborated and improved, the periscope as such came into use for the infantry garrisoning trenches. Manufactured in large quantities it soon became an essential part of infantry as well as of artillery and machine-gun equipment. In the present article, periscopes for land service and those forming part of the equipment of submarines will be described in turn.

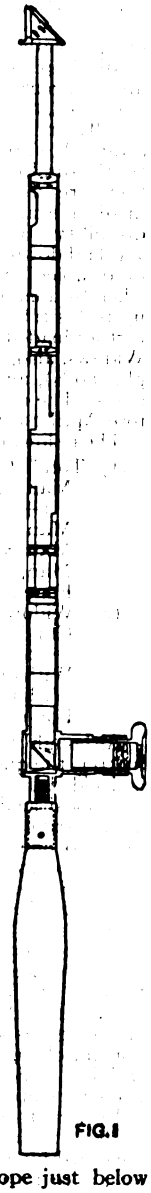

FIG. 1

(1) *Land-service Periscopes* vary much both in design and size, some being only a few inches long while others are as much as 80 ft. in length. The simplest form of periscope, and that most generally used by troops, consisted of a tube, rectangular in section, provided with two mirrors, the upper of which, inclined at an angle of 45° to the axis of the tube, reflected the image of the foreground vertically downwards to a second mirror, also inclined to the axis at 45° into which the observer looked. But in order to obtain an adequate field of view, the mirrors, and therefore the box, had to be made somewhat large, and in the close-quarters conditions of trench warfare even the few inches by which they projected over the parapet or other cover made them sufficiently obvious to draw fire. Less conspicuous periscopes were therefore designed, and these, in order to take in enough of the foreground, had to be provided with a magnifying as well as a reflecting system. In the British service half of the stereoscopic scissors-telescope used in rangefinders was frequently employed as a periscope. Its lower end was fitted with a ball-and-socket joint to enable it to be laid in any direction, and beneath this is a screw which can be screwed by means of a small lever into a piece of wood embedded in the side of a trench.

In an ingenious periscope designed by Messrs. R. & J. Beck of London (fig. 1) the upper prism is supported above the telescopic system on a flat strip of metal which can be slid through side supports on the body of the periscope. When in use, the prism is supported some inches above the body and is the only part that can be seen by the enemy. If it is shot away, it can be replaced in a few seconds. When the periscope is not in use, the prism is lowered and protects the upper lens in the body.

Small German periscopes were usually 1 metre or ½ a metre in length and had two eyepieces giving magnifications 10 and 15 diameters. The optical system is shown in fig. 2. They could be either held in the hand or attached to a direction stand.

A neat rainguard made of sheet metal, to the same curve as the body of the periscope and almost 8 inches long, is attached to the upper prism box by two spring straps. When in use, it is held at right angles to the periscope above the upper window by a bayonet catch; when not in use, it is lowered and sprung round the body of the periscope just below the upper prism box.

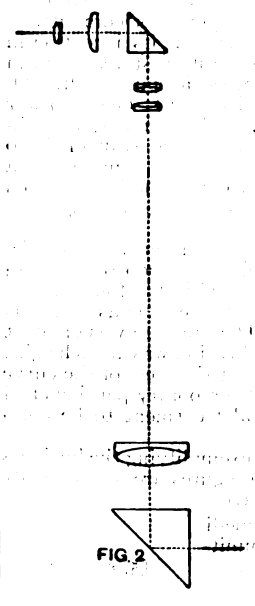

FIG. 2

Many periscopes of considerable length and special design have been used, to enable observations being made in comparative safety from behind large objects, *e.g.* houses, trees, etc., or from folds in the ground. Of these the most remarkable is the German *Giant Periscope*, two specimens of which exhibited in the collection of trophies in the Imperial War Museum, Crystal Palace, have excited considerable popular interest. This periscope is considerably larger than any others, and was designed for observing over obstacles of between 9 and 26 metres in height. It can be rapidly erected or taken down and transported on its carriage. It consists mainly of 3 parts, viz. a steel telescopic mast and upper and lower optical systems which are attached to it.

The telescopic mast is carried in trunnions on the carriage, and travels closed and in a horizontal position. Gears are provided for elevating, levelling, aligning the upper and lower optical systems, adjusting the inclination of the reflector and rotating the mast around a vertical axis so that observations may be made and azimuth angles taken in all directions. The

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telescopic mast consists of 8 tubes. The lower one is attached to the carriage, and the upper one is pulled out as far as it will go and retained in position by catches before the mast is raised. The other six are connected to each other and to the lowest one by wire

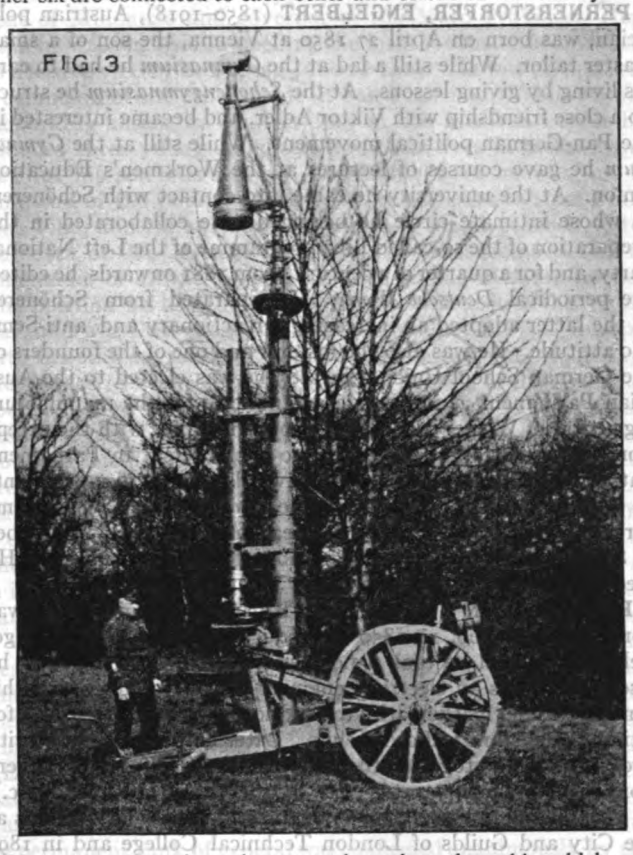
FIG. 3

cables and pulleys in such a way that when the cable which connects the two lowest tubes is wound in by means of a winch, each of the tubes except the fixed one will rise within the next one

FIG. 4

through the same distance. When erect, the mast is steadied by means of three guy ropes.

The details of the optical systems are as follows: The rays from a distant object after passing through a protecting window A (fig. 5) are reflected by a mirror B down the centre of the conical casing which contains the upper optical system and is attached to the top of the mast. The two achromatic lenses, C and D, bring the rays to a focus on the plane surface of the large lens, E, forming an image there. Immediately above this plane surface and almost touching it is a system of wires which enables angular distances from the centre of the field to be read at the eyepiece below. The mirror can be elevated and depressed by means of a flexible shaft which passes up the centre of the mast and actuates gear attached to the mirror frame.

From the large lens, E, the rays pass through the open air for a considerable distance, depending upon how much the mast has been raised, to the lower optical system. Here they pass through the lenses and prism shown into one of the eyepieces, F. By moving the lens G up and down the image can be formed in the correct position for the eyepiece at all extensions of the mast.

There are three eyepieces which are mounted on a revolving sleeve in such a way that any one of them can be quickly brought into use, to give the magnification suitable to the height of the mast. (Low power from 3 to 8; medium from 5 to 14; high from 7 to 21.) Each eyepiece is provided with a dummy eyepiece which comes opposite to the eye which is not observing and permits of it being kept open. This lessens eyestrain. Coloured anti-glare glasses are provided.

(2) *Submarine Periscopes.*—When a submarine is completely submerged the occupants are not able to see through the water except under very exceptional conditions. In the Mediterranean on a sunny day it is possible to see for several yards through the water at about 25 ft. below the surface. In the North Sea, and usually, it might be said that once the boat is submerged, direct observation through the water is impossible. In the very earliest submarines a cupola was built on the top of the hull, which was kept just above the surface when it was desired to take observations. To reduce resistance, these cupolas were made telescopic in the French submarines "Gymnote" and the "Gustave Zédé," but the arrangement proved unsatisfactory. An optical tube replaced this cupola in the "Gustave Zédé," and comprised a short tube (on top of the submarine) with a lens to close the top end, which was kept just above the surface when running submerged. Horizontal rays of light entering at the top were reflected by a prism down the tube and focussed on to a sheet of paper in front of the helmsman inside the submarine. This gave him a limited view of what lay directly ahead. The word "periscope" was first applied to this instrument.

The modern submarine periscope consists essentially of a long tube, the top of which is just above the water when diving, while the lower end passes through a stuffing box on the shell of the boat into the control-room. The top is closed by a pressure-tight window, inside of which is a prism which reflects the light rays vertically down the tube to a prism at the bottom end, where they are reflected in a horizontal direction and focussed in an eyepiece attached to the bottom of the tube. Thus the commander can see what is happening on the surface when navigating the submarine some 20 ft. or more below it.

FIG. 5

The greater the depth of submergence the less the disturbance made by the submarine on the surface of the water, and the greater the immunity from gun-fire, ramming, etc.; also in a sea-way the deeper the submarine the more readily is it controlled. For these reasons the length of the periscope has steadily increased, and the dimensions of the upper end have as steadily decreased. Increased length necessitated an increase in the diameter of the main tube to limit the amplitude of the vibrations caused by being pushed through the water. A typical instrument in the British navy was 30 ft. long, with a 5·9 in. diameter main tube, and the top 3 ft. of the upper tube 2 in. diameter. For the German "U" boats Messrs. Zeiss made a periscope 7 metres long, main tube 150 mm. (5·9 in.), and about 2 ft. 6 in. of the top tube 30 mm. (1·2 in.) diameter.

The main tube must be accurately machined as it has to be readily trained in its stuffing-box as well as be water-tight in all positions, through a considerable range of vertical travel. The modern practice is to take rapid observations rather than to keep the periscope above the water all the time. To facilitate this mechanical lifting, gear is provided which is readily controlled, and can raise or lower the periscope at a speed approaching 25 ft. per minute.

The field of view is usually about 40° at a magnification of 1·5. It is therefore necessary to train the periscope round when taking observations on different bearings. This can be done in two ways, either by rotating the optical train inside the main tube, or, as is more usually the case, rotating the whole periscope. With the increase in weight and size the effort required has increased, and power training has sometimes been necessary. Where possible,

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however, by refinements in workmanship, etc., efforts are made to keep the torque required so low as to be within the power of the operator. Usually a revolving scale round the edge of the field shows the direction of the view. If the whole instrument moves, the operator also moves round with it in the boat, and knows at once in which direction he is looking.

Owing to proximity to the magnetic compass the whole of the tube must be non-magnetic. High-strength bronze was used in the earlier practice in the British navy. A special nickelchrome steel was manufactured and machined by Messrs. Krupp for use for the outer tube of the German navy periscope used before the war, and a similar steel was developed and used in the British service, but it is costly and more difficult to machine to the required accuracy than is the case with bronze.

The use of aircraft for anti-submarine work led to the demand for a periscope which could be used for looking overhead. In the sky-searching periscope the upper prism can be rotated by mechanism inside the periscope, so that aerial observations can be readily made before the submarine "breaks surface."

To enable a distant ship or other object to be examined more closely it is possible in some periscopes to change the magnification from a normal power of 1.5 to a power of 6. This, and the sky searching previously mentioned, means increased internal gearing and a larger upper tube. As a rule every submarine has at least two periscopes, one unifocal with a small upper tube and the other bifocal and sky-searching with a larger upper tube.

Whilst in the British service sky searching up to right overhead was arranged for, German periscopes as a whole are limited to 20° above the horizontal. In each case 10° depression is allowed for to follow the roll of the submarine.

For special purposes other features are added, such as range-finding attachments, etc. A "night" periscope for use at dusk has been developed. It is much shorter than the typical instruments described, so that the maximum brightness of image is obtained.

The periscope when installed in the submarine is used for two purposes: (*a*) general observation for submerged navigation; (*b*) for correctly aligning the submarine when firing a torpedo at a target. In connexion with (*a*) the principal requirement is clearness of field. Continuous use of a periscope is very trying for the observer's eyes, and for use in bright weather light-filter screens are provided to reduce the glare. It has also been found that in foggy and misty weather suitable colour screens are of assistance. These screens are usually embodied in the eyepiece. For purposes of torpedo attack the periscope is used as a range-finder to determine the distance the target is away, and also in connexion with tables to determine the correct time to fire the torpedo, allowing for the speed of the enemy, course, etc. Officers of submarines have devised various mechanical devices to avoid calculations, and these have been added to the periscope. Although two periscopes are provided when attacking, one only would be shown for short periods to get check observation so as to prevent the wash of the upper tube revealing the proximity of the submarine.

PERKIN, WILLIAM HENRY (1860–), English chemist, was born at Sudbury, England, in 1860, eldest son of Sir William Perkin, founder of the aniline dye industry. He received his general education at the City of London School, and his scientific education at the Royal College of Science, South Kensington, and at the universities of Würzburg and Munich. During 1883–6 he held the position of *Privatdocent* in the university of Munich. In 1887 he returned to England and became professor of chemistry at the Heriot-Watt College, Edinburgh. In 1892 he accepted the chair of organic chemistry at the Victoria University, Manchester, which he held until 1912. During this period his stimulating teaching and brilliant researches attracted students from all parts, and he formed at Manchester a school of organic chemistry famous throughout Europe. In 1912 he succeeded Prof. Wm. Odling as Waynflete professor of chemistry at Oxford. He soon made his influence felt there—new and more extensive laboratories were built, and for the first time in England a period of research became a necessary part of the academic course in chemistry for an honours degree. Prof. Perkin was president of the Chemical Society from 1913 to 1916. He was awarded the Longstaff medal of the Chemical Society in 1900, and the Davy medal of the Royal Society in 1904. The main results of his work are embodied in a very numerous and brilliant series of papers in the *Transactions* of the Chemical Society. The earlier papers deal chiefly with the properties and modes of synthesis of cloud chain hydrocarbons and their derivatives. This work led naturally to the synthesis of many terpenes and members of the camphor group; also to the investigation of various alkaloids and natural colouring matters. In addition to purely scientific work Prof. Perkin always kept in close touch with chemical industry. His text-books on practical chemistry, inorganic and organic chemistry, written in conjunction with Prof. Kipping, are in general use.

PERNERSTORFER, ENGELBERT (1850–1918), Austrian politician, was born on April 27 1850 at Vienna, the son of a small master tailor. While still a lad at the *Gymnasium* he had to earn his living by giving lessons. At the *Schottengymnasium* he struck up a close friendship with Viktor Adler, and became interested in the Pan-German political movement. While still at the *Gymnasium* he gave courses of lectures at the Workmen's Education Union. At the university he came into contact with Schönerer, to whose intimate circle he belonged. He collaborated in the preparation of the so-called Linz programme of the Left National party, and for a quarter of a century, from 1881 onwards, he edited the periodical *Deutsche Worte*. He separated from Schönerer as the latter adopted an increasingly reactionary and anti-Semitic attitude. He was also the inspirer and one of the founders of the German School Union. In 1885 he was elected to the Austrian Parliament as independent candidate for the manufacturing centre of Wiener-Neustadt. From that time, with the exception of the electoral period 1897 to 1901, he sat in Parliament until his death, and from 1907 onwards was its vice-president. In 1907 he became president of the parliamentary Social Democratic party, which had in the meantime increased in number to 87 in consequence of the adoption of universal suffrage. He died, after a rather long illness, in Vienna on Jan. 7 1918.

PERRY, JOHN (1850–1920), British mathematician, was born in Ulster Feb. 14 1850 and educated at Queen's College, Belfast. Though he took a post as a schoolmaster in 1870, he also qualified as an electrical engineer and devoted much of his time to turning mathematics to practical account. He served for a time as assistant to Lord Kelvin. Later he was associated with Prof. Ayrton and together they were responsible for many inventions in electrical apparatus (*see* 3.76, 8.782 and 783, 9.236, etc.). In 1881 he became professor of engineering and mathematics at the City and Guilds of London Technical College and in 1896 professor of mathematics and mechanics at the Royal College of Science, retiring in 1914. He published many books on applied mathematics and did much to further scientific engineering, especially by his lectures to operatives and by such works as *The Steam Engine* (1874), *Spinning Tops* (1890), *The Calculus for Engineers* (1897), etc. During the World War he was an adviser on gyroscopic compasses. He died in London Aug. 4 1920.

PERSHING, JOHN JOSEPH (1860–), American soldier, was born near Laclede, Mo., Sept. 13 1860. He studied at the Kirksville (Mo.) Normal School (B.A. 1880); graduated from the U.S. Military Academy in 1886; was commissioned second-lieutenant and immediately assigned to the 6th Cavalry in a campaign against the Apaches in Arizona. His conduct won the praise of General Nelson A. Miles, and in 1890, during an uprising of the Sioux, he was sent to Dakota, in charge of the Indian scouts. In 1891 he was appointed military instructor at the university of Nebraska, remaining there four years. He entered the law school and received the degree of LL.B. in 1893, having been made first-lieutenant the preceding year. In 1897 he was appointed instructor in tactics at the U.S. Military Academy, but on the outbreak of the Spanish-American War (1898) asked to be assigned to active duty. He served in Cuba through the Santiago campaign, was appointed chief of ordnance with the rank of major of volunteers, and in June 1899 assistant adjutant-general. He organized in Cuba the Bureau of Insular Affairs of which he was head for several months. In Nov. 1899 he was sent to the Philippines as adjutant-general of the Department of Mindanao, and in 1901 was honourably discharged from volunteer service. The same year he was made captain in the regular army and later conducted a campaign against the Moros, which he completed with success in 1903. The same year he returned to America and was appointed a member of the General Staff. In 1905 he went to Japan as military attaché to the American embassy, and during the Russo-Japanese War spent several months as military observer with the Japanese army in Manchuria. As a reward for his success in the Philippines President

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Roosevelt in 1906 finally secured his promotion from captain to brigadier-general, passing him over 862 senior officers. Soon after he returned to the Philippines as commander of the Department of Mindanao and governor of the Moro Province. Here again he was engaged in quelling the insurbordinate Moros until his decisive victory at Bagsag June 12 1913. He was then placed in command of the 8th Brigade at San Francisco. While he was temporarily absent in 1915 on duty at the Mexican border his wife and three young daughters lost their lives in a disastrous fire, but his son was rescued. In March 1916 he was put in command of the punitive expedition into Mexico against Francisco Villa, and the same year was made major-general. After the death of Maj.-Gen. Funston in 1917 he succeeded him as commander of all the American troops on the Mexican border. This position he held until America's entrance into the World War, and was then chosen to command the A.E.F. in Europe. With his staff he reached England June 9 1917, and four days later landed in France to prepare for the coming of the American troops. In Oct. 1917 he was made general, U.S.A. In some quarters it was felt that as the American detachments arrived they should be hastily trained and then distributed among the Allied forces already in the field, but from the start General Pershing insisted upon the integrity of the American army, though willing in cases of emergency to place detached American units in the different Allied armies. He was convinced that the presence of an independent American army would be a serious blow to German *moral*. In Dec. 1917 he forbade American soldiers the use of alcoholic drinks, excepting light wines and beer, allowing these only in deference to French customs. As Commander-in-Chief of the A.E.F. he planned the American attack at the Marne salient in 1918, as well as American operations at St. Mihiel and in the Meuse-Argonne. His management of the A.E.F. is clearly described in his succinct *Final Report* (less than 100 pages), issued by the Government Printing Office, Washington, Dec. 1919. His nomination by President Wilson to the permanent rank of general was confirmed unanimously by the U.S. Senate Sept. 1 1919, a grade held previously by only four Americans—Washington, Grant, Sherman, and Sheridan. In 1921 he was appointed Chief-of-Staff. By King George V. he was given the decoration of G.C.B.

PERSIA (*see* 21.187).—The autumn of 1909 was a turning point in Persian history. The despotic Shah had abdicated, thus ending the bad old order. Great Britain and Russia were sympathetic to Persia, the latter Power not only appointing a minister with liberal ideas, but withdrawing her troops gradually from Kazvin and Tabriz. In other words the field was clear and Persia had every chance of setting her house in order. The new Assembly met in Nov., when Sipahdar read a speech from the throne, full of good intentions. Nor did his Cabinet fail at the first difficult task. When the question of disbanding the *mujahidin* or "warriors of the Holy War" arose, these soldiers of fortune, for the most part, assumed a menacing attitude and threatened to mutiny unless their exorbitant demands for pay were granted, but the matter was finally settled without bloodshed. Far more dangerous was the discord that raged among the Nationalists, who again broke up into two parties, the "Revolutionaries" (now mis-named "Democrats") being bitterly hostile to the Moderates. Unfortunately the former party, by its activity, its violence, and its secret organization, gained the ascendent. Nor were the leaders any better, Sardar-i-Assad, the Bakhtiari chief, intriguing with the "Revolutionaries" against Sipahdar. The raising of a joint loan of £500,000 from the two Powers, mainly to provide the pay due to the police and soldiers, encountered stormy opposition in the Assembly and was not carried through. The "Revolutionaries" forced their way into the Cabinet, with the result that no progress of any kind was made.

Sipahdar ultimately resigned and a "Democrat" Cabinet was formed under the influence of Sardar-i-Assad, whose nominee for the premiership was a Kajar prince, Mustaufi el Mamalik. It was hoped that office would sober the "Democrats," but little sense of responsibility was shown, together with an intense craving for the sweets of office. Generally speaking the Majlis made Cabinet rule impossible. It was broken up into several parties swayed by passion, intrigue or greed for money, and would lightly pass votes of censure whenever an incident which appeared to be unfavourable to Persia was reported, without giving the minister concerned the chance of explaining matters. Moreover, the hostility of the Majlis and of the Cabinet towards Russia was exasperating to the northern Power.

Chronic Disorder.—In the autumn of 1909 M. Passek, Russian consul-general, was attacked by tribesmen, when travelling to Shiraz with an escort of Cossacks. A few months later, the British consul was attacked near Abadeh and two Indian sowars of his escort were killed. The authority of the governor-general of Fars was threatened by the Kashgais. In the N., adherents of the ex-Shah drove the governor from Ardebil, and Russia was suspected of being implicated in this plot—probably with justice. Elsewhere in northern Persia there was little disorder compared with the unsatisfactory state of affairs in Fars, which gravely threatened British commerce and other interests. So much was this the case that Great Britain began to consider the situation as one that might demand British intervention, and, in the autumn, the Persian Government was notified that, failing the restoration of order within three months, Persian levies under British officers would be raised to guard the trade routes.

In the autumn of 1910, Nasir el Mulk was elected regent in the place of the deceased 'Azud el Mulk, and reached Teheran at a critical time. Mustaufi had been obliged to resign; Sipahdar again formed a Cabinet and Sardar-i-Assad had left for Europe. The new Cabinet was settling down when the ex-Shah, who had passed across Russia with munitions labeled "Mineral Waters," suddenly landed near Asterabad. At first, there was a panic at Teheran. Sipahdar, whose loyalty to the constitution was suspect, was induced to resign, his place being taken by the Bakhtiari chief Samsam es Sultaneh. The ex-Shah marched on Teheran while Salar ed Dauleh simultaneously advanced on the capital from Kermanshah. The Russians undoubtedly favoured the ex-Shah, but his troops were defeated, as was the horde of tribesmen under Salar. Finally the ex-Shah retired to Russia, mainly because Great Britain declined to consider the question of his return to the throne.

American Financial Mission, 1911.—The financial troubles of Persia were mainly due to the all-pervading corruption and irresponsibility of the governing class. It is to the credit of the "Democrats" that an effort was made to deal with the situation by engaging the services of Mr. Morgan Shuster, an American, as financial adviser. Upon examining the situation, Mr. Shuster realized that, without extraordinary powers, he could do little. He therefore demanded the powers of a dictator, which were granted him by the "Democrats," with whose views he found himself in sympathy. Russia regarded his actions with hostility. He was advised by the regent to reorganize everything else before interfering with the comparatively model organization of the customs under its Belgian officials. Instead of following this sound advice, he began work with the customs, exciting deep animosities. Indeed, in many ways, he ignored the realities of the situation. To take an important instance, Shuster wished to organize a Treasury gendarmerie and offered the task to Maj. C. B. Stokes of the Indian army, whose appointment as military *attaché* was expiring. Stokes was a Russophobe, owing to his strong pro-Persian proclivities, and Russia firmly objected to an appointment which would give him control over men stationed in every part of Persia. The matter caused much stir and was finally settled by Maj. Stokes being ordered to leave Persia and return to India. This was a rebuff to Shuster, but worse was to follow. The Russian Government was determined to oust him, but took action on a weak case. The Treasury gendarmes seized the principal property of Shu'a es Sultaneh, the young Shah's uncle, who had taken part in the ex-Shah's attempt. Actually he was a Turkish subject. However, the Russian consul-general, under the flimsy pretext that Shu'a owed money to the Russian Bank, sent some Russian Cossacks, who ordered the Treasury gendarmes to retire under threat of opening fire on them. A guard of Persian Cossacks was subsequently posted by orders of the Russian consul-general. On the following day Shuster dispatched a much stronger body of Treasury gendarmes who ejected the Persian Cossacks. Russia regarded this foolish act as a challenge and presented an ultimatum demanding an apology for the insult offered to her consul-general. When this had been accepted, she demanded the dismissal of Shuster. The Majlis at first refused with cries of "Death or Independence," while at Tabriz and Resht attacks were made on the Russians, who dealt sternly with the incidents, hanging the leading ecclesiastic and other notables at Tabriz. Russian troops supported

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the ultimatum by marching on Teheran, and the Persians, recovering from their fond illusions, submitted. The failure of Shuster was disappointing. His selection was, perhaps, unfortunate, but, in any case, Russia would hardly have permitted him to succeed.

Bombardment of the Meshed Shrine, March 1912.—There were few acts more discreditable to Russia or more harmful to her true interests than the bombardment of the shrine of the Iman Riza, the chief centre of pilgrimage in Persia. The Russian consul-general at Meshed, who was determined to play a hostile rôle in Persia, had taken advantage of local disturbances to bring in a large Russian force under a major-general. There was no need for this, and the population, cowed by its arrival, was peaceful. This state of affairs, however, was not allowed to continue, as it meant no honours and no loot for the Russians. A notorious *agent provocateur* was sent to the shrine, where he soon collected large crowds to listen to his incendiary speeches. This was all that was necessary and the shrine was bombarded by the Russians, nominally to expel the agitators. Actually they were taken away by night in a waggon under a Russian escort. Many innocent men and women were killed and wounded; the sacred tomb-chamber in which lie the remains of Persia's saint, close to those of Harun al Rashid, was repeatedly struck by the shell-fire; and the treasury, which contained the rich gifts of countless pilgrims, was removed, but was afterwards restored, although by no means intact. The outrage excited intense feeling in Persia and, to a lesser degree, throughout the Moslem world. It demonstrated beyond all doubt the sinister policy of Russia, and was the chief cause of the hatred with which the northern Power was regarded. In England the bombardment passed almost unnoticed, as it occurred simultaneously with the disaster to the "Titanic," which entirely absorbed public attention.

Persia in 1913.—The year before the outbreak of the World War found Persia in a miserable plight. Russia was constantly strengthening her hold on the N. by seizing on, or creating, pretexts for further intervention. Great Britain was bound by the Anglo-Russian Agreement to coöperate with the northern Power, but did her best to help Persia to maintain her independence, a task which native incapacity, intrigue and corruption rendered very difficult. In her sphere of influence in the S. she supported the organization and development of the Swedish gendarmerie by advances of money and by other means, and tried to secure capable governors for Fars and Kerman. The position in Fars, the storm-centre of southern Persia, remained thoroughly unsatisfactory. The Kashgai tribe, the most powerful in southern Persia, defied the governor-general and raided in Fars as did the Boir Ahmadis; the Khamseh Arabs raided the caravan routes in the Kerman province; and other tribes raided in the Fars, Yezd or Kerman provinces from time to time. It was generally realized that the evil was beyond the powers of the Persian Government to cure, but in pursuance of the British determination to avoid any increase of commitments—a decision that was eminently sound—action in the form of unsatisfactory palliatives was alone taken. Throughout this period, no Persian Cabinet would assume office without applying for a considerable advance of money from the two Powers. Money was given, the question of repayment was arranged, and there were practically no results. Much of the money was embezzled and the balance was spent to small advantage. The case of Capt. Eckford, who was killed by a raiding party of Boir Ahmadi tribesmen between Shiraz and Dasht-i-Arjan, is typical. The governor-general of Fars, Mukhbir es Sultaneh, who played a sinister rôle in the World War, took advantage of the incident to press for large sums of money, with which he proposed to raise a force of over 1,000 men, and expressed his confidence that he would be able to punish the Boir Ahmadis and other evil-doers without difficulty. The Swedish gendarmerie was already being organized in the province, but had the fatal defect from the point of view of a Persian governor-general that the money for their pay did not pass through his hands. At Teheran the Treasury was empty. A Cabinet bent on reform was being constituted with a programme which entailed a loan of about £5,500,000. Meanwhile, in order to support the governor-general of Fars in his unsuccessful attempts to restore order and punish the Boir Ahmadis, the British legation advanced a sum of £15,000 for three months and, later on, £100,000 for twelve and a half months. In Feb. 1913, the two Powers advanced Persia £400,000. The negotiations for a larger loan were connected with that of railway concessions of which some account is given below.

Salar ed Dauleh.—Among the many difficulties of the Persian Government, that of Salar ed Dauleh was particularly irritating. That troublesome prince had rebelled against his brother Mahommed 'Ali Shah, had been defeated and had been kept under honourable arrest. When Mahommed 'Ali Shah made a bid to regain the throne in 1911, Salar had, as mentioned above, organized a movement from the S.W. and proclaimed himself Shah but, again, had been decisively beaten. In 1912, the irrepressible prince reappeared on the scene and, after occupying Kurdistan, threatened Hamadan. Farman Farma, appointed governor-general of Kurdistan, held Kermanshah against him, inflicting a repulse which drove Salar to take to flight. He then proceeded to lead the life of a brigand chief, fomenting local troubles and blackmailing any wealthy landowner or merchant who was unfortunate enough to fall into his hands. After the formation of the Cabinet of 'Ala es Sultaneh in 1913, it was decided to make terms with the prince who, mainly through Russian support, was nominated governor of Gilan. The regent realized the danger of appointing this "stormy petrel" to a post where he controlled the main route between Russia and the capital, and refused to sanction the appointment. The Russian Government, for a while, declined to permit it to be cancelled, but finally at the repeated request of the British, induced Salar to accept a pension and leave Persia. During the same period there was considerable anxiety as to the movements of the ex-Shah who, it was feared, was intending to make another bid for the throne, but the enquiries made by the British Government tended to show that there was no real cause for anxiety on the subject.

The Swedish Gendarmerie.—The general condition of Persia is one of chronic anarchy which is more intense the nearer any particular locality may be to the powerful raiding tribes. This anarchy the Persian Government is impotent to stop until there is a radical change of character and a movement towards virility and honesty in the governing class. A study of the Blue Books from one point of view is a summary of outrages and of ineffectual measures taken for their punishment, the British minister making the best of an almost hopeless situation and staving off a total collapse by a hand-to-mouth policy of doles, warnings and good advice. In view of the fact that Russia had organized a Persian Cossack brigade in the N., it would have been only befitting that Great Britain should organize a force for the restoration of order in the S., but so afraid of increased commitments was the British Foreign Office that it agreed to the Persian Government engaging Swedish officers for the formation of a gendarmerie and, in the summer of 1911, a mission composed of 20 officers reached Persia under Col. Hjalmarson. The Swedes had no knowledge of the country, the Moslem people, the language or oriental intrigue. The Russians eyed their mission unfavourably and would have rejoiced at its failure. They considered that, if successful, the gendarmerie would certainly become a dangerous rival to the Cossack brigade, which was only nominally controlled by the Persian Government and was actually under the orders of the Russian legation. The Persian Cabinet, although anxious for the success of the gendarmerie, was generally apathetic and also irregular in making payments. The British legation, on the contrary, helped and supported the new force in every way, realizing that unless it succeeded in its very difficult task of restoring order, Persia might well break up into a number of robber-infested provinces. The Swedish officers who were drawn from the regular army, worked hard to train their men. At first, they enlisted the riff-raff of Teheran but gradually recruited a better class of men. Their ignorance of how to deal with Moslems led them to make many mistakes, but this was after all only natural. Generally speaking, they made good progress at the capital and in its neighbourhood.

The British legation, which was watching the dwindling of trade in Fars and the increasing lack of law and order, constantly urged the necessity for sending a force of gendarmes to that province and, in Feb. 1913, the first detachment left for Shiraz. Col. Hjalmarson's scheme for Persia was to place 1,500 men as road guards in Fars supported by a mobile column of 1,800 men. A contingent at Isfahan would form a link with headquarters at Teheran. He also intended to organize stations for the Qum-Sultanabad, for the Hamadan-Kermanshah, and the Samnan-Damghan routes. These schemes would require about 8,000 men and would bring up the number of instructors to twenty-eight. The cost would have been about £400,000 for the first year and, later on, considerably more. The problem of Fars was very difficult, owing both to the power and disposition of the Kashgais, Boir Ahmadis and other tribesmen, and the rugged nature of the terrain. The Swedes made an unfortunate start at Bushire where they enlisted 168 men locally, many of them noted bad characters. These men, owing to two of their number being stripped naked and flogged, all resigned. Probably it was fortunate that they did so, for had they escorted a caravan of arms and ammunition to Shiraz, as was the original intention, it is hardly likely that it would have reached its destination with its contents intact. The gendarmerie marched into Fars and on the way made a successful attack on some Arab robbers, recovering a certain amount of looted property. Owing to the men belonging to N. Persia it was found impossible to take over the route near the coast, as the heat overpowered them, but they occupied it as far as Kazerun. At first the newcomers were not attacked, although the petty chiefs, who lived by blackmailing caravans, realized that if they remained their profits would cease. They were however afraid to move and the gendarmerie gradually established themselves and engaged a num-

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ber of tribesmen as levies. In the vicinity of Shiraz, a detachment was taken out to attack the Kashgais before it was sufficiently trained, with the result that the men behaved badly and allowed themselves to be disarmed. However, they had constructed posts along the route and these they held at the outbreak of war.

The Bakhtiari Domination.—The chief rôle in the Persian revolution had been played by the Bakhtiari tribe which, entirely owing to the influence of Sirdar-i-Assad, had marched on Teheran and secured the abdication of Mahommed 'Ali Shah. During the years that followed, not only had they held the chief posts but their tribesmen had been the mainstay of the constitution. Whenever an expedition had been sent out, they drew money, arms and ammunition, most of which ultimately reached the Bakhtiari country. Sirdar-i-Assad had undoubtedly cherished the ambition of founding a new dynasty, but while events were favouring his designs, he became blind. However, his tribe continued to dominate Teheran and assumed a provocative attitude towards the gendarmerie. The Swedish officers took prompt action, surrounded the Bakhtiari quarter with machine-guns and artillery, and put an end to an intolerable state of affairs from which Europeans as well as Persians had suffered. The chiefs, perforce, agreed to dismiss the greater part of their contingents and felt the humiliation so keenly that they never again attempted to dominate the capital.

German Activity before the World War.—For some 20 years before the war, Germany had made strenuous efforts to increase her influence and interests in Persia. Perhaps the most definite success gained at the capital was the opening of a college staffed by German professors, to which the Persian Government was induced to contribute a handsome annual grant.

But to realize the persistence with which her policy was conducted, attention must be turned to the Persian Gulf. Before 1896 Germany had no representative or trade in that torrid region but, in that year, the campaign opened by the firm of Wonckhaus establishing itself at Lingeh where it began dealing in mother-of-pearl; and, in 1897, a German vice-consulate was founded at Bushire. Three years later Germany made great efforts to purchase a site for the terminus of the Bagdad railway at Kuwait, but the astute Sheikh Mubarak had previously concluded a secret treaty with Great Britain by the terms of which, in return for protection, he agreed not to sell or lease any of his territory without the consent of that Power. Germany did not accept this rebuff as final and induced Turkey, members of Mubarak's family, and the Wahabis to take a hand in the game, but all direct attacks were foiled by British sea-power. A more successful plan was to induce the Turks to establish posts in Khor 'Abdalla, an inlet running from behind Bubiyan Is. to within 30 m. of Basra. The fact that the creek was situated in Mubarak's territory mattered nothing, and these posts were occupied until the outbreak of the World War. Five years after its foundation at Lingeh, the firm of Wonckhaus, supported by German subsidies, opened its headquarters on the Bahrein Is. with branches at Basra and Bandar 'Abbas. The reason for the change of headquarters was soon evident as the islands are situated among the pearl banks, of which Germany attempted to gain control through a lease derived from the Sultan, whose claims in the Persian Gulf were shadowy. The little island of Halul, which is situated in the centre of the banks, was particularly aimed at, but Great Britain intervened and spoilt the new scheme. Germany was indefatigable in her efforts. Foiled entirely as regards the pearl fisheries, she attempted to control the working of the red oxide deposits of Abu Musa. The Sheikh of Sharja, a Trucial chief, bound by treaty with Great Britain not to enter in an agreement with any other Power, had granted a concession for working these deposits to three Arabs, two of whom lived at Lingeh, while the third partner was his own subject. Wonckhaus acquired the concession which the Sheikh promptly cancelled, sending a large body of his subjects to expel the concessionaires. This action raised a storm in the German press, but the case was too weak to be supported and merely a formal protest was made. The last attempt to be recorded was to secure a large piece of land along the river bank at Mohammerah, with the object of creating a German settlement, quays, etc., but again British vigilance was too strong. Much credit is due to Sir Percy Cox, the British Resident, for foiling every German attempt. In spite of these failures, in 1906 the Hamburg-Amerika Co. started a service to the Persian Gulf. The first steamer created a sensation, lavish hospitality being dispensed to all comers, who also welcomed the novelty of a band. Trade was small at first and native passengers were not encouraged, but shipments of railway material helped matters and ultimately a flourishing trade was established. Great Britain, at the actual outbreak of war, was engaged in negotiations with Germany and Turkey. So far as the former Power was concerned, but for the war she would have secured a strong position at Basra, the destined terminus of the Bagdad railway. The suzerainty of Turkey over Kuwait was also acknowledged. In other words British predominance in the Persian Gulf would have been weakened. So far as this important problem was concerned, the results of the war have been beneficial.

Persia at the Outbreak of the World War.—The regent left Persia for more than a year in 1912, merely returning to arrange the coronation of the young Shah. This took place with due pomp and circumstance in July 1914 and, as Nasir el Mulk left Persia again after the ceremony, the young monarch had hardly taken up his duties when the war broke out. His Majesty summoned the Majlis and duly proclaimed the strict neutrality of Persia. The position was, however, very difficult. The grandees were, in many cases, only anxious to receive money from one or more sides; the masses hated the Russians and disliked and mistrusted the British for being friends of their enemies. There was sympathy in some quarters for the Turks and "let the Christians devour one another" was frequently heard. But the outstanding feature was the powerlessness of Persia. Her military forces included the Cossack brigade 8,000 strong, the Swedish gendarmerie 7,000 strong, and the useless Persian troops under Persian officers.

At first sight it would seem unlikely that remote Persia should become a war theatre, but actually this was bound to be the case, unless she could defend her neutrality. A reference to the map will show that Azerbaijan, the N.W. province of Persia, marches with Turkey on the W. and with Russia to the N. Furthermore an advance by either belligerent through Persian territory would enable that Power to outflank the other and operate in open country, whereas a direct attack could only be made across the very high range which runs from the shores of the Black Sea to Mount Ararat. This strategical fact had been realized by Russia and Turkey before the outbreak of the World War, and both Powers, taking advantage of the impotence of Persia, had established themselves in Persian territory in the vicinity of Lake Urmia, the Turks holding the chief passes on the Perso-Turkish frontier which was only finally delimitated just before war began.

Russo-Turkish Operations in Azerbaijan.—At the outbreak of hostilities the Russians, in this section of the war theatre, assumed the offensive and drove the Turks back on Van. However, the Kurds on both sides of the frontier rallied to the Turks and, finding Tabriz undefended, entered it in Jan. 1915. They then moved northwards along the road to Julfa, only to be repulsed by a Russian detachment which subsequently reoccupied Tabriz. At Urmia the Kurds, driving in front of them the Christian tribesmen of Targavar, assaulted the town, hoping to massacre its Christian inhabitants. But, aided by a small Russian detachment and the tribesmen of Targavar, the townspeople drove off the enemy. The Russians, in view of the Turkish invasion of the Kars province, were obliged to draw in their outlying detachments, and this was followed by the exodus of 10,000 Christians.

In the spring of 1915, after the crushing defeat of the Turks at Sarikamish, the Russians reoccupied Urmia and advanced to Van. They were joined by the Assyrian Christians of Kurdistan, who, when left alone to bear the brunt, actually migrated with their families and flocks to the neighbourhood of Urmia, whence they raided their enemies the Kurds and generally did good service to the Russians, until the disintegration of the Russian army.

Operations in S.W. Persia.—Before war was declared by Turkey, the Government of India took the wise precaution of despatching a brigade of Indian troops to the Bahrein Islands. At the outbreak of hostilities, this force pushed up the Shatt al 'Arab to protect the important refineries of the Anglo-Persian Oil Co. on the island of Abadan. This brigade was rapidly increased to a division which, after defeating the Turks at Sahil, a few miles above the oil refineries, occupied Basra on Nov. 23. The occupation of Basra effectually protected the oil refineries, but these works in their turn depended on the oil-fields at Maidan-i-Naftun and the vulnerable pipe-line which was laid through Ahwaz and was 150 m. in length. The neighbouring tribesmen, partly through propaganda and partly through fanaticism, had breached and fired the pipe-line in several places. The Bakhtiari tribe, with which the British had maintained friendly relations for many years and which owned the ground on which the oil-wells were being worked, was generally hostile, the arrangement sometimes being that the fathers professed pro-British sympathies while the sons were fighting for the enemy. To protect the pipe-line, a brigade was despatched to Ahwaz, where it was faced by a considerable number of Turks supported by thousands of tribesmen. A reconnaissance in force found the enemy much stronger than was expected and was obliged to retreat with heavy losses, but

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the enemy showed no inclination to attack the main body of the British who, for some time, maintained a defensive attitude. In the spring, Maj.-Gen. Sir G. Gorringe was ordered to attack the Turks with the 12th division. The enemy retreated and Gorringe, after dealing with the hostile Beni Tauf, drove them back on Amara, which had meanwhile been captured by Maj.-Gen. Sir Charles Townshend. As a result of these operations, Persian soil was cleared of the enemy, the local tribes made their submission, the pipe-line was repaired, and the valuable oil again flowed along it.

German Activity in Persia.—It is interesting to study the policy of Germany in the Middle East after the outbreak of the World War. Its object was to embarrass Russia and, still more, Great Britain, by forcing Persia and Afghanistan into the war on their side, and by creating disturbances on the frontiers of India and inside India. The scheme was sound, for, if Persia alone had declared for the Central Powers, the claim that Islam was on their side might have brought in Afghanistan. As it was, with comparatively small forces and at a relatively small cost, Germany certainly drew forces to Persia, which would otherwise have been available for other fronts. Had it been possible to march a Turkish brigade across Persia to Afghanistan, the Amir would probably have been obliged to join in an invasion of India or would have been killed. India at that time was weakly held, while the "Emden" had cut her sea communications. In the many arguments shown for and against the advance on Bagdad, this important question is apt to be neglected.

The plan of operations in Persia was two-fold. Agents well-furnished with arms and money were sent to enlist levies and to march across central and southern Persia, murdering British and Russian officials, and plundering and driving out the small English colonies. These groups were to form supports to missions destined for Afghanistan and Baluchistan. These latter bore letters on vellum written to the address of the Amir of Afghanistan and the ruling princes of India, and signed by the German Foreign Secretary. They also had various German decorations for distribution. They carried on a propaganda which was anti-Christian, giving out that the Kaiser and his people had become converts to Islam and that the former was now known as *Hajji* Wilhelm. The most successful German agent and the earliest in the field was Wassmuss, who before the war was consul at Bushire. He succeeded in organizing a strong anti-British confederacy in Tangistan, Dashti and Dashtistan, although there was also a pro-British party in these districts. The attacks on Bushire forced the British to increase the small number of troops that normally sufficed to guard the important wireless installation and the cable. Its defence suffered from the fact that the cable station was at Reshire, six m. distant, while the residency and other houses occupied by the British covered a large area outside the town. The Tangistanis made several daring raids, in one of which two British officers were killed. The strongly anti-British attitude of the Persian Government, which made no effort to protect the British colony, resulted in the temporary occupation of Bushire by the British, a step that afforded German propaganda a real chance that was fully exploited. Generally speaking, the activity of Wassmuss detained troops at Bushire, which were sorely needed elsewhere. In Fars, too, Wassmuss was equally successful. He found Mukhbir es Sultaneh, the governor-general, strongly pro-German owing to his education at Berlin. He also found the Swedish officers of the gendarmerie equally friendly and, through their instrumentality, he won over that force to his side. As a result, in the autumn, the British vice-consul was murdered and, shortly afterwards, the consul and the entire colony were arrested and taken to the coast, the men being held prisoners by the Tangistanis, while the women were sent to Bushire. Qawam el Mulk, chief of the Khamseh Arabs, who was acting governor-general, was driven out and retired to Lingeh, thus leaving the German consul supreme in Fars.

The main route by which German parties entered Persia from Bagdad was through Kermanshah and Hamadan. In April 1915, the Turks advanced on Kermanshah with a force mainly composed of levies which expelled the British colony. The German consul at Kermanshah engaged levies and carried on a vigorous propaganda; he also drove back the British and Russian consuls when they sought to return under Persian escort. At Isfahan, Pugin, dressed as a Persian, with the profession of Islam on his lips, persuaded the credulous citizens and their religious leaders that the Kaiser was indeed a *hajji* or pilgrim to Mecca. Assassination was deliberately employed. First the Russian vice-consul was murdered and, later, the British consul-general was wounded and his Indian orderly killed. A letter from a German official, Seiler, was subsequently intercepted, in which he gloried in having arranged this cowardly stroke. Farther E. at Yezd, enemy parties looted the treasury of the Imperial Bank of Persia, a British company, and drove out the colony; and, at Kerman, similar action was taken, together with the assassination of a prominent British subject. At the end of 1915, seven out of the seventeen branches of the Imperial Bank were in enemy hands and the British colonies had been expelled from central and southern Persia. Only the Gulf ports remained safe, thanks to British sea-power and garrisons.

In the N. the position was very different. Owing to the danger to which the Allied legations were exposed, Russian troops had landed at Enzeli in May and had marched to Kazvin whence, as the situation grew more menacing, they had advanced to the Karaj river, some 25 m. W. of Teheran. This movement produced a crisis. The enemy ministers perforce had to leave Teheran and, as the Persian Foreign Minister was on their side, they felt sure of persuading the young Shah to follow them. Indeed, the dilemma of Sultan Ahmad was painful. On the one side, the enemy ministers warned him that Teheran would be stormed by the Russians, who would seize and probably kill him; on the other side the British and Russian representatives pointed out to His Majesty that if he left the capital and broke his neutrality by joining the ministers of the Central Powers, he might lose his throne. Finally the Shah decided to remain at Teheran. The enemy ministers retired to Qum, where they employed their forces in somewhat aimless raiding. This was soon stopped by Russian columns, and, before the end of the year, Russian troops had occupied Kashan and were threatening Isfahan.

German Mission to Afghanistan.—One of the dangers to be guarded against was that of German missions to Afghanistan and Baluchistan. Efforts were made to intercept such parties, but it took time to make the necessary arrangements, and it was not until 1916 that the eastern Persian cordon was in working order with the Russians patrolling the frontier as far S. as Kain, from which centre the British, with some regular troops and a number of locally raised levies, were responsible to the borders of Baluchistan. Persia being a land of vast distances, it is not surprising that a German mission was able, by means of very long marches, to reach Herat in safety. It was received with every honour, but displayed extraordinary lack of tact by openly decrying everything of Afghan manufacture, the arms manufactured at the arsenal at the capital, for instance, being criticized contemptuously. At Kabul too, the same behaviour brought the mission into trouble. The Amir, who had received it courteously, delayed matters by summoning a council representative of all the tribes and by lengthy meetings with the mission and his own advisers. The Germans gradually realized that, without a Turkish force, their efforts were wasted. They were finally dismissed, the Amir pointing out that he could hardly break with the Government of India until a large, well-equipped army reached Kabul from the west. The mission broke up into small parties, most of which successfully evaded the cordon. Other missions travelling farther S., including one to Bahram, Khan of Bampur, had no success whatever, the greedy Baluch in the last-named case stripping the enemy agents who were glad to escape with their lives.

Russo-Turkish Struggle in Western Persia.—In 1916 the ebb and flow of the struggle were very marked in western Persia. At first the Turks, shortly after the retreat of the British from Ctesiphon, occupied Kermanshah and pushed forward towards Hamadan. The Russians in their turn, justly elated at their astounding feat of arms at Erzerum, advanced and drove the enemy off the plateau, while a second force swept the hostile Bakhtiaris out of Isfahan and brought back the British and Russian communities. The capture of Kut again transformed the military situation and, in the summer, the Turks, 16,000 strong with 54 guns, gradually drove back the Russians who could only oppose them with 12,000 men and 19 guns. Kermanshah was evacuated and then Hamadan, the retreat continuing as far as the Sultan Bulak range which covered Kazvin and threatened a force marching on Teheran. This situation remain unchanged until the end of the year.

Raising the South Persia Rifles.—In 1916, it was decided, in consultation with the Persian Government, to organize a force of Persian troops to restore order in southern Persia and take the place of the Swedish gendarmerie. This force was to be 11,000 strong and the Cossack brigade was to be raised to a similar strength. Brig.-Gen. Sir Percy Sykes, who had spent many years in S. Persia, was appointed to undertake this task and landed at Bandar 'Abbas in March, with three other British officers and a few Indian instructors. The state of affairs was most unfavourable as, apart from the defeat of Qawam, the British agent and his escort were assassinated at Lingeh and two British officers were assassinated in Makran about the same time, both murders being due to German instigation; and finally this terrible month of April saw the grave disaster of Kut al Amara. Many experienced men expected a wave of fanaticism to sweep across Persia and there was certainly cause for deep anxiety, especially in Makran, but British coolness undoubtedly saved the situation. Recruiting operations at Bandar 'Abbas were started immediately after landing and, in spite of a strong anti-British party, men were rapidly enlisted and, before the end of a month, the Persian flag was hoisted with ceremony over a camp. The force, handled with much tact and patience by its British and Indian instruc-

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tors, never looked back and was soon able to protect Bandar 'Abbas and an important section of the caravan route from the raiding tribesmen.

The Success of Qawam el Mulk and his Sudden Death.—Qawam was aided by the British with money and munitions, and an exaggerated report of the means placed at his disposal led to the rebel Arab headmen kissing his feet. With their aid he defeated the Swedish gendarmerie, and was marching in triumph to Shiraz when he was killed by a fall from his horse. His son, a man of 28, was however able to restore Persian authority in Fars.

The March of Sir Percy Sykes to Kerman.—The success of Qawam and the landing of the mission at Bandar 'Abbas made the position of the German parties at Kerman decidedly insecure. The governor-general became hostile to them and they decided to retire westwards to Fars, the route farther N. being dangerous owing to the Russian advance southwards. They fled in two parties, and after suffering some losses from attacks on the road, were all captured by Qawam and imprisoned at Shiraz to the number of 60 Germans and Austrians, a dozen Turks and a few Afghans. A small force of Indian troops, consisting of a section of mountain guns, a squadron of cavalry and 500 rifles, was sent to Bandar 'Abbas and Sir Percy Sykes marched inland a distance of 280 m. to Kerman, where he was received with much cordiality. The various pro-German elements who had created a state of insecurity fled, the bank and telegraph offices were reopened, and the normal state of affairs was very quickly reëstablished. At Kerman, recruiting for a brigade of the S. Persia Rifles was started with much success, and, before long, it was dealing effectively with the robber bands which were destroying life and property in the province. The column, after halting for some weeks, marched on to Yezd, where the British colony had only recently returned. News being received of the Turkish advance and of a probable attack on Isfahan, the column, instead of marching direct to Shiraz as originally intended, proceeded to Isfahan and joined the force of 600 Russian Cossacks at the ancient capital of Persia. The Turkish force had reached Dunbeni, 60 m. to the N.W. of Isfahan, but had not advanced any further, and it appeared that exaggerated rumours as to the size of Sir Percy Sykes's force had been the cause of this change of plan. During the halt at Isfahan, the column marched out for 50 m. along the Ahwaz route, attacked Jafar Kuli, a noted brigand, who was holding it, and provided an escort for loads of British merchandise that had been lying at Kava Rukh for many months. Altogether 16,000 loads were brought in, and incidentally several merchants were saved from bankruptcy. When it finally became evident that the Turks would not advance on Isfahan, the column marched S. to Shiraz, which it reached in Nov., thereby completing a march of 1,000 m. through the heart of Persia.

Taking over the Swedish Gendarmerie in Fars.—At Shiraz the question of the gendarmerie had to be settled. The Persian Government had not actually given its consent to it being incorporated in the S. Persia Rifles, but was unable to pay or equip the force. Spread over the route for a distance of 300 m. from the borders of Fars in the N. to Kazerun in the S. and numbering some 3,000 men, the problem which confronted Sir Percy Sykes was one of extreme difficulty. He had no staff to administer or train such large numbers and he was aware that it was this force which had seized the British consul only a year previously and that many of the officers were pro-German in sentiment. But he also realized that, if the gendarmerie broke up into well-armed bands of robbers and devastated the country, few supplies would reach Shiraz. He consequently addressed the officers, explained to them that they were to be absorbed into the S. Persia Rifles, and expressed the hope that they would serve Persia loyally by helping to put down the brigandage that was slowly but surely extirpating the sedentary population. In March 1917, this action was indirectly approved by the Persian Government, which officially recognized the S. Persia Rifles. The men were in rags, half-starved and undisciplined. It was impossible to take them off the road immediately, as there were no barracks for them at Shiraz. It was a case of feeding, clothing and paying the men at first and of gradually restoring the discipline that appeared to be almost lost. With only three or four British officers available, much was done, and when a proper staff reached Shiraz in the spring of 1917, rapid progress was the order of the day.

The Restoration of Order in Southern Persia.—Since the assassination of Nasir ed Din in 1896, the authority of the Persian Government had weakened year by year, and in Fars the governor general had been at the mercy of the powerful Kashgai tribe. Under their capable chief, Solat ed Dauleh, these powerful nomads numbering 130,000 tribesmen, and moving in their migrations from the Persian Gulf to Qumisheh, dominated the province, of which Solah (Solat) was the "uncrowned king." They were armed with Mausers, had plenty of ammunition and displayed great bravery in the field. Solah collected the revenue in full from his tribesmen, but paid nothing to the Persian Government. He also sent powerful raiding parties throughout the greater part of the province, which looted and levied blackmail. If a governor-general attempted any opposition to Solah, the latter promptly prevented supplies and goods from reaching Shiraz. The result was scarcity in the bazaars and discontent, followed by riots, and the governor-general returned to Teheran. It was obvious that Solah would be hostile to the British. The Kashgais considered that raiding was their right and would combine against anyone who attempted to put an end to it. Generally speaking, they held western Fars at their mercy and, farther E., lay the territory of the Khamseh Arabs, who were 70,000 strong. Under their chief, Qawam el Mulk, they ranged from the neighbourhood of Bandar 'Abbas and Lar to the vicinity of Niriz and Dehbid. The Arabs were less well-armed than the Kashgais but were equally brave. They were also equally addicted to looting. The marked difference between the two chiefs was that Qawam was a polished Shirazi, anxious to improve the state of Fars, although he could not immediately stop looting, whereas Solah lived with his tribesmen all the year round and had the same mentality. Sir Percy Sykes met Solah, with whom an agreement was made to prevent his tribesmen from looting, and, although it was realized that he was thoroughly untrustworthy, he refrained from attacking the British during 1917, and allowed them time to open up communications and construct forts at Saidabad (Sirjan) and Niriz. With Qawam good relations were maintained throughout.

In the summer of 1917, a force of Indian troops was stationed at Dehbid which, by the infliction of a single salutary punishment, made the main route safe, and caravans once again began to pass. In the autumn, combined operations against tribes marked down for punishment were undertaken by the Fars and Kerman columns. So successful were they that, had there been no interruption, S. Persia would have rapidly settled down to comparative prosperity. But the reaction of the World War was destined to be felt still more strongly than before in remote Fars.

Successful Russian Campaign in Western Persia.—The saddest year in Russian history opened with military success in Persia. As already mentioned, at the end of 1916, the Turks were occupying Hamadan and facing the Russians at Kazvin. During the winter, however, the position in Mesopotamia entirely changed. Instead of weak, ill-equipped columns, severely handicapped by unfavourable climatic conditions, failing before Kut al Amara, there was the pleasant picture of overwhelming forces under the inspiring leadership of Gen. Sir Stanley Maude recapturing Kut in Feb. 1917 and following this up by the signal success of the surrender of Bagdad to the British. The position of the Turks in Persia became more and more difficult as the British advanced. On the day Bagdad was occupied they evacuated Kermanshah and, pursued by the Russians, reached the Persian frontier at Qasr-i-Shirin on March 31, worn out and hungry but not wholly demoralized. Meanwhile the British had despatched two brigades to the Jebel Hamrin, but found the range occupied in great force by the Turkish 18th corps, which did not retire until the 13th corps had evacuated Persian soil intact, when the united forces moved northwards. On April 2, a squadron of Cossacks met the British at Qizil Ribat, but marched back the same night. There was no question of maintaining contact, but the British helped their allies to establish themselves firmly on the Diala river.

The Russian Collapse in Persia and its Results.—March 1917, which witnessed the capture of Bagdad, also saw the abdication of the Tsar. Gradually the Russian troops in Persia became demoralized and, during the winter of 1917–8, the rot had set in and hordes of Russians made for home, plundering the villages for food, pulling down houses to secure timber for fuel and selling

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The second Agreement defined the loan, which was fixed at £2,000,000 at 7%, redeemable in 20 years. There were two letters, in the first of which the British Government promised co-operation in securing a revision of the treaties actually in force between the two Powers, compensation for damage suffered during the war, and any justifiable rectification of frontiers. In the second it was laid down that Great Britain would not claim from Persia the cost of maintaining British troops in Persia for the defence of her neutrality, and asked Persia, in return, not to claim compensation for any damage done by her troops.

The Agreement was signed, but no immediate steps were taken to elect a new Majlis and submit it for ratification. In consequence, everything was held to be in suspense.

Finance.—In 1920 a British Financial Adviser was engaged by the Persian Government, a member of the Treasury staff being selected for the post. To a certain extent he could occupy himself with superintending the payment of money in connexion with the Cossack brigade and other matters in which help was given to the Persian Government, but his office was in suspense and the loan of £2,000,000 could not be made until the Agreement was ratified. With all overdue instalments paid up, the total debt of Persia as at Dec. 31 1920 was as follows:—

Loans	Original Amount	Outstanding
1. Russian 5% Loan of 1900, 1902 . . . . . (Rubles)	32,500,000	31,223,170
2. Russian Consolidated 7% Loan 1911 . . . (Krans)	60,000,030	31,524,501
3. Indian 5% Loan . . .	£314,281 16s.4d	£180,421
4. Imperial Bank of Persia 5% Loan of May 8 1911 . .	£1,250,000	£1,223,061
5. British Advances of 1912–4, 7%	£490,000	£490,000
6. Russian Advances (Rubles)	1,891,500	1,576,250
7. British Advances 1915–7 . .	£817,000	£817,000
8. " " " (Krans)	1,000,000	1,000,000
9. " " 1918 (Krans)	—	92,500,000
10. British Loan, Aug. 9 1919 . .	£2,000,000	Not yet received.

The Anglo-Persian Military Commission.—Among the important questions was the formation of a uniform force for Persia. An Anglo-Persian Commission was appointed and recommended a total strength of 60,000 men. As funds for such a force were not immediately available, it was decided to absorb the S. Persia Rifles, 6,000 strong; the Cossack division, 8,000 strong; and the Swedish gendarmerie, 8,400 strong. The total force would be gradually raised to 40,000 and all other troops would be disbanded. The Chief Military Adviser would be British and the Chief of the General Staff a Persian, although there was no Persian officer who possessed the qualifications. This scheme was in abeyance in 1921, pending ratification of the Agreement.

The Bolshevist Invasion of Persia.—In May 1920 the Bolshevist fleet from Baku bombarded Enzeli, took possession of the remnants of Denikin's squadron and leisurely occupied Resht, where a Provisional Government was formed under Kuchik Khan. The British detachment at Enzeli was withdrawn to Kazvin. At Teheran there was a panic and the British were blamed for not protecting Persia. The Cossack brigade recaptured Resht some months later, but finally retreated in a demoralized condition and took refuge inside the British lines. In March 1921 there was a considerable Bolshevist force in the province of Gilan, but it was thought unlikely to prove a serious threat to Persia until the brigade of British troops should be withdrawn from Kazvin.

Railways.—The question of railways has loomed large in Persia partly from the political and strategical and partly from the commercial point of view. For many years Teheran had been the unsuccessful hunting-ground of seekers for concessions, who had finally been replaced by the representatives of Great Britain and Russia. It may be readily granted that the only satisfactory solution of the problem of transport in Persia lies in the construction of railways. Their influence would probably help the country to pass quickly from the methods of transport used by the patriarch Job to those of the 20th century. But there are many difficulties to be surmounted before railways can be constructed in Persia, the chief obstacles being financial and political.

Persia is a vast but miserably poor country with a scanty population living in isolated villages, generally lying many miles apart. The towns are small and do not increase, and there is very little trade. In the N. the country is more fertile, owing partly to a heavier rainfall, and there are important exports as well as imports, whereas in the S., if we except oil, there are practically no exports, carpets, pistachio nuts, opium, hides and wool making a small total compared with the large imports. In other words, unless minerals are found which it is profitable to export, Persian railways, constructed in the S. or W., cannot pay.

Had the Russian Government continued on the old lines it is probable that money would have been found for the construction of a railway across Persia. The grandiose scheme appealed to the Tsar, while his ministers considered that it would secure their hold on the Russian sphere and also bring them closer to the Indian Empire, thereby enabling them to exercise pressure on Great Britain. These facts were fully realized by the British Government, which was, however, unable to refuse to discuss the scheme and, in 1912, a *Société d'Études*, including British, Russian and French representatives, was formed, with the object of constructing a Trans-Persian railway. It was intended, in the first instance, to build a line to Teheran, starting from Alyat, a station to the S. of Baku. Negotiations in connexion with this, the first section of the Trans-Persian railway, were carried on until the outbreak of the World War. In addition to this important scheme the Russian Government in 1913 obtained a concession for the construction of a line to Tabriz, starting from the terminus of the Trans-Caucasus system at Julfa. This concession included rights for a service of steamers on Lake Urmia to which a branch was to be run, and also a concession for an extension to Kazvin. The line to Tabriz was opened in 1916.

Meanwhile the British had not been idle, and a syndicate, of which Messrs. Greenway & Lynch were the leading members, submitted to the Persian Government a scheme for the construction of a network of railways in southern Persia: (*a*) from Mohammerah or Khor Musa to Khurramabad and Burujird; (*b*) from Bandar 'Abbas to Kerman; (*c*) from Bandar 'Abbas to Shiraz; and (*d*) from Bandar 'Abbas to Mohammerah. This far-reaching scheme for a monopoly of railway construction in S. Persia included the right to develop ports where necessary. It also involved the issue by the Persian Government of bonds secured on the railways and their earnings and on any other available sources of revenue.

The syndicate decided to begin work on part (*a*) of the scheme. The base would probably have been Khor Musa, an inlet of the sea, which ran inland for many miles towards the Karun river and possessed remarkable advantages in the way of deep water and safe anchorage. The alternative was Mohammerah. The line would have been constructed across the level plain of Arabistan to Dizful and would then have risen through the hills to Khurramabad. Survey operations were attempted in the hills in 1913, but the greedy tribesmen attempted to levy such enormous sums for protecting the parties that the work came to a standstill. The results of the World War have entirely changed the position and it seems that this scheme will be allowed to fall into abeyance.

There is no doubt that if railways are constructed into the interior from the Persian Gulf, the port of Bandar 'Abbas, or perhaps a new port some miles to the W., will be selected. The route running across the Rudbar district and thence to Rigan and Kerman, over the low Gishu pass, avoids the very high passes to the S. of Kerman and, once the plateau is struck at Rigan, the country is ideally suitable for railway construction right across Persia. Upon the whole, this is the most satisfactory alignment. The route from Bandar 'Abbas to Shiraz and thence to Mohammerah would violate the principle that lines should be built into the interior and not run parallel to the coast, where they could not compete with sea transport.

After the World War the question of railways was again taken up by a strong group, which included Sir Charles Greenway, the chairman of the Anglo-Persian Oil Company. The scheme included a railway to Teheran from the Persian frontier at Kuraitu, at which point was the terminus of a metre-gauge line from Bagdad. A survey was commenced via Kermanshah, Hamadan, Kazvin and Teheran. Surveys to Enzeli and Tabriz were also contemplated. It was agreed that, upon the completion of the surveys, the Persian Government would have the right to call on the group to construct the railway line or lines either as a Persian State railway or as a private company. No agreement as to terms was drawn up.

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Medical Conditions.—Persia is divided up into a great elevated plateau which occupies the chief part of the area of the country and which is separated from the Caspian Sea in the north by a low-lying narrow strip of land from 20 to 60 m. broad, and from the Persian Gulf in the south by a strip of land little above sea level and about 40 m. in width. The strip of country bordering the Caspian Sea has a very high rainfall, its climate is damp and very relaxing, the temperature being moderate. Marshy and swampy areas with luxuriant forests and vegetation occupy a considerable portion of this part

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of Persia. Mosquitoes, including the Anopheles varieties, are very numerous, and insect life is abundant. Malaria is very common, and few residents escape infection. The medical conditions prevailing here are those which are found in other damp relaxing climates with no great extremes of temperature. Tuberculosis is fairly common, and respiratory diseases such as bronchitis, pneumonia and influenza are prevalent. There is great overcrowding in the towns, and owing to the lack of adequate sanitation water-borne diseases such as dysentery, enteric fever and cholera are prevalent. Typhus and smallpox and the ordinary infectious fevers are common. Heat stroke does not occur, but owing to the high humidity the climate is very oppressive and trying to European residents.

The plateau region of Persia, occupying almost the whole area of the country, is divided into a mountainous portion which covers the whole of the western half of Persia, the general level being from 3,000 to 6,000 ft. above the sea, while the remaining portion of the plateau is chiefly desert and its general level is from 2,000 to 3,000 ft. above the sea. The climate of the Persian plateau is temperate, the summer temperatures not exceeding those of England. The winter temperature depends largely on the altitude, and extremes of cold are experienced. The atmosphere is invigorating and healthful, but in spite of this diseases of various kinds are prevalent owing to the lack of sanitary precautions. Water-borne diseases such as enteric, dysentery and cholera are prevalent, and this is largely due to the extraordinary fondness of the Persians for conveying water through numerous channels both above and underground in the towns and villages. The water usually comes from mountain springs and is clear and sparkling, but becomes contaminated in the course of distribution. No water should ever be drunk from these channels without previous boiling or chlorination; the remarks made in the article on MESOPOTAMIA relating to protection from water-borne diseases apply with equal force to Persia. Prophylactic inoculation with T.A.B. vaccine is essential as a protection against enteric. Malaria is very common owing to the breeding of mosquitoes in the various streams and water channels. The malaria is very frequently of the malignant type, and is often not controlled by the oral administration of quinine. The intramuscular or intravenous administration of the drug should always be adopted in such cases for the first few days of treatment, after which a full course of treatment by the mouth should be given. It is very remarkable to find malaria so prevalent and of so malignant a type at such a high altitude as that of the Persian plateau.

Overcrowding and herding together of the poorer classes of the population occur especially in the cold months, for housing accommodation is very insufficient. In consequence of this the common infectious fevers and smallpox are prevalent. Tuberculosis and influenza are rife, and the lice-borne diseases, typhus and relapsing fever, are of common occurrence.

A special type of relapsing fever occurs along the Zenjan-Tabriz route, which is spread by a large tick (*Argas Persicus*) known as the "Mianeh bug," which has a great predilection for foreigners; this disease is very common at Mianeh and resembles clinically the lice-borne relapsing fever.

Eye disease is as common in Persia as Mesopotamia, and is due to the same causes. Sand flies are common and sand-fly fever is of frequent occurrence. Oriental sores are very common and are known by the Persian name "Salek," meaning a year, which is an average time for their duration. Venereal diseases such as gonorrhoea and syphilis are common amongst the natives.

Diarrhoeal diseases are very common in Persia, being spread by contaminated water, and food infected by dust and flies. These cause a very high infantile mortality amongst the natives. Neurasthenia and mental breakdown sometimes affect residents in Persia, the high altitude of the plateau being probably a causative factor.

In consequence of the Civil War and the Turkish and Russian invasions of 1914–7 much destruction of the dwellings of the poorer inhabitants occurred, and the animal transport so essential for the conveyance of food was greatly reduced. The food supplies were largely used up, and a serious famine occurred in 1917–8. Starvation carried off large numbers of the poorer inhabitants, and those debilitated by lack of nourishment and insufficient clothing became ready victims to such diseases as malignant malaria, dysentery, typhus, etc. (W. H. W.)

PERSIAN GULF.—The term "Persian Gulf" is, strictly speaking, restricted to the landlocked sea which extends in a south-easterly direction from the mouth of the Shatt al 'Arab 460 m. to the mountain mass of the promontory of Oman, terminating in Ras Musandam, but, for the purpose of this article, it will be considered to include the Gulf of Oman to which it is joined by the Strait of Ormuz, 29 m. wide. The Gulf itself has an average width of 120 miles. It is tidal, spring tides rising about 9 ft.; the water is somewhat salter than the Indian Ocean, and seldom exceeds 10 fathoms in depth; with the exception of the Shatt al 'Arab, the Jarrahi and the Hindiyan rivers, which mingle their waters with those of the sea at the W. end of the Gulf, all the streams that flow into it are so salt as to be undrinkable. The Euphrates and Tigris have within historical times silted up their mouths to an extent that has materially altered the coast-line of the Gulf and these rivers seem destined in the future to unite El Hasa to Fao, just as in the past they produced the fertile plains of Mesopotamia. The Persian Gulf is lacking in good harbours, anchorage being mostly shallow and exposed.

N. Coast.—From the Indian Ocean the Gulf of Oman is entered approximately where Persian territory begins at the tiny port of Gwattar. From Gwattar the coast-line, running W., first to the Strait of Ormuz, next along the N. shore of the Persian Gulf, and finally to the mouth of the Shatt al 'Arab,[1] is nominally under the exclusive control of the Persian Government. The inhabitants of this tract are Persians or Arabs who by domicile and intermarriage with Persians have lost nearly all their racial and most of their social characteristics, but retain a dialect of Arabic as their mother tongue.

S. Coast.—The S. coast on the Gulf of Oman may be regarded as commencing from Ras el Hadd; it extends to the Ras Musandam. This coast is under the nominal suzerainty of the Sultan of Muscat, the principal ports from E. to W. being Sur, Muscat, Matra, Khabura and Sohar. From Ras Musandam westwards the Arabian shore is inhabited by tribes of Arab origin, which are independent and in treaty relation with Great Britain.

Up to 1913 the Turks exercised the right of suzerainty over the maritime districts of El Hasa and Hofuf, and claimed it in Qatar and Kuwait. The Emir of Nejd, 'Abd el 'Aziz ibn Sa'ud, ejected them from the first-named districts; the war has put an end to their claims elsewhere in the Gulf. The Trucial chiefs of the Arabian coast hold sway between the peninsulas of Musandam and Qatar. From E. to W. their headquarters run as follows:—Ras el Kheima, Umm el Qaiwein, 'Ajman, Sharja, Dibai, Abu Dhabi, Qatar. The Sheikh of Bahrein exercises no authority over the mainland, which from the S. extremity of the bay in which Bahrein lies to Jebel Manifa N. of Qatif is recognized as within the territories of the Emir of Nejd (*see* ARABIA).

The friendly attitude of Ibn Sa'ud on the outbreak of war with Turkey made it imperative that the British Government should come to a definite understanding with him, and he was recognized by a treaty dated Dec. 28 1915, as independent ruler of Nejd and El Hasa, and given a limited dynastic guarantee, with a promise of support in case of foreign aggression. Great Britain assumed control of his foreign relations outside Arabia. He on his part undertook not to alienate any territory to a foreign Power, except with the consent of the British Government.

Shortly afterwards a treaty was made with the Chief of Qatar, whereby his position was assimilated to that of the Trucial chiefs. The British Government undertook in addition to afford their good offices to the Sheikh in the event of unprovoked aggression by land.

Climate.—The prevalent winds in the Gulf follow the configuration of the coast, *i.e.* N.W., known as the *shamal*, and S.E., known as the *qaus*. The former wind, rising often to a gale in a few hours and falling as suddenly, is foretold by no change in the barometer. With the *qaus* the reverse is the case. This wind is much dreaded by native mariners as it strikes nearly all the sheltered anchorages.

Rainfall varies from 6 in. to 9 in. at the W. end of the Gulf to a negligible quantity at Muscat. As is to be expected, the rainfall on the peninsula is somewhat greater than on the Arab coast. The influence of the S.W. monsoon, which is marked at Muscat, is scarcely noticeable in the Persian Gulf proper, though recent upper-air investigations conducted at Bagdad give some reason to think that the effects of the monsoon can be observed even there.

The temperature at the W. end of the Gulf varies from a minimum of 4° or 5° F. below freezing point at night in winter to a maximum of 115° F. in the shade during a few days in summer; the humidity of the air at Muscat is greater and the climate is, in consequence, much more trying, but even here a maximum of 109° F. has been recorded, the lowest minimum being 55°. Snow has been known to fall at Bushire. (A. T. W.)

Medical Conditions.—The medical conditions prevailing in the Persian Gulf are largely determined by the peculiarly trying climatic influences to which the inhabitants are exposed. The Arabian desert forms the W. and S. shores, which are almost uninhabited except for the small centres of population around its few widely separated towns, Kuwait, noted for its pearl fisheries, in the N.W. corner, being the most important of these. The E.

[1] The W. frontier of Persia was finally demarcated in 1914, a few months before the outbreak of war, by a mixed Anglo-Russian Perso-Turkish commission.

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and N. shores are formed by the desert country of southern Persia, and are similarly very sparsely populated, Bushire, in the N.E. part of the Gulf, the port for the Shiraz district of southern Persia, and Bandar 'Abbas, at the entrance of the Gulf, being the chief centres of population. The hot season of the year is from May to October, July and August being the hottest months. The Persian Gulf has an unenviable reputation for its dangers from heat-stroke, and the sun's rays seem to have a peculiar deadly power in this region, for the risk of exposure is greater than in any part of the world, though other countries have a temperature which is equally high. The explanation is to be found in the extreme flatness of the country and the absence of trees or vegetation. The clear atmosphere is in its upper strata free from clouds and dust, so that the sun's rays undergo scarcely any absorption and strike down with full force on the light-brown desert soil, from which they are radiated and reflected to a great extent. The relative humidity of the air along the shores of the Gulf is high, so that exposure to the direct and reflected rays of the sun and radiation from the hot soil are encountered in a moist atmosphere.

So trying is the heat that some parts of the Persian Gulf are almost uninhabitable to natives in the hotter months. The greatest care requires to be taken by white races to avoid exposure to the sun and heat. Dwellings require careful construction, with thick walls and roofs of non-conducting material to keep out the heat-rays, and fans and punkahs are essential for the promotion of currents of air in the inhabited rooms. Personal protection, in the shape of thick pith topees, or cork helmets, and spinal pads, is necessary in the hot months, the clothing being light and loose and not too thin. Fatigue from physical exertion is a predisposing cause of heat-stroke, and constipation and alcoholic indulgence should be avoided.

Should a person be infected with latent malaria, heat exposure is very likely to induce an acute malarial attack and the combination is almost certain to lead to hyperpyrexia. On this account malarial subjects living in the Persian Gulf should take especial care to have an effective course of treatment in order to eradicate the disease as far as possible. The frequent association of heat-stroke with malaria is to be borne in mind in the treatment of heat hyperpyrexia, for, should the temperature of the patient not subside rapidly after treatment with cold sponging in a current of air or cold baths and ice, an intramuscular or intravenous injection of 10 grains of quinine bihydrochloride should be given without delay. In the case of white people exposure to heat of itself frequently causes heat-stroke, but probably in almost all cases of heat hyperpyrexia amongst natives the malarial complication is the exciting cause and therefore with them quinine treatment is all-important. Natives are generally immune to the effects of heat apart from other complicating causes of high temperature, such as malaria, etc., whereas white races may be affected with heat-stroke from heat exposure even if in perfect health. If a white person suffers in the hot months from any disease causing fever, *e.g.* enteric or sand-fly fever, etc., there is always a serious danger of hyperpyrexia, and this has to be guarded against.

The Effects of Heat.—The effects of exposure in the case of white races are not only manifested by the acute attack of heat-stroke, but, if this is avoided by proper care, it is nevertheless certain that long residence in the Persian Gulf causes a certain amount of tissue degeneration, owing to the exposure of the body cells to abnormal conditions of temperature. The highly specialized cells, viz. those of the nervous system, suffer most; and nerve-cell fatigue is shown by manifestations of neurasthenia. Lack of the power of brain concentration and severe inability to undergo the mental strain of arduous work are often the penalty which white races pay.

Beri-beri is a dietetic deficiency disease which manifests itself by cardiac weakness with shortness of breath, swelling of the legs and peripheral neuritis with numbness of the limbs and weakness. The climatic conditions of the Persian Gulf particularly seem to predispose to this disease, for it very frequently attacks white persons resident there, especially if they are exposed to dietetic hardships.

Residents in the towns along the Persian Gulf are exposed to the same dangers from disease as are experienced in similar places in Mesopotamia and Persia (*see* MESOPOTAMIA and PERSIA). Thus malaria and sand-fly fever, dysentery, typhoid and paratyphoid fever, cholera, smallpox, and occasionally typhus fever, eye diseases, oriental sores and indeed any disease conveyed by impure water, flies, contaminated dust or the contagion of sufferers from infectious diseases, are prevalent in the inhabited places along the Persian Gulf, and precautions must always be taken to guard against them.

(W. H. W.)

Geology.—Large portions of the littoral had not up to 1921 been examined geologically. Of the numerous islands that dot the Gulf many are partly at least of volcanic origin, notably Qishm and Ormuz.

The geological formations represented are the following in descending order:—

Recent or sub-recent	Shelly conglomerates and dead coral reefs of the littoral; red sandhills of the coast of Trucial Oman; alluvium of Turkish Iraq; river and lake deposits of Oman and the interior of Persia.
Pleistocene	Foraminiferal oolite or "Miliolite."
Pliocene	Bakhtiari series; grits and conglomerates.
Miocene	Fars series; marls, clays and sandstones with limestones and interbedded strata of rock gypsum.
Lower Miocene	Clypeaster beds of the Bakhtiari mountains.
Oligocene and Eocene	Nummulitic limestones of Persia; Muscat series; and Bahrein series.
Upper Cretaceous or Lower Eocene	Ormuz series; lavas and tuffs with interbedded clays and sandstones.
Upper Cretaceous	Hippuritic limestones of Persia and Oman.
Jurassic or Lower Cretaceous	Serpentinous and other igneous rocks of Oman.
Carboniferous to Trias	Oman series; limestones and slates with beds of chert.
Archaean	Hatat beds; schists and quartzites.

The latest movement to which the Gulf has been or is now being subjected is one of gradual elevation, of which traces are found in recent littoral concretes, now as much as 450 ft. above present level, and in the flat ledge which surrounds Muscat harbour.

Numerous "shows" of petroleum exist along a broad belt running N.W. and S.E. through Mesopotamia and down the Persian Gulf. These are the most abundant at the foot of a chain of hills where the oil wells of Daliki, Bebehan, Ramuz and Shushtar, Dizful, Pusht-i-Kuh, and Qasr-i-Shirin are situated. Oil has, however, been struck in paying quantities hitherto only at a point 30 m. E. of Shushtar. Experimental boring on Qishm I. in 1916 had not given any result up to 1921.

Among other mineral products, asphalt is found at Bahrein; coal 30 m. inland from Sur, and some seams of good coal in newer strata; sulphur occurs in a fairly pure state at Khamir and Bustaneh near Lingeh, and on Qishm I.; copper, as copper glance and malachite, occurs in the interior of Oman; copper-mines are said to have been worked in the neighbourhood of the coast near Lingeh by the Portuguese, but all trace of them has been lost. Red ochre, for which there is only a limited market, is mined on Ormuz, Abu Musa and other islands in the Gulf; salt, as deposits, on Ormuz and Qishm I., and by evaporation, near Mohammerah, Fao and elsewhere on both sides of the Gulf; gypsum is widely distributed throughout the Gulf; iron, as haematite and pyrites, widely found through the Ormuz series.

Earthquakes are frequent and sometimes severe in the Persian Gulf proper, especially on Qishm I. and on the coast in the neighbourhood. In 1865 an earthquake levelled the villages of Darveh Asul near Mugam; in 1880 an earthquake caused 120 deaths in Basra; in 1883 severe shocks were felt from Bushire to Tahiri; in 1884 an earthquake caused 132 deaths on Qishm I., which was in consequence deserted; in 1897 an earthquake destroyed Qishm town and caused over 1,000 deaths; further shocks were experienced at Qishm and Bandar 'Abbas in 1902 and 1905.

Agriculture.—Cereals are produced in considerable quantities in the hinterlands of Mohammerah and Bushire and in the intervening coastal strip; the rest of the Gulf largely depends on imports from this part of Persia or from India. Dates are grown for the European market at Muscat and for local consumption on both sides of the Gulf, but not in considerable quantities. The Muscat date reaches maturity sooner than the Basra crop, and is commercially valuable.

Live Stock.—Camels are abundant on the Arabian side of the Persian Gulf littoral and are also found on the Persian coast, especially where the country is open. Horses are scarce in Oman and few are kept in Trucial Oman or in Bahrein or El Hasa. But they are more common in Qatar and Kuwait. Nejd, or Central Arabia, is the principal horse-breeding country adjacent to the Persian Gulf, and is the only one in the world, except the adjacent Syrian desert, where the genuine Arab is produced on any considerable scale.

Sailing Craft.—The Persian Gulf is by tradition the home of sailing craft, for their skill in handling which the Phoenicians afterwards became famous in the Mediterranean. There are some 14 types of native craft which belong to the Persian Gulf proper. The same principle of construction applies to nearly all; as a general rule these vessels are remarkable for the beauty of their lines. They sail well and are weatherly craft. The principal shipbuilding centres in the Persian Gulf are now Kuwait, Sur in Oman and Lingeh.

Fisheries.—Few seas are more prolific in fish than the Persian Gulf and the Gulf of Oman; the great proportion of known species are edible and many have a commercial value for the isinglass or oil

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extracted from them. Fish are extensively used for manure, especially in Muscat, where they are also fed to cattle without unpleasant results. Sharks are caught in enormous numbers with hook and harpoon; the flesh is considered by some to have aphrodisiacal properties; the dried fins and tails are exported to China; the oil is used for smearing boats. The turtle is also found, the carapace being exported as tortoiseshell, the animal being gently roasted or boiled alive over a slow fire to facilitate the separation of the shell from the flesh. The whale is often seen in the Gulf of Oman; porpoises and swordfishes are common.

Pearling Industry.—The pearling grounds of Bahrein are in over six fathoms of water, mostly beyond the three-mile limit. The geological formation of the bottom of the Persian Gulf and the temperature and shallowness of its waters appear to be favourable in a high degree to the growth of the pearl oyster. The pearl banks which are known and actually worked occupy a very considerable proportion of the whole area of the Gulf, chiefly upon the Arabian side. The pearl banks on the Persian side are found chiefly on the coast between Lingeh and Tahiri, and again in the neighbourhood of Kharag Island. The largest and most productive of all the banks are situated on the Arabian side of the Gulf and are fished annually; the banks of the Persian coast are poor as well as small and are fished at infrequent intervals. The total value of pearls exported was estimated in 1905 at about £1,500,000, the value at current prices of the 1919 outturn was probably about £2,500,000. Mother-of-pearl was exported before the World War to the value of £20,000; after the war high freights and absence of demand from Hamburg, the principal market, killed the trade for the time being. Some 4,500 boats employing some 75,000 men are employed in the pearling industry during the season, which lasts for almost three months, and can do little else but fish for the rest of the year.

Commerce.—A summary of import and export values of trade in the Persian Gulf, excluding Mohammerah and Basra, is appended. It is, however, not possible to make reliable deductions from these figures taken by themselves. The normal value, for example, of the post-war exports of Bahrein should be more nearly £3,000,000 than £1,000,000, owing to the enhanced value in terms of money of pearls, and the export trade of Bandar 'Abbas should likewise be more in a normal post-war than in a pre-war year. Of the total imports from 1912–3, one-half come direct from India and a quarter from the United Kingdom direct, the balance from foreign countries, European and Asiatic, in about equal proportions. For the latest post-war statistics up to 1921 the proportions were respectively two-thirds, one-sixth and one-sixth, owing primarily to the almost complete cessation of direct shipments from Europe to the Persian Gulf.

Mail Communications.—The Persian Gulf was at the end of the 18th century the most rapid route between Europe and India, and it was not until 1833 that the Red Sea route was adopted by the East India Co.; from this date until 1862 the Gulf fell into an extraordinary state of inaccessibility—letters for India being sent from Bagdad and Basra via Damascus, and correspondence from Bushire for Bagdad via Teheran. In 1862 the British India Steam Navigation Co. undertook their first mail contract for the Persian Gulf, and simultaneously the Euphrates-Tigris Steam Navigation Co. agreed to run a subsidized line of mail steamers from Basra to Bagdad.

The British India Co. maintain weekly and fortnightly services between Basra and the Persian Gulf. The fast weekly steamer stops only at Karachi, Bushire and Mohammerah on its way to Basra. The slow mail steamers stop at every port in the Gulf, either on the upward or the downward voyage.

Posts.—The reopening in 1862 of direct communications between India and the Persian Gulf gave rise to a demand for properly organized post-offices, and the Indian Postal Department accordingly opened branches in 1864 at Muscat and Bushire. Every port of importance on both sides of the Persian Gulf has an Indian post-office transacting all classes of business.

The existence of these offices on Persian soil has occasionally been the subject of complaint by the Persian Government. The justification for their continued existence has been found in the climatic conditions of the Gulf, which make it difficult for the Persian Government to staff their own offices adequately, and in the fact that the rupee is the only currency common to all ports of the Gulf and to India, while the trade of these ports is mainly with India.

Telegraphs.—The inception of the Persian Gulf telegraphs, which formed the first links in an intercontinental chain, was dictated not by local interests, but by broad considerations of national advantage. The Crimean War of 1856 brought home to the Porte the slowness of communication between the Persian Gulf and the outlying provinces of the Turkish Empire, while the Mutiny of 1857 taught the British Government a similar lesson in regard to India. In 1857, after some unfruitful preliminary attempts, the Turkish Government agreed to the construction of a line from Scutari to Bagdad on their behalf; this was finished in 1861 and was extended to Fao by 1864, after further lengthy negotiations, when it was linked up with the cable from Karachi which had been laid meanwhile. The route of the cables has been several times altered. They now run from Karachi to Jask, whence a cable runs to Muscat; from Jask one cable runs to Hanjam, and thence to Bushire; another cable runs direct to Bushire. Hanjam is connected by cable with Bandar 'Abbas. A double cable connects Bushire with Fao. Bushire, Hanjam, Bahrein, Abadan and Basra

Summary showing Import and Export Values of Trade in the Persian Gulf (excluding Iraq and Arabistan) in two pre-war years and in the latest post-war year available.

	Imports			Exports			Total
Arab Side	1912–3	1913–4	Post-War Year	1912–3	1913–4	Post-War Year	Post-War Year
Kuwait	£438,298	£370,817	£1,061,300	£132,260	£114,421	£276,092	£1,337,392
Bahrein Is.	2,239,527	1,877,630	1,414,423	2,295,136	1,740,008	946,344	2,360,767
Muscat	463,551	407,768	289,964*	301,477	271,536	242,188*	532,152
Total	£3,141,376	£2,656,215	£2,765,687	£2,728,873	£2,125,965	£1,464,624	£4,230,311
Persian Side							
Bushire	£951,720	£825,767	£2,723,357	£637,091	£601,765	£917,655	£3,641,012
Bandar 'Abbas	314,877	459,000	997,610†	283,942	266,700	279,945	1,277,555
Lingeh	164,325	180,120	159,283	193,895	126,381	99,858	259,141
Total	£1,430,922	£1,464,887	£3,880,250	£1,114,928	£994,846	£1,297,458	£5,177,708
Grand Total	£4,572,298	£4,121,102	£6,645,937	£3,843,801	£3,120,811	£2,546,264	£9,408,019

* 1918–9 in the case of Muscat, 1919–20 in other cases.
† Reckoning 55 Krans to the £.

Banks.—The Imperial Bank of Persia, in addition to branches all over Persia, has branches at Bushire, Bandar 'Abbas and Mohammerah. The Eastern Bank has a branch at Bahrein.

Currency.—Persian currency alone is legal in Persia, but the rupee is freely current in Persian ports. On the Arab coast the rupee is legal tender, and is almost exclusively used for commercial transactions, but the Maria Teresa dollar circulates freely, and is preferred by the inhabitants of the interior of Arabia. Persian currency is also in use, principally in Bahrein.

Lights and Buoys.—In view of the difficulties attending navigation in the Gulf, and the impossibility of arranging with the Governments of the littoral for the provision of lights and buoys except on terms which would have greatly hampered shipping, the British Government, in view of the great preponderance of British shipping in the Gulf, has established since 1912 a very complete system of lights and buoys, the cost of which is shared in equal moieties by the Government of India and H.M. Government in accordance with the recommendations of the Welby Commission. Lighthouses exist on one of the Quwain group of islands off Ras Musandam and on Tunb I.; light-buoys have been placed at Bushire in the outer and inner anchorages, at Bahrein and on the Shatt al 'Arab bar. Shore lights and unlighted buoys have also been provided where necessary. There is a lightship in the Shatt al 'Arab bar, which is very completely buoyed and lighted throughout its length from the lightship to Fao, where there is a fixed light.

are provided with wireless stations. Kuwait is connected by land line with Basra; Jask is connected by a land line to Karachi. Mohammerah is connected by land line and cable with Basra and Abadan and via Ahwaz with Bushire and with the inland Persian system. Bushire has its own telephone system; Mohammerah is connected by telephone with Basra. The whole system is under the control of the Indo-European Telegraph Department, whose director-in-chief is responsible to the Secretary of State for India. The Department, which also controls the principal international lines in Persia, is amply self-supporting.

Population and Religions.—In all the countries of the Persian Gulf, Islam in one or another of its forms prevails, almost to the exclusion of other religions. The Mahommedans of the Persian Gulf region belong to the following denominations:—Sunni, Shiah, Ibadhi, Wahabi and Khojah. The Wahabis may be regarded as a branch of the Sunnis and the Khojahs as a branch of the Shiahs. Shiahs predominate on the Persian coast except in the districts of Rud Hilleh, Shibkuh, Lingeh, Bastak, Biyaban, Jask, and on the islands of the Persian Gulf. The Persian province of S. Arabistan, which is under the hereditary government of the Sheikh of Mohammerah, is exclusively Shiah. The Sunnis are estimated at 100,000 out of a total population in the maritime districts of 300,000.

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Persian Makran is exclusively Sunni except for the district of Jask. At Gwadar, Sunni, Khojah and Ibadhi rub shoulders. The Oman sultanate is predominately Ibadhi. In the territory controlled by the Emir of Nejd the official religion is Wahabi, but a few Shiahs are still to be found in the districts of El Hasa and Hofuf. Bahrein is Sunni, but has a large Shiah population of Persian origin. Kuwait is Sunni, with Wahabi leanings.

The Khojahs number some 2,000 souls and are distributed over the ports of the Gulf, mainly on the Arab side. They are descended from Hindus of Sind and Kach, who were converted from Hinduism to the Isma'ili form of the Shiah faith in the 15th century of the Christian era.

Hindus total about 1,500 and are to be found in all the principal ports of the Gulf, especially at Gwadar, where their presence gives rise to occasional fanatical disturbances. Panislamic ideas have obtained little hold in this region; in Persia and wherever people are Shiahs the pretensions of the Sultan of Turkey to the headship of the Mahommedan world are rejected, as also in Oman, where the bulk of the population are Ibadhi.

Missions.—Roman Catholic missions have at intervals worked in the Persian Gulf, on the Persian side since the beginning of the 17th century; they are still represented at Bushire. The first Protestant mission to the Gulf was initiated by Henry Martyn in 1811; his Arabic New Testament appeared in 1816. The American Arabian mission was founded in 1889 in the United States; the first agents of the mission were the Rev. J. Cantine and the Rev. S. Zwemer, who established a branch at Bahrein in 1892 and later at Muscat. Political complications arising out of the work of the Arabian mission have been singularly few, a happy circumstance which must be attributed chiefly to the missionaries themselves, whose general opinion is that for a Mahommedan country the Persian Gulf and eastern Arabia are peculiarly free from religious fanaticism.

Historical.—The Persian Gulf has figured in history from the earliest times. A myth (preserved by Berosus) records that Oannes (Hea) the fish-god came up from that part of the Erythraean Sea which borders on Babylonia, to teach the inhabitants of that country letters and sciences and arts of every kind. This seems to indicate the arrival, in ships, of strangers of a higher grade of civilization. These strangers may have come from China, but Sir H. Rawlinson considers they were a dark race not belonging to the Semitic family. Rawlinson also suggests that the Phoenicians may have originally come from the Bahrein Is. and extended westwards to the settlements on the Mediterranean at least 5,000 years ago. Though there is no direct evidence of this connexion, enormous numbers of tumuli, probably of Phoenician origin, exist on the Bahrein Is., which also contain tumuli of Babylonian age. Babylonian tumuli have also been found at Bushire. Col. Yule, from Chinese annals of the 7th and 8th centuries, says that Chinese ships came as far as Siraf (Tahiri) and the Euphrates, where they lay at Hira near Kufa, and adds that this trade fell off in A.D. 878 owing to civil war in China. From the records of Fa-Hian of the 4th century it is clear that ships from China exchanged merchandise with Arab vessels at Ceylon, and this is confirmed by the account of Cosmas, who wrote between 530 and 550 A.D. Along the shores of the Persian Gulf in 326 A.D. came Nearchus, the admiral of Alexander, on his way from the Indies to the Tigris delta; from Basra sailed Sindbad in the 9th century in one of the many Arab craft which traded thence to India, Ceylon and Zanzibar. Thousands of years before Christ the pearls of Bahrein were sold in Egypt; Bahrein still supplies 80% of the world's output of pearls. After the Phoenicians, Babylonians, and Arabs came the Persians; though they never aspired to command of the seas and are indeed not a maritime race, the Persian Gulf was no obstacle to them, and at one time or another they occupied Muscat and parts of Oman and Bahrein, and penetrated into the greater part of Arabia.

Commerce between East and West had from early times followed this route in preference to that of the Red Sea, and when during the 15th century Genoa and Venice successively lost their positions in Oriental commerce, through the capture of Constantinople by the Turks and by the hostility of the Mamelukes of Egypt respectively, the country which most earnestly devoted itself to the quest of a new way to India was Portugal. Albuquerque seized several towns on the coast of Oman, including Muscat in 1507, and soon afterwards established his authority on the I. of Ormuz, at the N. of the Gulf. Towards the end of the 16th century the Dutch made their appearance in Indian waters as rivals of the Portuguese; and in 1616 the first British "factories" of the East India Co. were established on the Persian coast. In 1622 the Portuguese were expelled from Ormuz by joint efforts of the British by sea and of the Persians by land; in 1650 they finally left Muscat. In 1664 the French made their appearance on the scene, but did little trade. It is, however, of interest to note that in 1698, in consequence of a nominal agreement, from which nothing resulted, among the principal Europeans in the East, the French undertook the policing of the Persian Gulf against pirates. The Dutch, who had played no part in expelling the Portuguese, now became increasingly predominant, and the wars that were waged in Europe between England and Holland had their counterpart in the Persian Gulf.

In 1674 hostility between Holland and England ceased, but the position was radically unsatisfactory owing to the prevalence of piracy, from which both England and other nations suffered heavily. At the beginning of the 18th century the improved state of affairs in India began to have an effect on the Company's branches in the Persian Gulf and by the middle of the 18th century the Dutch settlements had disappeared.

Henceforward the bulk of the trade was in British hands, but piracy was rife, the slave trade flourished, and the coast towns and islands of the Persian Gulf had fallen from their ancient prosperity to a lower level than they had experienced for some centuries. To restore this prosperity had for about a century before 1921 been the secular mission of Great Britain in these lands, the British resident in the Persian Gulf, acting as the representative of the Government of India, being the umpire to whom by long custom all parties on both coasts appealed and who had by treaties been entrusted with the duty of preserving peace.

Students of international politics are familiar with the claims of nations to a position of preference in certain regions, based upon historic, economic or geographical considerations. The claims of Great Britain to such a position in this region are unique. But beyond two brief occupations of the I. of Kharag, and the continuous possession of a few square miles of desert land at Basidu, the S.W. end of the I. of Qishm, she has at no time acquired territory in that region, although she has for generations borne an honourable burden there which no other nation has ever undertaken anywhere, except in the capacity of sovereign. British influence kept the peace amongst peoples who were not subjects of the King-Emperor; Great Britain lighted, buoyed, charted and patrolled for over a century waters over which it claimed no formal lordship; and kept in strange ports an open door, through which traders of every nation might have equally free access to distant markets. On the other hand, a steady and increasing market was gained for the products of the British Empire, and in particular for those of India; the ports of the Gulf were made safe, not so much for the British as for the Indian trader; nearly 75% of the trade of the Gulf ports was in 1921 with India, and an even greater proportion in the hands of Indians, Persians and Arabs. A good market had been created for Indian products, particularly yarns and cereals. But more than this, Great Britain had gained a reputation for patient and persevering efforts to promote the spread of civilization in these regions, a prestige which yielded profit during the difficult years of the World War, and was not without its effect in India. With the exception of local disturbances of old standing at Muscat, and at Bushire (where they were fomented by German gold), the Arab and Persian population of both shores maintained a friendly attitude to Great Britain throughout the war, although British gunboats were seldom, if ever, seen at that time in waters which in peace they had regularly patrolled.

The peculiar interests, strategic, political and commercial, of Great Britain in the Persian Gulf have never been denied; they are intimately connected with the welfare of India, with the security of its communication with the outside world, and of its internal tranquillity. The considered policy of the British Government was embodied in 1903 in Lord Lansdowne's declaration in the House of Lords that "we should regard the establishment of

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a naval base or a fortified port in the Persian Gulf by any other Power as a very grave menace to British interests, and we should certainly resist it by all the means at our disposal." This declaration was formally reaffirmed in 1907 by Sir E. Grey, in a despatch to the British ambassador at St. Petersburg, which further stated that "H.M. Government will continue to direct all their efforts to the observance of the *status quo* in the Gulf, and the maintenance of British trade; in doing so they have no desire to exclude the legitimate trade of any other Power." These declarations were never openly challenged, and in 1912–4 the British Government entered into far-reaching negotiations with the Turkish and German Governments with the object of regularizing the position. The resulting agreements had not, however, been ratified before the declaration of war in 1914.

The Arms Traffic.—During the 3rd Afghan War the trade in modern arms and ammunition in the Persian Gulf attracted the attention of the British and Indian Governments for the first time. In 1880 the Government of India took preliminary steps in the matter within its own borders; in 1881 the importation of arms and ammunition into Persia was made illegal, but with little effect. In Far Eastern countries firearms are widely possessed and used. In 1890 the General Act of the Brussels Conference struck a blow at the arms trade in Africa and diverted it to the Persian Gulf, which was not subject to the Brussels Act.

The stream of arms flowing from Zanzibar to Muscat continued to increase in volume, and in 1892 no less than 11,500 firearms were landed at Muscat, of which more than half were at once reëxported. The figure was doubled by 1895 and trebled in 1897; in spite of prohibitions, imports into Persia continued on a large scale. Moved at last by the great quantity of military material that was being found in the Gulf, the British Government urged the Persian Government to enforce the actual law and to confiscate the stores of arms which had accumulated at Bushire. The Persian Government, thoroughly alarmed, took action, but with only temporary effect. Somewhat similar action was taken at Bahrein. These seizures created much indignation and anxiety among firms in England whose interests were involved.

From 1898 to 1908 the attitude of the British Government towards the question was one of regular attention without the power to intervene directly or effectually. In 1900 the consignment of arms and ammunition to the Persian Gulf through Indian ports with or without transhipment was made illegal. This was reinforced by an Act of Parliament empowering the sovereign to prohibit by proclamation the export of arms and ammunition from the United Kingdom to countries or places where they might be employed against British troops and subjects.

The trade, blocked at Persian ports and later at all Gulf ports except Muscat, continued to flourish, in spite of a naval blockade of the Makran coast by Great Britain in 1910–1. At length, however, in 1912 the Sultan of Muscat issued a proclamation requiring all arms imported into Muscat to be placed in a special warehouse from which they could not be removed except on production of an import permit from the competent authority at their destination. This killed the trade at Muscat; the French Government, who had claimed that the Sultan's proclamation was inconsistent with his treaty engagements with them, accepted the accomplished fact with good grace after lengthy diplomatic negotiations, and the trade was by 1913 almost dead, except at the N. end of the Gulf, where it still flourished on a small scale. The arms traffic has been responsible for much of the prevailing anarchy of the Middle East and indeed of Arabia. The possession of firearms places irresistible temptations in the path of unsophisticated and quick-tempered tribesmen. For this result the European Powers signatories of the Brussels Act of 1892 are to blame for lack of foresight and to some extent of goodwill. Joint Anglo-French action at any time during 1902–12 would probably have been effective in stopping the traffic.

Slave Trade.—On board the fleet which in 1626 conveyed Sir Dodmore Cotton, a British ambassador, with his staff, from Surat to Bandar 'Abbas, there were more than 300 slaves bought of Persians in India, and the only remark which this circumstance suggested to Sir T. Herbert was that "ships, besides the transporting of richer varieties from place to place, consociate the most remote regions of the earth by participation of commodities and other excellencies to each other." In 1772 it was decided by the English courts that a slave as soon as he set foot on the soil of the British Isles became free; the slave trade, however, continued actively until 1807, when an Act was passed to prevent British subjects dealing in slaves; in 1811 the traffic in slaves was declared to be felony; in 1833 the status of slavery was abolished throughout the British Dominions. In defiance of her commercial interests and of her popularity with the Moslem population of the Gulf, Great Britain set herself to suppress the trade, and executed a series of agreements with the chiefs of the Arabian littoral with this object. The arduous task of enforcing the observance of these treaties fell upon the Government of India and involved great sacrifice of lives and money.

In subsequent years over 700 slaves were rescued at sea and more than 2,000 otherwise released; the traffic was by 1920 virtually dead in the Gulf, but slavery as an institution seemed likely to continue for many decades to come to flourish inland in Muscat, in Central Arabia, and in a modified form in part of Persia.

AUTHORITIES.—The chief source of information is the late J. G. Lorimer's *Gazetteer of the Persian Gulf*, published confidentially by the Government of India in 1908. See also Lord Curzon's *Persia* (1892); papers by T. J. Bennett, of *The Times of India* (Royal Society of Arts, 1902), and the late Comm. A. W. Stiffe, Indian Navy (*Jour. R.G.S.* 1897); and handbooks prepared during the war of 1914–8 under the direction of the Historical Section of the Foreign Office. (A. T. W.)

PERTAB (or **PARTAB**) **SINGH,** SIR (1844–), Indian soldier and statesman (*see* 21.259), relinquished his position as Maharaja of Idar in 1911 in favour of his adopted son Daolat Singh, in order to resume the regency of Jodhpur which he had previously held on the death of his brother in 1895, but this time for his grand-nephew Summair Singh, then 13 years of age. When the World War broke out Sir Pertab, in the words of Lord Hardinge the Viceroy, "would not be denied his right to serve the King-Emperor in spite of his 70 years." He came to France for service in the field with his young ward, then only 16, and commanded the famous Jodhpur Lancers. In the later stages of the war he served with them in Egypt and Palestine. Sir Summair Singh died in 1918, two years after receiving ruling powers, and Sir Pertab again became regent, assisted by a council.

PERU (*see* 21.264).—No accurate statistics for the pop. of Peru exist, but probably there are between 3,500,000 and 4,000,000 inhabitants besides the savage tribes, still partly independent, who inhabit the remoter *montaña* or eastern forest region. The racial proportions are approximately:—

Negroes, pure-blooded or predominantly African	6%
Various (including Asiatics, African-Indian mixture, etc.)	10%
Indians, pure-blooded or nearly so	52%
Mestizos (mixed Indian and white blood)	30%
Whites (entirely of Caucasian blood)	2%

The *negroes* are either descendants of slaves of colonial times or, in fewer cases, people who have drifted in during recent years from the Barbados, Trinidad, Panama, etc. Though the negroes of colonial times were notorious for their brawls and riots, those of to-day seem to be reasonably law-abiding. They are addicted to many vicious practices which are gradually causing the population of Lima and other coast cities to decrease in physical strength and intelligence. Most of the negroes live on the coast. The *Indians* fall into two groups: those who dwell in the highlands or *sierra* in the interior and still preserve their ancient language and customs, and those who live on the coast and speak Spanish, dressing more or less after the European fashion and observing but few customs that can be called pre-Spanish. The lot of the highland Indians is, in many districts, very bad. This is due to three chief causes: the abuse meted out by the great landed proprietors ever since the conquest (1531) and continued with some abatement to the present day; the use of far too much alcohol and coca; the lack of even rudiments of public or personal hygiene. There is much evidence, however, that the lot of the Indians will improve within a generation or two. The younger generation of the land-holding class are beginning to see that it will be to their advantage to improve the material and social condition of the Indians on their estates; there is an increasing agitation in favour of suppressing the sale of sugar-brandy and other harmful liquors to the Indians and of regulating the consumption of coca; at the present time the Peruvian Government is beginning to take serious measures for the sanitation of the country. The *mestizos* compose the middle class, the artisans, small shopkeepers, clerks,

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petty politicians, etc. They tend to congregate in the cities. They are mostly unintelligent, though a small percentage of them enjoy an improved social status, won usually by the exercise of an intellectual calling, the law, medicine or literature. The *whites*, though few in number, were, until the revolution of July 1919, the dominant class in Peru. They owned most of the land and controlled all the more important political posts. For the most part they are thoroughly modern-minded and progressive people, intellectual and agreeable. It is to be regretted that few of the older generation recognized their responsibilities with regard to their Indian tenantry, but the younger men, according to observations in 1921, were beginning to take an interest in sociological problems.

Since 1890 all the Government railways then in existence, and additions to them made later, have been administered by the Peruvian Corporation, chiefly owned by foreign investors, which took over the railways and a number of other national resources. In 1920 the railways administered by the Peruvian Corporation were the following:—

	Length (miles)	Gauge (meters)
Central railway	248	1·44
Pisco to Ica railway	46	1·44
Southern railway	535	1·44
Pacasmayo railway	82	1·44
Paita to Piura railway	60	1·44
Chimbote railway	35	·91
Trujillo railway	64	·91
North-western railway	132	·91
Lima-Lurin railway	22	·91

Besides these important lines there are a number of others neither owned by the Government nor administered by the Peruvian Corporation. Chief of these are the Cerro de Pasco railway from Oroya to Cerro de Pasco and a few local lines in various coast valleys.

In the 10 years, 1910–20, a certain amount of road-building was done. In many parts of the coast comparatively little has to be done to make the surface of the desert a good road-bed for motor traffic. During the rubber boom of the previous decade there was a considerable development, in the forest region, of river traffic. But since 1910 that has slowly been diminishing, and in 1920 the Peruvian reaches of the Amazon were served by but one steamer which made one round trip per month.

Coastwise traffic by steamers is well organized and efficient. Two companies, one British and the other American, maintain direct sailings from New York to Callao, through the Panama Canal, the run being made in 12 days. There is also good direct service with England, the Mediterranean and Japan. The smaller ports of the Peruvian coast are served by the steamers of the Peruvian line, the Chilean line, the British line and a number of less important steamers. A direct service for freight only was in Feb. 1921 about to be inaugurated between the Peruvian coast and California. The telegraphs, wireless included, were in 1921 owned and administered by the Government. Experiments were then being made with the wireless telephone, also under Government. Two privately owned cable companies give coast and foreign service.

Industries and Commerce.—The chief exports of Peru are sugar, cotton and copper. There should be many other articles. Petroleum is already produced in considerable quantities, but Peru could attain a production of vegetable oil fully as important. Castor oil, linseed oil, cottonseed oil and rapeseed oil are a few of the possibilities. Meats, hides and wool could easily be exported on a large scale. Lumber, in the lower or easterly parts of the country, might well be made to take the place of the lost rubber trade. Peru suffers from the unimaginative ultra-conservatism of her landowning class and of her business men. The fundamental need is capital, and the only people in the country who have sufficient initiative to undertake these developments lack capital. Vanadium mining has been undertaken with unusual energy, and it is said that Peru to-day produces 95% of the world's vanadium.

Imports and Exports.
(In Peruvian pounds, equal to £ sterling.)

	Imports	Exports	Excess of Exports
1910	4,980,697	7,974,076	2,093,379
1911	5,438,245	7,422,027	1,983,782
1912	5,140,338	9,438,581	4,298,243
1913	6,088,776	9,137,780	3,049,003
1914	4,827,930	8,767,790	3,939,860
1915	3,095,544	11,521,807	8,426,263
1916	8,683,150	16,541,063	7,857,913
1917	13,502,851	18,643,414	5,140,563
1918	9,705,113	19,972,595	10,267,482

The effect of the World War upon Peruvian trade with Great Britain and the United States is displayed by the following table (in Peruvian pounds equal to £ sterling):—

	Imports from G.B.	Imports from U.S.	Exports to G.B.	Exports to U.S.
1912	1,367,976	1,248,880	3,237,564	3,599,851
1913	1,598,605	1,755,251	3,403,109	3,033,259
1914	1,338,552	1,570,723	3,274,097	3,046,892
1915	662,546	1,488,264	3,621,624	6,390,282
1916	1,496,304	5,116,582	2,961,841	10,404,334
1917	1,934,665	8,792,710	3,792,750	10,942,407

Government.—The Government of Peru is one of the most highly centralized in the world. Every question has to be decided in Lima, by the supreme Government, and often by the president in person. Directly or indirectly the president appoints all the prefects, sub-prefects and governors who administer the provincial subdivisions of the country. All of these officers are removable at his will. The Legislature (Chamber of Deputies and Senate) controls the purse-strings of the nation and acts as a check on executive extravagances.

From 1860 to 1919 the supreme law of the land was the Constitution of 1860. That constitution embodied all the leading principles of the extreme centralization already referred to. There was, however, a pronounced movement toward "regionalism" in the southern departments between 1910 and 1919. That movement aimed not only at liberalizing the administrative machinery, but also at a systematic improvement of the condition of the Indians.

In Jan. 1920 President Leguía's Government brought into being the Constitution of 1919, prepared chiefly by Senator Mariano H. Cornejo and Don Germán Leguía y Martinez. That constitution makes concessions to the demand for regionalism by creating "Regional Congresses," three in number, one for the north, one for the centre and one for the south.

History.—From 1908 to 1912 was the first term of Augusto B. Leguía y Salcedo as president of Peru. A number of internal reforms and improvements were planned by him, but the collapse of the rubber market caused great financial stringency and had the indirect result of curtailing the Government's reforming activities. It was during this first term of Leguía that the Yale Peruvian expedition, headed by Prof. Hiram Bingham of Yale, conducted extensive geographical and archaeological explorations in Peru. The results were published and did much to direct the attention of foreign capitalists and others to Peru. Other Yale expeditions continued their work in Peru until 1915 when, as a result of misunderstandings, Prof. Bingham and his followers were ordered out of the country. Between 1912 and 1915 Guillermo Billinghurst and Oscar Benavides were presidents, each for a short term of revolutionary character. During this period there were diplomatic conflicts between Peru and Bolivia and Peru and Ecuador, neither of them going so far as to become military in character.

The outbreak of the World War in Aug. 1914 found Peru in an exceedingly bad state financially and economically. Until well into 1915 financial depression of the most acute kind continued. But about the middle of 1915 a great demand for Peruvian cotton, sugar, copper and other products came into being, with the result that exportations, at war prices, attained proportions never known before.

From July 1915 to July 1919 José Pardo y Barreda was President. In his time came the question which side was to be favoured by Peru in the World War. The then ruling class was inclined, at first, to be pro-German, partly because they were not fond of England (due to conflicts with the Peruvian Corporation), partly because they did not like the "democratic" atmosphere of President Wilson's various documents, and also partly because they had personal, financial and sentimental ties with Germany. On the other hand, many members of that class and the mass of the thinking element of Peru as a whole were strongly in favour of the Allies. Consequently, soon after the declaration of war by the United States in 1917, the Government of Peru severed diplomatic relations with Germany.

On July 4 1919 Don Augusto B. Leguía, who had been elected president to succeed Don José Pardo y Barreda (president 1915–9), seized the person of President Pardo by means of a re-

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volutionary movement and himself became provisional President, being again duly reëlected to the presidency some time after. This movement caused profound consternation in Peru, where people were beginning to assure themselves that the day of revolutions was over. Leguía inaugurated an ambitious scheme of internal reform, including the sanitation of 31 Peruvian cities, the reorganization of the army by a French Military Commission, the reorganization of the navy by an American Naval Commission, the reconstruction of the educational system by American experts, and huge irrigation works built under the direction of an American engineer, C. W. Sutton.

The most important reforms brought about by the Government of President Leguía were those calculated to modernize the country. President Pardo had inaugurated the practice of calling in foreign expert advice by inviting to Peru Dr. Henry Hanson, of the department of public health of the Panama Canal zone. Dr. Hanson was first invited to study the malarial fevers in the vicinity of Lima, but in July 1919 a serious yellow-fever epidemic broke out in Piura, the northernmost coast department of Peru, and he was sent thither with full authority to stamp it out. He continued in Peru as director of sanitation, and his work was much widened so as to include the general sanitation of Callao and the stamping-out of a bad epidemic of yellow fever which broke out in the department of Lambayeque in Jan. 1921. The late Gen. William Gorgas was also invited to Peru in 1919 in order to supervise extensive projected improvements to be carried out by the Foundation Company of New York. Those improvements were to include the resewering of Lima, the repaving of many chief streets of Lima and the sanitation of 31 Peruvian cities. There was much opposition to the contract made between the Peruvian Government and the Foundation Company—Congress, for example, being largely of the opinion that the contract was derogatory to the dignity and probity of Peru. This, together with the death of Gen. Gorgas, practically nullified the projected improvements.

A French Military Aviation Commission, headed by Gen. Vassal, came to Peru soon after President Leguía assumed office. It was intended to instruct officers of the Peruvian army in the use of various types of aeroplanes, and a school was founded at Maranga, near Lima. Proper financial support was not forthcoming, however, and in the middle of Feb. 1921 the French mission resigned, complaining that the situation in which they found themselves was intolerable. An American Naval Commission, headed by Capt. Frank B. Freyer, U.S.N., was called to Peru in July 1920 for the purpose of reorganizing the sea forces of Peru. In Jan. 1921 Capt. Freyer was made chief of staff with powers practically equal to those of the minister of marine.

Educational improvements under the general supervision of the minister of justice and instruction were undertaken. A large number of American educational experts, under the leadership of Dr. H. Erwin Bard, went to Peru, and Dr. Bard was made director-general of instruction (1921). The National Museum of Archaeology, likewise dependent upon the minister of justice and instruction, was also placed under an American expert from the Smithsonian Institution. (P. A. Me.)

PÉTAIN, HENRI PHILIPPE BENONI OMER JOSEPH (1856–), French soldier, was born on May 24 1856. He was commissioned from St. Cyr 1878, passed in due course through the École de Guerre, filled various staff appointments, including that of instructor at the École de Guerre, and was promoted colonel in 1910. At the outbreak of the World War he was commanding an infantry regiment, but he was immediately given a brigade and then a division, and he acquitted himself so well during the opening weeks of the struggle that he was advanced to the command of an army corps in Artois in Oct. 1914. He greatly distinguished himself on the occasion of the French offensive near Arras in May 1915, where his corps completely broke through the German position, though exploitation proved to be impossible for want of reserves. Soon afterwards he was given command of the II. Army. When preparations were being made in the summer for the contemplated offensive in Champagne, he was called upon to aid Gen. Castelnau in framing the plans and in carrying them out. Then, when the Germans in the following Feb. were gaining ground very rapidly before Verdun and the safety of the place of arms hung in the balance, Castelnau was sent to stabilize the defence. A few days later, having provided for the indispensable, Castelnau handed over control of affairs to Pétain, who took the battle in hand with method and energy, fought the attack to a standstill and saved Verdun. He was rewarded by being made a Grand Officer of the Legion of Honour and was placed in command of the group of armies of the Centre.

During the following winter Gen. Nivelle succeeded Gen. Joffre as commander-in-chief. Pétain's group of armies was not embraced in Nivelle's offensive scheme, but it was known that he was thoroughly doubtful of its success, and after its failure Pétain was appointed, first on April 27 chief of the general staff of the army, and then on May 15 commander-in-chief of the French armies on the western front. This position he took up at a moment when his troops were discouraged and mutinies were breaking out owing to severe losses, disillusionment following on over-sanguine hopes, and war-weariness, when the effects of the Russian revolution and those of America's intervention were alike difficult to discern, and when his own country was losing heart. He saw clearly that, in view of the wastage in man-power caused by three years of devastating war, an offensive project on a great scale, such as his predecessor had adventured, was impossible for the time being, and he therefore resolved first to nurse back the army to a healthy state of *moral* and then to restore its offensive powers by one or two battles with limited objectives in which victory was made certain by careful and abundant preparations. It was in accordance with this policy that he fought the Aug. battle at Verdun and that of Oct. on the Chemin des Dames, for which he was given the Grand Cross of the Legion of Honour. He established and maintained a close understanding with Sir D. Haig, and when the British V. Army was virtually rolled up near St. Quentin in March 1918, his promptitude in despatching reinforcements to the point of danger did much to relieve the critical situation. After Foch became generalissimo, portions of Pétain's forces played the leading part in the decisive counter-stroke near Soissons which first turned the scale, and during the subsequent victorious operations of the Allies, the French commander-in-chief was most successful in coördinating the advance of his forces at all points along a very extended front, maintaining his liaison with the British on the one flank and the Americans on the other, and in the case of the latter taking an active part in the preparation of their two offensives. He was created marshal of France on the conclusion of hostilities, in recognition of his brilliant services during the war, and he was the recipient of many high honours from the Allied Governments. He subsequently held the position of vice-president of the Conseil Supérieur de la Guerre.

PETERS, KARL (1856–1918), German traveller (*see* 21.300). In 1907–8 Peters, who had again taken up residence in Germany brought actions for libel against a Munich journal and the *Cologne Gazette*, seeking to clear his character in regard to his administration in E. Africa. These actions wrought no change in public opinion in Germany and Peters remained on the retired list. However, in April 1914, at the instance of the Imperial Colonial Office he was granted a pension. During the World War he supported the extreme pan-German programme. In Feb. 1918 he published an autobiography, and he died at Woltorf, Brunswick, on Sept. 10 of the same year. He had lived to see German E. Africa, which he founded, conquered by British and Belgian troops.

PETERSON, SIR WILLIAM (1856–1921), British educationalist, was born at Edinburgh May 29 1856, the son of John Peterson, a merchant. He was educated at Edinburgh high school and University, and after being for a short time at Göttingen, in 1876 obtained the Ferguson classical scholarship and entered Corpus Christi College, Oxford. On leaving Oxford he was at first an assistant master at Harrow, but in 1879 became assistant pro-

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fessor of classics at Edinburgh. In 1882 he was made first principal of the newly founded University College at Dundee, but in 1895 he was appointed principal and professor of classics at McGill University, Canada. During his 24 years' tenure of this important position the university greatly progressed, and the scientific faculties in particular advanced considerably. In 1915 he was made K.C.M.G. In 1919 he was incapacitated by a stroke, and resigned his position, and being taken to England died at Hampstead Jan. 4 1921.

Sir William Peterson was for some years chairman of the Carnegie foundation for the advancement of teaching in America. His published works include editions of Quintilian's *Institutes of Oratory* (1891); the *Dialogue on Orators* of Tacitus (1893 and 1914); the *Speech of Cicero for Cluentius* (1895 and 1899); the *Cluni MS.* of Cicero (1901) and Cicero's *Verrine Orations* (1907); besides *Canadian Essays and Addresses* (1915).

PETROLEUM (*see* 21.316*).—Under the stimulus of increased consumption and many new uses for petroleum products, the search for petroleum both in the older producing countries and in new territories, often remote from civilization, was rewarded by important extensions and discoveries and, in many instances, by subsequent development, with the result that between the years 1908 and 1920 the world's petroleum production more than doubled. The increase is shown in the following table from the U.S. Geological Survey:—

World's Production.

	Barrels of 42 U.S. Gal.		
1908	285,552,746	1915	427,740,129
1909	298,616,405	1916	459,411,737
1910	327,937,629	1917	508,687,302
1911	344,174,355	1918	514,729,354
1912	352,446,598	1919	544,885,000
1913	383,547,399	1920	694,854,000
1914	403,745,652		

In the period 1908–21 many prolific fields in the United States were developed, enabling that country to keep its preëminent position; Mexico grew from unimportance to second position; Argentina, Venezuela, Trinidad, Egypt and Persia developed production of commercial importance; Russia added the Maikop and Ural-Caspian fields, and Japan the Akita prefecture. In 1920 the United States produced 63·8% of the world's output, and up to the end of that year had produced 62·1% of the world's total commercial yield. The rank of the various petroleum-producing countries is shown in the table given below:—

North America

United States.—Petroleum production in the United States in 1920 totalled 443,402,000 barrels. The following table from the U.S. Geological Survey gives the production of the important divisions in 1920 and in 1908, stated in bar. of 42 U.S. gallons:—

	1920	1908
Appalachian	30,511,000	24,945,517
California	105,668,000	44,854,737
Lima-Indiana	3,059,000	10,032,305
Rocky Mountain	17,517,000	397,428
Illinois	10,772,000	33,686,238
Mid-Continent	249,074,000	48,823,747
Gulf	26,801,000	15,772,137
Others	—	15,246
Total	443,402,000	178,527,355

The Appalachian area extends across the Appalachian Plateaus from south-western New York to Tennessee. It includes Kentucky, W. Virginia, Pennsylvania, New York and eastern Ohio. Oil and gas sands occur throughout a long stratigraphic interval, including rocks ranging in age from Ordovician to Carboniferous. Petroleum from the Appalachian area is a high-grade paraffin oil, the average gravity being about 45° Baumé (0·8,000 sp.gr.). The average for Kentucky is not quite so high. The Appalachian district is the oldest oil-producing area in the United States (*see* 21.317), and while a gradual decrease in its production from 1912 was shown, high prices and great demand resulted in substantial increases in 1919 and 1920. That the rate of decline was so slow is due to the remarkable thrift of small producers who have found it profitable to operate leases where production is one-sixth of a barrel a day and sometimes even less. A factor which has tended to revive and increase production in certain Pennsylvania districts is the so-called "water drive," by which water pressure is put on the rock to supplement the exhausted gas pressure. An instance of the result of the water drive is shown by figures of an eastern pipe-line attached to nearly 18,000 wells in the Bradford and Allegheny pools; this line in 1909 ran 1,531,000 bar.; in 1913 1,267,000 bar., a decrease of over 17%; and in 1920 the amount had risen again to about 1,568,000 bar., showing an increase in eight years of 23·8 per cent.

The Lima-Indiana field covers north-western Ohio and north-eastern Indiana, the oil being obtained from lenses or discontinuous layers in Trenton limestone. The average gravity is about 39° Baumé (0·8,285 sp.gr.), although some of the oil is much heavier. The Lima-Indiana field is steadily declining.

The principal productive area in the Illinois field is in the south-eastern part of the state, but there are also small scattered pools in central and western Illinois. Most of the oil is obtained from beds of sandstone in the Pennsylvania and Mississippian series of the Carboniferous system. In gravity the oils range from 27° to 37° Baumé (0·8,917 to 0·8,383 sp.gr.). This field is also declining.

In the period between 1908 and 1921, the greatest increases in production in the United States occurred in the mid-continent field, embracing Oklahoma, Kansas, northern and central Texas, northern Louisiana and southern Arkansas. In 1920 the mid-continent field

United States Geological Survey—World Production of Petroleum.

Country	Production, 1920				Total production, 1857–1920				
	Barrels of 42 U.S. gal.	Metric tons	Cubic meters	Per cent of total by volume	Date of First Production	Barrels of 42 U.S. gal.	Metric tons	Cubic meters	Per cent of total by volume
United States	443,402,000	62,188,000	70,492,000	63·8	1859	5,429,693,000	729,640,000	863,213,000	62·1
Mexico	163,540,000	24,410,000	26,000,000	23·5	1901	536,524,000	80,047,000	85,287,000	6·1
Russia	25,429,600	3,471,130	4,042,800	3·6	1863	1,904,021,000	252,072,000	302,701,000	21·8
Dutch East Indies	17,529,210	2,365,347	2,786,840	2·5	1893	219,584,000	29,690,000	34,910,000	2·5
Persia	12,352,655	1,685,219	1,963,825	1·8	1908	48,070,000	6,558,000	7,642,000	·5
India	7,500,000	1,000,000	1,192,000	1·1	1889	122,583,000	16,343,000	19,488,000	1·4
Rumania	7,435,344	1,034,123	1,182,110	1·1	1859	165,462,000	23,013,000	26,305,000	1·9
Poland (Galicia)	5,606,116	764,818	891,260	·8	1874	171,263,000	23,700,000	27,228,000	2·0
Peru	2,816,649	373,280	447,797	·4	1896	29,797,000	3,968,000	4,737,000	
Japan and Formosa	2,139,777	285,076	340,180	·3	1875	42,810,000	5,708,000	6,806,000	
Trinidad	2,083,027	289,712	331,160	·3	1908	11,356,000	1,580,000	1,805,000	
Argentina	1,665,989	242,502	264,859	·2	1911	7,225,000	1,043,000	1,149,000	
Egypt	1,042,000	152,120	165,660	·2	1907	6,990,000	1,017,000	1,111,000	
British Borneo (Sarawak)	1,015,949	146,285	161,516	·2		4,052,000	584,000	644,000	
Venezuela	456,996	69,539	72,653		1913	1,335,000	203,000	212,000	1·7
France (Alsace)	388,700	54,900	61,800		1880	723,000	102,000	115,000	
Germany	212,046	29,950	33,711		1880	17,120,000	2,318,000	2,722,000	
Canada	196,937	26,258	31,310	·2	1862	24,864,000	3,315,000	3,953,000	
Italy	34,180	4,750	5,434		1860	1,042,000	148,000	166,000	
Algeria	3,916	609	623		1915	37,000	6,000	6,000	
England	2,909	382	462		1919	5,000	56,000	67,000	
Other Countries						416,000			
Total	694,854,000	98,594,000	110,468,000	100·0		8,744,972,000	1,181,111,000	1,390,267,000	100·0

** These figures indicate the volume and page number of the previous article.*

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accounted for 249,074,000 bar., or 56·2% of the total U.S. production. Pools are scattered throughout the area and new pools are constantly being discovered. Most of the oil produced in Kansas, Oklahoma and northern Texas is obtained from beds of sandstone in formations of the Pennsylvanian series (Upper Carboniferous). The oil produced in southern Oklahoma is mainly from several pools in beds of sandstone of the Pennsylvanian series, though some oil is found in the "red beds" of the Permian series (latest Carboniferous). The oil found in northern Louisiana and central Texas is obtained from sandstone or other porous rocks of the Cretaceous and Tertiary systems. The average oil from the mid-continent field is of about 35° Baumé (0·8,485 sp.gr.), ranging from the thick black oil of some of the Louisiana fields, which has a gravity of 21° Baumé (0·9,272 sp.gr.), to the high-grade Cushing oil of above 55° Baumé (0·7,568 sp.gr.). The Glenn pool discovery in Creek county, Okla., in 1907 led to a great petroleum development in that state. This pool reached a maximum production of 125,000 bar. a day, sustained from Aug. 1907 to Feb. 1908. In 1912 the famous Cushing pool, also in Creek county, was discovered. In the latter part of 1913 a well in the Cushing pool was drilled to the Bartlesville sand at 2,600 ft., and resulted in a large gusher and the inauguration of an unprecedented drilling campaign. The oil was the highest-grade crude yet discovered W. of the Appalachian fields. Gusher wells were brought in with frequency, and the production of the pool, which at the end of 1913 averaged about 25,000 bar. a day, was averaging at the end of 1914 over 225,000 barrels. There was a temporary decline early in 1915, but in April production had increased to almost 300,000 barrels. Subsequently it reached a maximum of 320,000 bar., sustained for a 60-day period. The Cushing production was of such high grade and so large that it broke the oil market. In June 1915 the flush production of the field had been exhausted and a decline began. Cushing in 1915 yielded 17% of the total quantity of oil marketed in the United States. The Cushing pool early in 1921 was producing about 27,000 bar. a day.

In 1914 the rich Augusta pool in Butler county, Kan., was opened up, and in 1915 the El Dorado pool, also in Butler county, was discovered. In 1916–7 the Towanda extension of the El Dorado pool resulted in the district increasing its output from an average of between 15,000 and 20,000 bar. in the first five months of 1917, to 80,000 bar. in June and to nearly 100,000 bar. for a few days in September. The wells in the Towanda extension were of large capacity but proved to be short-lived, and the El Dorado-Towanda pool declined to about 50,000 bar. before the end of the year. The pool early in 1921 was producing about 29,000 bar. a day.

Late in 1917 the discovery of oil in a well 3,450 ft. deep, a mile and a half S. of the town of Ranger in central Texas, stimulated a most sensational development, covering possibly the widest "boom" area in the history of petroleum in the United States. This was generally termed a "deep sand" development, and opened up extensive pools in Eastland county, Stephens county and a portion of Comanche county in 1918. Oil in the deep sand pools is obtained from several different horizons in the so-called Bend series, which is of Pennsylvanian and Mississippian age. In July 1918 a prolific well was drilled in at 1,735 ft. in the Burkburnett field in Wichita county, northern Texas, and Burkburnett was the scene of another great oil boom. The Ranger field reached a maximum capacity of about 75,000 bar. a day in the middle of 1919, but declined thereafter. It was producing 57,000 bar. on Jan. 1 1920 and 14,000 bar. on Dec. 31 1920. The Stephens county pool (where development was slower) was producing about 37,000 bar. daily at the beginning of 1920 and had increased its production to close to 130,000 bar. at the end of that year, subsequently declining to about 90,000 bar. in May 1921. The Burkburnett pool, following the opening up of the Burkburnett extension, reached a maximum yield of over 100,000 bar. daily in 1919, from which peak it gradually declined in 1920. Early in 1921 it was producing about 60,000 bar. daily.

Another important development in the mid-continent field was the discovery in Sept. 1918 of oil in a shallow well near Homer, Claiborne parish, in northern Louisiana. A large gusher at greater depth was brought in in Aug. 1919, and the boom scenes of Ranger and Burkburnett were transferred to Shreveport, La. (the headquarters of the Claiborne parish development), where late in 1919 and early in 1920 other large wells yielding as high as 30,000 bar. daily were brought in in the Homer pool. From a production of about 25,000 bar. at the beginning of 1920 the Homer pool reached a production of over 100,000 bar. in a few months. This output declined rapidly because of the quick decrease in production of the larger wells, but an average output of about 50,000 bar. daily was maintained during the latter part of 1920 and the early months of 1921. Geologically the northern Louisiana producing area is in what is known as the Sabine Uplift, an uplift of considerable magnitude in the Coastal Plain sediments, the nature and age of which have not been definitely determined. One of the most important developments of the early part of 1921 was the discovery of oil in commercial quantity in southern Arkansas. The discovery well was brought in near El Dorado in Union county, and rapid drilling of subsequent wells increased the potential production of the new pool to between 40,000 and 60,000 bar. a day by April 1921.

Several important pools were opened up in the Gulf coast field, which first came into prominence in 1901 when the Spindletop pool in Jefferson county, Texas, was developed. The Gulf coast field includes southern Texas and southern Louisiana, and the petroleum is associated with masses of rock salt and gypsum in domes. The age of the oil-bearing strata ranges from Cretaceous to Quaternary. The field includes a great number of small scattered pools, some of which have developed wells of enormous productivity. The gravity of the oil ranges from 15° to 30° Baumé (0·9,655 to 0·8,750 sp.gr.), an average of about 22° Baumé (0·9,211 sp.gr.). Among the more important pools of the Gulf coast are the Goose Creek, Hull, Humble, W. Columbia and Damon Mound pools. West Columbia attracted attention in 1920 when on July 20 the pool was extended by a well flowing at the rate of 26,000 bar. daily. This flow was practically sustained until Aug. 28, when the well rapidly declined.

The Rocky Mountain field, which embraces the areas of production in Colorado, Wyoming and Montana, as well as prospective production in Utah and New Mexico, was stimulated by the drilling in of a large well in the Salt Creek pool, Natrona county, Wyo., in April 1912. This started a general boom in Wyoming, which state supplies the bulk of the Rocky Mountain production. Petroleum in the Rocky Mountain field is obtained from strata of the Carboniferous and Cretaceous age. Oils from older strata range in gravity from 18° to 24° Baumé (0·9,459 to 0·7,865 sp.gr.) and are of paraffin base. The development of the richest part of the Wyoming fields was restricted until 1920, pending passage of legislation and issuance of regulations with respect to Federal public lands. The Wyoming field includes a large number of small pools, and the greatest production is obtained from the Salt Creek pool, which early in 1921 was producing about 50,000 bar. daily.

The California field, one of the most prolific in the United States, is divided into two geographic groups, one occupying two sides of San Joaquin Valley and commonly known as the valley fields, and the other occupying a large area along the coast and commonly known as the coastal field. All the valley fields, except one, lie on the west side of San Joaquin Valley, and the oil in most of them is obtained from porous Tertiary sandstone. The conditions in the coastal fields are in many respects similar. A very small part of the oil produced in California is obtained from Cretaceous formations. The oils range in gravity from 9·09° to 54° Baumé (1·000 to 0·7,609 sp.gr.), and heavy oils, containing little sulphur, predominate. A fair average gravity is about 21° Baumé (0·9,272 sp.gr.). California for many years was the leading oil-producing state. It was supplanted by Oklahoma in 1907 and 1908 but regained first place in 1909. California held this position until 1915 when its production declined, while Oklahoma's output, because of the Cushing production, greatly increased, Oklahoma again taking first place. Oklahoma held first place through 1920 with California a close second. The principal producing districts of California are: the Kern River, McKittrick, Midway-Sunset, Lost Hills and Belridge districts, all in Kern county; the Coalinga field, in Fresno county; the Lompoc and Santa Maria fields in Santa Barbara county; the Ventura and Newhall fields in Ventura county; and the Los Angeles and Salt Lake and Whittier-Fullerton fields in Los Angeles county. The largest production is obtained from the Midway-Sunset field, which in 1920 produced 37,917,010 bar., a daily average of 103,598 barrels. The Los Angeles and Salt Lake field produced 28,694,163 bar., a daily average of 78,399 bar.; the Coalinga field 15,464,198 bar., a daily average of 42,252 barrels. Important addition to production in the Midway-Sunset field was made in 1920 and 1921 by the development of the Elk Hills district, where large wells ranging from 2,000 to 6,000 bar. were brought in. Production of this district increased from 25,000 bar. per month during Dec. 1919 to 1,500,000 bar. during Dec. 1920.

Oil shale deposits are found in Colorado, Utah, Wyoming, Nevada, Montana, California, Texas, Kentucky and W. Virginia in the United States, but while extensive experimental work has been done on retorting and much chemical investigation has been conducted as to the nature, properties and behaviour of oil shale, the establishment of the industry on a commercial scale has not yet been accomplished in the United States. By far the greatest attention has been paid to the oil shales of the western states.

Alaska.—Oil has been found in several localities in Alaska, notably in the district between Icy Cape and Cape Yatag, 400 m. N. W. of Sitka; in the Kayak field, several miles inland from Cape Suckling; in the Cook's Inlet field, between Itimma Peak and Itimma Lake; and in the Cold Bay field, opposite Kodiak Islands. Wells were drilled in the early 'nineties in the Kayak, Cook's Inlet and Cold Bay regions, but oil was not found in commercial quantity. In 1920 interest in Alaskan fields was revived, but no important drilling operations were reported. Production was 56,000 barrels.

Canada.—Canada's petroleum production declined steadily from 1908 to 1920. In 1920 the output totalled 198,425 bar. compared with 241,000 bar. in 1919 and 528,000 bar. in 1908. Virtually all of Canada's petroleum is produced in Ontario, and occurs in sandstone and limestone of Silurian and Devonian age. The gravity is about 30° Baumé (0·828 sp.gr.). A small production is obtained in New Brunswick and Alberta. In Aug. 1920 oil was discovered on the Mackenzie River, 150 m. S. of the Arctic Circle in the Canadian North-west Territory. The well was located N.W. of Fort Norman, and on Aug. 23 1920 it began to flow over the top of the mast from a depth of 783 feet. After an uninterrupted flow of 40 minutes the well was capped.

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The oil was analyzed as 38° Baumé (0·8,333 sp.gr.). This development attracted prospectors, the Dominion Government promulgating new regulations to apply to the unorganized districts affected by the discovery. Drilling in the Peace River district of the Northwest Territory also attracted attention in 1920 and 1921.

Mexico.—Mexico's petroleum development has been sensational in its rapid growth. Although yielding oil as early as 1901 it was not until 1910 that the production became a commercial factor. In the latter part of that year the famous Juan Casiano No. 7 well was drilled S. of the Dos Bocas well, the latter an uncontrolled gusher S. of Tampico, struck July 4 1908, which went to salt water several months later. The equally famous Potrero del Llano No. 4 well came in Dec. 27 1910 with an estimated initial flow of 10,000 bar. daily, increasing to 160,000 bar., and establishing itself as the largest producer up to that time. Both the Casiano and del Llano wells were in the so-called southern field as distinguished from the northern or Panuco field, these two fields being part of the Tampico-Tuxpam region. This lies in the northern part of the state of Vera Cruz and the southern part of the state of Tamaulipas. Oil in the Tampico region occurs in the Oligocene, Eocene and Cretaceous formations and is found in numerous pools. Before striking the big wells mentioned a considerable production had been developed at Ebano, 40 m. W. of Tampico, in the northern part of the Tampico-Tuxpam area and in the Tehuantepec area. The Tehuantepec-Tobasco area extends along the Gulf coast in southern Vera Cruz and the state of Tobasco. Its oil-bearing rocks are of the Pliocene and Pleistocene age, and it had not developed a large production up to 1921. Mexican crude oil ranges from 10° to 43° Baumé (1·000 to 0·8,092 sp.gr.), and generally becomes lighter from north to south. In the Panuco (northern) field it is from 10° to 14° Baumé (1·000 to 0·9,722 sp.gr.), and from 15° to 29° Baumé (0·9,655 to 0·8,805 sp.gr.) in the southern districts. Oil in the Tehuantepec field has a gravity of 32° Baumé (0·8,642 sp.gr.).

Generally speaking, Mexico's petroleum has been found in a succession of great gushers. Where these wells are isolated they have produced for long periods and in great volume. Where there is close and competitive drilling the exhaustion of the pools comes as a natural consequence. The explanation of the great gushers seems to lie in the very great porosity of the rock. Oil collects in a net-work of caves and channels previously dissolved out of a bed of thick limestone. This condition allows the petroleum to move about freely, while still underground. Furthermore, the petroleum generally lies over water under an artesian head, and as a consequence the field pressure is largely hydrostatic, causing the oil to flow. In 1908 the country was credited with an output of 3,932,900 bar.; in 1920, 163,000,000 barrels. The following table shows the production during that period:—

*Petroleum Production of Mexico, 1908 to 1920.**

	Barrels	Metric Tons
1908	3,932,900	624,968
1909	2,713,500	431,175
1910	3,634,080	577,455
1911	11,552,798	1,994,640
1912	16,558,215	2,631,100
1913	25,696,291	4,083,141
1914	26,235,403	4,168,805
1915	32,910,508	5,229,480
1916	40,545,712	6,445,957
1917	55,292,770	8,790,583
1918	63,828,327	10,147,587
1919	87,072,954	13,843,077
1920	163,000,000	22,638,888

**Boletin del Petroleo;* 1920 estimated.

In Jan. 1914, in the Panuco pool, a well with an estimated initial flow of 100,000 bar. daily was brought in, and further attention was attracted to this district in 1915 by the completion of an offset well estimated at 60,000 bar. daily. Political disturbances in Mexico from 1914 to 1917 seriously interrupted operations in the southern field. On Feb. 10 1916, however, Cerro Azul No. 4 well in the southern district was completed. This well was credited with having flowed 260,858 bar. on Feb. 19 of that year, being estimated the largest producer ever drilled, and in May 1921 was continuing its steady yield. In Aug. 1914 seepages from Potrero del Llano were ignited by lightning, and the fire was not extinguished until March 1915. The completion of a good-sized well in 1915 in the Tepetate pool, a short distance N.W. of Casiano, was the precursor of the intensive lot-drilling campaign which this district saw in 1918 and 1919. In those years about 20 wells of large initial capacity were completed in this pool. The Alamo pool, the southernmost producing area in the Tampico-Tuxpam region, came into prominence in Oct. 1914, when the famous Alamo No. 2 well was brought in with an estimated potential production of 50,000 barrels. This well has probably produced 27,000,000 bar. of oil. The oil in the Alamo pool is from 16° to 22° Baumé (0·9,589 to 0·9,211 sp.gr.). Large wells of low-grade oil have been developed in the Molino field, just N. of Alamo. In 1919–20 large gushers were completed in the so-called Naranjos pool in the southern field. It was estimated that this pool produced 90,000,000 bar. in 1920, possibly the largest output in history. Potrero del Llano No. 4 suddenly went to salt water in Dec. 1918. This occurrence caused wide comment, as it was the first instance of the approximate exhaustion of any of Mexico's prolific pools, if Dos Bocas is to be excepted. This well had produced up to that time about 100,000,000 bar. of oil, including seepage oil. The Juan Casiano No. 7 well went to salt water in Nov. 1919, having produced about 80,000,000 bar. of oil. Many of the large wells in the Tepetate pool were affected by salt water in 1919 and 1920. Salt-water invasion was also reported as serious in the Panuco field. The Zacamixtle pool in the southern district was discovered in 1920, yielding several large wells. In 1921 important wells were brought in in the Toteco district of the southern field between Zacamixtle and Cerro Azul. In 1920 it is estimated that this field produced 120,000,000 bar., all in a strip of land 42 m. long and less than a mile wide.

Central America.—No petroleum production has been developed in Central America, but prospecting has been done and some drilling was under way in 1920. Test wells have been sunk on Columbus I., east coast of Panama, and in the Estrella Valley of Costa Rica. Exploration work has been done in Honduras and Guatemala.

South America

Argentina.—Argentina's commercial production dates from 1908, when petroleum was found in a well being drilled for water by the Government near Comodoro Rivadavia, Chubut province, on the coast of Patagonia. The Government immediately reserved part of the oil-bearing land for a monopoly, and Argentina's petroleum development has been almost entirely in the hands of the administration. Oil occurs in nearly horizontal, supposedly Cretaceous, beds which are covered by Tertiary beds. The oil is heavy and of asphalt base and ranges in gravity from 18·9° to 21·8° Baumé (0·940 to 0·922 sp.gr.). Much attention was attracted to Argentina in 1921, when in Feb. the first large gusher to be opened in the Comodoro Rivadavia field came in with an estimated initial flow of 25,000 bar. daily. Argentina's oil production was 1,665,989 bar. in 1920, compared with 1,183,000 bar. in 1919.

Venezuela.—Active prospecting in Venezuela began in 1910, and during the next four or five years wells were drilled in several areas with varying success. A well in the Mene Grande field, on the east coast of Lake Maracaibo, Sucré district, drilled in 1913, established the occurrence of oil in paying quantity, and by 1915 the field had developed a considerable production, furnishing up to 1921 practically all the Venezuelan output. Drilling in the district of Colón, state of Zulia, commenced in 1914. Four wells credited as good producers in the Rio Oro and Rio Tarra sections had been completed by 1916 and were shut in. Two wells reported as proven in the Bolivar district, state of Zulia, were also capped. Operations in Venezuela in 1920 and 1921 were active, particularly in the Lake Maracaibo district. Venezuela's production in 1920 amounted to 456,996 bar., compared with 425,000 bar. in 1919. In 1920 the Mene Grande field was credited with having seven flowing wells, the oil being of about 16° Baumé (0·9,589 sp.gr.). The capped wells in the Rio Oro district are said to produce a high-grade, paraffin-base oil of about 36° Baumé (0·8,433 sp.gr.).

Colombia.—Although not ranking as an oil-producing country, in 1920 Colombia was credited with three wells of potential commercial importance. These were completed in 1918 and were shut down awaiting marketing facilities. The wells were drilled on a concession in the Rio Colorado region in Santander del Sur. They are located about 30 m. S. of Barranca Bermeja, which is 350 m. from the mouth of the Magdalena river. Oil from these wells is reported to test 26° to 31° Baumé (0·8,974 to 0·8,696 sp.gr.). Preparations for opening the wells had been made early in 1921 upon the completion of a pipe line and refinery. Drilling was accomplished in 1920 and 1921 on other concessions along the Magdalena river in the vicinity of the pioneer Colorado development. Development work was also undertaken in 1920 on a concession in the Venezuelan boundary region in Santander del Norte, on the Rio del Oro, opposite drilling work in the Colón district of Venezuela. Considerable interest was attached to Colombia petroleum development in 1911 when drilling was undertaken near Cartagena. In 1913 and 1914 wells were drilled in the Lorico district near the Sinu river, but production was not encountered in commercial quantity. The Magdalena-Santander field occurs in the Cretaceous limestone and sandstone and the coal-bearing Lower Tertiary (probably Oligocene) beds. The rocks of the Caribbean fields are similarly described.

Peru.—Peru has the distinction of being the oldest oil-producing country in S. America, first being credited with production in 1896. Its production has been steadily maintained, the principal fields being Negritos, Lobitos and Zorritos. Another petroliferous district near Lake Titicaca has not developed any considerable production. Oil is found chiefly at the north end (Pacific coastal district) of Peru, and occurs in several horizons of soft sandstone and shale of early Tertiary age. The oil ranges from 32° to 48° Baumé (0·8,642 to 0·7,865 sp.gr.). Peru's production in 1920 was 2,816,649 bar.; 1919, 2,616,000 bar.; 1908, 1,011,180 barrels.

Bolivia and *Ecuador* have been actively prospected for oil, but oil in commercial quantity has not been developed. *Chile* had several oil booms, particularly those based on the oil deposits of the province of Punta Arenas, N.W. of Tierra del Fuego, without successful results. Prospecting has been undertaken in *Brazil* and *Uruguay*.

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West Indies

Trinidad.—The oil fields of Trinidad are mainly in the southern part, and the oil is obtained from lenses of sandstone of Tertiary age. Trinidad first appeared as an oil producer in 1908, although wells were known to exist N. of the famous Pitch Lake at Guayaguayare, in the extreme S.E. of the island, in 1902. This district came into real prominence in 1908 when a well at 700 ft. spouted oil over the derrick. A rapid development followed. Oil in the Pitch Lake district varies in density from 14° to 25° Baumé (0·9,722 to 0·9,032 sp.gr.). In the latter part of 1911 regular oil shipments from Brighton began. In that year several large gushers were brought in, but immediately clogged, owing to sand. In 1913 a well came in rated at 40,000 bar. daily, but sanded up, and in subsequent years other large producers have been reported, the initial production of which has soon fallen off on account of sand. Trinidad's production in 1920 totalled 2,083,027 bar., compared with 1,841,000 in 1919.

An oil boom in *Cuba* in 1917 failed to yield any considerable production. The principal development was in a field near Havana. Prospecting and a little drilling work have been done in *Santo Domingo*. There was exploration work in *Barbados* and in *Haiti*.

Europe

Russia.—While Russia, as a result of the World War and the revolution that followed, dropped in world rank as regards petroleum production, it remained the largest European producer. Production is found in Tertiary clays and sands. Baku oils are of about 27° Baumé (0·8,917 sp.gr.), while in the Suraghany district of Baku province the oil is as high as 48° Baumé (0·7,865 sp.gr.). The production in 1920 was estimated at 25,429,600 bar.; 1919, 25,498,000; 1918, 40,456,182; 1917, 69,960,000; and in 1908, 62,186,447. The relatively small area comprising the Baku field supplies the bulk of Russia's production. Other productive fields are the Grosny, Maikop, Ural-Caspian (Emba) and Tcheleken fields. The Maikop field in the province of Kuban on the north flank of the Caucasus, N.E. of the Black Sea, was discovered in 1910. The finding of high-grade oil in a well flowing at the rate of 37,500 bar. daily caused an extraordinary rush. In 1915 the sensation in this field was the completion of a gusher credited with an initial flow of 60,000 bar., which maintained a large, steady production from March 23 to the close of the year. Maikop oil is about 40° Baumé (0·8,235 sp.gr.). The Ural-Caspian field, covering a large area in the Emba-Uralsk region round the north end of the Caspian Sea, first became a commercial factor in 1913. The district came into prominence on the completion of a well in May 1911, which at a depth of 732 ft. gushed with great violence. It began to flow in Feb. 1912, was closed down and reopened in Oct. 1912, producing 120,000 poods (1,944 tons or 14,480 bar.), and then settling down to 50,000 poods. (One pood equals 36·112 lb.) This famous gusher is estimated to have produced from 8,500,000 to 9,000,000 poods. Emba oil is about 28° Baumé (0·8,861 sp.gr.).

For many years the I. of Tcheleken, off the Asiatic coast of the Caspian Sea near Krasnovodsk, was the scene of moderate operations, but from 1911 onwards large yields were obtained from wells sunk in the Ali Tepe district in the south-western part. Tcheleken oil is about 22° Baumé (0·9,211 sp.gr.).

Galicia.—No new pools of importance were discovered in Galicia during the period 1908–20. Galician production showed a declining tendency beginning in 1910, and during the World War this condition was aggravated, as the fields were battlegrounds. Galicia's largest output is obtained from Eocene beds. The chief producing districts are: in eastern Galicia, Boryslaw-Tustanowice, Bitkow; in western Galicia, Bobrka, Potok and the Gorlice district. The bulk of Galicia's production comes from the Boryslaw-Tustanowice district. Boryslaw oil is 32° to 34° Baumé (0·8,642 to 0·8,537 sp.gr.), and is the standard market grade for Galicia. Bitkow oil is about 53° Baumé (0·7,650 sp.gr.); Bobrka, about 31° Baumé (0·8,696 sp.gr.); Potok, 34° to 45° Baumé (0·8,537 to 0·8,000 sp.gr.). Galicia's production in 1920 totalled 5,606,116 bar.; 1919, 6,054,000. The peak of production was in 1909, 14,932,799 barrels.

Rumania, like Galicia, a battleground during the World War, suffered in petroleum production. Most of the oil is obtained from Miocene and Pliocene beds, but part is obtained from Eocene and Oligocene and possibly from Cretaceous beds. The principal fields are Bushtenari, Campina, Moreni, Filipeshti, Baicoi and Bauzau. The oil is from 25° to 45° Baumé (0·9,032 to 0·8,000 sp.gr.). Production in 1920 was 7,435,344 bar.; 1919, 6,614,000; and in 1908, 8,252,157. The peak was reached in 1913, 13,554,768 barrels.

Yugoslavia.—In 1921 drilling began on concessions in Croatia.

Germany.—Oil is obtained largely at Hanover, where it occurs in domes associated with rock salt. The rocks are chiefly limestone and sandstone of upper Jurassic age. Oil at shallow depths is heavy, gravity from 17° to 19° Baumé (0·9,524 to 0·9,396 sp.gr.); at greater depths the oil is lighter. The production is not large, and in 1920 was 212,046 bar.; in 1919, 234,000.

France.—Production in Alsace occurs in sandstone of Eocene and Oligocene age and is comparatively small. The gravity ranges from 25° to 29° Baumé (0·9,032 to 0·8,805 sp.gr.). In 1920 the output was about 388,700 bar.; in 1919, 344,000.

Italy.—Italy's production, relatively small, is chiefly in the Emilia district of Lombardy on the north-eastern slope of the Apennines. Oil occurs in sandstones of Eocene and Miocene age, and ranges from 31° to 48° Baumé (0·8,696 to 0·8,187 sp.gr.). Production in 1920 amounted to 34,180 bar.; in 1919, 35,000; and in 1918, 50,966.

Great Britain.—Apart from the shale-oil industry of Scotland and Wales, Great Britain took its place as a petroleum-producing country in 1919, when the Hardstoft well was brought in in Derbyshire. This was one of 11 drilling locations, seven of which were in Derbyshire, two in N. Staffordshire and two in the Midlothian district of Scotland. The Hardstoft well was started in Oct. 1918, and struck oil in May 1919 at 3,078 ft. At 3,100 ft. it produced 10 or 11 bar. daily. The well was still overflowing naturally at the end of 1920. Up to that time its production totalled 4,575 bar. or 590 tons, of which 2,909 bar., or 375 tons, were produced in 1920. At the end of that year progress on the other prospecting wells stood as follows: six wells had reached 3,000 ft. or over, the deepest, Ironville No. 2 in the Derbyshire area, being shut down at 4,500 ft. pending results of Ironville No. 1. One new well was started in 1920, Apedale No. 2 (Staffordshire), to replace Apedale No. 1, which had to be abandoned. This development is undertaken by the British Government, although the operations are managed by a private company. Oil from the Hardstoft well tested 40° Baumé (0·8,236 sp.gr.).

Considerable production of petroleum is derived from the Scottish shale-oil fields in the territory from Dalmeny and Abercorn on the Firth of Forth southward to the district of Cobbinshaw and Tarbrax. The oil-shale industry in Scotland has been in commercial operation since 1850, and in 1920 there were 25,000 persons regularly employed in this enterprise. In 1917 3,116,529 long tons of oil were produced from Scottish oil-shale. There is a small oil-shale production in England and in Wales.

Africa

Egypt.—Prospecting in Egypt resulted in the discovery of oil on the borders of the Red Sea and the development of small production in 1911. In 1913 several large wells were brought in in the Gemsah district on the west shore of the Red Sea, near the junction of the Red Sea and the Gulf of Suez. In Oct. 1914 oil was struck in the Hurghada district, S. of Gemsah, and up to 1921 Egypt's production had been confined to these districts. The oil occurs in sandstone and in cavernous, dolomitic limestone, associated with thick beds of gypsum of Miocene (Tertiary) age, accompanied in some places by thick beds of salt. The underlying Nubian (Cretaceous) sandstone also contains some oil. Egyptian oil is about 40° Baumé (0·8,235 sp.gr.). Difficulties from salt-water flooding have been encountered in the fields, shortening the life of the large wells. Exploitation has been restricted to a comparatively small area. While Egypt's production almost doubled in 1918 as a result of increased activities that year it fell off in 1919, and in 1920 showed a sharp decrease. Production in 1918 was 2,079,750 bar.; in 1919 1,501,000; and in 1920, 1,042,000.

French Colonies.—Some oil has been obtained in the Cheliff river area in the district of Oran, Algeria. Over 30 wells have been drilled in the M'Sila and Medjila districts, but during the World War operations were practically discontinued. Interest in Algeria revived after the war. The oil-bearing formation is probably Upper Miocene and its structure is complex.

Prospecting has been active in Angola and Ashanti (Gold Coast), in the Tertiary coastal plain formations. Tests have been drilled in Angola and the Alto Daude district near Loanda and at Ambrizette. Showings of oil were reported in test wells drilled in the Betsiriry Valley, Madagascar, but no commercial production developed.

Asia

Persia is looked on as a new petroleum-producing country of unusual importance. Development has been virtually confined to the Maidan-i-Naphtun field in northern Arabistan, about 100 m. N. of the head of the Persian Gulf, where the first wells were completed in 1908. In 1914 10 wells were reported as being operated, and 20 more were shut down at the top of the sand. In the neighbouring Maidan-i-Naphtek field one well had been drilled and capped and a second begun. One test well had started in the White Oil Springs district. The following year a total of 12 wells had been completed in the Maidan-i-Naphtun field. The wells were reported to be prolific, with a combined capacity of 5,000,000 tons a year. Early in 1920 it was stated that the wells still maintained their high rate of yield. One well, which has been continuously flowing since Nov. 1911, was giving a larger production than ever, maintaining a steady daily average of 11,000 bar. with the well only partly opened. Persian production in 1920 was 12,352,655 bar.; in 1919, 6,412,000; in 1918, 6,856,063. Oil in the chief producing area occurs in the Miocene series. The gravity of the oil is about 21° Baumé (0·9,272 sp.gr.). In addition to the Maidan-i-Naphtun field, the Ahwaz-Pusht-i-Kuh and Gishon I. and the Persian Gulf regions are expected to yield petroleum.

Mesopotamia.—There are several petroliferous areas in Mesopotamia in the Tigris-Euphrates basin. Primitive development has yielded some oil in the Kirkuk–Mendali–Kasr-i-Shirin area north of Bagdad, in the Middle Tigris belt and in the Euphrates belt. Large-scale development of the Mesopotamian fields was interrupted by the war, but interest in them revived in 1920 and 1921.

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Palestine.—The first drilling for oil in Palestine, S.W. of the Dead Sea, was interrupted by the war. Prospecting had previously been active in the area between the river Jordan and Deraa, adjacent to the Hedjaz railway.

India.—The principal source in India is the Yenangyaung field in Burma, about 272 m. N. of Rangoon on Yenangyaung creek. Other important districts are the Singu, Minbu, Pakokku and Upper Chindwin. The oil is in rocks of Miocene age and is about 30° Baumé (0·8,750 sp.gr.). Deep drilling was a feature of the development in this field after 1914. Some wells come in with a large initial flow but fall off rapidly as the territory has been intensively developed. Coal-bearing rocks of Eocene age have yielded oil in small quantities in Assam and in the Punjab. India's production in 1920 was 7,500,000 bar.; 1919, 8,735,000; 1908, 5,047,038.

Japan and Formosa.—Japan's principal oil production is found in the Echigo Province field. Since 1908 the most important development has been in Akita prefecture. The first gusher was drilled in this field in May 1914, flowing at the rate of 12,000 bar. daily. Many other large wells have been developed. The Akita gushers have declined rapidly. Oil is obtained from coarse sandstone layers, interstratified with sandy shale of Tertiary age. The oil is about 25° Baumé (0·9,032 sp.gr.). A small production is also obtained in Formosa. Production of Japan and Formosa in 1920 was 2,139,777 bar.; in 1919, 2,175,000; and in 1908, 2,070,145.

China.—A joint investigation of petroleum resources in the provinces of Shen-si and Chih-li was undertaken in 1914 by the Chinese Government and a private corporation. Drilling of six wells began in the Yen-chang field, Shen-si, where previously a number of primitive wells had been put down and a small production obtained. In 1916 the abandonment of the enterprise was announced. No oil in commercial quantity was struck.

Oceania and the East Indies

Dutch East Indies.—Production of petroleum in the Dutch East Indies has shown a steadily increasing tendency. Production is obtained in Sumatra, Borneo and Java. Most of the oil-bearing rocks are associated with beds of coal and lignite of Miocene age. Oil of the Langkat district of Sumatra has a gravity of 33° to 55° Baumé (0·8,589 to 0·7,692 sp.gr.). Java oil is heavier, ranging between 23° and 40° Baumé (0·9,150 to 0·8,235 sp.gr.). Borneo oils from shallow wells have a gravity of about 14° Baumé (0·9,722 sp. gr.), and from the deeper wells a gravity of from 27° to 33° Baumé (0·8,917 to 0·8,589 sp.gr.). Production of the Dutch East Indies, including a small production from British Borneo, totalled 17,529,210 bar. in 1920; 15,428,000 in 1919; and 11,041,852 in 1908.

Papua.—Test drilling has been undertaken in Papua, and, while oil has been struck, difficulty has been caused by mud clogging.

Philippine Islands.—Prospecting and drilling work started in the Philippine Is. in 1920 in the Bondoc Peninsula district.

New Zealand and Australia.—Extensive prospecting and drilling work have been done in New Zealand, especially in the vicinity of New Plymouth; South Australia, in the Robe district, and in Queensland, in the Roma district. Exploitation in these districts has failed to develop petroleum production in commercial quantity. New South Wales has developed an oil-shale production amounting in 1918 to 32,395 long tons.

Oil in the World War.—Petroleum was a major essential in industrial, military and naval operations in connexion with the World War. Industrial plants required abnormally large quantities of lubricating oils and fuel oils. There was a rapid expansion in oil-burning fleets, and a new demand on petroleum was made by air craft, by the introduction of petrol-burning motor launches, by tanks used in military operations, and by the creation of the motor transport, which became a chief factor of a mobile army. Petroleum was a contraband of war, and German submarine warfare was largely directed against petroleum tank steamers. Military operations in Galicia and also in Rumania were dictated to a considerable degree by the condition of petroleum supply in the Central Powers. Galicia changed hands several times during the war, and after Rumania's entrance into the war in Sept. 1916 the oil fields of that country fell into the hands of the Austro-German armies. Considerable damage to the Galician and Rumanian fields was caused by military operations, and the output of these countries was reduced during the war. Before the capture of the Rumanian fields a systematic destruction of wells, derricks and oil supplies had been undertaken by an Allied military mission, and the Germans immediately installed a military commandant with trained assistants to rehabilitate the fields. The operations of Turkey against Russia had the Baku oil fields as their objective, and the early British operations in Mesopotamia were chiefly intended as a precautionary measure for the protection of the Persian oil fields.

In all the warring countries special Governmental departments were organized to handle petroleum problems, and in almost every country drastic restriction of home consumption was enforced. In England the Mineral Oil Production Department had jurisdiction over all questions of production of oil from home sources. The Pool Board attended to the distribution of oil in the British Is., and the Petrol Control Department acted on matters of petrol economy. The Petroleum Executive was formed in Aug. 1917 to handle matters of general policy. In France jurisdiction of petroleum matters was placed in the hands of a Commissioner-General of Petroleum, and a Petroleum Importing Consortium was created. During the last year of the war a Government commission for petroleum was formed in Italy, and throughout the war restrictions were placed on the importation and sale throughout that country. In Germany and Austria price and distribution were under control somewhat similar to that of food, and strict rationing was adopted. After the United States entered the war in 1917 a voluntary organization of the American industry was effected under the name of the National Petroleum War Service Committee, and in 1918 the Oil Division of the Government Fuel Administration was established. Restrictions on home consumption in the United States were confined entirely to voluntary methods. The Inter-Allied Petroleum Council, consisting of representatives of Great Britain, the United States, France and Italy, was formed in 1917. This Council arranged for the requirements of each of the Allies and for the transportation of the petroleum allotted.

America supplied 80% of the Allied petroleum requirements. The problem of transporting these great quantities was only secondary to the problem of production. Large additions were made to tanker fleets, principally of Great Britain and the United States, but as there was an inadequate supply of tankers early in the war, and as the German submarines sank many, this feature of the transportation problem was particularly serious. It became necessary to use the double bottoms of cargo vessels for transporting oil, and it is estimated that from 1917 to the close of the war 1,100,000 tons of fuel oil were so transported. The total quantity of fuel oil brought to British bases during the war exceeded 10,000,000 tons, of which 9,100,000 tons were issued to the British Admiralty. In addition American naval tankers imported 560,000 tons, which were distributed by small British craft to U.S. naval units along the British coast. The tanker-building programme, projected by the British Admiralty in the early stages of the war, resulted in the addition of 52 cargo tankers of 380,000 tons' capacity and 49 fleet auxiliaries of 95,000 tons' capacity. In 1918 there were 2,638,961 tons of fuel oil alone shipped from the eastern seaboard of the United States for the use of the Allied navies. In the same year more than 1,000,000 tons of distillates and other petroleum products also crossed the Atlantic, entailing more than 500 tank steamer loadings. The figures made public after the war showed that 48% of the British fleet was depending on oil for fuel. The maintenance of the blockade round the Central Powers involved the steady consumption of petroleum products. In the patrol around the British Is. the steaming of the fleet and other vessels averaged not less than 7,000,000 m. a month. At one time the situation as regards tank steamers was so serious that a single day's delay in any of the vessels caused considerable anxiety. In May 1917 stocks of oil were so low because of heavy shipping losses, due to submarines, that the fleet was unable to exercise properly and the army was frequently on a hand-to-mouth basis. At that date total stocks of oil in Great Britain amounted to only 900,000 tons, and the absolute minimum of safety was considered 1,500,000 tons. After 17 months stocks had been increased to 1,800,000 tons, and on cessation of hostilities the stock was considered satisfactory.

A campaign of intensive development in the petroleum fields, particularly of the United States and Mexico, brought about large increases in petroleum production, but requirements were so great that despite this increase stocks had to be drawn on heavily. At the close of the war American tankers afloat had increased 635,507 gross tons, and 51% of the total gross tonnage of tankers in

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service between America, Great Britain, France and Italy was American owned, while 49% was British owned. Because of the increased tonnage at the close of the war the United States was exporting each month for war purposes 2,200,000 bar. of fuel oil, 750,000 of motor gasoline, 500,000 of kerosene and 175,000 of aviation naphtha. The country's exports of fuel oil to Great Britain, France and Italy in 1918 represented an increase of 200% over 1914 and 23% over 1917. At the beginning of 1917 the total requirements of petroleum products for all British services reached a figure of about 3,500,000 tons per annum, nearly double pre-war requirements. By the end of 1918 the figure had increased to nearly 5,500,000 tons per annum. It is estimated that the maximum requirements of the Allies if the war had continued would have occurred in the spring of 1919, when 12,000,000 tons per annum (of which some 8,000,000 tons would have been absorbed by Great Britain) would have been required. During the last 18 months of the war the Inter-Allied Council dealt with between 12,000,000 and 13,000,000 tons of oil.

The British army in France used about 23,000 tons of motor spirit a month during the greater part of the war. The French army's monthly consumption of gasoline was 35,000 tons, of which 30,000 tons came from the United States. In Dec. 1917 the Allies had a scant month's supply of gasoline on hand, and between Dec. 25 1917 and Jan. 31 1918 90,000 tons of petroleum products were shipped to France from the United States, making possible the shifting of troops into threatened areas by motor lorries. Oil stocks in France, before the large shipments early in 1918, had gone down to 25,000 tons, less than the average held in France in normal times. During the days of most active fighting consumption reached as much as 2,000 tons a day. The British Ministry of Shipping was mainly responsible for the transporting of overseas supplies, and the Tanker Division of the Emergency Fleet Corps, U.S. Shipping Board, and a section of the War Trade Board had jurisdiction of the allocation of cargoes and of shipping belonging to the United States. The difficulties of getting production were accentuated by various specifications which each Government required as regards its oil supplies, and steps were taken by the Inter-Allied Council to effect some degree of standardization. In the United States the Committee of Standardization of Petroleum Specifications was formed to standardize petroleum products, requirements of the various Government departments, and also to recommend adoption by the states of standard specifications.

The war opened the eyes of all countries to the value of petroleum products. The Allied countries and the Central Powers conducted extensive investigations to provide substitutes. In Great Britain the Alcohol Motor Fuel Committee was formed to consider the fields of production of alcohol fuel, and its utilization either alone or in conjunction with fuels such as petrol and benzol. Efforts were successfully made to extract crude oil from cannel coal on a commercial scale at certain large gas works. The use of coal-tar oils as fuel oil was also considerably increased. Alcohol substitutes for petroleum were extensively experimented with in Germany and in the United States. In the latter country important experiments were made with colloidal fuel. The actual work of petroleum development in the British Is. was undertaken as a war measure, and, as already stated, the drilling of wells was started in Derbyshire, Staffordshire and the Midlothian district of Scotland on behalf of the British Government. Another war achievement was the construction of an 8-in. pipe line, 35 m. long, across Scotland from the vicinity of Glasgow to Grangemouth on the Firth of Forth. This pipe line was built so that tank steamers could discharge fuel oil for the Allied navies at Old Kilpatrick, near Glasgow. The pipe line then conveyed the oil to the Firth of Forth, where it was required by the navies. Tanker transportation to the Firth of Forth was very dangerous. The work of building the stations and ditching for the line was conducted by the British Admiralty, and the line laid by a U.S. naval unit. It was completed shortly before the Armistice was signed. The war also probably hastened the building and completion of the British navy's great oil reservoir at Rosyth. This was constructed of reinforced concrete, and is capable of storing 60,000,000 imp. gal. of liquid fuel. Concrete work on the first section began in July 1916, was completed in Aug. 1918, and oil was run into the tanks in Sept. 1918. Construction of the second section began in Aug. 1917, and was completed early in 1919.

Certain important producing and potentially productive oil areas changed nationality as a result of the World War, including parts of Galicia, formerly in the Austro-Hungarian Empire, now a part of Poland; Alsace, now French; Mesopotamia and Palestine, lost by Turkey, and placed under British mandate.

Financial and Industrial Progress.—The expansion of petroleum activity has involved a great increase in financial requirements. While the tendency has been toward consolidation and the perfecting of organizations of great size, there has also been, particularly in the United States, an extraordinary springing up and expansion of companies embracing one or two branches of the business, or often operating in almost every branch. The chief petroleum companies own or lease oil-bearing properties, work their own production, have pipe-line affiliations, own and operate refineries, own and lease tank cars and other marketing equipment, and own and operate tank steamers.

The nationalization of oil-bearing lands—the retention or vesting of ownership of subsoil rights in the hands of the State—has been a pronounced tendency in certain countries. In Russia petroleum lands were nationalized and were operated in part of 1919 and in 1920 by the Soviet Government. Argentina's petroleum development has been almost entirely in the hands of the Government since its inception. In May 1917 a new Mexican constitution provided for the nationalization of petroleum, and various decrees have been promulgated attempting to carry out the nationalization principle. In other Latin-American countries nationalization of petroleum lands is generally adhered to in working out new petroleum codes. Direct Government interest in petroleum development was brought about in Great Britain by the action of the British Government in becoming a majority shareholder in an oil company developing the Persian fields and active in other countries.

The importance of petroleum with respect to national security and industrial prosperity became generally recognized during the World War and resulted in intense investment and speculative interest in oil companies. Statistics compiled for 250 representative American oil companies showed capital invested as of Dec. 31 1919 to be $2,501,939,914. Of this group 142 companies were organized after 1912. The 108 companies in existence prior to 1912 showed a capital investment of $717,098,563 on Dec. 31 1911. The compilation showed that of the total increase in capitalization between 1912 and 1919, amounting to $1,784,841,351, $707,004,521 was added in one year, 1919. New oil companies formed in the United States in 1917, 1918, 1919 and 1920 represented an amazing capitalization. The records show that in 1920 1,712 companies were organized with an authorized capitalization of $2,787,000,000; in 1919, 1,629 companies with $3,786,000,000 capital; 1918, 820 companies with $1,430,000,000 capital; and in 1917, 512 companies with $840,000,000 capital.

Capital-borrowing by oil companies in the United Kingdom in 1919 totalled £15,852,600; in 1920 £13,004,600. The total capital of oil and kindred companies registered in the United Kingdom during 1920 was £33,105,050.

Four companies in Germany, classified under the head of "Petroleum, Mineral Oil, etc.," increased their capital in 1920 101,850,000 marks. There was a boom in the oil business in Rumania in 1919 and 1920. In the former year 128 new companies were organized with a total capitalization of 449,000,000 lei (nominal value 9½d. or $.19, but at that time much depreciated). Up to Oct. 1920 168 companies had been organized with an issued capital of 1,640,206,900 lei.

Well-drilling and Field Improvements.—Production is maintained and increased only by the constant drilling of new wells. A territory becomes "proven" after it has been demonstrated by test wells and by active development to have petroleum deposits. The search for oil in unproven territory is generally termed "wildcatting." The wildcatter is sometimes a small operator but more often in recent years a large company, for the operation entails large expenditure,

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In the United States, which in 1920 supplied 65% of the world's production, it is generally estimated that from 25% to 40% of current output is "flush" production; that is, production from the large initial flow of new wells, which subsequently would decline to moderate "settled" production or become exhausted. There were about 35,000 new wells completed in the United States in 1920; 24,000 of them were rated as oil producers. At the end of that year there were 7,200 wells drilling and 2,100 rigs erected or building for drilling. The number of wells producing oil in the United States, Oct. 31 1920, was 258,600. The average per well was 4·9 barrels.

The principal drilling systems are: (1) percussion, which includes the standard cable tool (American system) and the pole tool (Canadian system); (2) hydraulic rotary system; (3) combination system; (4) hydraulic circulating system (*see* 21.319). In the Appalachian region of the United States wells are sunk by the standard or churn system, with a modified light rig, and range in depth from a few hundred feet to 3,000 or 4,000 feet. In many sections groups of wells are pumped from the central station. The yield of wells in the Appalachian field is small, the average for Pennsylvania being about 0·3 bar. per well; New York, 0·2 bar.; Kentucky, 3·1 bar.; W. Virginia, 1·1 bar.; and eastern Ohio, 0·8 barrels. Wells in the mid-continent field are generally drilled by standard tools. The cable system is used in central Texas, and the rotary system in northern Texas and in some districts of Oklahoma. The rotary system exclusively is used in northern Louisiana. The depth ranges from 200 ft. to 3,500 ft., drilling in recent years averaging more than 2,000 ft. Recoveries per acre from mid-continent pools have been generally higher than in the eastern fields, but less than in the Gulf coast and California. The average production per well in Oklahoma and Kansas is 6 bar.; northern Texas, 31·6 bar.; central Texas, 22·9 bar.; and northern Louisiana, 31·6 barrels. The rotary method is used exclusively in the Gulf coast field, the depth of wells ranging from 1,000 to 3,500 ft., and the production per well being 34·6 bar. in coastal Louisiana and 49·7 bar. in coastal Texas. In the Rocky Mountain field the standard and rotary systems are used, the shallow districts of this field also being largely drilled by the standard cable system with the portable rig. The depth of the wells ranges from 1,000 to 3,500 feet. The average production per well is 55·9 barrels. In California drilling is about evenly divided between the standard and rotary systems. The combination rig is also extensively used, and there is some drilling by the hydraulic circulating system. Well-depths range from 1,000 to 3,500 ft. and the average production per well is about 32·3 barrels. A well of average depth in the mid-continent field could be drilled and equipped for less than $13,000 in 1913. In 1915 the cost increased to about $14,000; in 1918 to $24,000; and in 1920 to about $32,000. A factor in the advance in cost was the increased depth of the average well. Drilling cost of an average well in central Texas in 1920 was from $44,000 to $68,000; in certain Gulf coast pools, $39,000; while in the Rocky Mountain and California fields it has risen above $100,000 per well.

In Mexico, where the wells usually have a great initial production and where the yield of individual wells is often restricted only because of inadequate marketing facilities or as a precaution against water inroads, the percentage of current production that might be termed "flush" is much higher than in any other producing country. Mexico's production is obtained from comparatively few wells. The country was credited on Jan. 31 1921 with 367 producing wells, but it is estimated that the bulk of the 1920 production of 163,000,000 bar. was obtained from about 200 wells. The wells average about 2,000 ft. in depth. In the Tehuantepec field the wells have been of shallow depth and short-lived. Drilling in Mexico is about evenly divided between the rotary and standard cable system, and the hydraulic circulating system is used to some extent.

The Canadian pole tool system is used in Canada, while the deeper drilling in the Calgary district has been done by the standard cable system and there has also been some rotary drilling. Wells in the Petrolia district, Ontario, are about 500 ft. in depth and yield from 5 to 25 bar. a month. The standard cable system is principally used in Venezuela, although there has been a good deal of drilling with the rotary method, and a combination of both. Wells in the Mene Grande fields range from 600 to 1,700 feet. Wells in Colombia have been drilled by the cable system and combination cable and rotary, the depth being 1,700 to 2,300 feet. In Peru most wells in the Zorritos field are between 600 and 2,000 ft. in depth; in Labitos from 2,000 to over 3,000 ft.; and in Negritos the average is about 2,500 feet. The standard cable system of drilling is generally used in Peru, but there has been some rotary drilling in the Zorritos field, where a total of 920 wells had been drilled up to 1919, the greatest number of producing wells at any one time being about 50. In Lobitos a total of 118 wells were producing in 1919; in Negritos 732 were active. Drilling in Argentina has been done by practically all methods, but the one in most general use is the Galician pole tool system, which is a modification of the Canadian pole tool system, the equipment providing for a larger and heavier rig. The American standard cable system is also in use in Argentina and there is some rotary and also hydraulic circulating drilling. Production in 1919 was obtained from about 72 wells. In Trinidad wells range from 700 to 1,740 ft. in depth. Rotary drilling is used almost exclusively.

The Russian free fall system, a modification of the Canadian pole tool system, is used in Russia. In this, there is a free fall of the tools, which are then picked up. The diameter of some of the Russian wells is unusually large, the starting diameter being in many cases 36–40 inches. In the Baku field the depth of the wells ranges from 2,000 to 2,500 feet. Baku wells are famous for their large initial flow and large total yield. In Galicia, as well as in Rumania, the Canadian pole tool system, modified and adapted, is generally used, but the hydraulic circulating system is also used. Galician fields require deep drilling, many wells in Boryslaw-Tustanowice being over 4,000 feet. The pole tool system is also extensively used in Rumania. Wells range from 1,000 to 2,500 ft. in depth, and in the Moreni district wells of great capacity have been brought in. The standard cable system with portable rig is used almost exclusively in Italy. The same system, without portable rig, is used in Persia, India and Egypt. The Galician pole tool system is used in the Dutch East Indies. Persian production is obtained at from 1,100 to 1,400 feet. Deeper drilling was resorted to in the Yenangyaung field of Burma with good results, previous drilling not having exceeded 300 or 500 feet. Wells more than 2,000 ft. deep are drilled in the Singu field of India. Wells in Japan range from 600 to 2,000 ft., and the rotary system, introduced in the Akita field in 1913, is used almost exclusively. The diamond drill, a "core" drill used in prospecting for coal, iron and copper deposits, has been introduced as a geological aid in oil-field work. Another means recently employed for drilling test holes and shallow wells is a combination rotary, core and churn drill. Petroleum development of recent years has entailed deeper drilling with consequent heavier demand on oil-field materials. In the United States and in other countries the shallow fields have become exhausted. Drilling to 2,500 and 4,000 ft. has demanded sturdier equipment, heavier and larger casing and improved designs in drilling machinery. Better methods of handling heavy wrenches and bits and of dressing bits have been adopted.

New mechanical devices to aid in well-drilling are constantly being introduced. In electrical rotary drilling, an electric device keeps a check on the drilling crews, indicating when and how long the rotary was shut down. A register giving the weight of pipe resting on the bit is being perfected by experimental tests. It is designed to enable the driller to determine the amount of speed to use in certain formations, with a view to lessening "twist-offs" and thereby lessening the number of fishing jobs. While derricks in most oil-producing countries are chiefly of timber, the all-steel derrick has appeared in certain fields of the United States, Rumania, Galicia, Trinidad, England and South America. Electric power has become a factor in field work and has been adopted for the pumping of wells and for drilling, for driving slush, water, oil and vacuum pumps and for air compressors, gas extractors, machine shops, field lighting and dehydration of oil. Electric power has made advances in Texas, in California and in the mid-continent fields. It has been adopted in Rumania and in the Balakhany–Saboontchy–Romany–Surakhany area and the Bibi-Eibat field of Russia. Electrification of the Yenangyaung field of Burma has also been undertaken. The use of compressed air to increase oil extraction has been introduced recently in certain producing areas. The process consists of pumping compressed air or gas into some wells while others are pumped for oil. The advent of the internal-combustion engine has brought about the extended use of belt, chain and gear driven pumps, while previously single or duplex driven reciprocating steam pumps were mainly used. The turbine pump has also developed oil-field possibilities.

Transport and Storage

Pipe Lines.—With its large crude-oil production obtained from fields often far from refining and consuming centres, the petroleum industry of the United States has developed pipe-line systems of great mileage and capacity (*see* 21,320). In the fields themselves there are networks of gathering lines connecting the wells with main trunk lines and railways, the trunk-line systems connecting the fields with the refining centres. It is estimated that pipe lines in the United States totalled about 35,000 miles. Practically all of the crude oil produced (1,300,000 bar daily) is transported by pipe line, some of it only a few miles and some of it as far as 1,700 miles. About 150,000 bar. a day are taken from the eastern and mid-continent fields to the Atlantic seaboard through a connecting system of pipe lines. Mid-continent crude is also piped to the Gulf coast. It is estimated that the total U.S. production moves by pipe line an average of more than 500 miles. Pipe lines in Mexico have been constructed from the Panuco and Topila fields to Tampico and from the southern fields to Tampico and directly from the southern fields to the Gulf coast, where sea loading lines are installed. There is an international trunk line running into Canada connecting with lines in Ohio. In Venezuela the production in the Mene Grande field is run by pipe line about 35 m. to a refinery at San Lorenzo where there is also a terminal from which crude oil is barged to a refinery on the I. of Curaçao. A pipe line of about 25 m. has been constructed from wells in the Colorado district of Colombia to a refinery at Barranca Bermeja on the Magdalena river. The Lobitos field in Peru is connected by pipe line to the port of Talara, 16 m. distant, where there is a refinery and a terminal for export shipping. Argentina has short field pipe lines. In Trinidad there are pipe lines from the Pitch Lake district to refineries at La Brea and Port Fortin and also from this field and the Tabaquite district to Claxton's Bay, where they extend into sea loading lines. Pipe lines

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run from the Galician fields to refineries located in and near the fields. Rumania's pipe-line system leads from the fields to refineries near and around Ploeshti. A few days before Rumania's declaration of war a Government-owned pipe line was completed from Baicai to Constantza on the Black Sea. Oil from the Balakhany–Saboontchy–Romany–Surakhany oil field is piped to refineries on the outskirts of Baku. Oil from the Bibi-Eibat field is barged to the same place. A kerosene pipe line from Baku to Batoum on the Black Sea was completed in 1905. Grosny oil is piped to refineries near the town of Grosny. The Ural–Caspian fields are connected by pipe lines with Bolshaya Rakushka, where refineries are located. Tcheleken oil is shipped to Baku refineries. Oil from the Maikop field is piped to Ekaterinodar and to the port of Tonapse on the Black Sea.

Oil from the Gemsah and Hurghada fields of Egypt is transported by pipe lines to a refinery at Suez. Pipe lines connect the Maidan-i-Naphtun field of Persia to a refinery at tidewater located at Abadan. Oil from Singu and Yenangyaung fields is piped to refineries near Rangoon, a distance of about 275 miles. Oil from the Langkat district of Sumatra is piped to refineries at Pangkalan on the Bay of Aroe. Southern Sumatra fields are connected by pipe lines to refineries at Pladjoe and Bagoes Koenig, both near Palembang. Java production is transported to refineries at Wonokrono and Tjepoe, Borneo oil by lighters to a refinery on the harbour of Balik Papan.

Pump Stations.—In the United States, pump stations are usually 30 to 40 m. apart in the eastern and middle states, but there are cases of long-continued operation of 120 m. with one pump station. A steam pump station usually consists of a pump house, boiler house, gate house, office and tanks. Diesel engines are being installed extensively in pumping stations.

Sea Loading Lines.—Sea loading lines have been installed and are operating in Mexico, Peru, Trinidad, Russia and other places. These lines make possible the loading of vessels several miles at sea and are usually installed where no deep-water harbours exist and where, because of the shallow water, the building of piers would entail prohibitive expenditure. The lines are submarine and are usually coupled ashore, stretched out on rails and drawn into the water by vessels. When it is impossible to couple the pipe ashore, this is usually done on barges or rafts and the line deposited as the work proceeds. The first sea loading line in Mexico was pulled in 1913 by the use of wooden dollies on a wooden track. At present numerous companies have sea lines along the strip of island beach between the Panuco and Tuxpam rivers.

Storage.—Crude-oil storage facilities, where steel tanks or reservoirs, are grouped together on what are generally known as tank farms, some of which in the United States have a capacity in excess of 24,000,000 barrels. Steel tanks are usually of 37,000 or 55,000 bar. capacity, placed about 500 ft. apart from centre to centre. Each tank is surrounded by a levee of sufficient height to hold the entire content of the tank and enclosed for the purpose of isolating fires. Crude oil is stored in steel tanks, concrete tanks and earthen reservoirs, while many of the lease tanks are wooden. There were held in the United States in pipe line and tank farm storage, at the end of 1920, 138,000,000 bar. of crude oil. In addition, 21,000,000 bar. of crude oil were stored at refineries. Tanks are installed at refineries for holding oil during the running at the plants and for storage preparatory to shipment to markets. Stocks of refined products held at U.S. refineries at the close of 1920 totalled 2,433,700,000 gallons. Investigation and experimentation are constantly directed to the reduction of evaporation losses of crude oil and refined products during storage. An investigation by the U.S. Bureau of Mines showed that in just one stage of handling of crude production in the mid-continent field, the volume of gasoline lost by evaporation equaled one-thirtieth of the total gasoline production of the United States. The loss occurred during a few days when oil was stored on leases before being taken by pipe line, and amounted in 1919 in the mid-continent field alone to 122,100,000 gallons. Insulated storage tanks of about 10,000 bar. capacity are being experimented with by a few mid-continent casing-head gasoline manufacturers.

Tanks are usually protected from fire by steam lines from the boiler house so that free steam can be turned into the tanks on the approach of a thunderstorm. This steam displaces the explosive mixture in the tanks. The water spray method is also used. At pipe-line stations, and tank farms and refineries where there is a large number of tanks, a fire protective system which utilizes a frothy or foam mixture is often installed. This mixture has as its ingredients water, aluminium sulphate (crystal), sulphuric acid, ground glue, glucose, sodium bicarbonate and arsenious oxide. The system entails a piping and pumping system and the equipment includes solution tanks and foam-mixing boxes. Each storage tank has a mixing box into which pipe lines leading from the solution tanks discharge. The boxes are outside the tanks and the foam is admitted to the tank through a raised hatchway. The substance spreads over the surface of the oil. To insure the foam reaching the surface of the blazing oil at whatever depth without the bubbles being destroyed by the impact of the drop, a series of baffles is used retarding the descent. Tanks covered with a jacket of asbestos supported by steel framework are being experimented with. Submarine storage tanks, which if required can be rested on sea bottom, have been devised.

Tank Vessels.—The tank vessel plays a large part in the modern petroleum industry. It is used for transporting crude oil from producing countries and districts to refining countries and centres and for carrying refined products in bulk to the markets of the world. The world's tonnage of tank vessels (including steam, gas, sail and barge) increased from 1,525,000 gross tons in 1914 to about 4,000,000 tons at the end of 1920, with 1,100,000 tons under construction.

Great advances have been made in tanker construction and the loading and unloading of oil from tank vessels. The typical modern tanker carries 16,000 tons of oil, is equipped with quadruple expansion engines and boilers fired with liquid fuel, has a complete shelter deck the whole length of the vessel, oil-tight hatches and two pump rooms with pumps capable of discharging 1,200 to 1,500 tons per hour. The Diesel engine is also used for propulsion in some tankers, while the oil-fired steam-driven turbine is gaining headway. Oil cargoes are now loaded and discharged in a few hours. Devices have been perfected enabling vessels to take on a supply of fuel oil from tankers while under way on the high seas.

Refining

Refinery Operations.—The rapid expansion of the internal-combustion engine which, as developed in motor vehicles, began to be of importance as a consuming agency of petroleum products in 1907, has elevated gasoline (petrol) to the ranking by-product of crude oil. More recently the conversion of coal-burning vessels and industrial plants to the use of oil and the extension of utilization of the Diesel engine (an internal-combustion engine which does not demand so volatile an oil as gasoline) in the marine and in the industrial fields has placed fuel oil in a position of great prominence. Even so great an increase in crude-oil production as was recorded between 1908 and 1920 could not have supplied these consuming agencies had not refining methods been improved, new processes developed, and refinery capacity greatly expanded. As in the case of crude-oil production, the greatest refinery expansion has been in the United States, where in 1915 it is estimated there were 302 refineries with a crude-oil capacity of 1,043,245 bar. daily. On Jan. 1 1921 there were 415 refineries with a daily capacity of 1,888,800 barrels. The types of plants represented in this total were: 35 complete, 302 skimming, 60 wax and lubricants, 7 asphalt and 11 topping.

United States refineries in 1920 ran 434,000,000 bar. of crude oil, and produced 4,882,000,000 gal. of gasoline; 2,320,000,000 gal. of kerosene; 8,861,000,000 gal. of gas oil and fuel oil; 1,047,000,000 gal. of lubricating oil; 541,000,000 lb. of wax; 576,000 tons of coke; 1,290,000 tons of asphalt; and 1,492,000,000 gal. of miscellaneous oil. The principal refining centres in the United States are in the mid-continent territory, in the Pennsylvania region, and along the Atlantic, Gulf and Pacific coasts. Every large producing area has developed a refining industry, while the seaboard plants, in most instances, owe their location to strategic advantages respecting large domestic and export markets. Mexico has built up a substantial refining industry, although the largest proportion of its crude-oil production is transported to the United States for topping and refining, in most part by Atlantic and Gulf coast plants. Most of the Mexican plants are topping plants (that is, they divide the crude into tops, distillates and gas and fuel oils), but there are a few more complete refineries. All the refineries are located along or adjacent to the Gulf of Mexico or the eastern seaboard, comparatively near the producing fields. In 1920 there were 12 refineries reported in operation in Mexico with a daily capacity of 19,600 cub. metres of refined products. Four of these refineries were classified as complete plants, six as topping plants and two as natural-gas gasoline plants. There were five plants under construction, two complete refineries, one a topping plant and one a natural-gas gasoline plant. In 1920 61,000,000 bar. of Mexican crude oil were run by U.S. refineries. Canada has developed a substantial refining industry, these refineries operating on Canadian, United States, Mexican and Peruvian crude oil. There are one or more refineries or topping plants in Venezuela, the I. of Curaçao, Colombia, Trinidad, Peru and Argentina, these operating on domestic oil or oil from nearby territories. Galician crude oil is handled by refineries located within a radius of about 150 m. from the city of Lemberg, in and near the oil fields, and also by the Continental refineries in Hungary, Austria and Germany. It is estimated that Galician refineries are capable of handling about 40% of the crude production. Rumania's refineries are mainly located in the Prahova district and also in the Bacau, Dambovita, Constantza and Neamt districts. In 1920 Rumanian refineries used 988,000 tons of petroleum, and produced 212,000 tons of benzine, 197,000 tons of lamp oil, 30,000 tons of lubricants and 473,000 tons of fuel oil. The output of the different refined products by Russian refineries in 1916 (last figures available) totalled 56,917 million poods of fuel oil, 6,926 million poods of lubricating oils, 135 million poods of solar oils, 944 million poods of benzine and 57 million poods of paraffin. Russian refineries are located at Blacktown, suburb of Baku, these running oil from the Baku fields, at Grosny and Bolshaya Rakushka and at Ekaterinodar and Shirvansky. There are local refineries in Egypt, Persia, India, the East Indies and Japan, and Persian oil is also being handled by a refinery at Swansea, Wales.

Continuous Distillation.—Continuous-process stills were first introduced by Norman Henderson, a British chemist, in connexion with the distillation of shale-oil. This system was subsequently adopted by many refiners of petroleum. A modification of Henderson's benches of stills was the addition to each member of the series

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of a fractionating column, endeavouring to carry out the fractionating in one stage so that the one-bench stills would provide finished products. Similar considerations led to the development in California of the Trumble process, introduced by M. J. Trumble, a California chemist, consisting of an elaborate series of heat interchanges. In this process, oil is heated in a tubular furnace. It is dropped down a tower where, by means of distributors, it is brought in contact with the hot side of the column still and so gives a film evaporation. A recent modification of stills is the Allan system, introduced by Hugh Allan, a British chemist, whereby the oil is vaporized in the ordinary kind of Henderson still, but in place of being subsequently redistilled, or being collected via a column, vapours are blown into a series of vertical pipes, getting a fractional condensation from member to member, the latent heat of the high boiling components being used to reëvaporate any condensed volatile oil, thus obtaining the fractions desired. Topping and skimming plants to raise the flash point and to dehydrate heavy oil have multiplied rapidly, particularly in the United States. The skimming industry is represented in all the major oil fields and has other purposes which give the plants practically a universal field in the oil industry, namely, to remove the lighter constituents of the oil for storage for a long period, thus reducing the losses from evaporation, to dehydrate or clean the oil and, in conjunction with a complete refinery, to remove the lighter fractions cheaply and quickly, leaving a residue to be re-run for lubricants, coke and other products.

Cracking Processes.—The commercial development of the cracking process subsequent to 1913 marked an epoch in the petroleum industry. The growing importance of the internal-combustion engine made necessary a higher yield of motor fuel from the limited crude-oil supply, if the demands of this consuming agency were to be met. Modern cracking dates back to the patent obtained in 1889 by the late Sir Boverton Redwood and Prof. Dewar, British chemists (*see* 21.322), but commercial development followed the first patent of Dr. W. M. Burton, an American chemist, in 1913.

The following classification of oil cracking processes (representative patents) is made by the Kansas City Testing Laboratory (*Bulletin No. 15*):

I. Cracking in the vapour phase.
  A. Atmospheric pressure.
    Oil gas plants, very high temperature.
    Pintsch gas plants, very high temperature.
    Blaugas plants, 1,000–1,200° F.
    Parker (W. M.) process at 1,000° F. with or without steam.
    Greenstreet Cherry red with steam.
  B. With increased pressure.
    Rittman process above 950° F. and 200–300 lb. pressure.
    W. A. Hall process 1,100° F. and about 75 lb. pressure.

II. Cracking in the liquid phase.
  A. With distillation.
    1. At atmospheric pressure.
      Luther Atwood (1860).
      McAfee process with aluminium chloride.
      Russian and American practice for illum. oils.
    2. Above atmospheric pressure.
      Dewar and Redwood (1889).
      Bacon and Clark at 100–300 lb.
      Burton (Standard Oil Co.) 650–850° F. and 60–85 lb.
      Dubbs, J. A., over 10 lb. and over 300° F.
    3. Very high pressure (over 27 atmospheres).
  B. Without distillation and with high pressure.
    1. Without vapour space for equilibrium (continuous processes).
      Benton (1860) 700–1,000° F. and 500 lb.
      Goebel-Wellman.
      Mark (English).
    2. With vapour space.
      (*a*) Intermittent.
        Palmer (below 27 atmospheres for aromatics).
      (*b*) Continuous.

Dr. Burton's process is now extensively used in the United States. The development of this patent and the large-scale adaptation of the cracking process marked an era in the history of petroleum refining.

The following is a summary of an address made by Dr. Burton in May 1918, on the occasion of the presentation to him of the Wm. Gibbs medal by the American Chemical Society.

Dr. Burton pointed out that in 1910 the demand for gasoline created by automobiles began to grow so rapidly that it was obvious that something would have to be done to increase the supply of naphtha products. In those days the average yields of various products of petroleum were about as follows: naphtha products 18%, kerosene or illuminating products 30%, lubricating products 10%, loss 3%, leaving about 40% which was sold for gas-making or fuel in lieu of coal. The problem was to convert the high-boiling fractions existing in fuel and gas oil into low-boiling fractions needed by the internal-combustion engine. Dr. Burton and his associates worked for almost two years trying to devise a practical method, first by superheating and dissociation at high temperatures, but at atmospheric pressure; and, secondly, by the employment of various reagents, but their efforts were not successful. Having tried everything else that suggested itself these engineers decided to attack the problem from the pressure distillation standpoint. In view of the fact that distillation must take place at temperatures ranging from 350°C. to 450°C., at which the tensile strength of steel begins to diminish very rapidly, and in view of the fact that steel at such temperatures, in the presence of carbonaceous matter (and even of free carbon, which often comes as the result of pressure distillation), is likely to absorb such carbon, become crystalline and lose its tensile strength, the practical refiner doubted the success and safety of this method.

The first large still built had a charging capacity of 6,000 gal. of heavy oil. Serious leaks were encountered, but this problem was finally solved, as the oil carbonized under the influence of the high temperature and the carbon deposits stopped the leaks. There were many puzzling problems to be solved, such as the devising of a safety valve that would operate freely in spite of the intense heat and the presence of carbonaceous matter. The entire apparatus had to be constructed in such a way as to insure ease of operation and freedom from excessive repairs. The production and disposition of the so-called " fixed gases " were troublesome. It was found that in some cases the heavy oil with which the operation began evolved more gas than was needed to maintain the desired pressure, whereas other oils evolved an insufficient amount of gas for this purpose. This obstacle was converted into an aid by arranging a large number of stills in parallel so that the superfluous gases from some stills were conducted to others that needed them. The plan gave a perfect method of securing uniform pressure and control.

By starting with fuel-oil products having boiling points ranging from 200° C. to 350° C., it was possible to secure a very substantial yield of a product having boiling points ranging from 50° C. to 200° C., and it was found that losses thus incurred were trifling, averaging less than 3 per cent. It was found that the high-boiling residues thus produced yielded a product almost identical with the natural asphalt.

Developed from the single 6,000 gal. still there were then (1918), Dr. Burton stated, over 500 stills of a larger capacity. During the preceding five years more than 20,000,000 bar. of gasoline or naphtha products had been produced by these stills in the United States.

It is estimated that cracked gasoline probably accounts for about 15% of all gasoline manufactured in the United States. Casing-head gasoline, manufactured from natural gas, the development of which ranks with cracked gasoline as one of the most important refining advances, is perhaps the source of from 12% to 15 per cent.

Natural Gas.—The United States and Canada produce all but a small fraction of the natural gas output of the world (*see* 21.321). The main areas of Pennsylvania, W. Virginia and Ohio have developed remarkable staying qualities, and these three states produced virtually two-thirds of the total production of the continent. The mid-continent field has shown a great increase in the natural gas production and the Wyoming field has proved productive. There is some natural gas production in Russia, Rumania, Persia, Galicia, India, Japan and Mexico. The total production of natural gas in the United States in 1918 was 721,000,000,000,000 cubic feet. It is estimated that no less than 14,000,000 inhabitants of the United States are enjoying this fuel as a source of heat, light and power.

Natural Gas Gasoline.—Although the foundation of the natural gas gasoline industry in the United States was laid in 1903 and 1904, the real expansion of this important phase of gasoline production began in 1909. In 1911, the first year for which statistics on the subject are available, 132 plants produced 7,425,839 gal. of raw gasoline from natural gas. In 1918 the industry included 1,004 plants which produced 282,535,550 gal. of raw gasoline. Of the total, 865 were compression plants producing 219,767,207 gal. and 139 absorption plants producing 62,768,343 gallons. A canvass made in 1921 showed a total of 444 casing-head gasoline plants in Kansas, Oklahoma and northern and central Texas, having a daily output of 1,101,155 gal. of raw gasoline. Prior to 1916 the greatest proportion of gasoline production from natural gas was obtained from casing-head gas, oil-well gas or " wet " natural gas by the compression and condensation method. The development of the absorption process has extended the field of the natural gas gasoline industry to include practically all of the natural gas production in the United States, for there is but little gas production that does not contain an appreciable percentage of pentane and hexane, the hydrocarbons of the paraffin series that are the principal constituents of gasoline. Much of the so-called " wet " gas obtained from oil wells when they are first opened and from gas wells that produce no petroleum, has been sufficiently rich in gasoline vapours to warrant treatment by the absorption process, though excluded from successful treatment by compression and condensation. The following extracts are from *Handbook of Casinghead Gas*, by Henry P. Westcott:—

" Casing-head gas received its name from the casing-head on the top of the casing through which it flows. It is the gas that flows from oil wells, coming out between the casing and the tubing. The volume varies from a few hundred cubic feet to several hundred thousand cubic feet per day. Invariably the gas becomes richer in gasoline content as the wells grow older. Generally a gasoline plant or property consists of a number of oil leases grouped around a main compressor station in which the actual making of gasoline takes place. The gas lines from different wells on each lease run to a main line in which is placed a meter to measure the gasoline from that

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lease. The main line runs to the compressor station or plant. There are a few plants extracting gasoline from a volume as small as 5,000 cub. ft. of gas per day, while some of the large plants are extracting gasoline from a volume of two and three million cub. ft. per day. The amount of gas necessary to make a profitable proposition is not only dependent upon the volume of gas but also on the quality of the gas. To further assist in the production, a vacuum pump or compressor is installed in the same building with the booster compressor. The object of the vacuum pump is to pump the gas from the wells and create a vacuum which materially increases the flow of the gas. Vacuum has been used in oil wells to increase the production even when gas could not be used for making gasoline.

"There are two processes for extracting gasoline. The one most commonly used is that of compression. The other is the absorption process, which is not only used with casing-head gas but also with natural gas, commonly called "lean gas," which carries as low as one-tenth of a gallon or less of gasoline per one thousand cubic feet. This process is used with gas at high as well as low pressure.

"In the compression process, the equipment consists of one or more two-stage compressors, coils, accumulating tanks, electric generator and other accessories. The casing-head gas is compressed to a pressure of from 50 to 300 pounds and then passed through a system of coils on which cold water is constantly dripping. This cools the gas, condensing the gasoline from it, the liquid being separated into respective accumulating tanks and the residue gas passing off to be used for power or heating purposes. After the gasoline is collected in the accumulating tanks, it passes into blending tanks, where it is blended with naphtha and other blending mediums to lower the gravity so as to permit of shipping without severe loss through evaporation and to make the shipping of it a safe matter.

"The absorption process is a method of passing the gas through oil and separating the gasoline vapour from it by absorption of gasoline into the oil. There are two general designs in absorption plants, one of which uses the horizontal and the other the vertical absorbers. With either system the oil is used over and over again."

Work of experimentation has been done on a process for extracting gasoline from natural gas by a method whereby natural gas is passed through absorbers containing charcoal, the gasoline absorbed by the charcoal and then distilled out.

Marketing of Products.—Expansion of the use of petroleum products has resulted in many improvements in marketing methods and great additions to marketing equipment and facilities. In the United States a large number of tank cars is used in transporting products from refineries to consuming centres and to ports for export shipment. The tank car is still used to some extent to carry crude oil from the field to refineries, but chiefly this is when a new field is opened up and before pipe-line connexions have been made. Tank cars are widely used in Europe for petroleum products.

There were 49,901 petroleum tank cars in the United States and Canada on Jan. 1 1914, and in 1921 the number had increased to 137,493. Rigid requirements are enforced in tank-car construction in the United States. Cars must be of steam boiler quality, and exceptional strength is prescribed for the frame. The insulated tank car to handle highly volatile casing-head gasoline has been successfully introduced and is also being adopted for transporting straight-run gasoline because it reduces loss by evaporation. The growth of motor-vehicle gasoline demand, particularly extensive and rapid in the United States, has created new distributing methods and devices. In that country and Canada gasoline filling installations for motor cars have been established in the cities and on every road of any importance. Thousands of filling stations have been built. Gasoline is delivered from tank wagons or steel barrels to the tanks built underground at the filling stations. The oil is lifted from these tanks by pumps (which measure the amount given by each stroke of the pump) and delivered through a hose into the automobile's tank. Lubricating oil at some stations is delivered in much the same way. An innovation is the visible pump at filling stations.

Fuel-oil bunkering stations have been established along the ocean routes to meet the increase in the oil-burning naval and merchant fleets of all countries. These stations include large storage tanks and berth and loading facilities in some cases, while in many instances they are simply storage reservoirs and oil is loaded on steamers from barges supplied from these stations. It is estimated that the number of fuel-oil stations for steamships located on trading routes approaches 300.

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(L. M. F.)

PETROLOGY (*see* 21.323).—During 1910–21 there was a steady advance in all departments of petrology, and new developments occurred which were not only interesting in themselves but gave promise of being important in the future. Up to a comparatively recent time petrology was in the main a descriptive science. The discovery of the application of the microscope to the study of very thin sections of rocks opened up a new field of investigation and showed how defective had been the means employed by the older geologists. It became possible to identify even the smallest mineral grains and to ascertain their relations to one another and the manner in which they were built together from the rock mass. For many years the description of the microscopic characters of minerals and rocks was held to be, if not the only, at least the most important, part of petrographical literature. The processes by which rocks are altered by atmospheric agencies and by underground water were revealed in detail. A great body of literature was accumulated, and a great diversity of rock types soon came to be recognized, some of them occurring in abundance in many parts of the world and others rare and exceptional either in their mineral composition or in their minute structures. Textbooks of petrography were in general a description of the recognized rock types, their composition, structure and the stages of their decay, with notes on their geographical distribution and their geological age. Chemical analyses were used principally as a means of identifying the classes to which individual rocks belonged and as a guide to the minerals of which the rocks consisted.

In time it came to be recognized that this aspect of the subject, if not unscientific, was at least incomplete. More attention of recent years has been directed to other problems connected with rocks—such especially as the conditions of their origin, their chemical classification and the physical laws which determine what minerals shall be formed, in what order they will crystallize and through what stages they will pass when subjected to cooling, pressure and metamorphism. In fact, the effect of the laws of physics and chemistry on the mineral composition and structure of rocks had become by 1921 a branch of petrology which was rapidly developing. It would be a mistake to regard this as wholly a new development, for many of the older geologists—such as Hall Gregory Watt, Daubrée, Fouqué and Lévy, Sorby, Morozewich—had carefully studied these problems and had made some notable discoveries. Essentially, however, it was necessary to attack these questions by experimental methods. The old charcoal furnace was very unsatisfactory and difficult to regulate; the gas furnace in all respects was much superior; but the advent of the electric furnace has placed in the hands of the experimentalist a weapon of enormously greater power and far more manageable. There is no difficulty now in attaining temperatures such as occur in the deeper parts of the earth's crust and in the interior of volcanoes and in maintaining these temperatures quite steady for several days or weeks if necessary. The electric pyrometer has replaced the gas thermometer and the older Seger and Wedgwood cones, and has reached such precision that an error of one or two degrees is all that need be expected in measuring temperatures up to 1600° Centigrade. By means of the electric arc, temperatures can be obtained which are beyond those which exist in the upper parts of the earth's crust, but furnaces of this type have been little used in these researches. Very high pressures can be easily obtained provided the temperature is low and there is no necessity to study the action of compressed gases. It is less easy, however, to perform experiments by which the action of steam and other gases on molten rock magmas at temperatures about 1000° and under pressures over 100 atmospheres can be exactly determined. More than one investigator has now been able to attain this, and a very correct reproduction of the conditions under which igneous rocks crystallize is consequently possible in the laboratory.

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Descriptive petrology has been by no means in abeyance, though the five years of war turned the activities of many geologists to other fields. Exploring expeditions, such as those of Scott, Shackleton and Bruce in the Antarctic, have brought home large collections of rocks which have been examined and described, and the constant activities of geological surveys in all parts of the world, together with the researches of geological specialists, have added largely to our knowledge.

Igneous Magmas.—Of the three great groups into which rocks are naturally subdivided, the sedimentary, igneous and metamorphic, the first is on the whole best understood and presents the smallest number of unsolved difficulties. The manner in which sediments are laid down on the bottoms of seas and lakes, in river deltas and valleys and on land surfaces, at the present time is open to investigation by simple means, and, except in the case of the deposits of the deeper parts of the oceans, is reasonably clear. Igneous magmas, on the other hand, are essentially obscure in their origin and history, and they have been the subject of much investigation in recent years. The origin of magmas is a problem belonging to geology rather than petrology. They have been regarded as unconsolidated remnants of the primeval molten globe, which by geological changes, such as the secular contraction arising from cooling and the pressures by which mountain chains have been upheaved, have been afforded an outlet to the surface, where they appear as volcanoes, or have been forced between the rocks of the upper layers of the earth's crust where they may be laid bare by subsequent denudation as " bosses " of granite or gabbro or intrusive sills of porphyry or dolerite. Others have held that magmas may arise in whole or in part by the fusion of solid rocks (of any of the above three classes); the agencies producing fusion being rise of temperature, either through crushing and movement or by depression into those regions where a high temperature naturally prevails, or through penetration of gases from the earth's interior which are not only intensely hot but are capable of combining and setting free large quantities of energy. It is conceivable also that deep within the earth's crust masses of rock occur at temperatures so high that, if pressure be relieved by the vaulting-up of the overlying crust or by fissures opening to the surface, they may become liquid and rise through any available channels.

Hardly less obscure than the origin of magmas is the question of their variety or differentiation. The outstanding fact in this connexion is that no large developments of igneous rock are really homogeneous and even in small masses it is frequent to find that a great number of varieties or rock-species occur, differing in their chemical composition and their minerals. Granite, diorite, gabbro, norite and peridotite may all occur within a small outcrop not more than one or two square miles in area. The origin of differentiation has been much discussed. Some have ascribed it to diffusion or to a principle by which the heavier atoms in the molten mass will be concentrated either towards the bottom or towards the cooler edges or surfaces of contact with the surrounding rocks. Along these lines no satisfactory explanation has been found. More recent speculations have followed three lines: (*a*) subsidence or flotation of crystals; (*b*) absorption of sedimentary or other foreign rocks; (*c*) concentration of vapours.

(*a*) *Subsidence or Flotation of Crystals.*—When crystals form in a liquid they will, if heavier than the liquid, tend to subside and be collected near the base; and if lighter, they will tend to rise. If the crystals differ in composition from the liquid, as they usually do, consolidation will result in a mass which is not homogeneous. Thus, for example, olivine crystallizes early in a basic magma and, being heavy, will tend to sink; consequently magnesia and iron will be in excess (and silica will be less abundant) at the base, while felspar will predominate towards the top of such a mass. Instances occur showing this arrangement, but they are very exceptional; it is not the case that dolerite and gabbro masses as a rule have a pale-coloured felspathic top and a dark base rich in olivine and the oxides of iron. For such cases as do occur another explanation is often available. If now it were possible at an advanced stage in crystallization to drain away or force into another position the still liquid part of the magma a type of rock different from the original magma would be produced, because most of the heavy ferromagnesian minerals would have been abstracted.

The explanation is so simple and so well justified by experiment that it is difficult to believe it has no application in the differentiation of rock types. There is much evidence, however, that forbids us to accept it as important. For example, the study of great dolerite intrusions by means of bores shows that they are generally nearly homogeneous throughout. Top and bottom are very much the same as a rule; yet these masses must have cooled and crystallized with extreme slowness; and every chance was afforded for the accumulation of heavy crystals in their deeper parts. Again, it is the case that where many varieties of rock occur in one mass the densest are not generally in the lowest horizons. Still more important is the fact that field evidence often shows clearly that the more basic members of a complex intrusion have been injected in a liquid state into an earlier less basic mass already in position. In that case, if the more basic member was produced by the gravitational sinking of heavy crystals these must have been subsequently melted up, a process for which it is very difficult to suggest an explanation.

(*b*) *Absorption of Foreign Rocks.*—A second method of differentiation which has received much attention of recent years is by absorption of country rock. A gabbro mass, for example, may be supposed to dissolve a felspathic sandstone with which it is in contact and thus give rise to a more acid magma which might be represented by quartz-dolerite or even by granite. Intrusive masses of igneous rock, as they ascend from beneath, break across the overlying strata and may shatter them into many small blocks. On these and on the surrounding walls a solvent action is likely to take place. If the invaded rock is heavier than the intrusive magma its fragments will tend to sink, and as they are warmed up they will slowly disappear. There can be no doubt that this action is by no means unusual and many good instances of it are known, but there is little reason to believe that it is an important cause of differentiation. Where igneous rocks have absorbed sediment in any quantity they present in general an abnormal facies. Granites, for example, which have dissolved clay, slate or mica-schist usually contain andalusite, sillimanite, cordierite, garnet or corundum, minerals which do not normally occur in such rocks. The magmas are said to be " contaminated." Gabbros under similar conditions contain cordierite, garnet and an excess of hypersthene (forming cordierite norites) and are easily distinguished from normal gabbros. Absorption of limestone by some nepheline syenites is indicated by the presence of crystalline calcite in the igneous rock, and peridotites may contain corundum. Perhaps the diamond is an accessory of this type in olivine rocks which have dissolved graphitic matter. Even when igneous rocks are absorbed the result will as a rule be an abnormality. This is fairly evident in the majority of cases merely by a study of the analyses of true igneous rock types and ordinary sediments.

It is to be remembered, however, that a study of the crystallized igneous rocks exposed by denudation of the earth's surface reveals to us merely the last stages in their history when the upward propulsive force was spent, the fluid mass had come to rest, its temperature had fallen to such a point that crystallization had begun, part of its gases had escaped and the whole mass was encased in a solid envelope which had resulted from the rapid chilling of its external parts in contact with the cold surrounding rocks. At an earlier stage the magma was at a higher temperature and was in active movement. Constant stirring was going on and dissolved matter rapidly scattered through the whole mass. In the deeper parts of the crust the solid rocks may be mostly gneisses or old intrusive rocks different in character and in their relative abundance from the sediments of post-Archaean times, richer in alkalis and more nearly akin in composition to the igneous masses. These conditions would favour absorption and mask the consequences; and if it took place on a very large scale and time were given for diffusion a magma might be produced which would closely mimic a purely igneous magma. It has also been suggested that the absorption of foreign matter might upset the equilibrium of the original magma and give rise to partial magmas incompletely soluble in one another. It would be very difficult in such a case to determine the original nature of the rock or the amount and composition of the material dissolved.

(*c*) *Concentration of Vapours.*—The theory that differentiation of magmas arises from the formation of partial magmas during cooling, which separated because they became insoluble in one another (as phenol does with water), is favoured by many geologists, but a recent examination of the physical laws determining the production of such magmas has led to the conclusion that nothing is known that would make this process appear likely. Many geologists, however, who have a wide knowledge of igneous rocks in the field, hold that there is evidence to show that differentiation took place before crystallization began, and that the various types of rock were already distinct when they were injected in liquid form into the positions they now occupy.

It has been suggested, though it has not been clearly explained, that the gases dissolved in magmas determine the sequence of crystallization and may exert a powerful influence in differentiation. A magma rich in gases when it begins to crystallize yields crystals of anhydrous minerals. The gases, if they do not escape, must increase in relative amount in the liquid residuum. The early minerals are those like olivine and augite, which can be crystallized without difficulty from anhydrous melts; the later minerals, such as the alkali felspars and quartz, crystallize readily only in presence of steam and other gases (or of solvents of a nature not usually present in rocks). In some respects the crystallization of an igneous rock

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resembles the cooling and evaporation of a saline solution, the gases playing the part of solvent. The minerals appear in the order of their insolubility. It is probable that the history of magmas will never be clearly understood till a very careful study is made of the consolidation of rock-making silicates under high pressures of steam and other gases such as are known to abound in natural volcanic magmas.

Classification of Magmas.—The igneous rocks of one geological period and province have often so many peculiarities in common that they can be regarded as having resulted from the consolidation of a single reservoir of molten matter. The chain of volcanoes that fringes the shores of the Pacific Ocean from Tierra del Fuego to Alaska, and thence by Japan and the Philippines to Java and Sumatra, is characterized by rocks which have so much similarity in many important characters that they are certainly of allied origin, even if they have not proceeded from the one source. These rocks are all of Tertiary and recent age; their eruptions began in Eocene or Miocene time and have continued, with more or less frequent intermissions, up to the present day. For another example of this we may take the igneous rocks of the western and mid-Atlantic area, from Jan Mayen, through Iceland, the Hebrides, Canaries, Cape Verde Is., etc. All these volcanic centres have many rock types in common, and the whole assemblage is strikingly different from the Pacific igneous rocks. Each of these magmas has been taken as a type, and it has been found that in the older geological periods they are also represented; for example, the early Devonian eruptions in Scotland are distinctly of the Pacific type, while the Carboniferous eruptions in the same district are of the Atlantic type. If we seek for a precise definition of their respective characters it is not easy to give a complete answer. It may be said, however, that the Pacific suite has a great prevalence of hypersthene andesites, and andesites of all kinds. The Atlantic lavas, on the other hand, are predominantly olivine basalts, with trachytes and phonolites. Another feature which is especially striking is that practically all the rocks carrying nepheline and other felspathoids or "alkali minerals" are found in the Atlantic suites. This has been regarded as proving that the Atlantic magmas are richer in alkalis and the Pacific in lime, but it is by no means certain that this is the explanation. In fact, a full chemical discussion of the relations of these rock-series to one another has yet to be undertaken, but from the work of Becke it seems that the Pacific are essentially richer in silica, and in the "light" elements generally, while the Atlantic contain more of the "heavy" elements, such as magnesia, iron, chromium, titanium. Several authors have pointed out that the rocks of the Pacific group are associated with a folded mountain chain and consequently have appeared in a region undergoing lateral compression and upheaval; the Atlantic, on the other hand, are associated with a region of subsidence, with vertical dislocations along lines of fissure and faulting—in other words, a region subjected to lateral tension and depression. A third group of igneous rocks, very well characterized and distinct in many respects, is the pillow lavas or spilites, which are perhaps the most abundant volcanic rocks of the earlier geological periods and are very widespread in the Lake Superior district, middle Europe, Wales and Scotland. Among these lavas types rich in soda are common and albitization is a frequent pneumatolytic change. These rocks seem to accompany depressions formed in consequence of folding.

The attempt to classify volcanic magmas in groups which accompany definite types of earth movements, folding and faulting, is exceedingly fascinating. A general survey of the world's volcanics from this standpoint has been undertaken by Iddings and Stark, but the results are by no means conclusive. A great deal has yet to be done before we understand the full range of variation of many local magmas, their relation to one another and the approximate age of the intrusive types. It seems, however, that Atlantic, Pacific and spilitic suites are not in all cases sharply distinct. Harker believes, for example, that the Hebridean Tertiary magmas of Scotland are Atlantic with some Pacific affinities. He had formerly classified them as Pacific. Bailey and Clough have found in the same district a group of pillow lavas occupying a central volcanic subsidence or "caldera." In that case, accordingly, all three types occur in one narrowly circumscribed area. If so, they cannot be regarded as distinct types of magma, but rather as facies which may be developed or may appear as offshoots of a magma. Their connexion with definite types of telluric movement becomes doubtful. American petrologists also, from a study of the Tertiary magmas of the Western States, are by no means satisfied that the alkali rocks, such as phonolites, tephrites and leucitic lavas, may not belong to a definitely Pacific assemblage. In Australia, Atlantic and Pacific magmas seem to be intermixed, but in Africa Atlantic igneous rocks accompany fault-fissuring, and this extends into Arabia and Palestine. There is no doubt that on a broad scale the Atlantic and Pacific types have appeared again and again in the earth's history, and have maintained their distinctive characters. The distinction, however, is not absolute, and the rule has many exceptions. Recognition of a number of additional types has recently been proposed, and along this line it is probable that there may be considerable advance in the near future.

Experiments on Constitution of Binary Magmas.—A molten rock magma may be regarded as a liquid composed principally of oxides (mostly silicates). It crystallizes from a variety of causes, of which cooling is the most important, though relief of pressure and escape of gases may also play a part.

The laws followed in such a case have been very carefully investigated, not only for metals, salts and organic compounds but also for many minerals. It is generally true that a mixture of two substances will have a lower consolidation point than one of the pure substances, and, if mixed in certain proportions, they will consolidate at lower temperatures than either of the components. Thus salt and ice, if mixed in the solid state at temperatures a little below the freezing-point of water, will melt, forming a liquid which is colder than the ice originally taken; and aqueous solutions of salts have always a freezing-point lower than that of pure water. For each pair of substances there is a definite mixture which has the lowest temperature of consolidation and this is known as the *eutectic* mixture.

In the diagram (fig. 1) the horizontal coördinate represents composition, the vertical represents temperature. A mixture of any given composition is represented by a vertical line and different points in that line represent different temperatures of the mixture. The two sloping lines AE and EB divide the diagram into two regions, of which the uppermost indicates substances in a purely liquid state; below the line the substance is in part or wholly in a solid condition. A vertical (composition) line, accordingly, when it cuts these lines shows where a substance begins to crystallize. The point where the curves meet is the eutectic point E, and shows the composition of the mixture which has the lowest freezing temperature and the temperature at which it consolidates. The horizontal line drawn through the eutectic point separates the diagram into two regions, a lower one in which the substance is entirely solid and an upper one in which liquid is present. If we take any vertical line in the diagram, it will indicate a mixture of definite composition ST and, followed downwards, it shows the changes taking place in such a mixture as the temperature falls. Above the line AE the mixture is a cooling liquid. At S crystallization begins. At T the last liquid portion disappears and consolidation is complete; below T the substance is a cooling solid. The diagram refers only to substances that crystallize on solidifying; glasses are solids which essentially resemble highly viscous liquids in their properties. When crystallization begins the substance which is in excess of the eutectic mixture will crystallize out first, the residual liquid becoming poorer in that component until it has reached the eutectic composition, when the two components will go on crystallizing simultaneously till all is solid. The composition of the liquid will travel along the line AE from S to the point E, where it will remain constant.

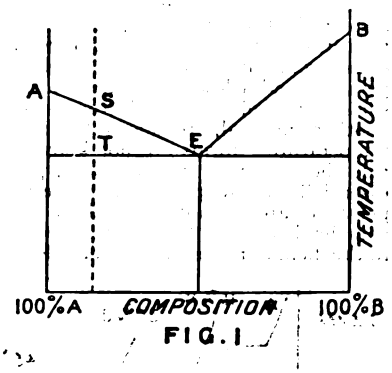

FIG. 1

Such a diagram is based on a series of experiments in which a known mixture of two substances (very carefully purified) is heated in a furnace (generally electric) to a temperature well above its melting-point. The mixture is then allowed to cool slowly and steadily, and its temperature recorded at short intervals or continuously by some form of pyrometer or recording thermometer. The rate of cooling can be very accurately ascertained and plotted (fig. 2). Crystallization is attended by liberation of heat (the liquid losing its latent heat as it passes into a solid), and this involves a retardation of cooling. The simple liquid cools at a uniform rate; crystallization

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begins and the cooling slows down; at a certain point the liquid is all crystallized and the mixture, now a solid mass of crystals, will go on cooling uniformly. The change of slope in the curve of cooling accordingly corresponds to the passage of the substance from S to E in temperature (or from the purely liquid to the purely solid areas).

The physical condition of the substance at any given temperature can also be ascertained by the method of chilling. If the charge be taken from the furnace and plunged in water (or in some cases mercury) the mixture consolidates almost immediately, and any parts which were liquid will assume the form of a glass, or a very finely crystalline aggregate. This is especially the case with silicates, many of which crystallize with difficulty. Microscopic investigation will enable us to determine the nature and relative proportions of the crystals which were present. The results obtained can be checked by experiments on mixtures having a different composition, and in this way a complete diagram built up on a sound experimental basis. The case outlined above is the simplest known. Many complications may appear, requiring special precautions and elaborate investigation. Thus the liquid may not begin to crystallize at the proper point on the upper curve, as some substances crystallize with difficulty and the liquid becomes " undercooled." A heating-up experiment may be tried to check the cooling experiments; the same phenomena should appear in the reverse order if no complications are present. Many silicates crystallize with great difficulty in ordinary crucible experiments (such as the felspars, albite and orthoclase). Again, it may be impossible to melt the mixture we desire to investigate in any furnace which is suitable for experiments of this kind. Magnesia, alumina, and lime are examples of substances which cannot be fused at temperatures such as 1600° to 1700° C., which are the limits of accurate work in our laboratories at present; part of the diagram accordingly will be incomplete when substances like these are studied, but an approximate solution can generally be made by extrapolation. Another frequent complication is the appearance of transformations in the solid state. The first mineral to crystallize becomes unstable as the temperature falls and changes spontaneously into another crystalline form of the same substance. The change will be attended by an alteration in the slope of the cooling curve, for in such cases heat is either liberated or absorbed, and successful chilling tests can often be made by which the mineral transformation can be clearly demonstrated. Silica, for example, appears in three minerals, cristobalite, tridymite and quartz, the transition temperatures being 1470° and 870°. Each of these minerals occurs in two forms. Carbonate of lime has a high-temperature and a low-temperature form. Below 1190° calcium metasilicate crystallizes as wollastonite; above that temperature it forms another mineral, pseudo-wollastonite. Many of these " high-temperature " forms are not known as natural minerals, and as a rule they are very rare in rocks, probably because rock cooling is essentially a slow process, and the most stable forms at low temperatures are the only ones likely to be present when the mass has completely cooled. Some very interesting results have been obtained in this field of research; for example, it is known that quartz has two

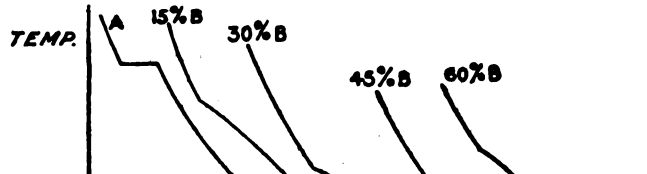

FIG. 2.

modifications, one above 575°, the other below that temperature, and it has been proposed to use quartz as a geological thermometer to show at what temperature it crystallized in a rock mass. If above 575° it would appear as quartz and on cooling would pass into α-quartz; and by various indications, such as crystalline form, cracks, etc., a record of this transformation may be obtained.

Very interesting modifications of the process of crystallization occur when two or more of the minerals formed are members of an isomorphous series and can in consequence form mixed crystals. This is very common among the minerals of igneous rocks, of which the felspars, pyroxenes, olivine (and probably also hornblende, mica, nepheline and the felspathoids) all belong to isomorphous series. If we have, for example, two components such as albite and anorthite, they will tend to form mixed crystals (known generally as plagioclase felspars). Anorthite has the higher melting-point (about 1550° C.); albite crystallizes in crucibles only with great reluctance at a temperature about 1100° C. A mixture containing equal proportions of anorthite and albite will melt at about 1450°, and on cooling will begin to form crystals at that temperature. These crystals will contain about 60% anorthite—that is to say, they are enriched in the less fusible component. As crystallization proceeds, the felspar that separates becomes gradually less rich in anorthite. The composition of the liquid also alters, because the crystallization is abstracting anorthite molecules more rapidly than albite molecules. This process may go on till the felspar has all crystallized, the last deposited being near albite in composition, and the crystals, examined microscopically, will show zones, of which the internal are rich in anorthite and the external are progressively richer and richer in albite. But if sufficient time is allowed, a reaction sets in between the crystals and the liquid; in other words, the felspars crystallized are not in equilibrium with the magma except at the moment of crystallization, and as the magma becomes richer in albite it will attack the early plagioclase, replacing it by a variety containing more albite. These phenomena are well known to petrologists as zonal structure of plagioclase felspars; and corrosion of the cores and internal zones of the crystals is almost universal in such rocks as basalt and andesite. Rocks of similar composition which have cooled very slowly, such as gabbro and norite, as a rule do not contain zoned plagioclase crystals, no doubt because equilibrium has been attained and homogeneous crystals formed by the process above described.

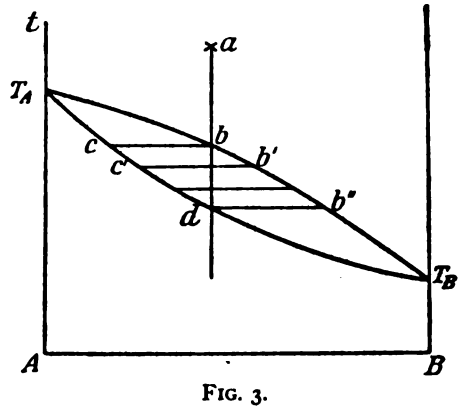

FIG. 3.

This may be illustrated by fig. 3. The horizontal line represents composition, the vertical temperature. A is 100% albite, B is 100% anorthite. The upper curve is the liquidus above which there is only liquid; the lower is the solidus below which all is crystallized: between these lines is a space representing stages in which crystallization is going on but still incomplete. Each point on the solidus has a corresponding point on the liquidus, which is found by drawing a horizontal line across the intervening space. A mixture of any composition, say *a* at *ab*, is completely liquid. As the temperature falls it begins to crystallize at *b*. The crystals formed have the composition *c*. Further cooling results in the formation of crystals at *b'* the composition being *c'*. At *b''* all is crystallized, the last crystals being *d*. If resorption is completely accomplished the final crystals have the composition *x*, but they are usually more rich in albite: this will depend on the rate of cooling, the number and size of the crystals formed, and on a variety of other factors.

The theoretical investigations of Roozeboom and Gibbs have shown that five types of crystallization of isomorphous substances may occur, in some of which the mutual solubility of the two components is unlimited, while in others it is limited so that only mixed crystals of certain types may occur. Several of these have been identified in rock-forming minerals, and others are suspected though not yet proved.

Ternary Magmas.—Magmas of three components (ternary) are much more complicated than binary magmas. To represent their behaviour a triangular diagram is necessary. Usually an equilateral triangle is employed and the distance from any point to the three sides of the triangle is made to represent the three components of any mixture in their true proportions; the sum of these three perpendiculars is constant and equal to the height of the triangle: if lines be drawn through the point, parallel to the sides of the triangle, they will cut the sides at distances which will represent the relative proportions of the components. Any mixture of three components can be represented by one point in this triangle. To represent temperature another coördinate is required which is perpendicular to the plane of the triangular diagram: and a solid model must be made, resembling a triangular prism with flat base and an irregular surface representing the consolidation temperatures as the top of the prism. Each of the three vertical surfaces of the prism represents the behaviour of the mixture of two of the components.

To enable us to construct such a model a very large number of experiments must be made, first with binary mixtures and then with mixtures of the three substances. Their exact temperature of first crystallization must be ascertained in each case and also the nature of the mineral which crystallizes. Simultaneous crystallization of two minerals will follow, and the temperature at which the second mineral appears is to be determined. Three minerals will ultimately

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appear, and the last process will probably be the formation of a ternary eutectic at which the temperature remains steady till the liquid disappears and finally the completely solid mass cools down.

As a very simple case we may take the diagram in fig. 4. A, B and C represent the three pure substances. AB, BC and AC represent mixtures of two components. E_{ac}, E_{bc} and E_{ab} represent the three binary eutectic mixtures. The ternary eutectic is represented by E_{abc}, containing about equal quantities of C and B and a smaller amount of A. If *a* represent the composition of a certain liquid which is allowed to cool and crystallize, composition will change along the line A_{ab}. At a certain point the A component will crystallize out and the liquid will become poorer in A (richer in B and C), and the composition will change from *a* towards *b* (away from point A). After a time the liquid becomes saturated for *b* which will start to crystallize, and now the liquid changes composition along the line bE_{abc} as the temperature continues to fall; finally C also begins to crystallize, and the ternary eutectic point is reached at which the three components crystallize simultaneously in definite proportions (represented by the position of E_{abc}) until it is completely solidified.

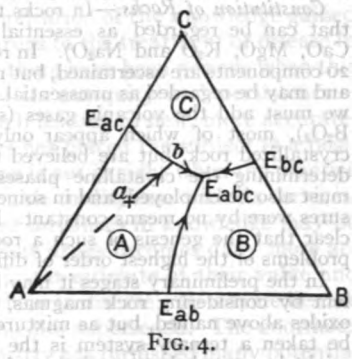

FIG. 4.

It is probable that nothing quite so simple as this occurs in ordinary rock-forming minerals, at least the silicates, but some metallic alloys show this type. In considering silicates the following considerations must be kept in mind: (*a*) The liability to form compounds, which behave as new substances with their own fusion-points and eutectics. (*b*) The occurrence of isomorphous compounds is almost universal and these form mixed crystals unstable in the changing magma, and liable to resorption (this may upset the formation of a ternary eutectic altogether). (*c*) Compounds may appear at an early stage which subsequently become unstable and are replaced by different minerals (incongruent). (*d*) Many silicates refuse to crystallize in ordinary crucible experiments (except in presence of solvents which do not appear in the final product).

We must also keep in mind that in the crystallization of rocks certain conditions prevail which may modify the process to an unknown extent. Thus: (*a*) All magmas contain gases of various kinds which may have a very powerful influence in determining what minerals will form. (*b*) Intrusive magmas are under great pressure and the pressure diminishes as they rise to the surface; the pressure may act directly or by increasing the concentration of the gases dissolved in the magma. (*c*) Cooling in deep-seated magmas is extremely slow. This will tend to prevent supersaturation by undercooling and lessen the chance of the abnormality in the

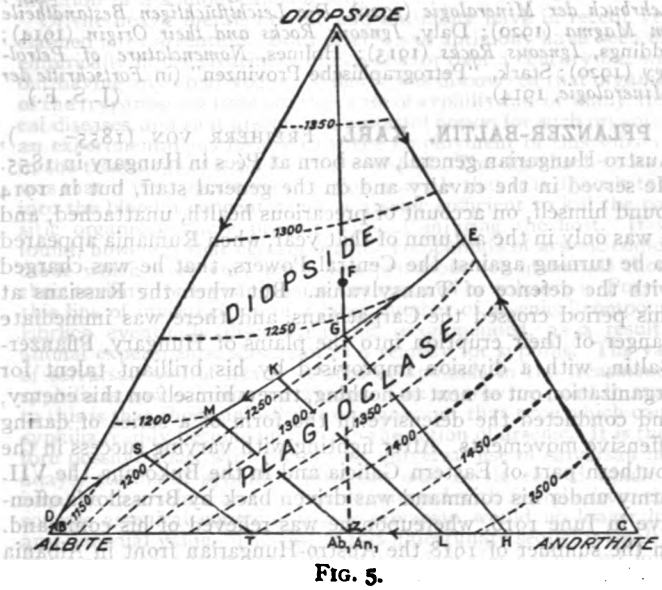

FIG. 5.

sequence of crystallization which may appear in rapidly cooled melts. It will also favour the complete transformation of early unstable minerals into stable permanent forms. Many varieties of minerals have already been obtained experimentally which are not known to occur in rocks. They are stable only at high temperatures (and possibly under low pressures).

As an example of the effect of isomorphous minerals on the sequence of crystallization we may take a mixture consisting of 50% diopside and 50% plagioclase (containing equal proportions of albite and anorthite). The composition diagram (fig. 5) is a triangle with each mineral at one of the corners and the mixture is represented by a point (F). Crystallization begins with a separation of diopside (supposed to be a simple mineral and not an isomorphous mixture, as it would usually be in rocks) at about 1275°. At 1245° the excess of diopside (G) has separated out, and felspar begins to crystallize. It has about 75% anorthite (H). Thereafter diopside and felspar both crystallize, but as the temperature travels along the line EGD from G to K the composition of the felspar changes from H to L (if we suppose that all the early felspar which is unduly rich in anorthite is stage by stage absorbed). The resulting rock has the mineral composition above stated; but if resorption of felspar is incomplete the last-formed felspar is richer in albite and has a composition T. The felspar crystals in that case are zonal with basic centres. If at any time crystallization is suddenly brought to an end, a glassy ground-mass will be formed, which is richer in soda and silica than the original magma and contains zoned felspar crystals. This is exceedingly like what takes place in many basaltic lavas. Again, if the original mixture had been richer in felspar, so that the composition point lay below the line DE, felspar would have crystallized out first. This seems to be in keeping with the structure of many dolerites, which contain felspar partly enclosed in augite

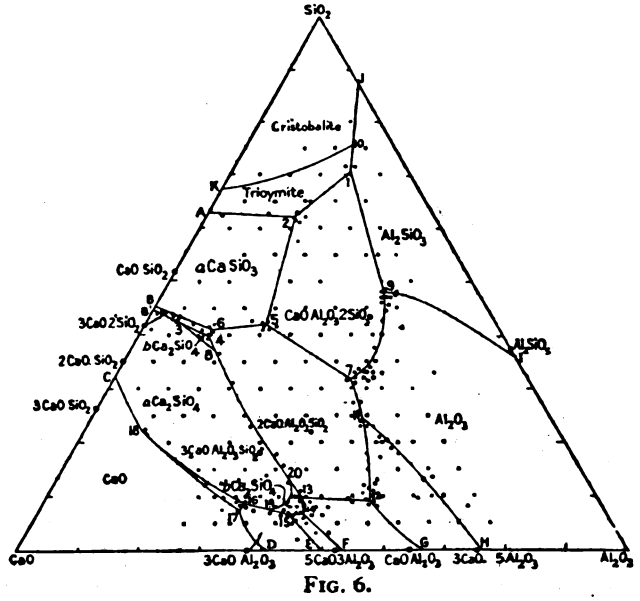

FIG. 6.

crystals of later formation (ophitic structure), while others show that the augite appears in porphyritic crystals and began crystallizing before felspar. Another interesting feature of this diagram is that there is no tertiary eutectic point, and the liquid residue continually changes in composition up to its final disappearance.

The phenomena of these component systems are extraordinarily varied. One of the best known is the system Al_2O_3–CaO–SiO_2 which has been very fully tested at the Geophysical Laboratory in Washington by Shepherd and Rankin. A copy of their diagram is given here (fig. 6). It is divided into fields, of which six are occupied by substances known to occur as minerals, cristobalite, tridymite, wollastonite, anorthite, sillimanite and corundum. In each of these fields the mineral named will crystallize if the temperature of the melt falls. The fields are separated by lines which show under what circumstances the two minerals whose fields adjoin will crystallize. Where three fields meet, the conditions exist at which three minerals will exist simultaneously (or, to express it otherwise, are in equilibrium with a liquid of the composition indicated). In no case do four fields meet in one point.

This system is also of much interest to technologists desiring to understand the chemistry of the manufacture of Portland cement. This is a mixture of lime, alumina and silica, with a fairly definite composition, and the compounds which form on fusing or sintering the mixture are indicated by the diagram. Similarly, the CaO corner of the figure shows what is the result of heating lime containing a little alumina and silica (impure limestone) to a very high temperature. Silica is also a refractory mineral and is used in silica-bricks and ganisters for lining furnaces. A little lime and alumina are mixed with it (either naturally or expressly to obtain certain results), and the behaviour of such mixtures is indicated by the appropriate corner of the ternary scheme. These investigations accordingly are of the greatest value in many industries such as pottery, steel-making, glass-melting, brick-making, cement manufacture, lime-burning and the quartz-glass industry. During the war the Carnegie Geophysical Institute at Washington, which has earned great fame

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for these researches, was able to direct the manufacture of chemical and optical glasses in the United States in a most successful manner, and performed very valuable services to American industry.

Theory of Ternary Mixtures.—The theory of ternary mixtures has been very fully worked out mathematically by Willard Gibbs, Backhuis Roozeboom, Schreinemakers, Smits, Kuenen, Tammann and others, and may be said to be well understood in its main applications. Experimental investigation has also made great progress. It is a laborious matter, requiring great skill and very elaborate appliances. The diagram we have given showing the tertiary system CaO, Al_2O_3, SiO_2, required over 7,000 experiments, in some of which the heating had to be continued for many hours and even for days; and the thermal results had usually to be checked by microscopic examination of the product. Other systems equally important have received very careful study. These are not so simple as the instance quoted, because mineral transformations, either during or after crystallization of the melts, often give rise to many complications. Thus, for example, $CaSiO_3$ crystallizes as pseudo-wollastonite at high temperatures, which may change to wollastonite at low temperatures. $MgSiO_3$ has four forms—kupferite, magnesia amphibole, enstatite and clinoenstatite. Where both these substances separate from the melt, none of the above-named minerals appears, but a diopside clinoenstatite solid solution or isomorphous mixture, which belongs to the common group of minerals known as the pyroxenes.

These facts are of the greatest interest to both mineralogists and petrologists. They have introduced many new minerals (artificial) to our knowledge, and taught us their relationships at atmospheric pressures in certain dry melts. They have also enabled us to understand many of the peculiarities of the minerals that occur in rocks, and the method of their origin.

As another instance we may quote the relations of forsterite (Mg_2SiO_4) and rustalite ($MgSiO_3$). Forsterite may crystallize from melts of suitable composition and after a time it may become unstable in the residual magma; then it is dissolved up or "corroded" and clinoenstatite replaces it. Again, if an enstatite ($MgSiO_3$) mixture be fused and allowed to cool, forsterite begins to separate out; it will tend to be reabsorbed and converted at a lower temperature to clinoenstatite, but if this be prevented the mixture solidifies as forsterite, clinoenstatite and quartz. To the petrologist this is of great interest, because forsterite is one of the constituents of olivine, a very common mineral of the basic igneous rocks. Now olivine generally occurs along with some member of the pyroxene group, and the olivine crystals show rounded outlines, which have been taken to indicate corrosion or resorption by the magma after crystallization with concurrent formation of pyroxene. In some rocks there is clear evidence that olivine crystallized early and subsequently was entirely dissolved. In other rocks olivine is found enveloped in clusters of enstatite crystals which have evidently formed at its expense; and it is a very frequent characteristic of the olivines of gabbro and norite that they are surrounded by "reaction rims" or "corrosion borders" consisting of enstatite, tremolite and other magnesian silicates that have a higher percentage of silica than olivine itself. The meaning of these phenomena was fairly well apprehended by petrologists, and now their conclusions have been confirmed by experimental evidence. Another feature of some interest is that, in the ternary system under consideration, it has been shown that forsterite may crystallize early, then disappear by corrosion, and a second generation of forsterite may subsequently crystallize. Whether this is a common phenomenon is not yet known, and its exact relation to the frequent appearance of minerals in two generations in rocks remains to be demonstrated.

The number of ternary systems that have as yet been fully investigated is small, though the results are of the highest importance. Those which contain the alkalis potash and soda present certain special difficulties, such as the volatility of part of the mixtures and the difficulty of crystallizing some of the minerals. Rapid progress is being made and it is unlikely that experimental difficulties will retard the advance of knowledge. A special case, of the greatest possible interest to the petrologist, arises where one or more of the components are volatile. Natural magmas are probably always richly charged with gases. The theory of such systems has been explored by Schreinemakers, Smits and others. Experiments with mixtures enclosed in steel bombs which can withstand great pressures at high temperatures have been very successful in certain cases, but as yet only the borders of this field have been explored. A good deal of work has been done on the dissociation pressure of sulphides of the metals, a subject of great importance as regards the paragenesis of natural sulphides and the conditions under which mineral veins have been formed. The effect of steam in the formation of silicates is under investigation and during the next few years will probably be the subject of much research.

Quaternary Mixtures.—We have seen that systems of three components are much more complicated than systems of two components; and the addition of a fourth component greatly increases the difficulties. The theory of such systems is not as yet fully explored; in fact, it is quite probable that many of the problems will not be solvable by mathematics. No four-component system has yet been completely studied, though parts of such systems have received investigation. As a diagram a solid figure bounded by three equilateral triangles may be used, and projections similar to those employed to represent the faces of crystals have been tried. Systems more complicated than the quaternary systems are at present beyond mathematical and experimental investigation.

Constitution of Rocks.—In rocks the least number of components that can be regarded as essential is seven (SiO_2, Al_2O_3, Fe_2O_3, CaO, MgO, K_2O and Na_2O). In rock analyses as a rule from 12 to 20 components are ascertained, but most of these are in small amount and may be regarded as unessential. To the seven main components we must add the volcanic gases (such as H_2O, F, Cl, HCl, SO_3, B_2O_3), most of which appear only in very small quantity in the crystallized rock, but are believed to exert a powerful influence in determining the crystalline phases that appear. High pressures must also be employed, and in some cases it is certain that the pressures were by no means constant. For these and other reasons it is clear that the genesis of such a rock as granite or basalt presents problems of the highest order of difficulty.

In the preliminary stages it may be possible to simplify the problem by considering rock magmas, not as a mixture of the seven oxides above named, but as mixtures of minerals. If three minerals be taken a ternary system is the result. For example, a granite might be regarded as consisting of orthoclase, quartz and albite; a nepheline syenite as consisting of nepheline, albite and aegirine; a basalt as composed of olivine, diopside, anorthite. Such systems, of course, are a mere approximation and it is already known that it may not be safe to treat them as simply ternary. In the system diopside-forsterite-silica, for example, it is proved that under certain conditions spinel crystallizes, and the reactions can only be regarded as those of a four-component mixture. Another difficulty that is bound to prove important is the occurrence of isomorphous minerals. In petrology this is practically universal. Except quartz, all the common rock-forming minerals are members of complicated isomorphous groups (felspars, nepheline, sodalite, micas, pyroxenes, amphiboles, olivines); and even in simple ternary systems, if two of the three minerals are isomorphous, there may be, strictly speaking, no eutectic mixture as the last stage of crystallization. It is not too much to say that the crystallization of rocks is very largely a problem of the formation of isomorphous crystals, and it is unsafe to apply to rocks the results derived from mixtures of minerals that do not show similar relations.

BIBLIOGRAPHY.—For the recent advances in physico-chemical and experimental petrology no English textbook is available. Harker's *Natural History of Igneous Rocks* (1909) gives a sketch of the subject from the standpoint of its time, but is now out of date. A more adequate work is Boeke's *Physikalische-Chemische Petrographie* (1915), which gives full references and is the best general account. Vogt's *Silikat Schmelslösungen* (1904) is interesting but very speculative. His *Sulphid Silikatschmelzungen* (in course of publication) deals with some special aspects of the problem. The fundamental works on the theory of equilibrium are Roozeboom's *Heterogene Gleichgewichte* and its continuation (3rd vol.) by Schreinemakers. See also Bancroft, *The Phase Rule*, and Findlay, *The Phase Rule*; Tammann, *Krystallieiren und Schmelzen*. For English and American students the best authorities are the papers published by the workers of the Geophysical Institution in Washington. See also Niggli, *Lehrbuch der Mineralogie* (1920), *Die Leichtflüchtigen Bestandtheile im Magma* (1920); Daly, *Igneous Rocks and their Origin* (1914); Iddings, *Igneous Rocks* (1913); Holmes, *Nomenclature of Petrology* (1920); Stark, "Petrographische Provinzen" (in *Fortschritte der Mineralogie*, 1914). (J. S. F.)

PFLANZER-BALTIN, KARL, FREIHERR VON (1855–), Austro-Hungarian general, was born at Pécs in Hungary in 1855. He served in the cavalry and on the general staff, but in 1914 found himself, on account of precarious health, unattached, and it was only in the autumn of that year, when Rumania appeared to be turning against the Central Powers, that he was charged with the defence of Transylvania. But when the Russians at this period crossed the Carpathians, and there was immediate danger of their eruption into the plains of Hungary, Pflanzer-Baltin, with a division improvised by his brilliant talent for organization out of next to nothing, threw himself on this enemy, and conducted the defensive in the form of a series of daring offensive movements. After fighting with varying success in the southern part of Eastern Galicia and in the Bukovina the VII. Army under his command was driven back by Brussilov's offensive in June 1916, whereupon he was relieved of his command. In the summer of 1918 the Austro-Hungarian front in Albania yielded before the attack of the Entente army. Pflanzer-Baltin, entrusted with the command in this theatre of operations, won back, after a brief and powerful attack, the old positions southwards of Fjeri and Berat—the last considerable success which fell to the Austro-Hungarian army in the field. (A.-K.)

PHARMACOLOGY (*see* 21.347).—The science of experimental pharmacology is a product chiefly of the last half-century, and

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the subject has more recently made rapid advances, due largely to the creation of new laboratories and the institution of new chairs devoted to pharmacological research. The chief importance of the work lies in the application of the knowledge gained of the physiological action of drugs to the treatment of disease in man and animals; and, though there have been periods when this branch of therapy—in spite of its antiquity and persistence—has been suspect, recent research leading to new, more accurate, and more scientific use of drugs has placed the subject in a position so indubitable that the time is not in sight when the practice of medicine or surgery will be able to dispense with its services.

The main directions of recent advances in knowledge may be indicated. The action of familiar drugs becomes daily more accurately known, leading to a juster estimate of their value and greater precision in the use of them in disease. New remedies are being introduced and older remedies superseded. The enormous development of synthetic chemistry has furnished many potential remedies, all of which are now subjected to pharmacological investigation before they are used on man. One relatively recent development which has proved fruitful in results of great practical importance in the treatment of disease is that of experimental therapeutics, where the cure of disease artificially produced in experimental animals is investigated. So far this has been most successful in the case of experimental trypanosomiasis, largely owing to the ease with which a disease of this nature can be induced in laboratory animals and the constancy and certainty of its duration.

Here only such developments of pharmacology need be mentioned as have already passed from the by-way of mere academic interest into the highroad of practical application.

Of the simpler saline compounds the familiar Epsom salts—magnesium sulphate—has been found to have more interesting actions than that for which it is generally used. When given as a purgative very little of it is absorbed into the blood, owing to the difficulty which both magnesium and sulphate ions experience in passing through membranes like the lining of the gut. But if injected hypodermically or intravenously in sufficient quantity it has a powerful action on the nervous system, causing a kind of motor paralysis and anaesthesia. This effect of magnesium—for the sulphate ion takes no part in it—has been utilized in the treatment of tetanus, in which condition magnesium salts have been injected intraspinally, with benefit in many cases in so far as the relief of symptoms is concerned. This depressant action of magnesium on the nervous system is antagonized in a dramatic way by calcium salts; an animal paralysed by magnesium being restored, in suitable cases, to a normal condition in a few seconds by intravenous injection of a soluble calcium salt.

Of the heavy metals arsenic and antimony have in recent years claimed most attention. Both arsenic and antimony have been used empirically in the treatment of syphilis for over a century but without having any great vogue. When it was discovered that organisms of the trypanosome type are the cause of syphilis and of many tropical diseases, and that arsenic is a powerful poison for such organisms, an experimental justification for the employment of this substance in the treatment of syphilis was furnished. The drawback to its use was that it is so poisonous to higher animals that it is difficult to get into the blood a concentration of arsenic sufficient to kill the parasitic organisms there present without injuring the host. It was found, however, that certain organic compounds of arsenic could be made which were very much less poisonous for mammals though their toxicity for trypanosomes was retained or enhanced. Pursuing this line of investigation of a large number of arsenical compounds Ehrlich eventually discovered and recommended, as a result of animal experiments, salvarsan as a remedy for syphilis. The value of salvarsan and of nearly related compounds in the treatment of syphilis is now common knowledge. One interesting point in regard to this is that those unicellular organisms of that type which causes syphilis readily become immune to the action of arsenic. It is therefore possible that, with the almost universal use of salvarsan nowadays, strains of syphilitic infection may be developed which are immune to arsenic; and for people infected with syphilis from these sources arsenical compounds like salvarsan would no longer have any remedial value. The risk of this unfortunate sequel is small because usually salvarsan treatment renders the patient no longer liable to infect other people and only in this way could an "arsenic-fast" infecting organism be produced, but the risk would seem to be not negligible. Fortunately no such immunity to mercury occurs.

The fact that antimony belongs to the same chemical group as arsenic suggested the possibility that it, too, might be valuable in these diseases, and pharmacological investigation showed that antimony has for trypanosomes a toxicity superior even to that of arsenic. Though no organic compound of antimony has been discovered comparable in advantageous properties with the salvarsan compound of arsenic, the familiar tartar emetic (potassio-tartrate of antimony) has been found, when administered intravenously, adequate for the treatment of two important diseases, Kala-Agar and Bilharzia—diseases due to organisms different from trypanosomes and for which no other effective remedy is known. These discoveries have led to a revival of the use of antimony in medicine; in the 17th and 18th centuries especially, antimony was regarded almost as a panacea, but later it lost a prestige which it is now regaining.

One of the established pharmacological actions of lead is to stimulate involuntary muscle of every kind, as exemplified in cases of industrial poisoning by the occurrence of colic caused by irregular and spasmodic contraction of the muscle of the bowel. While lead-poisoning tends to become less common, owing to trade precautions and earlier recognition of it, stress has been laid on the frequency with which lead is used, especially in industrial districts in the N. of England, to procure criminal abortion, which it tends to do—though only in poisonous quantities—by the irritant action of lead on the muscle of the uterus. For this purpose lead plaster, which is easily procurable by the laity, is frequently used by ingestion.

Of the simpler derivatives of benzol, carbolic acid itself, which was first employed by Lister as an antiseptic now over half a century ago, has gone largely out of use, especially as a surgical antiseptic, though certain closely related compounds have important antiseptic uses. Thus benzoic acid and benzoates are very widely used as antiseptics in preserved foods and are, so far as careful experiments have shown, harmless in the quantities used for this purpose. Salicylic acid has come to be a favourite antiseptic for many infective skin diseases.

The group of antipyretic derivatives of benzol continue to be widely employed not so much for reducing febrile temperatures as for their action in relieving pain, which they effect by a paralysing action on that part of the brain which is responsible for the perception of pain. A large number of new compounds of this type have been investigated but so far only one of them threatens to usurp the supremacy of the older phenacetin and antipyrine, namely aspirin. Aspirin is a compound of salicylic acid and acetic acid. Salicylic acid and its compounds have a very important, and partly specific, effect in rheumatic fever in which they relieve the pain and reduce the temperature; but aspirin is more effective in relieving non-rheumatic pain such as headache. It is a relatively harmless drug; but occasionally alarming, if not serious, symptoms are produced by it in people specially susceptible to its action, the most frequent symptom being oedematous swelling of the face, which, however, disappears when the drug is discontinued.

Though much new work has been done on the effect of moderate doses of alcohol, little has been added which was beyond the shrewd suspicion of those who have intelligently experienced its effects throughout the ages. That it has killed more than it has cured is more than probable; that, if the imperfection of human nature persists, alcohol, if it is banished, will be replaced by something worse is not unlikely. Numerous new artificial hypnotics have been investigated, of which veronal, legitimately used, has proved safe and efficient. Unfortunately cases of veronal habit have become increasingly frequent, and deaths from overdosage, of which the lay papers have afforded numerous examples in recent years, must have served to warn the general public of its dangers.

Of the general anaesthetics ether has steadily gained in favour for routine purposes. To get rid of its irritant action on the lungs and bronchi, it has been administered in limited cases intravenously and by rectal injection, but experiments are in progress which may result in the discovery of an anaesthetic ether deprived even of the slight drawbacks which at present attach to it.

With regard to the great group of alkaloids, much light has been thrown in recent years both on their chemical constitution and their exact pharmacological actions, and no apology need be made for taking the alkaloids of opium first. These can be divided chemically into two groups, of which morphine is representative of the one and papaverine of the other. The two groups differ considerably in their actions, as might be expected. The papaverine group has a much more pronounced action than the morphine group in relieving spasmodic contraction of smooth muscle—a pharmacological explanation of the clinically observed fact that preparations of opium, which contain a mixture of the alkaloids, are better for relieving colic, for example, than pure morphine. Preparations like tincture of opium have long been used for the relief of pain by external application, in spite of the fact that pharmacological evidence was against its having any action on the sensory nerve ends, but more recent and exact research has shown that some of the alkaloids have a distinct local anaesthetic action, apart from the effect they have in relieving pain by an action on the central nervous system.

The stimulant action of caffeine on the higher functions of the brain is recognized in the world-wide practice of consuming beverages, such as tea and coffee, which owe their stimulant action to the caffeine that they contain. But caffeine also stimulates the kidney and causes an increased flow of urine. Caffeine is chemically a trimethyl-xanthine and two closely allied compounds, theobromine and theophylline—dimethyl-xanthines—are more powerful diuretics while having less effect on the central nervous system. They are used, in preference to caffeine, where diuretic action alone is desired.

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Cocaine is another alkaloid which was discovered as the result of the use by natives of S. America of the leaves of the coca plant as a stimulant. The active ingredient of these leaves is the alkaloid cocaine, which was found to be a powerful local anaesthetic and which rapidly displaced from use the older and less efficient remedies for the prevention of local pain. But the stimulant action of cocaine on the brain has not been overlooked by civilized races; and the habit, insidious and disastrous, of indulging in cocaine as a stimulant has become a serious problem especially in America and in France and has necessitated restrictive legislation upon the sale of the drug in most countries. This is only one of the many drugs used as a stimulant-intoxicant, others being morphine and its derivatives and the various hypnotics. When drugs having this narcotic action are taken for a very few times the person rapidly develops a craving for them. If the practice is continued, larger and larger doses have to be taken to produce the same effect, and in no long period a habit is developed, always difficult and sometimes impossible to break off.

One disadvantage of cocaine as a local anaesthetic—for example in dentistry—is that it is a very poisonous substance if absorbed into the general bloodstream in sufficient quantity and with sufficient rapidity. This danger can be prevented to a large extent, as is now the general practice, by injecting with it adrenaline which causes such a powerful contraction of the blood-vessels in the region of the injection that the cocaine is absorbed very slowly; and, as it is being excreted continuously, the risk of a dangerously high concentration occurring in the blood is minimised. Artificial compounds resembling cocaine have been manufactured which are equally good local anaesthetics but are less generally poisonous. Such local anaesthetics act by blocking the passage of impulses through the nerves, so that painful sensations can no longer pass through the affected nerve. A similar effect can be produced on the spinal cord if the anaesthetic is injected so as to come into immediate contact with it. By this method of " intra-spinal anaesthesia " the whole of the lower limbs and of the lower part of the body can be rendered insensitive to pain, because conduction of pain sensations from this region to the receiving station (the brain) is blocked at the site of injection.

The plant belladonna is said to have been so named because it was used in by-gone days by ladies fair for the sinister purpose of dilating their pupils to enhance their charms. The chief active principle of belladonna—atropine—is still in daily use for dilating the pupil, usually under more prosaic circumstances. This effect is only one example of a general action of atropine in paralysing all parasympathetic nerve terminations throughout the body. Other closely allied alkaloids found in other plants of the order *Atropaceae* have a similar action. One such alkaloid, hyoscine, also called scopolamine, differs from atropine in its action on the central nervous system, having a depressant in place of a stimulant action, and hyoscine is now in common use as a hypnotic for certain conditions. In combination with morphine, it is used to produce general analgesia, with temporary loss of memory, in the treatment of child-birth, for which the romantic name of " twilight sleep " has come into vogue.

Hyoscine contains an asymmetric carbon atom and laevo-rotatory hyoscine is much more active than the dextro-rotatory form. This difference—a superior activity of the laevo-compound—has been found also in the case of other optical isomers, *e.g.* of adrenaline and hyoscyamine, and seems to be very generally true.

Ipecacuanha has been used as a remedy for dysentery with varying success for nearly three centuries. It is now known for certain that it is curative only in one form of dysentery, that due to an amoeboid parasite; and also that the curative effect is due to the fact that the alkaloid emetine found in ipecacuanha is, though possibly only indirectly, a specific poison for this parasite. Emetine is now given hypodermically in amoeboid dysentery and an artificial compound of it—emetine bismuth iodide—has been found superior to it in the treatment of chronic dysentery.

Consequent upon the advances in knowledge of the physiology and pathology of the heart, the cardiac tonics of which digitalis is the chief have been investigated more fully, and a considerable part of the advantageous action of digitalis in heart disease, especially in auricular fibrillation, is found to be due to its impairing the conduction from the auricle to the ventricle.

Drugs which cause the muscle of the uterus to contract are of great value in certain cases of labour, especially for preventing uterine haemorrhage. The extract of pituitary gland, which powerfully stimulates the contractions of the uterus, has now largely replaced the preparations of ergot so long used in midwifery practice for this purpose. The active principles of ergot itself have at last been determined and two of them found to be amines—tyramine and histamine—derivatives of the aminoacids tyrosine and histidine respectively. The discovery of the wide incidence of such amines, of their physiological action and of their chemical relation to adrenaline, has formed one of the most brilliant and fruitful chapters in modern biological research and has tended to bring into closer relation and coöperation the subjects of physiology, pharmacology and pathology.

(J. A. G.*)

PHILADELPHIA (*see* 21.367), retaining its rank as third city in the United States, had in 1920 a pop. of 1,823,779, an increase of 274,681 or 17·7% over the 1,549,098 of 1910. The pop. of 1920 comprised whites, 1,688,313; negroes, 134,098, and Chinese, Japanese and Indians, 1,368. The increase in the white pop. since 1910 was 224,942 or 15·4%, while the corresponding increase in the negro pop. was 49,639 or 58·8%. In 1920 males were 908,067, or 49·8%, and females 915,712, or 50·2%.

Government and Finance.—The Bullitt Act, under which the city government had functioned since 1887, gave way in 1920 to the Woodward Act, which became effective with the beginning of the term of Mayor J. Hampton Moore, in Jan. 1920. The new charter differs greatly from its predecessor. Under it a dual council is succeeded by a single body composed of one member for each 20,000 assessed voters in each state senatorial district, the membership in 1920 being twenty-one. The councilmen serve for four years, and receive a salary of $5,000. In the executive department, the department of supplies is superseded by a purchasing agent, and the department of health and public charities is separated into two with a director for each, the title " Public Charities " giving way to " Public Welfare." Further provisions enable the city to do its own street cleaning and garbage and ash removal, and place the great majority of city employees under civil service rules. By this provision not only small office-holders but the police and fire departments are removed from the possibilities of political activity.

The cost of city operations has grown steadily since 1911, when, under provisions of the state school code of May 18 1911, the Board of Education was separated from the city government. The combined cost in 1911 was $33,846,875.91. With the school expenses eliminated the cost in 1912 of city government was $30,213,067.44; and, barring a slight decrease in 1913, has grown steadily until it reached $48,520,872.92 in 1919. The tax rate, with the school tax transferred to a separate item, was $1 in 1912, $1.25 in 1917, $1.75 in 1918 and $2.15 in 1920. This rate applied to real estate valued in 1919 at $1,805,494,000. At the close of 1919, the gross funded outstanding debt of the city was $173,473,450, of which the commissioners of the sinking fund held $31,898 400, leaving a net funded debt outstanding of $141,575,050.

Commerce and Industry.—As a distinctive manufacturing centre, Philadelphia shared the general depression of 1914, but advanced rapidly with the increasing European demand after the outbreak of the World War.

This is shown in the following table of the export values of the port of Philadelphia from 1910–20:—

	Exports		Exports
1910	$65,256,949	1916	$321,044,815
1911	70,869,648	1917	501,234,069
1912	72,769,617	1918	427,244,212
1913	72,236,967	1919	522,391,091
1914	66,256,811	1920	451,043,216
1915	132,437,556		

Importation figures also show a remarkable increase in the decade. The imports in 1910 were valued at $89,610,401; in 1915, $69,473,983; and in 1920, $282,157,831. In 1910, 9,871,667 gross tons of shipping arrived and 9,771,266 tons cleared; in 1915, 9,315,157 tons arrived and 9,377,901 cleared; and in 1920, 12,246,427 tons arrived and 12,820,377 cleared. The following table of coal exportation shows the increasing value of the product as compared with tonnage shipped:—

	Coal exported in tons	Value
1910	866,148	$2,505,745
1915	1,127,415	3,445,643
1919	1,072,773	6,434,581

This remarkable increase in the activities of the port was made possible by the completion of large parts of the 35-ft. channel from Allegheny Ave., Philadelphia, to the sea. The channel, about 800 ft. wide throughout, was 56% completed on Dec. 31 1920 (the remaining sections having a depth of 30 ft.), while a similar channel in the Schuylkill river, from Passyunk Ave. Bridge to the Delaware, was 65% completed. Both channels are national operations, authorized by Congressional action and carried on with biennial appropriations. The completion of more than half of the main channel opened the port to shipping of a heavier tonnage and the result was manifest in the increased number of lines plying from Philadelphia. In 1914 there were 27 transatlantic and 5 coastal lines; in 1918, at the close of the World War, 36 transatlantic and 4 coastal; and in April 1921, 49 transatlantic and 10 coastal lines. A survey of the Pennsylvania department of internal affairs shows that Philadelphia in 1919 had 4,454 manufacturing establishments, with 297,436 employees, and products of $1,951,998,000. The capital invested was $1,005,658,500. Metals and metal products were first with 946 establishments, 66,991 employees, and products of $366,780,000. Textile factories

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numbered 502, with 44,294 employees and products of $292,107,000. The values of other products were: food and kindred lines, $283,531,000; chemicals and allied products, $210,240,000; clothing manufacture, $189,629,000; paper and printing industry, $146,510,000; leather and rubber goods, $130,585,000; building and contracting, $70,344,700; lumber and its remanufacture, $41,747,700; and tobacco and its products, $27,648,000.

History.—Municipal history in 1910–20 was marked with few items of interest outside of the political aspect and the natural effect of American participation in the World War. The late John G. Johnson, the noted corporation lawyer, who died April 14 1917, gave the city his collection of 1,300 pictures, appraised at $4,445,802, but estimated to be worth $7,000,000. In May 1919 the art collection of Mrs. Emily L. Harrison was left to the Pennsylvania Museum and School of Industrial Art for permanent exhibition in Memorial Hall. In Oct. of the same year, the George W. Elkins collection of paintings, containing 110 masterpieces of the Dutch, Flemish and 18th-century portrait schools, and valued at approximately $2,500,000, was left to the city for display in the new Art Museum. In 1921 the late John Howard McFadden, a cotton broker, left to the municipality his collection of about 50 18th-century English paintings, estimated at $2,000,000. The collection includes the famous Gainsborough, "Lady Rodney," and a number of fine portraits by Romney and Raeburn. Under the will the collection was to be housed in the projected Art Museum in Fairmount Park, provided that it was completed by 1928. In March 1921, the architects announced that it would be completed within three years.

A free library was being built in 1921, and a convention hall was planned for the Parkway, a thoroughfare from City Hall to Fairmount Park completed in 1919. Three large municipal piers were completed between 1916 and 1920 and three more were under construction. An elaborate subway and elevated transit system was being built by the city, the first line of which, to Frankford, was expected to be in operation by 1922.

War Period.—Philadelphia sent 54,127 men into the National army through the draft, and nearly equalled that figure with volunteer enlistments in the regular army, National Guard and Marine Corps. The city supplied the personnel of two full regiments of the 28th Div. and practically the full personnel of two regiments of the 79th Div., National army.

The city subscribed to the different Liberty Loans and to the Victory Loan as follows:—

Loan	Apportionment	Subscribed	Per capita Subscription
First Liberty	$94,694,750	$145,172,950	$80
Second Liberty	139,499,950	234,901,000	130
Third Liberty	136,499,950	169,350,600	94
Fourth Liberty	259,198,000	311,306,250	172
Victory	186,209,450	208,482,200	115

(A. E. McK.)

PHILIPPINE ISLANDS (*see* 21.392).—The census of 1918 gave the pop. as 10,350,640, of whom 855,368 were classed as non-Christians. The 9,495,272 Christians were in 1918: Filipinos, 9,429,857; Chinese, 45,156; Japanese, 6,684; Americans, 6,405; Spaniards, 4,015; English, 1,063; all others, 2,092. The non-Christians were subdivided into Mahommedans and pagans. In 1917 H. Otley Beyer, of the University of the Philippines, estimated the Mahommedan pop. at 315,980, while the provincial governors of Mindanao and Sulu estimated it in 1919 at 402,799. Of the pagans, approximately 30,000 were Negritos, and most of the others belonged to Malayan stocks. Head-hunting among the pagans virtually ceased owing to vigilant Government control.

The Christians include eight races, namely, Tagalog, Sambal, Pampanga, Pangasinan, Iloko, Ibanag, Bicol, all inhabiting the island of Luzon and islands near it, and the Bisaya, inhabiting the southern islands, including part of Mindanao. Each race has a distinct language, which differs from the others as widely as the Romance languages differ among themselves. The English language is used currently in all parts of the islands, being spoken by more people than ever spoke Spanish. Literacy is high among the Christian population. The cultural position of the Negritos is about the same as when they were discovered by the Spanish in 1521. The so-called "wild" peoples (all pagans except for a few who have embraced Christianity) occupy about the stage of culture exhibited in the 16th century by the ancestors of the Christian Filipinos. The culture of the Christian Filipinos is distinctly occidental and is unique in the Orient.

Manila, the capital, and Baguio, the summer capital, located in the uplands, in the Mountain province, are the only two chartered cities. Manila, the metropolis, which coincides with Manila province, had in 1918 a pop. of 283,613, or 20,858 to the sq. m., and Baguio had 5,462. In the 55 provinces and sub-provinces, there were in 1918 881 municipalities, 80 municipal districts, and 15 other subdivisions. The largest municipalities in 1918 were: Cebú with 65,300 inhabitants; Albay (Luzon), with 53,105; Iloilo (Panay), with 49,808; Batangas (Luzon), with 41,182; Ormoc (Leyte), with 38,247; Laoag (Ilocos Norte), with 38,294; and Baybay (Leyte), with 36,934. The most important are Cebú and Iloilo. The most populous provinces are: Cebú, with 857,410 inhabitants; Leyte, with 597,995; Pangasinan, with 567,644; Iloilo, with 508,272; Occidental Negros, with 397,325; Sámar, with 380,211; Bohol, with 359,600, and Batangas, with 340,195. The most densely populated provinces, apart from Manila, are Ilocos Sur (Luzon), with 217,410 inhabitants, or 492 to the sq. m.; Siquijor (Oriental Negros), with 56,695, or 461 to the sq. m.; Cebú, with 459 to the sq. m.; La Unión (Luzon), with 160,575, or 459 to the sq. m.; Cavite (Luzon), with 157,347, or 339 to the sq. m.; Pampanga (Luzon), with 257,641, or 313 to the sq. m.; Pangasinan (Luzon), with 292 to the sq. m.; and Laguna (Luzon), with 195,371, or 271 to the sq. mile. The Batanes Is., a sub-province lying N. of Luzon, have the smallest pop. of any provincial division (8,214), and a density of 111 to the sq. mile. The least densely populated is the sub-province of Apayao (Mountain province, Luzon), which has 11,123 inhabitants, but only 6 to the sq. mile. The majority of the people are engaged in agricultural and allied pursuits, and among the professional classes are men of considerable attainments.

Agriculture.—Between 1913 and 1918 the cultivated area of the Philippine Islands (total area, 73,585,583 ac. or 115,026 sq. m.) rose from 5,859,877 ac. or 7·96% of the whole, to 7,294,159 ac., or 9·91% of the whole. The Filipino *tao* or peasant, naturally a good farmer, has been slow to adopt modern and more efficient methods, but through the efforts of the Bureaus of Agriculture and Education a beginning has been made in some places. In 1918 the value of the agricultural output was $183,479,158. The nine most important crops were those of which the following table shows the area, production and value in 1910 and 1918:—

	Acreage		Production (tons)		Value	
	1918	1910	1918	1910	1918	1910
Rice	3,379,305	2,944,588	1,539,186	810,786	$67,581,687	$31,300,133
Abacá (manila hemp)	1,265,894	1,175,585	166,863	168,452	46,246,612	13,476,171
Coco-nuts	828,936	405,556	1,506,796,110 (number)	937,927,927 (number)	28,266,896	19,470,813
Sugar-cane	507,612	205,412	396,242	152,639	20,579,389	7,631,966
Indian corn	1,033,413	1,432,026	309,798	392,484	10,509,324	11,774,525
Tobacco	193,754	132,456	61,555	28,006	7,609,577	3,780,915
Cacao	2,820	3,151	566	74	252,335	33,406
Coffee	1,896	2,637	721	85	222,991	34,378
Maguey (aloe)	80,524	21,237	16,664	4,628	1,853,606	277,700

The production of rice fails to meet demand, and imports are necessary. In 1910 imports amounted to 184,620 tons, and total consumption to 712,674 tons; in 1918 imports and exports were, respectively, 159,130 tons and 47 tons; and consumption, 1,161,344 tons; in 1919 imports and exports were respectively 148,724 and 296 tons, and total consumption, 1,067,699 tons. To prevent profiteering in so vital a commodity, the Government has, in times of scarcity, purchased rice abroad, and sold it at a fair price. The cultivation of abacá has been given a new impetus by a law (No. 2380) which grades the product according to the cleaning of the fibre. Sugar is raised in almost all the islands, but chiefly in Negros, Panay and Luzon. The construction of up-to-date sugar "centrals" in many localities

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is redeeming Philippine sugar from the evil reputation which the "muscavado" sugar formerly bore. Corn is raised chiefly in Cebú, where the soil is especially fitted for it, and where this grain, instead of rice, is the chief crop. Tobacco is raised especially in Luzon and Cebú, the product of the Cagayan valley in Luzon being that most esteemed. Cacao comes chiefly from the provinces of Albay and Camarines in Luzon; coffee from Mindoro I. and the Mountain province (Luzon); and maguey (introduced from America) from Cebú and the province of Ilocos Sur (Luzon). An effort is being made to encourage the raising of sisal instead of maguey, the former being the better fibre. Abacá is a natural monopoly in the Philippine Islands, for it can be grown commercially nowhere else. It is grown in many of the islands, but in recent years extensive plantations have been laid out in Mindanao, where the constant moisture needed for its growth is afforded. For many years, this fibre formed one-half the exports from the islands, and is still one of the leading exports. The export of 89,438 metric tons in 1900 rose to 164,754 tons in 1910, and to 165,129 tons in 1918. Exports for 1919 fell to 131,898 tons valued at $26,861,526, while exports for 1920 were 139,250 tons valued at $35,862,000. The timber resources are important, virgin forests covering about 40,000 sq. miles. About 99% of all timber lands belong to the Government. Much of the timber consists of valuable hard woods. Timber land is not sold, but is developed under the licence system, small operators being granted a licence for one year, and large operators for 20 years. During 1919, 2,950 licences were issued, some of which were for gathering firewood. About 100,000,000 bd. ft. of lumber is used annually in the Philippines. Exports of lumber in 1918 were 4,178,520 bd. ft., valued at $219,397, and in 1919, 4,503,304 bd. ft., valued at $259,592. Modern forest products include charcoal, nipa, from which sugar and alcohol are made, various rattans and fibres, copal, tan barks, dyewoods, gutta percha and rubber, paper pulp, a soap bark, pili nuts, wax, wood-oil and medicinal plants. A school of forestry is maintained by the Government in which up-to-date, scientific lumbering instruction is given. The chief animal is the carabao or water buffalo, of which there were 1,047,164 in 1913 and 1,271,208 in 1917. Other domestic animals for these two years numbered respectively: cows, 418,114 and 603,107; horses and mules, 179,089 and 214,204. During most years of American occupation, the carabao was assailed by rinderpest, and the archipelago in 1920 was slowly recovering from its effects. The heavy mortality of carabao hampered agriculture, especially the cultivation of rice which was much retarded at times. The Government employed various methods in its efforts to eradicate the disease, including inoculation with a special serum, strict quarantine, and even the killing of whole herds.

Minerals.—Mineral products include gold, silver, iron, copper, manganese, coal, petroleum, shale, sulphur, asphalt, asbestos, clay products, lime, sand and gravel, stone, salt, and mineral waters. The total value of the mineral output in 1907 was $117,046; in 1917, $3,018,225; and in 1918, $3,276,677. Between July 1 1902 and Dec. 31 1918, 10,943 mining claims were taken out, of which 6,683 were for gold, 1,893 for petroleum and 607 for copper. The gold output in 1908 was valued at $217,250; in 1913 at $868,362; in 1917 at $1,408,309; in 1918 (from 24 mines) at $1,287,985 and in 1919 at $1,309,724. Iron-ore deposits in Surigao province, estimated to contain about 500,000,000 metric tons, with 45 to 50% iron, have been reserved for the Government. Other rich deposits are said to exist in Bukidnon province in Mindanao. The manufactured iron all came from the mines of Angac in Luzon and was chiefly used for the making of plough points. Copper is found especially in Luzon at Mancayan, where it has been mined and smelted many years by the Igorot by primitive methods. Deposits of coal are found in many localities, although much of it is lignite. Attempts have been made to develop the deposits in the eastern part of Batan I., and in 1920 the Philippine Coal Mining Co. was said to be producing about 300 tons daily. In 1919 the output was 32,892 metric tons, valued at $411,000. Much attention has been given to the development of the coal deposits by the Government, and no little money was lost, but the industry seems at last to be on a good basis. Deposits of fair steaming coal are said to cover 58 sq. m. and to contain 61,788,000 metric tons. The National Coal Co. was organized in 1919, with Government capital, to exploit Government deposits.

Manufactures.—The Philippines have passed beyond the initial stage of manufacturing, although it is probably true that the manufacturing industries will long be limited in number. Embroideries and laces, the making of which has been fostered by the Bureau of Education as well as by some private schools, find a ready market, and during the World War when Belgium and Switzerland were unable to supply their markets, demand for the Philippine product was stimulated. The industry is still largely one of the home. Rope is made from abacá, both by the old rope-walk method and by modern machinery. Much of the abacá is stripped by machinery, although fibre cleaned carefully by hand is still the best. Saw-milling is increasing in importance, some of the mills being equipped with modern machinery. In 1910 there was only one sugar "central" in the archipelago for the production of centrifugal sugar. In 1920 there were 28, and the reputation of Philippine sugar was rising in consequence. The war gave a great stimulus to the expressing of coco-nut oil, because of the impossibility of obtaining sufficient shipping for the export of the bulky copra. There were in 1920 more than 30 oil-mills, which produced over 100,000 tons of oil, the value of the product having increased in five years from about $1,000,000 to about $30,000,000 and furnishing about one-fourth of the export trade of the islands. The Philippines are the third producing coconut region in the world, there being over 800,000 ac. with about 68,000,000 trees, of which some 40,000,000 were bearing in 1920. The output of cigars in 1910 was 285,561,328; in 1913, 282,096,996; in 1918, 367,022,982 and in 1919, 517,343,450. The output of cigarettes for the same years was respectively 4,173,507,249; 4,384,807,247; 4,720,005,675 and 5,203,331,200. In 1918 there were 82 factories manufacturing cigars and 23 manufacturing cigarettes. In 1916 a tobacco inspection law was enacted by the Philippine Legislature providing for the improvement of the leaf and for inspection of leaf tobacco and of manufactured products, and prohibiting export to the United States unless certain fixed standards were met. In 1918 there were 10,583 factories in the archipelago, of which 1,047 were in Manila. Of the 182,117 employees, 21,828 were in Manila.

Communications.—In 1908 there were only 246 m. of first-class roads and bridges in the archipelago; in 1913, 1,303 m. of the first class; 1,264 m. of the second; and 1,937 of the third; and in 1919, 2,796; 1,235; and 1,984 m. respectively. Third-class roads are as a general rule fit only for carts and animals, and then only during the dry season. In 1919 cost of maintenance of old roads and bridges was $1,959,780. The archipelago has two railway systems, namely the Manila Railroad Co. operating in Luzon, and the Philippine Railway Co. operating in the islands of Cebú and Panay. The first had in 1913 517 m. of tracks and in 1918 640 m. This company, under contract with the Government, partly completed a line to the summer capital, Baguio, but could not carry the project to a successful end. In Jan. 1917 the Government of the Philippine Islands purchased the company's holdings and since that period the lines have been undergoing reconstruction. The Philippine Railway Co., an American concern, had 60 m. of track in 1910 (the first year of operation), and 133 m. in 1918. Under authority of an Act of Congress, approved Feb. 6 1905, the Insular Government guarantees 4% interest for a period not to exceed 30 years on the first lien bonds issued by the Manila Railroad Co. for new construction in southern Luzon, and the same to the Philippine Railway Co. The combined issues of both companies totalled $22,263,000. The lines in southern Luzon and those in Cebú and Panay have opened to active trade large stretches of territory and are affecting the industry of their districts. During recent years the number of motor vehicles has increased markedly, and they are now seen in almost all parts of the islands. An up-to-date electric street-railway system is operated in Manila. Post-offices increased in number from 540 in 1908 to 828 in 1918, and municipalities with free delivery service from 31 in 1908 to 462 in 1918. Telegraph offices (Government owned and operated) increased during the same period from 161 to 320. The inter-island cables are also owned and operated by the Government. Manila has an efficient telephone service.

Shipping.—Manila is the chief port, but the ports of Iloilo, Cebú, Zamboanga, and a few others share to some degree in the domestic and foreign trade. In 1911 there were 906 entries of foreign ships and 854 departures, with net tonnage of 1,849,475 and 1,787,650 respectively; and in 1918, 652 entries and 659 departures, with net tonnages of 1,412,871 and 1,544,648 respectively. The United Kingdom, which had uniformly occupied first place in the total foreign carrying trade of the islands, lost that position to Japan in 1917, but regained it in 1919, when British bottoms carried 525,000 tons. In the latter year, British and Japanese vessels carried 63% of the total foreign trade. Ships of the United States, which moved only 44,000 tons in 1916, moved 441,000 tons in 1919, while Philippine shipping engaged in foreign trade rose from 80,000 tons in 1916 to 128,000 tons in 1919. In value of cargo, British bottoms led in the import carrying trade up to and including 1917. In that year British ships carried cargoes valued at $25,865,273; Japanese, $18,964,331; and United States, $9,731,816. In 1918, Japanese ships carried import cargoes valued at $29,304,836; United States, $28,041,294; and British, $24,406,231. In the export trade, British bottoms also took first place up to and including 1917. In that year, British ships carried exports valued at $28,903,609; United States, $27,599,076; and Japanese, $24,657,632. In 1918 U.S. vessels carried exports valued at $53,389,398; British, $36,093,713; and Japanese, $24,544,204. In 1918 ships of the United States took first place in the total value of the foreign carrying trade, moving goods valued at $81,403,692, with the United Kingdom and Japan taking second and third place respectively. In recent years new piers and warehouses have been built in Manila.

Foreign Trade.—Imports rose from $29,186,120 in 1908 to $149,400,000 in 1920. Exports were $32,601,072 in 1908; $151,100,000 in 1920. The balance of trade was in favour of the Philippines during 1914–8, and in 1920. Import trade with the United States rose from $35,813 in 1874 to $92,289,773 in 1920. Exports to the United States rose from $2,657,333 in 1874 to $105,216,263 in 1920. In 1874 the import and export trade with the United Kingdom was valued respectively at $1,737,487 and $3,032,950; and in 1918 at $2,764,407 and $19,481,698 respectively. Imports from and exports to Japan were valued respectively at $13,104,055 and $7,968,304;

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China, $6,576,962 and $3,249,290; French East Indies, $6,978,043 (mainly rice) and $1,302,376; Hong-Kong, $56,877 and $5,051,664. Total trade with France was valued at $1,785,167 in 1918; Germany, $366,534; Spain, $3,940,167; Australasia, $4,431,883; British East Indies, $3,515,885; Switzerland, $607,870; Italy, $189,152; Netherlands, $45,463; Hawaii, $479,436; Siam, $1,219,673 and all other countries, $1,494,421.

Government.—In 1913, upon the occasion of the appointment by the President of the United States of a new governor-general of the Philippines, majority membership on the Philippine Commission was given to the Filipinos by presidential appointment. On Aug 29 1916 the U.S. Congress passed the Jones Act. The short preamble declared that "it has always been the purpose of the people of the United States to withdraw their sovereignty over the Philippine Islands and to recognize their independence as soon as a stable form of government can be established therein." The Act created a Senate to supersede the Philippine Commission, 12 senatorial districts being established, each of which is represented by two senators elected by duly qualified voters except the 12th district (consisting of the Department of Mindanao and Sulu, the Mountain province, Baguio, and Nueva Vizcaya), whose senators are appointed by the governor-general. The Philippine Assembly was replaced by the House of Representatives, the membership of 81 of the Assembly to be increased in the new body by three representatives from the Mountain province, one from Nueva Vizcaya, and five from the Department of Mindanao and Sulu. Senators are required to be over 30 years of age, able to read and write English or Spanish, and to have been residents of the Philippines for at least two consecutive years and actual residents of the senatorial districts from which elected for at least one year immediately preceding election. Representatives must be over 25 years of age, and have the same residential qualification.

Senators are elected for six years, representatives for three. The Act extended the suffrage to males of 21 or over, to include those who under previous law were legal voters and had exercised their right; those who owned real property to the value of $250; those who annually paid $15 or more of the established taxes; and those who were able to read and write either Spanish, English, or a native language. Two resident commissioners with three-year terms were provided for, and paid by, the United States, to be over 30 years of age and *bona fide* electors; these commissioners to have seats in the House of Representatives at Washington, with right of debate but no vote in that body. The Legislature convenes on Oct. 16, but it may change that date within certain limits if it choose. A governor-general, vice-governor, auditor, and deputy auditor are appointed by the President of the United States, by and with the consent of the Senate. The vice-governor is in control of the Bureaus of Education and Health, but the remainder of his former bureaus and his subordinate duties were shifted to the Interior Department. Power is given to the Legislature to reorganize the other departments and bureaus of the Government. The chief justice and associate justices of the Supreme Court are appointed by the President of the United States by and with the consent of the Senate, and the judges of the courts of first instance are similarly appointed by the governor-general by and with the advice of the Senate of the Philippine Islands. The awards of the Supreme Court are reviewable by the Supreme Court of the United States.

The Government as reorganized consists of the following groups of departments, bureaus, and offices. On the governor-general depend directly the Bureau of Audits, the civil service, and all other offices and branches of the service not assigned by law to any department. On the Department of the Interior depend the Bureau of non-Christian tribes (provided for in the organic Act), the Philippine general hospital, Boards of Pharmaceutical Examiners, Medical Examiners, Dental Examiners and Dental Hygiene, Optical Examiners, examination for nurses. On the Executive Bureau depend the Philippine constabulary, and Bureau of Dependent Children. On the Department of Public Instruction depend the Bureau of Education, the Philippine Health Service, and Bureau of Quarantine Service. On the Department of Finance depend the Bureaus of Customs, Internal Revenue, Treasury and Printing, the general supervision over banks, banking transactions, coinage, currency, and (except as otherwise specially provided) over all funds the investment of which may be authorized by law. On the Department of Justice depend the Bureau of Justice, the courts of first instance and the inferior courts, Philippine Library and Museum, Bureau of Prisons and Public Utility Commission. On the Department of Agriculture and Natural Resources depend the Bureaus of Agriculture, Forestry, Lands, Science, Weather, and matters concerning hunting, fisheries, sponges and other sea products. On the Department of Commerce and Communications depend the Bureau of Public Works, Posts, Supply, Labor, Coast and Geodetic Survey, and Commerce and Industry. The secretaries of the several departments form the Cabinet.

There are in all 46 provinces, 34 of which are regular provinces and the rest special or sub-provinces. The chief executive of a province is the provincial governor, who is elective. He together with two other members, also elective, forms the provincial board or legislative branch of the provincial Government. In the special or sub-provinces, with the exception of Mindoro, Palawan, and Batanes, the provincial governor is appointive. The chief official of a town or municipality is the municipal president. The municipal council or legislative branch of the municipal Government consists of from 8 to 18 councillors, according to the size of the municipality.

In Oct. 1918 the governor-general, by an executive order, created the Council of State as an advisory body. This body, composed of the heads of all the executive departments and the presiding officers of the two Houses of the Philippine Archipelago, has become an integral part of the governmental system and is frequently referred to in legislation. The meetings of the Council have practically superseded those of the Cabinet, and it has been entrusted by the Legislature with certain executive functions. Policies decided on in the Council meeting are assured full consideration in the Legislature. Among other things the Council prepares and submits the budget.

Education.—Special attention has been paid to public education by the Government. Each of the 49 school divisions of the archipelago follows in general provincial boundary lines, except that of Manila and four insular schools, namely Philippine normal school, Philippine school of arts and trades, Philippine nautical school, and Central Luzon agricultural school, each of which is considered a distinct division. The public-school system, which aims at the creation of a staff of English-speaking Filipino teachers, is under the director of education, with central offices in Manila. There are seven elementary grades (four primary and three intermediate) and a four-year high-school course. Much attention is paid to industrial training, and to recreational athletics. Baseball and other games have had great influence throughout the islands. Each school division is in charge of a division superintendent and each of the several districts in a division of a supervising teacher. In 1908 there were 3,932 public schools, with a total enrolment of 486,676. In 1919, 749 new primary schools and 111 new intermediate schools were opened, with an increase during one year of 104,560 pupils in the elementary grades, and a record enrolment of 776,596 pupils in all public schools. During that year, 2,963 additional elementary teachers were appointed, and 300 primary schools constructed. Tuition fees were abolished in all intermediate schools. In 1908 $2,563,553 was spent for public education, and in 1918 $5,365,105. The Philippine normal school, in Manila, draws its pupils from all parts of the islands. There were in 1920 50 provincial high schools, 20 provincial trade schools, 14 provincial shops, 13 large agricultural schools, 15 farm schools, and 162 settlement farm schools. The farm schools ranged in size from about 125 to 2,000 ac. and the settlement farm schools from about 40 to 125 acres. School gardens, which have become an essential part of the public educational system, number about 4,000, and home gardens, the result of this instruction, over 100,000. A standard type of school buildings has been evolved, and there were in 1920 865 satisfactory school buildings (many constructed of concrete) and 2,170 buildings of semi-permanent and permanent types. In 1910 the Government began the systematic supervision of private schools, requiring courses in English and harmonizing the work with that of the public schools. New methods, courses, and text-books have been introduced, and all private schools complying with requirements have been given the same standing as Government schools. In 1920 there were about 300 accredited private schools with a total enrolment of 38,544 and a teaching force of 1,600. Higher education is provided for by the university of the Philippines, a Government institution, and by the Dominican University of Santo Tomás. The university of the Philippines in 1920 had 31 buildings of permanent materials. The total enrolment for 1919–20 was 3,427. Its three presidents were, successively, an American, a Filipino and an American. The university of Santo Tomás, the oldest university under the flag of the United States, has departments of law, medicine, pharmacy, civil engineering, philosophy and letters, and theology. It has five buildings including a dormitory, and for the year 1919–20 had an enrolment of 701. Between the years 1914 and 1919 its graduates numbered 347. The educational programme of the islands has from the first had the hearty endorsement of the Filipino people, and Filipino legislators have at all times supported almost unanimously any movement looking toward the improvement of educational conditions. In Dec. 1918, $15,000,000 were appropriated by the Legislature for the extension of public schools. Instruction is being extended rapidly among the non-Christian population. In addition to the education supplied in the Philippines, some 9,000 Filipinos are attending schools, colleges and universities in the United States;

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some of these receive Government aid, but the majority are paying for their own instruction. The work of the Philippine library and museum is largely educational in character. This institution was first founded as the Philippine library, May 20 1909. After the passage of the Jones Bill of 1916 it was amalgamated with the Philippine archives and the museum. It has charge of all the books owned by the Insular Government. The manuscripts of the library number several millions, the books in all over a quarter of a million.

Finance.—Philippine currency in circulation on June 30 1908 amounted to 40,337,982 pesos or 4·82 *per capita;* on Dec. 31 1913 to 50,697,253 or 5·53 *per capita;* and on Dec. 31 1919 to 146,500,000, or 14·16 *per capita.* The Philippine peso, nominally equivalent to $0.50 U.S., was in June 1921 quoted in New York City at $0.46 and has even reached much lower levels; in Nov. 1921 it was quoted at $0.4975. The total revenues and expenditures of the Insular Government for the year ending June 30 1908 were respectively, $10,899,261 and $11,469,785; and for 1919, $39,843,461 and $43,371,294. The great increases in revenues began in 1916 simultaneously with the large trade balances in favour of the Philippines. Revenues are mainly from customs collections, internal revenues and receipts from land taxes and leases. Customs collections for the year 1919 were $7,712,653 and for 1920, $8,878,932; and collections of internal revenues for 1919 $26,641,373. The latter collections come mainly from the excise tax, licence, profession and occupation taxes, cedulas, franchise taxes, income tax, documentary stamp tax, and inheritance tax. The bonded indebtedness for the Insular and municipal Governments as of June 30 1919 was $20,125,000, that for the former being $16,000,000. Commercial bank assets rose from $31,872,964 in 1913 to $177,293,860 in 1919. In 1908 postal savings bank deposits were $774,105 and withdrawals $512,839; and in 1918 $2,942,762 and $2,599,775 respectively; in 1919 there were 417 postal savings banks in operation. In 1919, operations of the eight banks in Manila reached a total of $4,197,682,000. The Philippine National Bank, the sole depository of the Government, with headquarters in Manila, has 11 branches and 41 provincial agencies in the Philippines, and branches in Shanghai and New York. Its assets on June 30 1920 amounted to $118,749,138. More recently reverses, due, it is reported, to poor management and the business crisis, overtook the institution.

History.—W. Cameron Forbes was appointed acting governor-general in May 1909, and on Nov. 11 of the same year governor-general, succeeding James T. Smith. During his term, which expired on Oct. 6 1913, many public improvements were made, and the principle of the Filipinization of the civil service was carried out consistently, although comparatively few Filipinos were appointed to the higher offices.

The Taal volcano, which had been quiescent for a century and a half, erupted on Jan. 30 1911. Some 1,300 lives were lost. The outburst was accompanied by violent earthquakes, of which 1,014 were registered in Manila in about a fortnight. Earthquakes are of frequent occurrence in all parts of the islands, but are rarely of magnitude. During Governor-General Forbes's term no general appropriation measure for the expenses of Government was passed after that of 1910, because the two Houses could not agree upon the method of drawing it. In consequence, the provision of the organic Act of 1902 which declared that in the event of the failure to pass a general appropriation measure, the sum appropriated last should be considered as reappropriated, was declared to be in effect, and proclamation was so made each year. The breach between the two Houses tended to widen, and much constructive legislation that should have been enacted failed of passage. Educational measures, however, were generally assured of enactment and one is continually struck by the number of measures of this kind passed by each session of the Legislature. During this period also the demand for political independence by certain Filipino leaders, especially by Manuel Quezon, for part of the time resident commissioner in Washington, was constant and insistent. The Americans in the Philippines, regarded as appointees of the political party in control in the United States, were skilfully made to appear hostile to Filipino interests, and that administration was represented as withholding an inherent right of the Filipino people. The desire of the Filipinos for independence was and is real, and has grown with each succeeding year; the whole course of American administration has fostered that aspiration, and continually greater autonomy has been granted, although differences of opinion have been manifest as to the safety with which this could be done.

The change of administration in Washington in 1913 was hailed with delight by the Filipinos, in the belief that it would soon lead to political independence. On Oct. 6 1913 Francis Burton Harrison, who had been appointed governor-general by President Wilson, arrived in Manila, and immediately assumed office. By presidential appointment the majority on the Philippine Commission passed to the Filipinos. Various changes were made by the new governor-general in the personnel of several of the bureaus, the chief innovation being that Filipinos were appointed to a number of the higher posts. On Jan. 1 1917 there were 31 Americans and 22 Filipinos acting as chiefs and assistant chiefs, and on July 1 1920, 20 Americans and 30 Filipinos. On the latter date there were 760 Americans and 12,047 Filipinos connected with the Government, while in 1913 there had been 2,623 of the former and 6,363 of the latter. This increased rapidity in the Filipinization of the civil service after 1913, especially of the higher offices, has been criticized on the ground of decreased efficiency, but while this was necessarily the result to a considerable extent, it was not universally so, and the policy led, as a natural corollary, to a greater official harmony than had reigned previously. In Feb. 1916 an Act of the Legislature, providing a temporary pension for employees who had been in the service of the Philippine Government for from six to ten years or longer, gave an impetus to many Americans to request retirement under the terms of that Act. While technically the provisions of the Act apply to Filipinos as well as to Americans, it has been the policy of the Government to retire eligible Filipinos only because of age or physical disability. Upon the declaration of war against Germany by the United States, many Americans resigned to enlist, and it was felt that Americans were leaving the Philippine service too rapidly, especially the teachers. A very earnest effort was made after the war to recruit American teachers.

The virtual Filipino autonomy resulting from the above-mentioned changes was increased by the enactment by Congress in Aug. 1916 of the Jones Act, by which the Philippine Commission was replaced by an elective Senate (see *Government* above). The era of good feeling, inaugurated in 1913 by the change of Government, was seen almost immediately in the passing of an appropriation measure for the general expenses of Government—the first to be enacted since 1910. Such measures have been passed annually since. One of the early Acts of the Legislature was to reduce certain salaries, especially those of the Philippine commissioners and of certain bureau chiefs; but, as in the United States, a bonus system was later adopted because of the increase in the cost of living and the governor-general recommended that salaries be increased. In 1915 the Philippine National Bank was created, taking over the former Agricultural Bank owned by the Government, which had never functioned acceptably. In the same year the Code Committee, after several years' work, finished the administrative code of the islands, which was passed by the Legislature. Among the first Acts of the all-Filipino Legislature of 1916–7 was the reorganization of the several departments of the Government, the result being that the Department of Public Instruction came to be the only one directly under an American.

The period was marked by generous appropriations for educational purposes, the most notable of these being the appropriation of $15,352,912 for the extension of free elemental education (see *Education* above). A previous Act prohibiting the display of the Philippine flag was repealed, a measure desired most ardently by Filipinos.

Upon the declaration of war against Germany by the United States, the Filipinos offered to supply a division of troops for the U.S. army and to supply funds for the construction of a destroyer and submarine for the U.S. navy, and there was a generous subscription to the Red Cross and to Liberty bonds. A volunteer National Guard was formed, which was joined by many of the Filipino youth, this being disbanded in 1919. There were also many Filipinos who served in the army and navy of the United States. In this connexion it should be noted that Filipinos have been admitted to West Point and Annapolis. Some 22

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German ships, which had been interned in Manila harbour at the beginning of the World War, were seized after the American declaration of war, and the crews sent to an internment camp in the United States after a partly successful attempt had been made to damage the machinery and scuttle the vessels. Business during the war was brisk, notwithstanding the lack of shipping; but after the war, a depression developed from which the islands had not recovered in 1921. Governor-General Harrison resigned his post, as from March 3 1921, because of the change of administration in the United States, and Vice-Governor Yeater became acting governor-general. Shortly after assuming office, President Harding despatched Maj.-Gen. Leonard Wood and W. Cameron Forbes to the Philippines to make a complete survey and report on conditions. On Oct. 5 1921 Gen. Wood took oath of office as governor-general of the islands.

The Wood-Forbes report recommended, among other things, "that the present general status of the Philippine Islands continue until the people have had time to absorb and thoroughly master the powers already in their hands," and "that under no circumstances should the American Government permit to be established in the Philippine Islands a situation which would leave the United States in a position of responsibility without authority."

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(J. A. Ro.)

PHILLIMORE, WALTER GEORGE FRANK PHILLIMORE, 1ST BARON (1845–), English judge, was born in London Nov. 21 1845, the eldest son of Sir Robert Joseph Phillimore, 1st bart., a distinguished judge and authority on ecclesiastical and international law (*see* 21.405). He was educated at Westminster and Christ Church, Oxford, where he had a distinguished career, obtaining first classes in classics and law, winning the Vinerian scholarship and being elected to an All Souls fellowship. He was called to the bar in 1868. In 1885 he succeeded his father as 2nd bart., and in 1897 was made a judge of the Queen's Bench division, being in 1913 appointed a lord justice of appeal. He retired from the bench in 1916, and in 1918 was raised to the peerage.

As an authority on ecclesiastical law Lord Phillimore carried on the tradition of his family. He published a revised edition of J. H. Blunt's *Book of Church Law* (1872), besides a second edition of Sir Robert Phillimore's *Ecclesiastical Law* (1895), and also contributed the articles *Ecclesiastical Jurisdiction* and *Canon Law* (in part) to the *E.B.* He was from 1905 to 1908 president of the International Law Association, and has published *Three Centuries of Treaties of Peace and their Teaching* (1917), besides issuing (1889) a third edition of vol. iv. of Sir Robert Phillimore's *International Law.* In 1918 he was appointed chairman of the naval prize tribunal. He was English representative on the commission which sat at The Hague (1920) to prepare the scheme of a permanent Court of International Justice, and was also chairman of the Foreign Office committee on the League of Nations.

PHILLIPS, STEPHEN (1868–1915), English poet (*see* 21.407), died at Deal Dec. 9 1915.

PHILLPOTTS, EDEN (1862–), British novelist, poet and dramatist, was born in India Nov. 4 1862, and was educated at Plymouth. He was a clerk for ten years in the Sun fire insurance office, then studied for the stage, but turned his attention to literature, producing a number of successful novels with a Devonshire setting. They include *Some Everyday Folks* (1893); *Children of the Mist* (1898); *The Human Boy* (1899); *Sons of the Morning* (1900); *My Devon Year* (1903); *The Mother* (1908; dramatized 1913); *Orphan Dinah* (1920) and a play, *St. George and the Dragons* (1919). His play, *The Secret Woman* (dramatized from his novel of that title), was refused a licence but, after a public protest by twenty-four authors, it was performed six times at matinées in 1912 under the management of Mr. Granville Barker. He also published single poems such as *The Iscariot* (1912), and two collections of poems, *Plain Song* (1917) and *As the Wind Blows* (1920).

PHILOSOPHY (*see* 21.440).—At the opening of the decade 1910–20, the ground covered by the philosophical sciences was so vast that any one writer could see only a small portion of it in clear perspective; and even within the partial field where he was most at home, he might well find it hard to catch the real drift of tendencies which had not fully disclosed their ultimate scope.

Among the leading philosophers of that date three distinguished representatives of already established types of thought, William James, Shadworth Hodgson and Alfred Fouillée, were shortly to pass away. In Shadworth Hodgson there passed from the scene perhaps the last survivor of the classic "British" succession of thinkers, whose characteristic method in philosophy was the direct psychological analysis of the given "moment of experience" as distinct from metaphysical or epistemological inquiry into the "transcendental" implications of Being or of Thought. His philosophy seems likely to be the last attempt to develop a system in entire independence of the influence of Kant's "Copernican revolution," unless, indeed, the recent work of Prof. S. Alexander should prove capable of development into something like a system. William James's work in general philosophy exhibits three distinct strains, none too closely connected with one another: (1) a fundamental *metaphysical* pluralism; (2) a radical empiricism in *method;* (3) the adoption in *logic* of a purely utilitarian theory of truth and falsehood. It was this peculiar view of truth as "that which works" or "that which produces practically useful results" which, from its apparently paradoxical character, made the principal sensation among James's contemporaries for the moment, and from which he chose the name ("pragmatism") for his type of thought; but it is open to question whether his abiding place in the history of philosophy will not depend primarily on his brilliant defence of pluralism against the singularism of philosophies of the "one substance" and "absolutist" types.

The outstanding event in 1910–2, as far as philosophy is concerned, was certainly the rapid rise of Bergson to a European reputation. *Les Données Immédiates de la Conscience* had been published as long ago as 1889, *Matière et Mémoire* in 1896, and *L'Évolution Créatrice* had reached a fourth edition in 1908, but the author's ideas can hardly be said to have attracted universal attention much before 1910. The English translations, *Time and Free Will, Matter and Memory* and *Creative Evolution* all belong to 1910–1. A great amount of work in various European languages appeared in exposition or criticism of Bergson's special tenets. Special reference may perhaps be made to H. W. Carr's *Henri Bergson, The Philosophy of Change* (1911), and J. McKellar Stewart's *A Critical Exposition of Bergson's Philosophy* (1912). Without attempting to pronounce on the permanent value of Bergson's ideas, it may at least be said that his works contain the most systematic and brilliant exposition of Irrationalism since Schopenhauer, and that his presentation has the advantage of exhibiting the irrationalist position unencumbered by Schopenhauer's temperamental pessimism.

Bergson's main doctrine may perhaps be briefly summarized as follows. The human intellect is itself a product of evolution, a tool fashioned by natural selection for the purpose of enabling mankind to find their way about among the inanimate bodies

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which make up their physical surroundings. Hence the crowning achievement of the intellect is the creation of the science of geometry, which therefore furnishes the ideal model to which human science in general is everywhere striving to approximate. The aim of all sciences is to become exact sciences, *i.e.* sciences of number and measure. But the only magnitudes which we can measure directly are straight lines. Consequently all measurement of other magnitudes has to be effected by artifices which enable us to substitute lengths for the various "intensive" magnitudes (lapses of duration, degrees of temperature, electric charges, and the like), which meet us in the "real world" of actual life. In particular, the measurement of time only becomes possible by the artifice of representing the real duration through which we live by the image of a line on which we can measure off different lengths. This device, though indispensable to science, inevitably falsifies the facts of living experience. For it gives rise to the belief in a "Newtonian" time, which is homogeneous, like the straight line, and "flows equably," whereas the "real duration" of experience, which is the very stuff of which our inner life of feeling and conation is made, is non-homogeneous and "flows" with very varying rapidity according as we are well or ill, interested or bored, pleased or pained, and the like. From the initial substitution of the unreal "uniform" time of science for the infinitely varying "real duration," out of which the processes of life and consciousness are made, further arise all the illusions characteristic of a mechanical theory of the universe. It is our tendency to envisage time under the form of a line, which leads to the belief in permanent "substances" or things, as the bearers or supports of change, and further conducts us to the notion of a rigid determinism by producing the illusion that what happens in the various moments of time is all completely "given" at once, as all the points on a straight line are given "simultaneously." This again leads to a radically false conception of "evolution." It creates the belief that nothing radically new is ever produced in the evolutionary process; whatever emerges in the course of the process, on a determinist theory, must be already completely contained in its antecedent conditions, and adequate knowledge of those conditions must enable you to say beforehand exactly what will emerge from them. Hence for science, which to be true to its geometrical ideal must be strictly mechanical, the whole process of evolution can be nothing but the rearrangement, according to mechanical law, of selfsame and permanent units. Real life, as we know it at first hand in the act of living it, is of a wholly different kind. It is a single continuous process of becoming, in which there is no permanent substratum; it presents us at every moment with the emergence of the qualitatively new, fresh qualities, fresh adaptations to environment, which could never have been anticipated from any knowledge of what had gone before, until they had actually emerged. You cannot expect to know the direction this *élan vital*, as Bergson names the impulse which Schopenhauer had called the "will to live," will take until it has been actually taken; life is thus essentially contingent. (It follows, of course, that determinism is false as regards that special manifestation of the *élan vital* which we call will or choice. To speak of our decisions as necessitated or determined by our pasts is virtually to think of them as already made *for* us before we make them.) Instinctive or impulsive activity is thus but a manifestation of the forward-going *élan vital*, the tendency of the process which is life to exhibit itself in ever newer forms. Science is the inevitably unsuccessful attempt of the intellect to reconstruct the process in "geometrical" form by reversing its sense. It looks back at a process which has culminated in the appearance of something new (*e.g.* a new modification of an animal species), notes what the earlier stages of the process have been, and then assumes that it could have predicted from a knowledge of antecedent conditions the new manifestation of the *élan vital* with which it had, in fact, to be already acquainted before it could think of the antecedent events as conditions of *this* result. Hence, if philosophy is to understand life, its method must be the reverse of that of the scientific intellect. It must renounce the intellect and its logic, which latter is indeed merely the abstract schematism of the "geometrical" procedure, and surrender itself without reserve to the intuitions and presages which attend on complete immersion in the stream of the *élan vital*.

It may perhaps be suggested that the real test of Bergson's ability to construct an irrational philosophy on this basis must be sought in the success with which it can be applied to the interpretation of the spiritual life of humanity, a task with which Bergson has not as yet fully grappled. Meanwhile, there appear to be some reasons for doubting whether the foundations of his thought are themselves securely laid. The condemnation of the intellect is based upon the assumption that because it is a "product of evolution" it can have no function but that of enabling us to find our way about among *things;* this is why geometry, which deals with the "surfaces of solid things," is declared to be its highest achievement, and why it is denied all value for the interpretation of life. But it might reasonably be contended that from the dawn of time men have had to occupy themselves at least as much with reaching a common understanding of one another as with learning their way about among "solid bodies," and that we should therefore expect an intellect which is a "product of evolution" to be competent to deal with life as well as with the surfaces of solid bodies. Again, it is plain that the alleged necessity for science of a spatial schematism, which inevitably misrepresents the facts of "real duration," depends entirely on the results of the one chapter (*Données Immédiates de la Conscience*, ch. 1) which expounds the author's peculiar theory of measurable magnitudes. Now this chapter bears evident marks of hasty construction. The author seems to have forgotten that even in geometry straight lines are not the only measurable magnitudes. It is indispensable that we should be able to measure angles, a consideration which of itself should have given the author pause. In fact, the whole treatment of the distinction between "extensive" and "intensive" magnitudes, upon which so much depends for Bergson's development of his theory, is, as it stands, at least perfunctory. Again, the very language employed to distinguish "real duration" from the unreal time of science, viz. that the portions of real duration flow with varying *rapidity*, seems to imply that these varying rapidities are comparable with one another, and consequently that "Newtonian" time has, after all, the significance for real life which Bergson refuses to allow.

There has been much discussion in philosophical quarters of Bergson's place in the classification of philosophers. William James, in his latest works, claimed him as a pragmatist, and it has been maintained on the continent of Europe that his doctrine is not only a form, but the one really coherent form, of pragmatism. There is, of course, a real affinity between Bergson and the pragmatists, which rests on their common distrust of the intellect. On the other hand, whereas pragmatism, at least in its inception, made it a fundamental point to insist on a pluralistic theory of the world, Bergson's doctrine of the *élan vital* is definitely singularist. Thus he touches Bradley on one side of his doctrine as closely as he touches James on the other. In fact, the complaints which pragmatists used to make a few years ago of the miraculous feats ascribed by "idealists" to the Absolute might easily be urged *totidem verbis* against the *élan vital*. According to another view, Bergson is most correctly described as a "mystic," though he can hardly be called so if the word is used with any precision. Mysticism is primarily not a peculiar way of thinking but a peculiar way of being. What the great mystics of the past have aimed at is first and foremost a transformation of human character by which it becomes responsive to stimuli from a "transcendental" world, inaccessible to ordinary perception. Since no such transcendental world is recognized in the Bergsonian scheme, it seems merely misleading to speak of his philosophy as mysticism.

A second feature of the philosophical movement in the earlier days of the decade was, in Great Britain and America, the rise of the so-called "New Realism." This also may be regarded as a conscious reaction against the idealistic doctrines of the last generation which go back for their inspiration to Fichte and Hegel, but it was a reaction which was in many ways the direct antith-

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esis of the movement represented by Bergson. The new realism, though it manifested itself in a great variety of forms, was in all its various guises definitely intellectualistic. This was shown by the general dissatisfaction of its representatives with the Kantian strain in the thought of their older contemporaries. What is particularly objected to, as the source of "idealistic" or "mentalistic" fallacies, is the Kantian view that both sense, in virtue of the pure forms of intuition, and thought, in virtue of its scheme of categories, are in part constitutive of the objects they apprehend. The tendency common to all the writers who may be classed together as typical of the latest forms of realism is to regard both sense and thought as simply apprehensive of data which do not depend on the percipient mind, either for their existence or for their apprehended qualities and relations. The degree of consistency with which this doctrine is held varies with its individual representatives, but, thought out consistently, it plainly tends in the direction of ultra-intellectualism, since it leads to the view that the specific task of philosophy is simply to apprehend as completely as possible objects and relations which exist and have the characters which they are discovered by science to have quite independently of the perceiving or knowing mind. On the psychological side this tendency shows itself in its extreme form in the doctrine that known relations between objects are purely non-mental, not the "work of the mind," as T. H. Green had taught. The function of the intellect is not to create relations between its objects, but simply to discover what the relations between them are. On this point there seemed to be general agreement between such writers as Alexander, Russell, and Moore in England, Woodbridge, Fullerton, Montague and others in America, and Couturat in France. It is a natural development of the same view that the attempt should be made to deny the existence of what are commonly called "presentations," and to hold that in sense perception we have only two distinguishable factors, an extra-mental presented thing and the process of apprehending it. Presentations, *i.e.* mental "contents," which psychologists have usually regarded as immediate objects of cognition from which we may go on to infer propositions about the extra-mental things which are their exciting causes, are then dismissed as unnecessary fictions. This is the point of view adopted by Prof. Alexander, according to whom there are, strictly speaking, neither contents of cognition nor cognitive states or processes. The contents of the mind consist solely of conations of various types, and the universe is thus reduced to conative tendencies and the objects in which they terminate and find their satisfaction.

This extreme view, that presentations had no existence, was not shared by all the writers who exhibited the realistic tendency. Thus, in his *Problems of Philosophy* (1911), Mr. Bertrand Russell maintains that apart from the general predicates of things and the relations between them, which are universal and must not be said to *exist*, what we know is composed of minds, physical things and sense-data, *i.e.* what are more usually spoken of as sense-qualities: red, sweet, salt, and the like. Sense-data are neither mental (processes of consciousness) nor physical. We are *acquainted* directly with our own minds and also with sense-data. But we have no acquaintance either with physical things or with minds other than our own. Any knowledge we have of the minds of others or of physical things is merely knowledge by *description*, and its possibility depends on the truth that things with which we have no acquaintance can be indirectly known if it is possible to describe them in terms of sense-data with which we *have* acquaintance. Since Mr. Russell accepts the familiar arguments against the physical reality of sensible qualities, it follows on his theory that we have no acquaintance with physical things. I know a physical thing only by inference, as, *e.g.*, "the cause of such-and-such a definite group of sense-data." This is a description obtained by a combination of sense-data which I know at first hand by acquaintance with the universals "the" and "cause of," and with these universals I have also immediate acquaintance. My acquaintance with the meaning of "the" secures that the otherwise unknown physical thing signified by the descriptive phrase shall be strictly individual. Thus my knowledge through sense-data of physical objects is like the knowledge I have, *e.g.* about the "magnates of the Education Department," when I know that there is such a body, and what it does, but have never met any of its members. For science, the most important point in the theory of knowledge is that we can be directly acquainted with relations and universals, though these entities do not properly exist. Immediate knowledge of this kind is what we mean by *a priori* knowledge, *i.e.* knowledge which does not involve awareness of any proposition about what actually exists. As the principles of inference are among the relations with which we have acquaintance *a priori*, we are able to have a derivative *a priori* knowledge of all truths which are deduced by correct inference from *a priori* principles with which we are directly acquainted. This covers the whole domain of the sciences of logic and pure mathematics, as, contrary to the Kantian opinion, all pure mathematics can be shown to consist of propositions deduced logically from premises which involve only logical concepts and relations with which we are directly acquainted. It is added that we must also include under *a priori* knowledge our direct acquaintance with the relative intrinsic worth of various goods. This is why there can be a science of ethics. The chief special work of the particular type of realism represented by Mr. Russell and his associates was done, in close connection with the earlier work of mathematicians like Peano and Frege, in the field of mathematical logic, with a view to the exhibition of pure mathematics as a vast body of deductions from the principles of the logic of relations, first treated with due elaboration in the third volume of E. Schröder's *Algebra der Logik* (1895), and applied with particular thoroughness to arithmetic in Frege's *Grundgesetze der Arithmetik* (1893–1903). The *magnum opus* of Messrs. Whitehead and Russell, *Principia Mathematica*, represents the fullest development of logic as a calculus of relations. The most brilliant account of the principles and methods of the mathematical logicians is, perhaps, that of Couturat (*Principes des Mathématiques*, 1905).

Russell and also G. E. Moore made some application of their doctrine to ethics (see G. E. Moore, *Principia Ethica*, 1903; *Ethics*, 1912; and Russell, *Philosophical Essays*, 1910), but without any very satisfactory results. From their point of view the principal business of ethics is to discover true propositions about the relative intrinsic worth of different "goods." As both writers assume that there are a plurality of such propositions, and that each of them is known *a priori* independently of the others, the impression they leave upon a reader not previously committed to their theory is that they have really no better standard for determining the worth of various goods than their own personal preferences. It is characteristic of both writers that they assume without serious inquiry that *conduct* can only be good in a derivative sense as leading to the production of some good other than itself. Hence, though both reject the older forms of utilitarianism as ascribing a fictitious worth to pleasure, their own doctrine is itself utilitarian in its general character. Beyond discovering true propositions concerning the relative worth of goods, ethics seeks to furnish rules of right conduct, *i.e.* conduct which produces good results, but these rules are always of the most rough-and-ready sort and constantly require modification to suit special cases. Hence the ground is left open in practice for an enormous development of reflective casuistry. Messrs. Moore and Russell have furnished us with some acute observations on the relative goodness of various objects, but because of their refusal to look at human life as a whole they cannot be said to have advanced the study of ethics as an interpretation of life. In their ethical writings, slender as they are in bulk, one cannot see the wood for the trees; they are too much occupied with the search for true propositions about "goods" to develop a satisfactory theory of "*the* good."

Besides the irrationalism of Bergson and the atomistic intellectualism of the new realists, one may mention as characteristic of the years preceding the World War a third tendency, which held in some respects a middle place between the former two. This was the revival of philosophical Theism, in connection with which important work was done, especially by Prof. James

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Ward, Dr. Rashdall and Prof. Bernardino Varisco. Ward and Varisco agree in refusing to accept the unfavourable verdict of pragmatism and Bergson on the worth of the intellect in philosophy, and are so far pronounced rationalists as to require of any philosophical theory of the world that it should be able to justify itself before the bar of reason; neither is, however, an "intellectualist," since neither ascribes to cognition a primacy in importance for the philosophical interpretation of the world over feeling and conation; and both admit, like Kant, our right to believe what we cannot demonstrate, provided that such belief, if accepted, would form the natural completion of the conceptions to which strictly logical analysis of the contents of science points. Both hold in common with Bergson and the pragmatists the reality of contingency and the production of the genuinely "new," but both deny that there is anything irrational or repugnant to the intellect in these conceptions. Ward's views find their development in his *Realms of Ends* (1911), Varisco's in *I Massimi Problemi* (1910) and *Conosci te stesso* (1912). Both thinkers show very markedly the influence of Lotze, whose final results in the main agree with theirs; Ward is, on the whole, Kantian, Varisco Leibnitzian in manner.

Ward's starting point is afforded by the contrast between the unity which thought demands of its world and the apparent plurality which meets us in the world of sense perception. The problem which philosophy has to solve is, according to him, on what lines the world of experience can be thought of as one without our ceasing to recognize that it is also truly many. The history of the post-Kantian "idealist" schools has demonstrated that the problem is insoluble if we attack it from the side of the "one." Since the world of perception is not primarily given to *us* as one but as many, *we* have to start from its given multiplicity and work toward such a final conception of its unity of plan as our data will permit. Ward thus begins by a tentative inquiry how far the metaphysical assumptions of pluralism will allow us to recognize the experience-world as exhibiting unity. This leads him, *inter alia*, to a brilliant criticism of the concepts of mechanism and "evolution" as they figure in singularist philosophies. The result of the criticism is much that of Bergson's critique of the "geometrical" bias ascribed by him to the intellect. A mechanistic monism must reduce "evolution" to a process by which things unfold what has all along been in them in an "incapsulated" form; but the process known to genuine science by the unhappy name of evolution is really more properly "epigenesis," the growth of the qualitatively new, and therefore unpredictable, out of the old. Starting with an original pure pluralism which resolves the course of things into interactions between agents, each of whom is independent of any other, we can see that a pluralistic universe would develop a tendency to unity in the very process by which its members establish a *modus vivendi* among themselves, but it is uncertain whether such a tendency would give us the amount of unity we presuppose in the real world when we assume the validity for it of general laws, and it certainly does not warrant our ascribing to it such a unity as would justify the belief that the universe is such as to permit the realization of our moral and spiritual ideals. *If*, however, the pluralist should modify his hypothesis by regarding one member of his universe as a God from whom the rest derive their real but dependent existence, we could find in the existence of such a God good ground for faith in the persistence of spiritual life after bodily death, and the final victory of good over evil; the alleged difficulties of Theism, in particular the alleged impossibility of reconciling the goodness of God with the presence of evil in His world, have no conclusive force. Thus we are free, as Kant held, to exercise a reasonable faith in God and in immortality; and such a faith, while meeting the demands of morality and religion, involves no breach with the intellect, as it amounts only to a further step along the road which the pluralist is forced to tread in accounting for the presence of even so much unity of plan as he has to admit in the visible world.

Varisco reaches a very similar position as the result of a polemic against the empiricist metaphysic of the ordinary Comtist. He begins with an analysis of the actual moment of sense perception. The objects apprehended in such perception stand at once in two sets of relations. On the one hand, they are connected in various ways with one another, and as so connected they form a system which lies open to the perception not only of the special "I" who speak of apprehending them, but to the perception of innumerable other beings, each of whom can equally say "I apprehend" them. Considered from this point of view the system of sense-data and their interconnections may be said to form the common perceived world of mankind at large. But also a given sense-datum which I apprehend is, at the moment of its apprehension, present along with experiences (feelings, conations) which are intimate and private to me and directly accessible to no other being which calls itself "I." In this sense the perceived objects may be said to be *my* objects. Thus there is a sense in which the whole world of fact to which the individual has to adjust himself in action is inseparably bound up with the individual's inner life. Varisco develops this idea in a way which may remind us strongly of T. H. Green, but is at least equally reminiscent of Leibnitz, the one great philosopher whom Green persistently misunderstood. It is fatal to the empiricist theories which regard the "external world" as simply given in sensation that the world reveals itself to science as a complicated network of relations between terms, and neither the universals which pervade it nor some at least of the terms they connect are sense-data. The universals are apprehended by thought, and the self to which they are known, the only thing which we apprehend directly as it is, is also no sense-datum. It is our immediate non-sensuous apprehension of the self which owns its "states" that supplies us with our standard of real Being. Hence Varisco is led to postulate as indispensable factors in the scheme of the universe not only the sense-data and the system of relations between them, but the plurality of persons whose sense-data they are and whose thought apprehends their complicated relations. From these considerations follows the reality of freedom and contingency. For each individual has its unique qualitative character, by which it is distinguished from every other, and the course of phenomenal events thus depends on two factors, the unique characters of individuals and the universal relations between them, and the former factor is obviously incalculable with certainty just because it is what is not common to two or more individuals. Hence the actual course of things is only partly calculable, and this admission of contingency, or spontaneity in the individual, involves no breach with the principle that it is for philosophy to satisfy our intellectual demands. We may call the element of spontaneity a logical (since logic is concerned solely with the universal laws of interconnection and interaction), but not irrational.

At this point arises the supreme issue for a philosophical interpretation of the universe, an issue which is one of value or worth. The question is whether we regard the principle of organization in the universe as immanent, and manifesting itself in an endless succession of individuals which are all transitory; or whether we are to think of it as itself a transcendent individual, and of the finite individuals in which it exhibits itself as permanent factors in the universe. In the former case, the values of the individuals will be all relative, and there will be no meaning in attaching value or purpose to the world-order itself, as it is only the individual which properly has either; in the second case, there will be a meaning in regarding the values we ascribe to human personalities as absolute, and we shall be able to ascribe value and purpose to the universe as a whole, no less than to its various members. Varisco's view is that philosophy as such cannot decide this issue between an impersonal immanent principle of order and "the traditional Christian conception of God." Our decision will turn upon the intensity of our faith in the correspondence between the order of facts and our spiritual ideals. His own preference is for the Christian solution, as an expression of personal faith.

In the sphere of ethics, the attention of modern philosophers of all schools has seemed to be more concentrated on the inquiry into the presuppositions and methods of science than on the interpretation of our inner life. "*Erkenntnistheorie*" is more

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in the fashion than "discourses on conduct." This is, as has always been the case, specially true of the work of the Neo-Kantians. Special notice is perhaps due to the important volume, *Substansbegriff und Funktionsbegriff* (1910), by the distinguished Neo-Kantian writer, E. Cassirer, which is specially valuable for its insight into the real character of the universals, or laws, of exact physical science, and for its criticism of the work done on the philosophy of mathematics by distinguished "new realists." In the sphere of "philosophy of religion" one may perhaps give special commendation to Evelyn Underhill's brilliant attempt to make a thorough study of the meaning and worth of the mystic "way of life" (*Mysticism*, 1910), as well as to the important and elaborate restatement of the principles of "idealism," with special application to the problems of religion, by Prof. B. Bosanquet in his *Principles of Individuality and Value* (the Gifford Lectures at Edinburgh for 1911) and its sequel, *The Value and Destiny of the Individual* (Gifford Lectures, 1912).

It was not much easier in 1921 than it might have been in 1910 to detect a single main stream of tendency in latter-day philosophical thinking. Perhaps, however, it may be said that some of the issues were slowly clarifying. Except possibly in Italy, where the Hegelian influence was marked in the work of Croce and Gentile, "absolute idealism" of the Hegelian type seemed to be losing ground. The veterans of the movement continued to produce impressive work. (It may be sufficient to mention, in addition to B. Bosanquet's two volumes, F. H. Bradley's *Essay on Truth and Reality*, 1914, and J. M. E. McTaggart's *The Nature of Existence*, vol. i., 1921.) But, at least outside Italy, the school no longer seemed to attract recruits among younger men. "Pragmatism" (or "Humanism") seemed also, since the death of William James, to have taken its place definitely as a movement which had "done its do," and Bergson to be on the way to that canonization as a "classic" which means, among other things, that the canonized is felt to belong to the past rather than to the present. Nor had the philosophy of pure mathematics produced any work of absolutely first-rate importance since the third volume of the monumental *Principia Mathematica* of Whitehead and Russell. In 1920–1 the remarkable developments given to the doctrine of "Relativity" in physics by Einstein and others seemed to have caused a displacement of the centre of gravity of "epistemological" discussion. For some time to come the most topically interesting problem for the "epistemologist" and the metaphysician was likely to be the evaluation of the new physical ideas from the standpoint of general philosophy, and perhaps the most significant fact in quite recent philosophical literature in the English language was the impression which had been produced by Whitehead's two remarkable volumes, *Principles of Natural Knowledge* (1919) and *The Concept of Nature* (1920). The future would show whether these works might not give rise to a new and brilliant *Naturphilosophie* with marked affinities to Plato in the *Timaeus* and to Berkeley. For the present, physics seemed likely to occupy the same sort of central position in philosophical speculation which mathematics had held since 1900.

As far as could be discerned in 1921, the main directions in contemporary philosophy seemed to be three.

(1) Theism of a strongly ethical kind with a metaphysical basis of "monadism" or "personal idealism" and definitely hostile to that depreciation of human individuality which was common among the religiously minded idealists of the latter part of the nineteenth century. The theists of this type commonly call themselves "idealists" and hold fast to the conception of a real unity of the world of persons in a supramundane God, whom the world would not refuse to speak of as "personal," though some of them would hesitate to call him a "person." Striking examples of valuable works from this standpoint are James Ward's *Psychological Principles* (1918—the most philosophical treatment of psychology so far produced in Great Britain or perhaps in Europe); W. R. Sorley, *Moral Values and the Idea of God* (1918); A. S. Pringle-Pattison, *The Idea of God* (1917); C. C. J. Webb, *God and Personality* (1918); *Divine Personality and Human Life* (1920).

(2) "Neutral Monism" in its various forms, all agreeing in the attempt to deny that disparateness of mind and matter upon which Descartes taught modern philosophy at its very inception to insist, and the desire, speaking generally, to reduce the importance of mind, "consciousness," "the subject" in the scheme of things, to a minimum. This tendency has, perhaps, been most marked in the United States of America, where it has given rise to a whole school of young metaphysicians calling themselves "New Realists" (in contradistinction from the older realists of the Aristotelian tradition) and has been carried into psychology, with some exaggeration of its distinctive point of view, by the so-called "Behaviourists."

In Great Britain the same tendency has been shown in the later work of B. A. W. Russell, but its most striking product was perhaps S. Alexander's *Space, Time and Deity* (1920), where the principles of "New Realism" are combined with the speculations of Minkowski, Einstein and others on "Relativity" in an attempt to take stock of the universe and its contents. As the result is to represent these contents as an hierarchical order in which mind, however low its real rank, at least holds the highest rank with which we are acquainted, it is perhaps not unfair to say that, in Mr. Alexander's construction, relativity is at any rate "relatively" more prominent than "new realism." There is a certain community of temper between the work of the "New Realists" and one or two important works on special topics which do not commit themselves unreservedly to any metaphysical standpoint, though they may fairly be said at least to be not "idealistic," such as C. D. Broad's *Perception, Physics and Reality* (1914) and J. Laird's *Problems of the Self* (1917). J. Laird's later work, *A Study in Realism* (1920), is much more decidedly in line with the "new realism," though (as might be expected from an author whose earlier book was chiefly notable for the vigour with which it defended the position that the self, while unquestionably real, is neither the body nor any part of it) free from the tendency of many "new realists" to depreciate the importance of mind in the scheme of things.

It was as yet too early in 1921 to feel sure what the value of this revival of "realism" was. As against the older tendency to regard Nature as very largely the creation of the human mind and, in fact, something of an "illusion" which happens unaccountably to be shared by every one, it may fairly be said to be largely justified, and it seems also likely to prove a serviceable ally to the moralist who believes in "objective" obligation against the perennial endeavour of the mere anthropologist to confound moral distinctions with capricious "personal" likings and dislikes. It is a strong point of the doctrine that it refuses to regard the universals of science and ethics as "figments" (like the older sensationalism), or (like Kantianism) as "creations of the mind." They are genuinely there "in the facts," and have to be accepted no less than the deliverances of sense as "part of the facts." In so far as the "realistic" tendency seems likely to deliver us in natural philosophy from the belief in a "material substrate" and the rejection of the wealth of "sensible qualities" to the realm of illusion, and in ethics from the theory that moral values are purely "subjective," it promises to do admirable work for the clarification of thought. But it may be suspected that some of the protagonists of the movement are too much in a hurry to philosophize with due discrimination. The "neutral monism" to which they seem to tend in metaphysics is no new thing, and one may doubt whether it really deserves to survive its drastic criticism by J. Ward at the end of the last century (*Naturalism and Agnosticism*, 1899). It seems probable that some of the dialectical victories of the "realist" are easily won by substituting the alleged dualism of matter and mind for the very different duality of knower and known. To deny that the universe consists of two classes of substances, radically distinct and disparate in all their properties, is one thing; to maintain, as some, if not all, "new realists" do, that minds might disappear from the universe and yet leave it with all its colours, tones, odours, perhaps with all its "values," unaffected is quite another. Reference to the "subject" of knowledge may be irrelevant to the discussion of particular problems in nature precisely because

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the " subject " is equally relevant to the whole of Nature. To the present writer, at least, it seems that none of the " realists " of the moment has so clear an insight into the real significance of the " subject " and the real character of " Nature " as was shown long ago by John Grote in his remarkable, but unfortunately not very readable, work *Exploratio Philosophica.*

(3) The third tendency which calls for note is what one may call " Spiritualist Pluralism." According to this view the universe consists in the end of a vast plurality of minds, but there is no one central and supreme mind controlling its destiny. Anti-materialism and atheism are thus conjoined. The view itself is, indeed, not a new one. It has been long upheld, as an interpretation of Hegelianism, by J. M. E. McTaggart, and is, of course, not so very different from the " theism " of those " personal idealists " who make a point of objecting to the traditional doctrine of the Divine Omnipotence. But the pluralistic universe of spirits, as conceived by these thinkers, is, of course, an orderly one. The believers in a " finite God " have always stipulated that the limits of their Deity's knowledge or power shall be so widely drawn as to leave Him in a position to act as an overruling Providence to the rest of us. McTaggart's scheme does not include a God at all, but, for reasons which he has, perhaps, not made fully apparent, he is persuaded that it is in the nature of spirits to fall into line with one another and even to advance inevitably by a natural law to complete fruition of perfection and happiness. His world, to use an illustration of his own, is like the senior common room of a college without a master. (Have we here a last vestige of the old, comfortable Godwinian dogma of the " perfectibility of human nature "? There is a distinct flavour of the 18th-century optimism, against which *Candide* was a protest, about this metaphysic. The times of violence, it is taken for granted, lie behind us in the dim past; " culture " and " enlightenment " are a sufficient guarantee against their return, exactly as was thought by those representatives of the French *noblesse* who came up to Paris for the meeting of the States-General in 1789.) Naturally enough, the events of the recent years of world-wide war (1914–8), which made even the most optimistic feel how very insecure the foundations of our " moral civilization " are, were not favourable to spiritualistic pluralism of this easy-going and cheerful kind. Aerial bombardments and poison gases brought it home to all of us that the world is as " dangerous " as Nietzsche could have wished it to be. But an anarchic version of spiritualistic pluralism was enunciated with great vigour at the end of the war by the brilliant Italian philosopher, A. Aliotta, who had formerly professed a theistic " personal idealism," in his small but striking manifesto *La guerra eterna ed il dramma dell' existenza.* According to Aliotta, what the " real world " of spirits resembles is not a college in the long vacation but one of the fronts of the recent war. Spirits are ingenerable and indestructible, and their life is an unending warfare for incompatible ideals. The issue of the conflict is unknown and unknowable, and, indeed, it is just the fact that it is unknowable which makes the fight worth while. It seems even to be held that good would not really be good unless there was some one to hate and resist it. *Arma amens capio nec sat rationis in armis.* Aliotta, in his later phase, rejects Theism with disdain. His reasons appear to be primarily ethical. If there is a " God above," it is argued, we know already that the issue of the secular warfare of good with evil is decided. Good is going to win and we know it; the battle is thus as good as over already, and there is no more heroism in playing a man's part in the world than there is in charging an unloaded battery on a day of field manœuvres. Aliotta's zeal and energy have created, apparently, a whole band of enthusiasts for a pluralism of this kind among the younger Italian philosophers. The weak points in the intellectual construction are, however, obvious. The alleged ethical objections to Theism only hold good on the assumption that Divine Providence is absolutely incompatible with human freedom, and no serious attempt is made to justify this assumption that Theism means hyper-Calvinism. That in a theistic universe good will be triumphant " in God's good time " may be certain, but it does not follow that it will triumph without our efforts or that it does not depend largely on us when that " good time " shall be. Again, it must not be forgotten that the Theist does not commonly profess to be able to demonstrate his creed with mathematical certainty. He lives by faith and hope and usually professes to *prove* no more than that the scheme of things leaves him room to hope. It is probably impossible to reason an intellectually alert but morally frivolous man into belief in God. Still more unreasonable does it seem to hold, as Aliotta and his followers sometimes appear to hold, that the very meaning of " good " is " something which one has to fight for." If this were so, evil would clearly become very good if it were so generally hated by most men that its partisans were compelled to fight very hard on its behalf. It must always be more than a meaningless form of words to ask the question: " Is what you propose to fight about worth fighting for?" To put it differently, the proposition " that for which I am fighting is good " is always a synthetic proposition in Kant's sense of that phrase.

The years from 1918 to 1921, at all events in Great Britain, seem to have been rather barren in works of practical philosophy of outstanding importance. There were, of course, many reasons for this: the disturbance, by the war, of the ordinary avocations of the class by whom such works are chiefly produced, the rise in the cost of living which lowered the demand for books, and above all the great increase in the cost of paper and labour. Mention should, however, be made of one admirable work, L. T. Hobhouse's, *The Metaphysical Theory of the State* (1918). Hobhouse's work is a hostile criticism of the Hegelian tendency to deify the State as a sort of " super-person," which he takes as exemplified by B. Bosanquet's *Philosophical Theory of the State,* and a reassertion of the traditional " liberal " conception of the State as a system of machinery for the promotion of the welfare of individuals. The criticism of the Hegelian adoption of Rousseau's conception of the " general will " is severe but illuminating. It may be that Hegelianism tends to make men conservatives (though our own Hegelians have as often been socialists), and that Hobhouse's personal political inclinations at times run away with him. He seems so convinced of the antecedent probability that any governmental enactment will be a bad one as almost to hold that any " rebel " (a Marat or an Hébert?) may be presumed to be in the right until it is proved that he is in the wrong. But in view of the dangerous tendency of present society to " look to Government " for everything, and of the serious moral abuses to which the metaphor of the " personality " of the State may lead when it is taken to be more than a metaphor, the book must be regarded as a singularly timely contribution to philosophical politics.

In pure logic perhaps the most important English publication of very recent years has been the issue in 1921 of the first volume of W. E. Johnston's long-expected *Logic.* Mention should also be made of B. Bosanquet's *Implication and Linear Inference,* a welcome appendix to the more voluminous logical work of the veteran philosopher which throws a good deal of fresh light on his fundamental position.

The years of war and uneasy reconstruction have not been barren of useful work in the history of philosophy. In N. Kemp Smith's *Commentary to Kant's Critique of Pure Reason* (1918), we have at last in English an adequate historical and exegetical companion to the most famous of all German works on metaphysics and the theory of knowledge which will be indispensable to all serious students and may take rank with anything which the Germans themselves have done for their illustrious philosopher. If Smith's work is not quite on the gigantic scale of Vaihinger's great German commentary, it has the advantage of covering the whole of the *Critique,* whereas Vaihinger breaks off at the end of the *Transcendental Aesthetic.* In all other respects the British commentator may fairly sustain comparison with his Continental predecessor. Another very welcome contribution to the history of modern thought is J. Gibson's *Locke's Theory of Knowledge* (1917), which should do a great deal towards making the real greatness of Locke as a rationalist philosopher clear to his countrymen and dispelling the strange conception of him as

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a sensationalistic empiricist made current among us in the 'seventies of the last century by T. H. Green's *Introduction* to the Green and Grose edition of Hume. It were much to be wished that some competent scholar would do for Hume, a philosopher who has been no less strangely misunderstood, what Gibson has done for Locke. We still need to have it established by a really historical study of the *Treatise* and the dialogues on *Natural Religion* that Hume was neither an empiricist, as Green would make him, nor a positivist, as Huxley represents, but precisely what he calls himself, an "academic or sceptical" philosopher, and that the true measure of his intellectual greatness can only be taken when this simple fact is kept steadily in mind. A gap is also filled in our philosophical literature by the appearance of W. R. Sorley's *History of English Philosophy* (1920), which begins with Alcuin of York and carries the story down to the end of the 19th century. The veteran J. T. Merz completed his masterly *History of European Thought*, a work to which it would be hard to find a parallel in its scope and the accuracy of knowledge in many fields which it displays, by the issue of the fourth volume in 1914. He has since given us an interesting addendum, containing an outline of his own philosophical interpretation of experience in *A Fragment on the Human Mind* (1919), where it is interesting to see how profoundly a thinker at home in all the developments of French and German thought has been influenced by our own Berkeley and Hume. The *Fragment* is one of many signs that there is possibly a great future before a really critical Neo-Berkeleyanism. Berkeley received scant justice at the hands of the Anglo-Hegelian "Idealists" of the late 19th century, who seem to have been under the impression that his best-known doctrine was meant as a kind of "subjectivism." The 20th century seems likely, by laying stress on the very real element of "*naïf* realism" in his work, to arrive at a more intelligent and more generous estimate of its permanent value. We should not omit to chronicle the real service done to philosophical literature by the Open Court Publishing Company in the reissue (1916) of the epoch-making work of Boole on the *Laws of Thought*, the original edition of which had become very scarce. It is a great misfortune, owing presumably to the deaths of Dr. Paul Carus and Mr. P. E. B. Jourdain, that the complete republication of the logical writings of G. Boole and his great contemporary Augustus De Morgan has not been proceeded with. A reprint of De Morgan's *Formal Logic*, his contributions to the logic of relatives, and *Trigonometry and Double Algebra*, if of no other of his works, is badly needed by the student of the history of modern exact logic.

It is gratifying to note that the study of the great Greek founders of science and philosophy is still zealously prosecuted in Great Britain and in other countries, notably in Italy, which has been remarkably fertile in recent years in all departments of philosophical literature. It may be recorded that all through the war the issue of the great Oxford translation of Aristotle provided for by the will of Jowett slowly proceeded, the last part issued up to the middle of 1921 being the revision of Jowett's own version of the *Politics* by W. D. Ross. The Aristotelian student may be excused if he feels a little impatient at the continued non-appearance of just those Aristotelian works which are at once the most interesting and the least adequately represented in English, the *Organon*, *Physics*, *De Caelo*, *De Generatione* and *Meteorologica*. But for these logical and cosmological writings the English Aristotle was in 1921 well-nigh complete. Another most valuable work which progressed steadily after 1914, and in 1921 needed only one more volume to be completed, is the handsome edition of Kant's works with that indispensable *subsidium*, a full collection of variant readings edited by the eminent scholar, E. Cassirer. If, in binding and quality of paper, the later volumes inevitably fall off to some extent from the high standard of the earlier, this edition is in all other respects what an edition of a great classic ought to be. It was at last possible to read Kant with pleasure to the eye and with full certainty whether what one had before one was what Kant himself actually allowed to be printed or a (good or bad) conjecture of some modern Kant-scholar. We have too long acquiesced, and that not only in philosophical works, in a standard of textual accuracy where modern writers are concerned which would be rightly deemed barbarous in editions of the Greek and Latin classics. It is to be hoped that this bad practice will not be tolerated much longer by self-respecting scholars.

The changes in the third edition (1921) of J. Burnet's *Early Greek Philosophy*, the most critical and careful study of the beginnings of Greek science, are an interesting indication of the advance our knowledge of classical antiquity had made since 1908. No contemporary work on the primary Greek philosophers is of quite such first-rate importance as L. Robin's important *La Théorie Platonicienne* of 1908, the one modern work which systematically and in detail begins the investigation of Plato's philosophy with the proper initial question, what Plato was understood to mean by men like Xenocrates and Aristotle, who heard his doctrines from his own lips. J. Burnet's *Greek Philosophy, Thales to Plato* (1914) proceeds on similar lines, but the writer is limited by the facts that Plato is only one part of his subject and that he has perforce to give most of his space to the exposition of the dialogues. His actual interpretation of Plato was deferred to his second volume, not yet published in 1921. But Robin had issued a brief but important appendix to his main work, *Études sur la signification et la place de la Physique dans la Philosophie de Platon* (1919). Mention should also be made of the admirable Platonic studies of Adolfo Levi, *Sulle interpretazioni immanentistiche della filosofia di Platone* and *Il Concetto del Tempo nella filosofia di Platone* (1920). These are contributions of first-rate importance to the recovery of the genuine tradition of the first generations of the Platonic Academy. It ought to be clear that it is on the recovery of this tradition, for which there is ample available evidence, that our hopes of definitely ascertaining the real meaning of the first and greatest of all philosophical writers must depend.

The Neo-Thomist movement in the Catholic universities of the Continent still continued, in 1921, to flourish vigorously and to show its vitality in the general excellence of the work in such journals as the Italian *Rivista di Filosofia Neo-Scolastica* and the *Revue Neo-Scolastique de Philosophie* issued by the philosophical faculty of the university of Louvain. Among the actual books produced quite recently by the movement, mention may be made of the brief but highly condensed and valuable study of St. Thomas's thought in its entirety, *Le Thomisme*, by E. Gilson of the university of Strassburg. The English reader will get an admirable introduction to a great philosophy too little known among us by combining the study of this general introduction to Thomism with that of the very sympathetic exposition of Thomist natural theology by P. H. Wicksteed, *The Reactions between Dogma and Philosophy Illustrated from the Works of S. Thomas* (1920). The appearance of works like this last leads one to hope that it might soon be impossible for the average historian of philosophy among us to write as though nothing of any significance had been thought or said in philosophy between Plotinus (or even Aristotle) and Descartes. Two other recent contributions to the study of ancient and mediaeval thought may be mentioned. G. M. Stratton's *Greek Physiological Psychology* (1917) is a painstaking and laudable attempt to edit the important fragment of *Theophrastus de Sensu* with a translation and full explanatory commentary. In *Opera hactenus inedita Rogeri Bacon fasc. V.* (1920), A. G. Steele happily resumed the task, interrupted by the war since 1913, of providing a complete edition of Roger Bacon's writings.

In U. von Wilamowitz-Moellendorf's two large volumes entitled *Platon* (vol. i., 1917; vol. ii., 1919), the veteran German professor makes some interesting and valuable suggestions, but he is debarred from acting as a competent interpreter of Plato partly by complete lack of training in philosophical thought, partly by a habit of treating ingenious guesses of his own about the motives of a classical writer and the circumstances in which his various works were composed as certainties, partly by a curious want of finish in verbal Greek scholarship which makes his long series of conjectural emendations, in spite of a few felicities, into a systematic depravation of the Platonic text.

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During the decade, many of the familiar figures of the philosophical world were removed by death. This was only to be expected in the case of octogenarians like Wundt and Windelband and J. F. Brentano, still more in that of a nonagenarian like the Italian positivist, R. Ardigo (1828–1920). In Great Britain there were few losses among the elder philosophers since the death of the nonagenarian, A. Campbell Fraser. Of the elderly, but not old, the United States lost their leading philosopher, Josiah Royce; France, Gaston Milhaud and Émile Boutroux (1845-1921); and Austria, Alexis Meinong. Still more regrettable was the death of men who were still young or in their intellectual prime, as Louis Couturat in France and Oswald Kulpe in Germany.

(A. E. T.)

PHYSIOLOGY (*see* 21.554).—Since 1910 increased attention has been paid, in physiological research, to phenomena common to living beings in general, and recent investigation has added considerably to our knowledge and corrected earlier theories.

As distinguished from *Morphology*, the science of the form and structure of living organisms, *Physiology* may be said to be concerned with their activities, chemical and physical. But there can be no hard and fast line between the two bodies of doctrine. A function depends on the way the machine is made. And many provinces of modern research, such as those depending on changes of general form in response to external agents, combine morphology and physiology. For convenience of research, physiology is often divided into *biochemistry* and *biophysics*. But this distinction can scarcely be regarded as a scientific one, since in all vital processes both chemical and physical factors intervene. It is true that some of the problems of the biochemist consist in the elucidation of the chemical nature of vital products, and might be looked upon as the chemical side of morphology; but the methods of investigation distinguish them from those of the organic chemist.

Animal and Plant.—There is no real or fundamental difference between the animal and plant organism. Great as may appear to be the external differences between a dog and a tree, when we proceed to examine the physiological factors of which their life is made up, we find that the elementary processes are essentially alike. The most striking contrast, that of movement, does not exist in the simplest members of the two kingdoms. While certain plants, such as algae and bacteria, are motile in some stages, certain polyps and ascidians become fixed in the later periods of their life. Other instances might be given. The difference between the net result of the chemical changes occurring in the green plants and those occurring in animals is due to the presence in the former of the green pigment, chlorophyll, and does not show itself in fungi. By the aid of chlorophyll, the energy of the sun's light is used to build up the carbon dioxide, formed in the combustion of food by all cells, into sugar and oxygen. These again become available as sources of energy to living matter. In this connexion, it may be noted that the work of Willstätter and Stoll has made it practically certain that carbon dioxide and water become attached in some way to the chlorophyll particles, a molecular rearrangement takes place with addition of energy when light is absorbed, a peroxide of formaldehyde is produced, and this is then decomposed into gaseous oxygen and formaldehyde by the agency of an enzyme (catalase). From formaldehyde the higher sugars are readily produced by polymerization. The precise chemistry of the reactions is not yet clear—it may be that formic acid and hydrogen peroxide result from the action of water on the formaldehyde peroxide. In this case, catalase splits up hydrogen peroxide into water and oxygen, while the formic acid is reduced by light (absorbed by chlorophyll) to formaldehyde. However this may be, the final result of the process is that, in the light, green plants take up carbon dioxide and give off oxygen. In the dark, they behave like animals, giving off carbon dioxide by combustion. Such combustion, of course, is actually proceeding in the light also, although obscured by the opposite phenomenon.

Vitalism.—Some discussion, not very profitable as far as physiology is concerned, has taken place as to the existence of a form of energy, or, as held by some, of a kind of directing agency peculiar to living beings. The aim of all physiological experimentation is to express vital processes in terms of physical and chemical laws. We call this "explaining" them. The methods used, moreover, are those of physics and chemistry. Owing to the complexity of the phenomena, we have to be content in many cases with expression in terms of simpler *physiological* laws, leaving the further analysis of these laws to the future. As Claude Bernard pointed out, the laws of physics and chemistry manifest their action in systems of a special kind, differing from those familiar to workers in the former sciences, so that the separation of a biological group is quite justified. At the same time, there is intimate connexion and overlapping, a process subject to continual increase.

As to the existence of a peculiar form of "vital" energy, it is to be admitted that we have no direct method of measuring the energy contained in a given mass of carbon and oxygen, although we know that a definite quantity of work can be obtained by allowing them to combine. Thus, the energy of living things cannot be looked upon as altogether peculiar. Indeed, measurements of any form of energy are usually made by converting them into other forms. The first law of energetics tells us that this is permissible. The striking fact that any organism behaves as a unified and coördinated set of activities has led to the assumption of a directing agency of some kind. We shall see later that notable progress has been made in the explanation of the factors responsible for many aspects of this integration.

The position of consciousness in physiological processes is by no means clear. While it may be held that the province of physiology is to investigate what can be made out experimentally in the nervous centres, it does not seem impossible that consciousness may ultimately fall into place as one of the functions of nervous tissue.

Relation to Physical Chemistry.—One of the most striking aspects of the development of modern physiology is the important part played by considerations derived from physical chemistry. The osmotic pressure of solutions, the action of the various inorganic ions arising from the electrolytic dissociation of salts, acids and bases, especially the hydrogen ion, and the maintenance of the neutrality necessary to the normal function of the cell, together with the properties of matter in the colloidal state and of heterogeneous systems in general may be mentioned. The absorption of substances at the surfaces of contact of phases that do not mix has been found to explain many otherwise puzzling facts, and is doubtless a prominent factor in the formation of the membrane covering the surface of cells in general and regulating the passage of dissolved substances into and out of the cell protoplasm.

This is perhaps the most appropriate place to refer to the relation of vital processes to the second law of energetics. In one of its aspects, this law points out how the transformation of heat energy into other forms is limited, owing to our conditions of existence being at a temperature so far above absolute zero. The properties which we recognize as "vital" are especially manifested during the change of one form of energy into another. In this process, it is of much importance from the point of view of economy that the free chemical energy of our food should not be "degraded" to heat before utilization in muscular work, and so on. Similarly, the energy of the sun's light must be converted to chemical energy by the green plant as directly as possible, without passing through the stage of heat. Accordingly we find that arrangements are made to ensure that loss from such causes shall be as small as possible.

Nature of Protoplasm.—As usually seen in such organisms as the amoeba or the leucocytes of the blood, protoplasm exhibits the properties of a liquid. It contains numerous particles in Brownian movement, a fact which shows the absence of obstacles holding them in place. This liquid, however, is itself a colloidal solution and can be seen under special modes of illumination to be closely packed with extremely minute particles. Under some states of activity, as in dividing cells or when electrically stimulated, this "hydrosol," to use Graham's word, becomes a

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"gel," in which the particles have joined together to form minute closed chambers in which liquid is confined, the whole mass then possessing the properties of a solid. This process occurs when a warm solution of gelatin solidifies on cooling. It will be clear that if protoplasm contains many-formed solid structures, as in highly differentiated cells, together with comparatively little free water, it may be scarcely possible to detect its liquid nature. However difficult it may be to conceive the way in which different chemical processes can occur at different places in a liquid, this must be the case, and suggestions have been made as to the temporary formation of separating membranes or other less mechanical means of isolation. The notion of protoplasm as a giant molecule in the chemical sense, with numerous side-chains of a variety of composition capable of reacting together, is held by but few physiologists at the present time. A view of this kind is contained in the theory of "biogens," to which reference will be made later.

The *cell-membrane* is evidently formed by surface condensation of some constituents of protoplasm. In ordinary circumstances, it is impermeable to salts, to glucose and to amino-acids. But since these substances must obtain access to the interior as foods at certain times, it is clear that the membrane must become more permeable when required. The constituents of the membrane being deposited at the surface owing to their properties of reducing surface energy, the actual chemical composition of this layer must be of a complex nature. It is probably, for the most part, an intimate mixture of fatty substances with watery proteins. These may form two kinds of colloidal systems—minute droplets of fat may be surrounded by a continuous solution of protein, like islands in a sea, or they may themselves run together and enclose droplets of protein, similar to the land surrounding a number of lakes or ponds. The properties of these two systems, as regards the passage across them of materials, will not be identical. Thus, rabbits cannot get through the system of islands, fish can do so; while the reverse will be the case with the other kind of system. Familiar instances of the contrast are well known in the forms of cream and butter. The former is a suspension of droplets of oil in a watery solution, the latter consists of droplets of the watery solution in a continuous medium of fat. The investigations of Clowes have shown how, by the action of electrolytes, particularly of calcium ions, one system can be changed into the other. A difficulty is sometimes felt as to how a membrane which refuses passage to sugar allows visible solid particles to pass through, as can be seen in the amœba and leucocytes. The explanation lies in the manner in which a needle can be dropped through a soap film without breaking the film. A continuous film of the membrane is formed over the point as it enters and again over the eye-end as it leaves. Thus the membrane is never actually broken. A further point to be remembered in the modifications of the cell-membrane is that, being formed of materials present in the cell, it is an integral part of this and must change in correspondence with functional changes in the cell itself. Thus it appears that it becomes more permeable in states of activity, as in the contraction of muscle and in the secretory process of gland cells. If the surrounding medium itself contains substances that lower surface tension, these no doubt contribute to the structure of the membrane. Such is usually the case in the cells making up the animal body, less so in the plant.

Certain substances, proteins and others, become more or less solidified in the process of concentration in surface films, as Ramsden has shown. This fact must also play a part in the formation of the cell-membrane.

As to the *chemical nature* of protoplasm itself, it seems very questionable whether it can be regarded as a uniform chemical compound. Although proteins take a large share, various other substances, such as the complex fats known as *lipoids* or *lipines*, are important components. All the constituents are interconnected in a highly heterogeneous system, partly chemical, partly physical, of many phases and intersected by semi-permeable membranes forming and disappearing at intervals.

Attention may here be called to the special properties of the *carbon atom* as forming the basis of the chemical changes associated with living matter. Compounds of carbon do not naturally react otherwise than slowly. They are, therefore, subject to ready modification in this respect by the agency of the catalysts called "enzymes." Owing to the capacity of carbon atoms to unite together in long chains or rings of a relatively stable nature, along with the possession of four valencies capable of union with four different groups, we have the possibility of the production of highly complex large molecules. Another property of importance in the carriage of energy is the power of combining with elements of opposite character, such as hydrogen and oxygen. The hydrocarbons give up energy on oxidation, while the carbon dioxide can be reduced and built up again by addition of energy to form stores of potential energy for future use.

Although such large complex molecules are of great importance, the view of the essential nature of protoplasm as a further growth of the chemical molecule, the "biogen" hypothesis, cannot be accepted. According to this view, food material is combined chemically, as a side chain, with a giant molecule, while certain other side chains consist of oxygen. In oxidation, to give energy, combination takes place between these side chains. It follows from such a view that oxygen must be stored up in living cells in an "intra-molecular" form. Now, investigations from many points of view have failed to obtain evidence of the existence of such reserve oxygen. There is no proof that an organism possesses any store of oxygen beyond that contained in the lungs or dissolved in the fluids. It appears that the mechanism of living matter is more analogous to that of a petrol engine, in which the fuel does not form part of the structure previously to its combustion, but that this combustion takes place in intimate relation with the moving parts and that it is owing to the special arrangement of these that the chemical energy of the fuel is converted into the mechanical energy of motion. It is true that such cells as those of muscle and secreting glands have been shown to prepare during rest a store of some kind of system possessing potential energy, ready for use on stimulation to activity. But the process of conversion of this system to one of lower energy content is not associated with the consumption of oxygen or evolution of carbon dioxide. Thus the system is not comparable with a "biogen" and may probably be rather of a physical than a chemical nature. The energy necessary to form it is obtained by the combustion of some food material, apparently carbohydrate, with the giving off of carbon dioxide and involving some loss in the form of heat. The state of activity and the actual combustion process are therefore separate phenomena and the conception of giant molecules throws no light on their nature. It is rather as if the combustion of the fuel in our petrol engine were used, through some mechanism, to pump water to a high level, from which the energy could be obtained by allowing it to run down when required.

The Nucleus of the Cell.—Although this component is present in all the more highly organized cells, it is obvious that it cannot be essential in this actual form. Bacteria, for example, do not appear to possess a nucleus, although the materials out of which it is made are probably present distributed through the cell. If, as Morley Roberts suggests, the nucleus is a store of enzymes, the tools of the cell, it might be supposed that, in the absence of the nucleus, these tools are not kept in a special receptacle. Although statements have been made that oxidative processes are especially carried out by the nucleus, the evidence is unconvincing.

The nucleus undergoes a remarkable series of changes in the course of the subdivision of one cell into two daughter cells. This process, known as "karyokinesis" or "mitosis," exhibits a complex play of directed or polar forces. The inheritance of the Mendelian characters of organisms is conveyed by the nuclear constituents. The general characters are held by some to be transmitted by the cytoplasm. But, although it is difficult to believe that the cytoplasm plays no part, it would appear that if all the general characters are thus carried, those of the male parent would be practically unrepresented, since the spermatozoa are almost devoid of cytoplasm. Further evidence is needed.

When a nucleated cell is cut into two parts, one alone containing the nucleus, this part can continue to exist, whereas the other part degenerates and dies. Thus, the nucleus is essential to the life and growth of a cell in those cases where it has become a specially differentiated part. The fact is particularly manifest in the case of the cells called *neurones*, which make up the nervous system. Here there is a very long fine fibre arising from a nucleated mass. This is a "nerve-fibre," and if cut away from its nucleated origin, it degenerates and ceases to be able to conduct nerve impulses.

Nutrition.—During 1910–21 much attention was given to problems of the phenomena of nutrition, necessitated in great part by the conditions brought about by the World War of 1914–8. Since the chief use of food is to supply energy and energy cannot be created, it must always be kept in mind that a given amount of food can only provide a certain definite quantity of energy. For convenience of measurement, this is expressed in terms of heat units, calories. An adequate diet must have a certain minimal calorie value, or energy value, differing according to work done, age, weight, etc. Whatever else may be necessary, and whatever may be the composition of the diet, this energy value must be provided. The fact must not be allowed to be obscured by recent work on the importance of special constituents, such as "vitamins" or the presence of particular chemical compounds.

Further, food is obviously required in the growing organism to make new tissue and in the adult to replace wear and tear. Although the actual quantity needed for these purposes is not great, it is clear that it must contain all the chemical elements making up the constituents of the new tissues. There are moreover certain rather complex chemical compounds that must be

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supplied, since the higher animals are unable to make them. Nitrogen is needed for the production of proteins, and is in fact taken in food in this latter form, although afterwards broken down into its constituent amino-acids in the process of digestion. A certain minimal amount of protein food is therefore a necessity. When burned, protein gives energy, and might therefore be used for this purpose, if taken in sufficient quantity. But such a proceeding would be costly and wasteful. Accordingly, we make up the greater part of the energy value of our food by non-nitrogenous compounds, fats and carbo-hydrates. The latter appear also to be necessary for proper assimilation of protein. Some discussion has taken place as to the actual necessity of fat, since it has been shown that in the organism fat can be made from carbo-hydrate. Careful experiments indicate that it is not indispensable. Its chief value, physiologically, lies in its high energy value, greatly owing to the very small amount of water contained in the forms used for food.

On account of the fact that the nitrogen of protein appears to be needed only or mainly for the construction of new body substance, there has been a tendency to reduce the consumption of protein. This is advocated chiefly on grounds of economy. Although excessive consumption of this or any food is physiologically harmful, there does not appear to be satisfactory reason for supposing that protein is particularly injurious. On the other hand, it has been stated that a consumption of protein in considerable excess of the minimum requirement is of advantage in conferring greater resistance to infection. Apart from the ill effects of any diet deficient in energy value as a whole, no satisfactory evidence has been brought in support of the statement. It may be said that if any reasonable diet of animal or vegetable structures, including fruit, be taken, it will only be necessary to take account of its energy value. Sufficient proteins and vitamins will be automatically obtained. The dictum of the present writer "Take care of the calories, the proteins will take care of themselves" may indeed be read "Take care of the calories, other things will take care of themselves."

It may be useful to give the composition of the diet put forward by the Royal Society Food Committee as a standard for a man of 70 kilos weight, doing moderate work:

Protein	70 grammes =	280 calories
Fat	90 grammes =	810 "
Carbo-hydrate	550 grammes =	2200 "
	Total	3290 calories

It is understood that this refers to that part of the diet actually utilized and does not include undigested components.

In addition to the above-mentioned, there are certain things which, although they do not contribute to the energy value of a diet, are nevertheless indispensable for the proper working of the cell machinery and the utilization of the material presented to it. Water is needed for the carrying on of chemical reactions and for the conveyance of products from place to place. The colloidal systems of the cell are maintained and modified by salts, especially those of sodium, potassium and calcium. This adjustment, as Macallum has pointed out, is doubtless an inheritance from adaptation to the composition of the ocean in early geologic times, from whose inhabitants the present land animals are descended. We find, moreover, certain metals, such as iron, manganese, copper and magnesium, present in small amount in living organisms. We know that iron is a constituent of the red pigment of the blood corpuscles, by which oxygen is supplied to the tissues. In certain invertebrate organisms, it is replaced by copper. Magnesium is a corresponding element in the green pigment of plants, chlorophyll, without which life would come to an end owing to the using up of the oxygen of the atmosphere. Iron and manganese are of importance in the mechanism by which food is burned and its energy obtained. Certain moulds will not develop completely without zinc. It is more than likely that many other metals present in traces are more than mere accidental contaminations. Calcium, as we have already seen, plays an important part in the adjustment of colloidal systems. Potassium, although we know it to be indispensable, presents difficulties. Zwaardemaker maintains that its importance rests in its radio-activity, but other workers have not been able to replace it by other radio-active elements. Sodium salts, at the present time, serve chiefly to make up the osmotic pressure of the blood and tissue fluids. The occurrence of iodine in the internal secretion of the thyroid gland must not be overlooked.

Vitamins.—Not the least interesting of those constituents of a diet whose presence is absolutely necessary, although small quantities suffice, are the accessory food factors called by this name. The name "vitamine" was originally given owing to a mistaken view of their chemical nature. But, since it has come into general use and is conveniently short, objection to it may be removed, as Drummond has pointed out, by omitting the final "e" and using it merely as a name, without implication of chemical structure.

So far as known at present, they are three in number, distinguished by the addition of the letters A, B and C. Vitamin-A is commonly found in association with certain fats, such as butter and cod-liver oil, but it is also present in fresh vegetables. It is essential to normal growth and maintenance and its absence appears to be responsible for rickets in children. Vitamin-B is found in the germ of seeds, such as wheat and rice, but it is widely spread. Its absence from polished rice results in beri-beri, when this food material is the only one taken. Vitamin-C is required for normal nutrition, although the precise manner in which it acts is unknown. In its absence, the disease known as scurvy makes its appearance. This vitamin is much less stable than the preceding ones and is found only, to any notable extent, in fresh fruit and vegetables. Although all of these factors occur in animal products, they are present there owing to the vegetable food taken by animals. Their ultimate source is the plant, since animals are unable to make them. It is more particularly Vitamin-C that is defective in animal products. Fresh meat contains it in a very small amount. Owing to the minute quantities that are physiologically sufficient and are alone accessible for investigation, their chemical nature is as yet unknown. They do not undergo change in the course of their activity, but are excreted or destroyed more or less rapidly. Thus, their activity appears to be of a catalytic nature, but nothing very definite can be stated at present.

The normal growth of plants is also dependent on similar accessory factors. The "bios" of yeast, and Allen's work on diatoms may be referred to here. Bacteria, also, require in many cases special materials, such as haemoglobin, or particular amino-acids, for satisfactory culture.

It should be noted that certain products formed by organs in the body itself have powerful effects on the chemical changes of growth and nutrition. To these "internal secretions" or "hormones" reference will be made below.

Anabolism and Catabolism.—It was held at one time that all food materials, previous to further utilization, must be built up into the actual constitution of complex protoplasmic molecules such as "biogens." And that the activities of organs typified by muscular contraction and glandular secretion consisted in the breaking down of such complex chemical individuals. The former process was spoken of as "anabolism" or "assimilation," the latter as "catabolism" or "dissimilation." More recent work has led to a somewhat different point of view, as already indicated above. It appears that glucose, for example, is burned without becoming a part of the protoplasmic structure and, although the energy thus available is used for the storing up of potential energy in some complex system, to be used up in subsequent contraction or secretion, this system may not necessarily be of a purely chemical nature. If the anabolic and catabolic processes are opposite chemical reactions in the sense of the building up and breaking down of the same compounds, it is natural to suppose that while the former process is taking place the latter is *ipso facto* decreased. Hence, the view that the nerves producing a reduction of activity (inhibition) are anabolic in action. Investigation, however, has failed to give confirmation of such a view of the nature of the inhibitory process.

Allied to the above problem is that of the existence of nerves influencing the growth or repair of tissues. Although definite statements cannot yet be made, evidence of any such influence, apart from changes in blood supply, is inconclusive.

Enzymes.—These catalytic agents are of great importance in the chemical changes of living organisms. It is generally recognized that they are colloidal and that the reactions accelerated by them

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take place on their surfaces. Thus, a preliminary absorption of the components of a reaction occurs preparatory to the actual chemical change. Whether this increased concentration or close approximation by molecular forces is in itself sufficient to account for the effects or whether there is an intermediate compound formed between the material of the surface of the enzyme and the substances to be acted upon is not yet clear. No such compound has been prepared, but its existence may be so brief as to elude detection. It is evident, however, that the chemical nature of the surface of the enzyme particles may be held responsible for the variety of limited and special activities met with amongst these substances. At the same time, it is not to be forgotten that the physical properties of this surface depend on its chemical nature. In this connexion the views of Langmuir on the orientation of molecules in surface layers may be referred to. In regions of molecular forces, no valid distinction can be drawn between chemical and physical forces.

Much discussion has taken place as to whether enzymes have synthetic as well as hydrolytic powers. In the majority of cases we are dealing with undoubted reversible reactions, which attain an equilibrium position other than complete change in either direction. But the two opposite reactions which determine the equilibrium point proceed naturally at a very slow rate. If an enzyme were to accelerate one of these without the other, the equilibrium position would consist in practically complete change in one direction. If this position as reached under the action of an enzyme is anywhere but at the extreme in one or the other sense, it follows that the enzyme has quickened *both* the hydrolytic and the synthetic reactions. Many cases of this kind are now known. The actual position of the equilibrium depends on the concentration of water in the system. Thus, in order that the synthetic activity may be preponderant, arrangements are required by which this concentration of free water may be decreased. This may be effected in the cell by colloidal imbibition by absorption on surfaces, or by osmotic action. If the products of synthesis are rapidly removed either by being deposited in an insoluble form, as for example starch or glycogen are, or by being carried away in the blood stream, the synthetic process may be continuous, since equilibrium is not reached.

Oxidation.—As is well known, the living organism is able to burn food materials, such as glucose, fat and so on, which are only oxidized with such extreme slowness by atmospheric oxygen that combustion appears to be absent in many cases. The mechanism by which oxidation is effected in the organism consists in making use by enzymes of products of oxidation of certain materials which are attacked by atmospheric oxygen. Although details of the mechanism are not altogether clear, the main facts are as follows. When a substance, such as an unsaturated fat or lecithin, is oxidized by oxygen as it exists in the air, it is said to undergo *autoxidation*. In this process, *pari passu* with the formation of the ordinary oxide, which of course affords available energy, a peroxide is formed by the aid of this energy. It appears also from Mrs. Onslow's work that the autoxidation may be hastened by an enzyme, thus affording a larger supply of the peroxide. But while a peroxide in itself has greater oxidizing power than oxygen in the molecular state has, or in other words its oxidation potential is higher, this potential is not sufficiently high to attack glucose or lactic acid. If, however, a small amount of a ferrous salt be added, a catalytic separation of oxygen in an " active " state occurs and such refractory materials as lactic acid are then oxidized (Fenton's reaction). Whether active oxygen is atomic or whether it is in the process of changing its valency, as Ramsay used to teach, is uncertain. The important fact is that we find in living organisms an enzyme, " peroxidase," capable of acting on peroxides in the same way as the iron in Fenton's reaction. Indeed, it seems likely that either iron or manganese is the responsible constituent of the enzyme.

Oxidation or reduction may also be brought about by substances which remove hydrogen from water, thus leaving reactive oxygen. As Hopkins has shown, a sulphur group (S-S) may take up hydrogen to form HS-SH, while this compound in its turn may hand on hydrogen to an " acceptor," and so reduce it.

Integration.—Organisms behave as coördinated systems, not as collections of separate cells. There must accordingly be means of inter-communication between all parts. In the animal, the most obvious of these is the nervous system, which makes its appearance at a very early stage of evolution. It may be compared to the telephone system of a city, by which any part can be connected up with any other. This comparison is in many ways an instructive one. Any one subscriber can be put into communication with any other and his line is a " final common path " for messages from various sources. Thus, the nerve supplying any particular muscle is made use of in many various movements, since it can be connected up in the brain with different nerves conveying their respective messages from the sense-organs.

Details of researches on the activities of the central nervous system are beyond the scope of this article. In general it may be said that the conception of a series of alternative parallel arcs at different levels in the hierarchy has shown itself an illuminating one. When the higher arcs come into use, those of lower levels fall into disuse and become relatively resistant to the passage of impulses. These lower arcs still remain potentially active and when the higher parts are removed gradually become functional again, to a greater or less degree. In some cases, their activity is kept in check by the higher arcs and liable to become more or less excessive when the influence of these is removed. Such " release " phenomena play an important part in the manifestations of the nerve centres, especially in abnormal states.

Pavlov's method of " conditioned reflexes," by which physiological, objective, research on the cerebral cortex can be made, has already led to many valuable results. The part played by inhibitory processes has been shown to be a very important one.

As animals grow in size and complexity, some system analogous to that of mechanical transport by roads or railways becomes necessary. Oxygen has to be conveyed to all parts of the body from the place in which it is obtained from the air. The carbon dioxide and other products of chemical change require removal for the purpose of elimination by the organs devoted to this purpose. Food has to be taken from the alimentary canal to other organs in which it is burned or used for repair. As is well known, it is by means of the blood flowing in a voluminous network of tubes that this aspect of integration is effected. Thus, materials in quantity are carried from one organ to another. As regards oxygen and carbon dioxide, further remarks will be found below.

Much attention has naturally been given to the pump, known as the heart, which serves to keep the blood flowing through the vascular system. The most important recent work is that of Starling embodied in the *Law of the Heart*. It was found that all the responses of this organ to the demands of the circulation, apart from the effects of nervous reflexes upon it, could be explained on the basis of a certain property common to all muscle. This property, which was clearly brought out by the work of A. V. Hill, is that the magnitude of any given contractile effort depends on the *length* of the fibres when the contraction begins. Hence, the more blood enters the heart during rest the greater is the force expelling it in the next following beat. The property of muscle referred to shows that the source of the contractile stress must be sought in certain *surfaces* arranged longitudinally or in the direction of the pull exerted. (For recent work on the capillaries, *see* SHOCK.)

But the system of mechanical transport of a town serves to carry letters in addition to materials for actual use as such. The chemical substance of these letters is not utilized, but they contain messages by which a supply of something or other is ordered to be sent from its source to a place where it is wanted. The so-called " internal secretions," " chemical messengers " or " hormones " correspond to the letters of the postal system. These are produced in some organ and carried by the blood to other situations in which they set various processes into activity. Thus, for example, adrenaline is sent out from the suprarenal glands into the blood. Reaching the liver, it causes a supply of glucose to be set free and supplied to the body generally. It has, of course, other actions as well. We know many of these chemical messengers at the present time. They are formed in the thyroid, pituitary, pancreas, sex-glands and so on. In one or two cases their chemical nature is known, but for the most part this is not yet the case. It seems very probable that every tissue in the organism has its influence on other tissues. In the culture of tissues under the microscope,—a method of investigation which has now reached much perfection,—it is found that the growth and differentiation of one kind of tissue is greatly influenced by the presence of other tissues.

In the higher plants, this effect of one part upon another is well shown by the inhibitory effect of the apical growing tip upon the growth of other buds. The work of Child suggests that this effect is of the nature of a protoplasmic transmission of some influence rather than the diffusion of an actual inhibiting hormone, as was supposed by the previous workers.

Carriage of Oxygen and Carbon Dioxide.—Although it has been known for some time that it is the haemoglobin of the red corpuscles that carries oxygen from the lungs to the rest of the body, there is still much to learn about the mode in which this gas is attached to the haemoglobin. There are some puzzling phenomena, not the least of which is the fact that we know of no other chemical compound that takes up and gives off oxygen in a way similar to that of haemoglobin. In particular, one which combines with oxygen in proportion to the pressure of the gas up to a saturation point which appears, in the case of the blood pigment, to correspond with one molecule of oxygen to each molecule of haemoglobin. Much valuable work has been done on the relationship referred to, especially by Barcroft and his coadjutors, more especially on the way in which it is affected by changes in the conditions present in the blood and tissues. The problem is one of paramount importance in the life of the higher organisms.

The problem of the carriage of carbon dioxide is in a more disputed state. While some hold that it is effected by the proteins of the blood acting as acids and driving off carbon dioxide from sodium bicarbonate when the tension of carbon dioxide is lowered, others hold that this gas is carried by haemoglobin in the same way in which oxygen is carried. The decision necessitates difficult measurements and is still uncertain.

Regulation of Reaction.—Whether the sodium bicarbonate of the blood acts as a carrier of carbon dioxide or not, there is no doubt that it has an important function in preserving the neutrality of the blood. As would be expected from the fact that the various chem-

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ical processes take place with the intervention of colloids, they are very sensitive to changes in hydrogen-ion concentration. This is particularly the case with enzymes. The blood contains sodium bicarbonate, which in itself has an alkaline reaction, owing to hydrolytic dissociation, together with carbon dioxide which forms an acid when dissolved in water. The reaction or hydrogen-ion concentration of the blood is thus controlled by the relative proportion of these two constituents, and is normally at a very slight degree of alkalinity. If acid is formed anywhere and passes into the blood, it combines with part of the bicarbonate, driving off carbon dioxide and thus raising the acidity. But the respiratory centre is enormously sensitive to such a rise and removes carbon dioxide by increased ventilation of the lungs until it is reduced to a level corresponding to the reduction of the bicarbonate. It has been held by some that the proteins assist in the process, but it is very doubtful whether this effect is more than very trifling, if present at all.

Excretion of Waste Products.—The removal of one of the chief of these, carbon dioxide, has been discussed. The most important of the non-volatile products is urea, most of which is derived from the ammonia of the amino-acids absorbed in excess of the amount required for repair. There are a number of others in small quantity, some nitrogenous, others not, which, although not really of a toxic nature, are of no value. These are all non-colloidal and therefore pass freely through the wall of the blood-vessels. The colloidal constituents of the blood, mainly proteins, and the blood corpuscles do not normally pass through, except in a few places, such as the liver, where the membrane is incomplete. Owing to the pressure produced by the heart, there is a tendency to a continuous filtration through the walls of the blood-vessels of a solution containing all the diffusible constituents of the blood. But the proteins of the blood do not diffuse and, since they are such as to have an osmotic pressure of about 30 to 40 mm. of mercury, they may be regarded as attracting water with a force of this magnitude. Unless the blood pressure exceeds this value, therefore, no filtration occurs, and where it is below, reabsorption takes place. The pressure in the arterioles and beginning of the capillaries exceeds the osmotic pressure of the colloids, whereas it is lower than this in the rest of the circulation. In the greater part of the body, the filtered fluid escaping reabsorption is known as lymph. In the kidneys, the glomeruli are arranged so as to filter a large amount of fluid, which is the first stage of the production of urine. This process as described would suffice to remove all the waste products. But if the whole filtrate were allowed to escape from the kidney, not only would a large quantity of water be lost, but with it such valuable substances as salts and food materials, sugar and amino-acids. What we actually find is that the filtrate is caused to pass along a system of tubules, in the course of which a large part of the water, together with useful solutes, is reabsorbed, while the useless waste products are left in more concentrated solution. It has been shown by Cushny that if it be supposed that the fluid absorbed has invariably the normal composition and concentration of the blood plasma as regards diffusible substances, but without the waste products, all the phenomena of renal function can readily be explained.

It would appear that the chief function of the plasma proteins is to confer a colloidal osmotic pressure, so that excessive filtration is avoided. In the absence of such an osmotic pressure, not only would a large amount of liquid be exuded into the tissues, but there would be no force available for its reabsorption and a dropsical state would result. In fact, this is what happens when a simple salt solution is introduced into the circulation (*see* SHOCK).

On the basis of the theory given above, it will be noted that the energy for the actual production of the glomerular filtrate is provided by the blood pressure, that is, by the contraction of the heart. On the other hand, the cells lining the tubules have to do work against osmotic forces, since they remove a dilute solution from a more concentrated one. This work increases as the fluid passing along the tubules becomes more concentrated. It must be provided by some cellular mechanism analogous to a pump, requiring the provision of energy to actuate it. The investigations of Tamura indicate that this consumption of energy per unit time is unchanged, whatever may be the amount of urine produced by the kidney. Hence, the more concentrated the glomerular filtrate, the less fluid is reabsorbed from it.

Stimulation and Environment.—The capacity of an organism to respond in an appropriate manner to changes in its environment clearly depends on its power of properly appreciating such changes. Hence, the more richly endowed is an organism with means by which it is enabled to be affected by the various forms of energy impinging upon it, the better it is fitted to profit, both materially and intellectually, by knowledge of the outer world.

In order to understand the essential character of a receptor or sense-organ, as we call the structures by which such information is obtained, one or two fundamental facts brought out more clearly by investigations in recent years have to be considered.

Receptor organs are connected to the brain each by its own set of nerve fibres. These fibres proceed to special regions in the brain, and it appears that whatever the manner in which impulses are set in motion along the fibres, the process in them is the same. So that the fact that the sensations aroused are in one case light, in another taste, and so on, depends on the terminus in the brain. And from whatever source this terminal "centre" is aroused to action, the effect in consciousness is the same. If, for example, the trunk of a nerve of taste is stimulated, either electrically, mechanically, or chemically, a sensation of taste is evoked. A further fact that has been made clear by Adrian's experiments is that the nerve-impulse itself cannot be made other than of a definite magnitude by varying the strength of the stimulus. In any particular state of the nerve, if it is excited at all, the maximum response possible is obtained. In the case of the heart muscle, this fact has long been known and was given the name of the "law of all-or-nothing" by its discoverer, Bowditch. This law has now been shown to hold for voluntary muscle and for nerve. It is true that the work of Adrian was done on motor nerves, but no difference between these and sensory fibres in other respects has been shown to exist, and there is some direct evidence that the law holds in the case of the optic nerve. It appears then that the impulses travelling along nerves are the same in all cases and that their various results are due merely to the structures in which the fibres end. The statement applies also to efferent nerves, in that there is no difference in nature between nerves which have excitatory and those which have inhibitory action on the structures in which they end. The difference, as Langley pointed out, is in the manner in which their final connexion is made. The question is indeed an aspect of Müller's law of specific sense-energies. The name is not very explicit, but the law states that the excitation, however produced, of each nerve of special sense gives rise to its own peculiar sensation.

We see then that what is required in a receptor organ is that some process shall be set going in it on the incidence of a particular form of external energy, and that this process shall be such as to stimulate the nerve fibres arising from the organ. It is clear that receptors of a different kind are necessary in the cases of light, sound, heat, touch and so on. While the nerve fibre itself can be stimulated by pressure or by heat of sufficient intensity, it is insensitive to light or sound waves, and even in the former case its sensibility to direct action is far too small for the appreciation of the fine degrees of touch, temperature, etc., which is required. The state of affairs is well shown by the properties of the heat and cold spots on the skin. There are distinct receptors for temperatures above that of the skin and below it. The former give a sensation of heat, the latter of cold, and a temperature that feels warm to a heat spot has no effect on a cold spot and *vice versa*. Thus each is especially sensitive to its own appropriate stimulus. If an electrical stimulus or a temperature high enough to affect the nerve fibres directly is used, the sensation from a heat spot is one of warmth, the opposite from a cold spot. But the intensity of stimulus necessary is much greater than that required in the stimulus for which the particular organ is adjusted. The paradoxical fact that a temperature of 45°C. feels hot to a heat spot and cold to a cold spot is readily explained on the basis of stimulation of the nerves of the organ and the operation of the law of specific sensation. Although it is not easy to prove the fact directly, there is every reason to believe that, at all events in the higher senses, each separate nerve fibre has its own special connexion in the brain and its own individual sensation.

It was remarked above that, so far as evidence goes, all nerve impulses are alike. There is, however, a possibility, pointed out by Keith Lucas, that these impulses may, within the limits imposed by the refractory period, follow one another at different intervals of time. Then, if a particular nerve fibre is connected with two or more neurones in the centre, and if the properties of transmission or refractory periods of these "synapses" differ, it may happen that a rapid series of impulses may be able to pass one and not the others. In this way, a single nerve fibre may serve more than one purpose.

For further details the following books may be consulted: Starling, *Principles of Human Physiology* (3rd ed., London, 1920); Bayliss, *Introduction to General Physiology* (London, 1919); Bayliss, *Principles of General Physiology* (3rd ed., London, 1920). In the latter, references will be found in the "bibliography" to special monographs and original papers. (W. M. B.)

PICKERING, EDWARD CHARLES (1846–1919), American physicist and astronomer (*see* 21.582), died in Cambridge, Mass., Feb. 3 1919.

PINERO, SIR ARTHUR WING (1855–), English dramatist (*see* 21.625). Amongst his later plays are *The Mind the Paint Girl* (1912); *The Big Drum* (1915); *Mr. Livermore's Dream* (1917); *The Freaks* (1918); and a wordless play, *Monica's Blue Boy* with accompanying music by Frederic Cowen.

PIRRIE, WILLIAM JAMES, 1ST VISCOUNT (1847–), British shipbuilder and engineer, was born at Quebec May 31 1847, and educated at the Belfast Royal Academic Institution. In 1862 he entered the shipbuilding firm of Messrs. Harland & Wolff of Belfast, and by his industry and talent he rose to be its head, becoming partner in 1874 and later chairman. His success was particularly associated with the building by his firm of the White Star Line steamships, the first of the line, the "Oceanic," being launched in 1870. From 1896 to 1897 he was

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Lord Mayor of Belfast, and in 1898 the freedom of the city was conferred upon him. In 1906 he was raised to the peerage as Baron Pirrie, and was for a time comptroller of the household of the Lord Lieutenant of Ireland, and pro-chancellor of Queen's University, Belfast. Towards the close of the World War, in 1918, he was made controller-general of merchant shipping. In 1921, on the King's visit to Belfast to inaugurate the new Parliament of Northern Ireland, he was created a viscount.

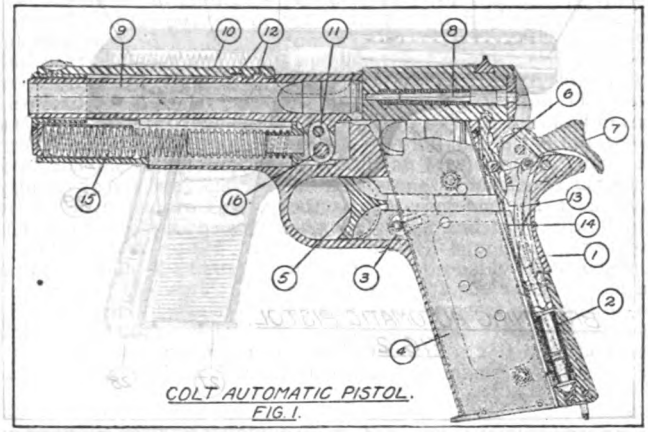
PISSARRO, LUCIEN (1863–). Anglo-French painter and engraver, was born in Paris on Feb. 20 1863, the son of the painter Camille Pissarro (*see* 21.652). He studied art under his father, and at the suggestion of Auguste Lepère took up wood engraving. In 1891 he came to England, and there began his studies in typography. In 1894 he started the Eragny Press and published a series of books, using until 1903 the Vale type designed by Charles Ricketts and afterwards the Brook type designed by himself. The initial letters, borders and illustrations engraved on wood were throughout mainly from his own designs, and sometimes show very skilful and refined use of colour and gold. Among the most notable productions of his press are *L'Histoire de Soliman Ben-Daoud* (1907); *Le Livre de Jade* (1911) and *La Charrue d'Erable* (1912), with illustrations engraved in colour from drawings by Camille Pissarro, one of his son's few essays in reproductive engraving. He also produced a considerable number of isolated woodcuts. As a painter, he uses the " spectral palette " of the impressionists, and works in a high key. He early devoted himself to the study of subtle gradations and variations in colour, and adopted a pointillist technique, afterwards modified into a broader method of handling, with more emphasis on design. His work is almost entirely English landscape, notable recent examples being " Coldharbour, Teatime " and " Crockhurst Lane, Coldharbour." He became a member of the New English Art Club, was a member of the Camden Town Group, and was the principal founder of the Monarro Group. He became a naturalized British subject in 1916. He is represented in the Tate Gallery, and in the art galleries of Leeds and Manchester.

PISTOL (*see* 21.654).—During recent years the automatic pistol has been gradually perfected and adapted to replace the revolver as a military side arm, despite the fact that there are many who maintain that the revolver is the more dependable weapon. The automatic pistol, like all complicated mechanisms, occasionally malfunctions, usually due to a defective magazine or cartridge. This disadvantage is, however, offset by the fact that from the pistol about three times the number of shots per minute may be fired as from a revolver; its magazines are changed instantly, thus giving sustained fire while loaded magazines are at hand. This gives a great advantage to the user of a properly working pistol, as a revolver is often useless at close quarters, such as obtained in trench raids, after its six shots have been fired. In such positions the volume of fire from a group of pistols is much greater than that from an equal number of revolvers even if a pistol is occasionally disabled by a jam.

Owing to its simpler mechanism, the revolver is more reliable for civilian self-defence where more than two or three shots are seldom required; the weapon then being unused and often neglected for long periods. The revolver is also considered superior to the automatic pistol in safety. In the latter, the loaded cartridge automatically inserted in the chamber after each shot is liable to be forgotten and left there when the magazine is taken out. To prevent accidental discharge from this source, some of the newer models have a " magazine safety," which prevents the pistol from being fired when the magazine is out. In addition, a " grip safety," which prevents discharge unless the rear part of the grip is pressed in at the same time the trigger is pulled; and a safety catch, which locks the slide and hammer, are often used. Recent models of revolvers show no improvements of note, and it is probable that with the attention now being given to the design of the automatic pistol, that weapon will eventually be made as reliable, safe, and quick to get into action as a good revolver.

In European armies previous to the World War, the pistol was used almost exclusively as an officer's side arm. Their weapons were of small calibre, ranging from 7·63 mm. to 9 mm., and lacked stopping power. During the war the use of the pistol and revolver was extended to include many branches of the service not armed with rifles, particularly by the United States, British and German armies. The large calibre weapons of the former armies gave them a great advantage in pistol fighting, and their use confirmed previous opinions that a large calibre heavy bullet of short range and low velocity is more effective in a pistol than a high velocity, small calibre bullet.

Automatic pistols have now been adopted by the armies of the United States, Belgium, Spain, Italy, Denmark, Portugal, Switzerland, Germany and Austria. The British navy has adopted the Webley automatic pistol. In the table on page 107, details are given.



COLT AUTOMATIC PISTOL.
FIG. 1.

Colt Automatic Pistol.—The Colt automatic pistol, calibre .45 (fig. 1), was adopted by the U. S. army in 1911. This pistol differs radically from older Colt models in that it has a sloping handle, grip safety (1), spiral mainspring (2), an improved method of locking the barrel and breech, also an improved slide action and magazine catch (3). The magazine (4) has a capacity of seven cartridges. The ammunition for this pistol has a muzzle velocity of 800 f.s. with a 230-grain bullet. The striking energy is 329 ft. lb., which gives a penetration of 6 in. of white pine at 25 yards. The pistol is capable of great rapidity of fire, 21 shots having been fired in 12 seconds beginning with the pistol empty.

The action of the .45-calibre pistol, assuming that it is cocked and ready to fire, is as follows: When the trigger (5) is pulled, the sear (6) is released, and the hammer (7), actuated by the mainspring (2), goes forward and strikes the firing-pin (8), which transmits the blow to the primer of the cartridge. The pressure of the gases generated in the barrel (9) by the explosion of the powder in the cartridge, is exerted in a forward direction against the bullet, and in a rearward direction through the cartridge case against the face of the slide (10), driving the slide and the barrel to the rear together. The link (11), one end of which is fixed to the frame and the other to the barrel, causes a downward pull on the barrel when it recoils, which disengages the barrel lugs (12) from the slide, and the barrel is then stopped in its lowest position. The slide continues to move to the rear, opening the breech, and cocks the hammer (7) which moves the hammer strut (13) downward, compressing the mainspring (2). The sear (6) actuated by the sear spring (14) engages in the notch on the hammer (7). Extracting and ejecting of the empty shell are accomplished and the recoil spring (15) compressed until the slide reaches its rearmost position, when another cartridge is raised into loading position. The cartridge is forced into the chamber of the barrel by the return movement of the slide under pressure of the recoil spring. The slide during its forward motion encounters the rear extension of the barrel and forces the barrel forward; the rear end of the barrel swings upward on the link (11) to the normal firing position. When the slide and barrel reach their forward position they are positively locked together by the locking lugs on the barrel and their joint forward movement is arrested by the barrel lug encountering the pin on the slide stop (16). The pistol is again ready for firing.

The inertia of the slide augmented by that of the barrel is so much greater than the inertia of the bullet that the latter has been driven from the muzzle of the barrel with its maximum velocity before the slide and the barrel have recoiled to the point where the barrel commences its unlocking movement. This construction delays the opening of the breech of the barrel until after the bullet has left the muzzle and therefore practically prevents the escape of any of the powder gases to the rear after the breech has been opened.

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This factor of safety is further increased by the tension of the recoil spring and mainspring, both of which oppose the rearward movement of the slide.

The U.S. army uses the pistol as the standard side arm. All officers and enlisted men in the cavalry, field artillery, tank corps, signal corps and machine-gun companies, and most of the officers and non-commissioned officers in other branches are armed with it.

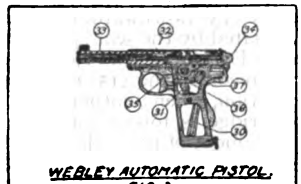
In the shortage of pistols incident to the World War, Colt and Smith & Wesson revolvers of the same calibre, chambered for the same rimless cartridges, were used. The use of the rimless cartridge in the revolver was accomplished by providing semicircular loading clips which hold three cartridges by lugs which fit in the cannelure of the cartridge. The ejection is accomplished by this means. The clips make the loading much faster.

The Colt automatic pistol is also made in ·22-in., ·25-in., ·32-in., ·380-in., and ·38-in. calibre military models.

BROWNING AUTOMATIC PISTOL.
FIG. 2.

Browning Automatic Pistol.—The new model Browning automatic pistol (fig. 2) made by the Fabrique Nationale, Belgium, is representative of modern automatic pistols of pocket size. This pistol is made in 7·65-mm. (·32) and 9-mm. (·380) calibres. A military model of 9-mm. calibre is also made which is used by the Belgian army. The pistol shown is of the "blow back" type, the barrel (17) being locked to the frame (18), the slide (19) being free to recoil. On pulling the trigger (20) and pressing in the grip safety (21), the sear (22) revolves on its axis and releases the firing-pin (23), which actuated by the coiled firing-pin spring (24), moves forward and fires the cartridge. The inertia of the slide assisted by the recoil spring (25) delays the rearward motion of the slide until the bullet passes through the barrel. The slide then recoils, compresses the recoil spring and the firing-pin spring and ejects the empty cartridge case. When the notch in the under side of the firing-pin passes over the sear nose, the latter actuated by the sear spring (26) rises and holds the firing-pin in a cocked position. When the effect of the recoil is overcome, the slide moves forward in the usual manner feeding a loaded cartridge in the chamber. The magazine (27) is released by the catch (28), and when the magazine is taken out the magazine safety (29) locks the sear and prevents discharge.

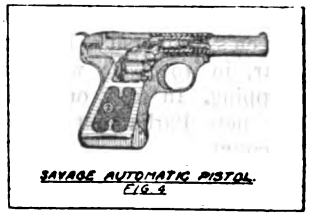
Webley Automatic Pistol.—The Webley, the only automatic pistol manufactured in Great Britain, is made in ·25, ·32, ·380, ·38 and ·455 calibres (fig. 3). The latter size, which fires a 220-grain bullet, has been adopted by the British navy. The action is unique in that a flat recoil spring (30), situated in a recess in the right grip and compressed by the recoil lever (31), absorbs the recoil and returns the slide (32) to firing position. In the larger calibres, the barrel (33) is locked to the slide at the moment of firing and these parts recoil together a short distance; the barrel then rises upon diagonal cam-shaped lugs which unlock the slide and permit it to travel back alone. During this rearward movement, the empty case is ejected and the hammer (34) cocked. The forward motion of the slide then feeds a cartridge from the magazine in the chamber in the usual manner. The trigger (35) is connected with the sear (not shown) by means of a trigger auxiliary lever (36) and sear tail (37). The magazine is situated in the handle and holds eight cartridges.

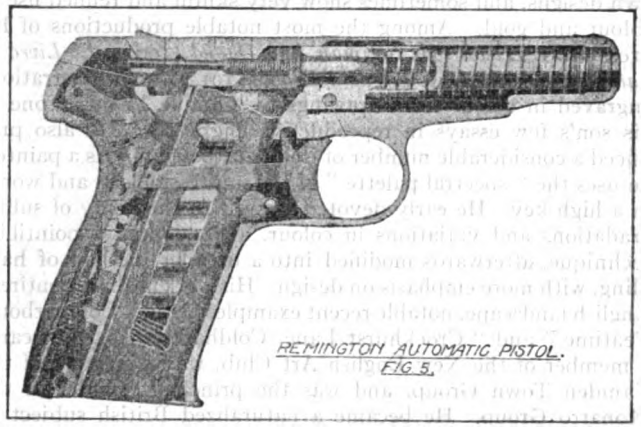


WEBLEY AUTOMATIC PISTOL.
FIG. 3.

The ·32 calibre Webley pistol is used by the London metropolitan police. A ·25 calibre hammerless model has recently been brought out which has a spiral recoil spring parallel to the barrel in a recess in the slide.

Savage Automatic Pistol.—This pistol (fig. 4), which is extensively used in the United States, and has been adopted by the army and navy of Portugal, is made in ·32 and ·380 calibres. The magazine for the former holds ten cartridges; that for the latter, nine. The 1917 model differs from the previous one in that an outside cocking lever is added, and the shape of the grip changed to facilitate aiming. There is no grip safety or magazine safety on this pistol, the cocking lever indicating whether it is in firing position. The barrel and breech are locked at the moment of firing by means of a locking lug on top of the barrel which engages with an angular locking slot in the bolt and makes it necessary for the barrel to rotate about one-eighth of a turn to the right to unlock. The resistance of the bullet to rotation in the rifling tends to twist the barrel to the left and prevents the bolt from turning it to the right until the bullet leaves the barrel. The momentum of the recoil then forces the bolt back, the angular slot rotates the barrel and the rest of the cycle of operations is performed much as in the pistols already explained.


SAVAGE AUTOMATIC PISTOL.
FIG. 4.


REMINGTON AUTOMATIC PISTOL.
FIG. 5.

Remington Automatic Pistol.—The newest (1920) model automatic pistol to be placed on the market is the Remington ·380 calibre automatic (fig. 5). In general this weapon follows the usual lines of automatic pistols. The breech closure is of the positively locked recoil-operated type. The recoil spring is held in a sleeve concentric with the barrel, and the magazine, which holds seven cartridges, is in the stock. The weapon has three safety devices: a grip safety, a side safety catch which also indicates whether the weapon is cocked or not, and a magazine safety which prevents the pistol from being fired when the magazine is withdrawn. The recoil when a shot is fired forces a movable breech block in the slide backward for about $\frac{3}{16}$ in., and into contact with recesses in the frame, this movement accomplishes primary extraction and transmits an initial thrust to the slide which is free to move backward against the recoil spring. This movement of the slide through a camming action lifts the breech block out of engagement with the frame and carries the breech back, cocking an internal hammer and ejecting the empty case. The chamber is reloaded in the usual manner on the return stroke. There are no screws in this pistol and it may be disassembled without tools other than the firing-pin.

European Pistols.—The German Parabellum (Luger) and Mauser pistols have been little changed from those described in previous editions of the *E.B.* The Parabellum 9-mm. calibre is the standard German military arm, but during the shortage, incident to the World War, they used a great variety of weapons, the principal ones being the Mauser, Bayard, Browning, Borchardt, Bergman, Pieper, Sauer and Dreyse. There were reported to be 28 different models of pistols and revolvers in use in the German army. The Parabellum is also used by the Swiss and Bulgarian armies.

A drum or "snail" magazine (fig. 6) holding 32 cartridges was applied to the Luger pistol during the war. This magazine consists of a straight section similar to the ordinary pistol magazine with a round enclosed drum at the bottom. There are two springs, one functioning as an ordinary magazine spring, and a flat drum spring resembling a clock spring which with its casing fills the drum except for space for a single row of cartridges around the edge. There is a lever and catch on the outside for winding this spring and a rotating feeding lever inside which fits in the cartridge space between the inner casing and drum. The magazine spring is compressed between the last cartridge and this lever, which being revolved by the drum spring pushes the magazine spring and cartridges around the drum as the pistol is fired. When the drum is empty the magazine spring functions in the usual manner. This style of magazine was also applied

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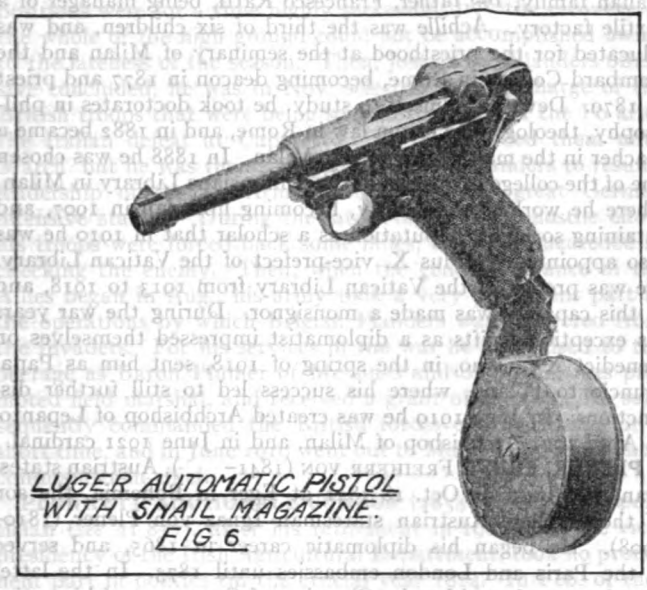
to the Bergman pistol gun and the Mondragon semi-automatic rifle. It destroys the balance of an arm and is of doubtful value.

The Bayard automatic pistol 9-mm. calibre is used in the Danish army. The commercial pistols of this make in ·32 and ·380 calibres



LUGER AUTOMATIC PISTOL WITH SNAIL MAGAZINE. FIG. 6

are the smallest automatics of these calibres on the market. The Victoria is the smallest ·25 calibre. The Mannlicher is used by the Austrian army.

The Campo-Giro automatic pistol 9-mm. calibre was adopted by Spain in 1914. The principal merit claimed for it is that a special recoil check lessens the shock and permits more accurate firing.

AUTOMATIC PISTOLS AND THEIR CARTRIDGES

Cartridge	Barrel Length, Inches	Weight of Bullet, Grains	Muzzle Velocity, Ft. Seconds	Energy of Bullet, Ft. Lb.
·22 Long rifle rim fire	..	..	..	..
·22 Colt Auto. target model	6½	40	765	51·8
·25 Auto. Colt, Webley & Scott, Harrington & Richardson (also interchangeable with 6·35 mm. Browning [Fabrique Nationale], Mauser, Pieper, Clement, Steyr, Victoria).	3½	50	733	59·7
7·63 mm. Mauser, Borchardt	5½	86	1,397	373
7·65 Luger	4⅞	93	1,173·5	284·3
·32 Auto. Colt, Webley & Scott, Savage, Harrington & Richardson (also interchangeable with 7·65 mm. Browning [Fabrique Nationale], Bayard, Mauser, Pieper, Schwartzlose, Clement, Steyr, Frommer).	4	74	964	152·4
·35 Smith and Wesson	3½	76	809	110·5
9 mm. Luger	4	125	1,039·2	299·8
·38 Auto. Colt, Bayard	5¼	130	1,146·3	379·4
·380 Colt Auto., Savage, Webley, Browning 9 mm. (Short), Remington, Bayard	3¾	95	887	116
·45 Colt Auto.	5	200	910·2	368
·45 Colt Auto., U.S. Government	5	230	809	335
·445 Webley Naval Automatic	..	220	710	..
·455 Colt Automatic	..	..	..	..

(H. O'L.)

PITTSBURGH (*see* 21.678) had, according to the U.S. census of 1920, a pop. of 588,193. The increase over 1910 was 54,288 or 10·2%. After the 1920 census was taken the township of Chartiers, with a pop. of 5,000, was annexed, petitions were filed for the annexation of the borough of Homestead with a pop. of 20,452, and a movement was on foot for the merger of the boroughs of Wilkensburg (24,403), Ingram (4,000), Grafton (5,934) and others. Within the metropolitan district of a 10-m. radius, but outside the city limits proper, there was a further population equal in number to that within the municipality itself. In Allegheny county, of which Pittsburgh is the county seat and business centre, there were in 1920 1,184,832 persons, 13·6% of the total pop. of Pennsylvania.

The sesqui-centennial of Pittsburgh, elaborately observed in 1908, marked the beginning of a new period of corporate, educational, social and material development. By legislative enactment (1911) the former Common and Select Councils gave way to a small council of nine members, elected by general vote of the entire city. The mayor continued to appoint the heads of departments (safety, works, health, charities, supplies, property, water, treasury). The comptroller also was elected as formerly by popular vote. The expanding of public business in the city and county, exceeding the capacity of the city hall and the court-house, led to the erection by joint action of a new City-County Building, a fine structure of nine stories. The county in 1920 was completing a twin tunnel under Mount Washington to connect the southern hill district with the city by a high level bridge over the Monongahela river, which will bring that district within 15 minutes' transit of the centre of the city. In 1919 the taxable valuation of Pittsburgh was $1,113,667,425, and the tax rate in 1921 was, for the city, 20 mills on land, 14 mills on buildings and 8·50 mills for school purposes. In 1919 a bond issue of $22,500,000 was voted by the people for subway, boulevards, playgrounds, bridges, parks, etc.

The value of Pittsburgh's products in 1919 was $602,582,300, compared to $246,694,000 in 1914. In 1920 it held sixth place in bank clearings ($8,982,887,399) and first place in *per capita* deposits (total $817,013,249) and in the manufactured products—iron, steel, glass, electrical machinery, steel cars, tin-plate, air brakes, fire-brick, white lead, pickles and preserves, corks and aluminium. The production of pig iron in the city in 1919 was 31,015,364 tons and in the surrounding district 7,440,746 more, a total of 38,456,110 tons. Metal and metal products were valued at $324,261,900; chemical products $2,045,800; clay, glass and stone products $4,345,500; clothing manufacture $7,122,800; slaughtering and meat-packing $21,134,700; confectionery $6,490,500; leather and rubber products $5,589,700; cork-cutting $4,016,500; oil-well supplies $3,678,100. The production of radium in 1920 (18 gr.) probably exceeded that of the rest of the world. The sum of $970,072,700 was invested in 2,580 industrial plants, mills, foundries and furnaces, in which were employed 221,621 men, with a daily pay-roll (1920) exceeding $2,500,000. The annual tonnage of Pittsburgh is 2½ times the combined tonnage of New York, London and Hamburg. As a port of entry the value of imports in 1918 was $6,391,960. The city's contribution to the Liberty and Victory loans was $625,429,600, to the Red Cross $10,194,765, and to the seven relief agencies $13,909,000, making a total of $649,533,365.

In 1911 the Legislature adopted a new school code for the entire commonwealth, coming into operation Nov. 11 1911. Under this code a Board of Education, consisting of 15 members appointed by the Common Pleas judges, took control. Separate school districts were abolished; a new city superintendent, with associate superintendents, was appointed; the scattered and unrelated school agencies were consolidated; new high schools and junior high schools established and buildings erected, such as the Schenley high school, built in 1916 at a cost of $1,500,000 and accommodating 2,000 students. New ward schools of modern construction were established. The teachers numbered in 1920 2,015 in 133 grade schools and 494 in 11 high schools, and the enrolment of pupils in grades was 74,654 and in high schools 12,169. There were in evening grades 198 teachers and 6,245 pupils, and in evening high schools 148 teachers and 5,090 pupils. The public-school system was supplemented by parochial schools which had in 1920 650 teachers and 33,000 pupils. In addition to the high schools there were a number of academies and other schools, 77 in all, on private foundations. The development of higher education during the decade was notable. The Holy Ghost College

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became Duquesne University, and in 1920 had 2,129 students, including department of law, 86 students, and evening school of accounts and finance, 1,120 students. The Carnegie Institute in the decade increased the extent of its service to the community; its central library, with 464,313 volumes, had 8 branches, 16 stations, 128 school stations, 10 club stations and 8 playground stations, with a circulation of 1,363,365 books; both the scientific museum and the art department added greatly to their collections; in the school of technology the enrolment grew from 2,102 students in 1909 to 4,982 students in 1920, including those in the departments of science and engineering, arts, industries and the Margaret Morrison school for women. The university of Pittsburgh, established in 1908 by assembling the scattered departments of what was the Western University of Pennsylvania, and taking over 43 ac. near the Carnegie Institute for a campus, grew rapidly in its new location, and in 1920 numbered 4,979 students. In the same year there were in the city 227 social, health, religious and welfare agencies.

After careful study of playground systems a bond issue of $800,000 was voted (1919) to initiate a constructive development of parks and playgrounds at public expense. Another civic improvement was the plan that a permanent committee of citizens should be engaged in the solving of the housing problem, and that the chamber of commerce, coöperating with the state, should employ a director in charge of the Americanization programme in which the public schools and corporations coöperate. The Society for the Improvement of the Poor, constructed and opened (1921) the Wayfaring hotel to accommodate 500 men. The 20 hospitals, modern in construction and equipment, with 4,500 beds, included special hospitals for children, eye and ear, maternity, tuberculosis, and contagious diseases. The Magee hospital, established by legacy of $3,500,000 under will of the late C. L. Magee, by agreement the maternity hospital of the university of Pittsburgh, is perhaps the most modern and complete maternity hospital in America. (S. B. Mc.)

PIUS X. [GIUSEPPE SARTO] (1835–1914), Pope (*see* 21.690), died Aug. 20 1914. Although the pontificate of Pius X. lasted only 11 years (Aug. 4 1903—Aug. 20 1914), it has been said that his work for the Church, reconstructive and reformative, surpassed that of any of his predecessors since the days of Sixtus V., who died in 1590. In the defence of the Faith, his condemnation of the 65 propositions of Modernism in 1907 will rank in Catholic theology as a parallel to the condemnation of the 68 propositions of Molinism by Innocent XI. in 1637 or the 101 propositions of Jansenism condemned by Clement XI. in 1713. The activity of the pontificate may be judged by the fact that its output of papal Bulls and greater official papal documents (counting only those published) exceeded 3,322. These bear upon undertakings and reforms of the first importance—the codification of canon law; the protection of the liberty of the Conclave by the abolition of the Exclusiva; the simplification and security of the conditions of marriage by the *Ne Temere* legislation; the restoration of the Rota as the supreme Court of Appeal; the regulation of the triennial or quinquennial visits of bishops to Rome; the legislation as to Church music; and the decree as to First Communion, and the encouragement of international eucharistic congresses; the reform of the Roman breviary; the founding of the biblical institute for the work of Scriptural research; the regulation of studies in the seminaries; the creation of the commission for the great work of editing the true text of the Vulgate; the reconstruction of the official machinery of the Roman Curia; the transfer of the English-speaking countries from the propaganda or missionary régime to the normal government of the Church. To these may be added in the domain of discipline the unflinching vindication by Pius X. of the Church's right to dopose delinquent bishops, carried out even at the cost of rupture of diplomatic relations with France; an apostolic visitation rigorously carried out through the dioceses of Italy, resulting in four bishops being caused to resign on account of neglect or inefficiency; a further regulation by which no one can be proposed for a bishopric unless his promotion receives the visa of the Holy Office, which means that his past life has been free from ecclesiastical censure or reproach.

The well-known personal characteristics of Pius X. were his piety, charity, deep humility, simplicity, pastoral zeal, combined with great charm of manner to all who approached him. For war he had nothing but horror and it was the shock of the outbreak of the World War that hastened his death. It is said that one of his last acts was to refuse the request of the Austrian Emperor to bless his soldiers, saying, "I do not bless war: I bless peace." (J. Mo.*)

PIUS XI. [ACHILLE RATTI], elected Pope on Feb. 6 1922 at the Conclave following the death of Benedict XV., was born May 30 1857, at Desio, near Milan. He came of a middle-class Italian family, his father, Francesco Ratti, being manager of a textile factory. Achille was the third of six children, and was educated for the priesthood at the seminary of Milan and the Lombard College in Rome, becoming deacon in 1877 and priest in 1879. Devoting himself to study, he took doctorates in philosophy, theology and canon law in Rome, and in 1882 became a teacher in the major seminary at Milan. In 1888 he was chosen one of the college of doctors of the Ambrosiana Library in Milan, where he worked assiduously, becoming librarian in 1907, and attaining so high a reputation as a scholar that in 1910 he was also appointed by Pius X. vice-prefect of the Vatican Library. He was prefect of the Vatican Library from 1913 to 1918, and in this capacity was made a monsignor. During the war years his exceptional gifts as a diplomatist impressed themselves on Benedict XV., who, in the spring of 1918, sent him as Papal Nuncio to Poland, where his success led to still further distinctions. In June 1919 he was created Archbishop of Lepanto, in April 1921 Archbishop of Milan, and in June 1921 cardinal.

PLENER, ERNST, FREIHERR VON (1841–), Austrian statesman, was born on Oct. 18 1841 at Eger in Bohemia, the son of the excellent Austrian statesman Ignaz von Plener (1810–1908). He began his diplomatic career in 1865, and served in the Paris and London embassies until 1873. In the latter year he was elected by the Chamber of Commerce of his native place to the Chamber of Deputies of the Reichsrat, where he was soon reckoned among the most conspicuous members of the Constitutional party. In the Taaffe period (1879–93) he was one of the leaders, and from 1888 the acknowledged head of the German-Liberals in their struggles against the Slav-Conservative majority in the Chamber. Consequently he represented Germanism on the nationalities question, but was not averse to concessions compatible with the maintenance throughout the whole monarchy of the position due to the German Austrians. He sought to compromise the quarrel between Germans and Czechs, and the so-called "points" of 1890, a summary of the bases for a German-Czech understanding, were essentially his work. In the Windischgrätz Coalition Ministry (1893–95), Plener took over the portfolio of Finance. Soon after his retirement from the Finance Ministry, Plener was appointed president of the Supreme Audit Department (*Oberste Rechnungshof*). He became a member of the Upper House in 1900.

Plener wrote a series of economic and political works, among others *Die Englische Fabriksgesetzgebung* (1871); *Englische Baugenossenschaften* (1873). His speeches were published by his friends in 1911. He himself published *Erinnerungen* (3 vols., 1911–21). (A. F. Pr.)

PLUMER, HERBERT CHARLES ONSLOW PLUMER, 1ST BARON (1857–), British field marshal, was born March 18 1857, and entered the army in 1876. He served on the Red Sea Littoral in 1884, and in 1896 commanded a mounted regiment in the Matabele Campaign, for which he was promoted brevet lieutenant-colonel. Before the outbreak of the South African War in 1899 he was sent out to the Cape on special service, and he raised the Rhodesian field force, which he commanded during the early months of the contest. He assisted in the relief of Mafeking, and was promoted colonel, appointed A.D.C. to the Queen, and given the C.B. In the later stages he was constantly in command of a column or a group of columns, and he was promoted major-general on the conclusion of hostilities. He commanded a brigade at home from 1902–4 and was then appointed quartermaster-general at headquarters, a position which he vacated at the end of 1905; shortly afterwards he was appointed commander of the 5th Division. He was promoted lieutenant-general in 1908 and in 1911 was placed in charge of the Northern Command.

In May 1915 Sir Herbert Plumer was selected to lead the II. Army on the western front, and shortly afterwards he was promoted general. His army was not very actively engaged during the remainder of 1915, nor yet in 1916, in which year he was given the G.C.M.G. for his services. But on June 7 1917

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Plumer gained a signal victory at Messines on the opening of the Flanders offensive, for which he was given the G.C.B. Three months later he assumed charge of the operations east of Ypres, which had been making slow progress, and his dispositions were for a time highly successful; but the recovery of the whole of the high ground could not be accomplished owing to the lateness of the season. Then, just as the Flanders offensive concluded, he was in Nov. selected to take charge of the British troops that were being sent to the basin of the Po after the Italian defeat at Caporetto. He commanded them until March but he was then summoned back to Flanders to resume leadership of the II. Army just before the great German offensive started. During the later stages of the hostile effort his troops were forced back some miles, but they succeeded in checking the enemy. Then, when the general advance of the Allies began in Aug., his army took a very prominent part in the operations by which Belgian Flanders was recovered from the invaders. For his services in the war he was raised to the peerage as Baron Plumer of Messines and of Bilton, was promoted field marshal, and received a grant of £30,000. He subsequently commanded the British forces on the Rhine for a short time, and in June 1919 went out to Malta as governor and commander-in-chief.

PLUNKETT, SIR HORACE CURZON (1854–), Irish politician (*see* 21.857), after his retirement in 1907 from the vice-presidency of the Irish Agricultural Department, took no prominent part in politics till the crucial year 1914. In Feb. of that year, when suggestions for an agreed settlement of the Irish difficulty were pouring in from all sides, he came out, in a long letter to *The Times*, with a scheme of his own, under which Ulster should accept the Home Rule bill, but should have a right to secede after a term of years, while the Ulster Volunteers should become a Territorial Force, partly as an ultimate safeguard of the Ulster Unionists. Hitherto he had been regarded as a moderate Unionist, but this suggestion rendered him suspect in Ulster eyes, and the suspicion was confirmed when he published in the third week of July a pamphlet entitled *The Better Way: an Appeal to Ulster not to Desert Ireland*, in which he announced his conversion to Home Rule and appealed to Ulster to give Home Rule a chance, re-stating the arguments of his previous letter, and suggesting a conference of Irishmen on the bill. This was his attempt to avert civil war; but the situation was revolutionized by the outbreak of the World War. Once again, in 1917, a year after the Dublin rebellion, he took the lead in an honest attempt to solve the Irish question. When Mr. Lloyd George set up a comprehensive convention of Irishmen to consider the matter, and report their conclusions, there was great difficulty in finding a suitable chairman; but the first meeting unanimously chose Sir Horace for the post. He was himself sanguine, and worked at his task with singular devotion; but the absence of Sinn Fein from the gathering, the impossibility of reconciling the views of the Ulstermen and the southern Unionists, and the occurrence of a number of tragic events in Ireland, prevented the adoption of any report with colourable unanimity. In 1920–1 he was a prominent advocate of "Dominion Home Rule" (*see* IRELAND: *History*).

PODMORE, FRANK (1856–1910), English psychologist, was born at Elstree, Herts, Feb. 5 1856. Educated at Haileybury and Pembroke College, Oxford, he became interested in psychical research, and was closely associated with Edmund Gurney and F. W. H. Myers in the telepathic and psychical investigations described in their joint publication *Phantasms of the Living* (1886). He also published *Apparitions and Thought Transference* (1894); *Studies in Psychical Research* (1897); *Modern Spiritualism* (1902) and other works on the subject. He was found drowned near Malvern Aug. 15 1910.

POINCARÉ, JULES HENRI (1854–1912), French physicist (*see* 21.892), was born at Nancy April 29 1854, and educated at the *lycée* in that town. As a boy he served in an ambulance corps during the Franco-Prussian War of 1870, and later passed with distinction through the École Polytechnique in mining, becoming a mining engineer, but soon abandoning practical work for teaching, first at Caen and later in the university of Paris. He won the King of Sweden's open prize for a mathematical treatise in 1889, and in 1908 was elected to the Académie Française. He was a voluminous writer on his own special subjects. Some details of his contributions to science are given in 19.859, 25.786 and 26.947. He died in Paris July 17 1912.

POINCARÉ, LUCIEN (1862–1920), French physicist (*see* 21.892), was born at Bar-le-Duc July 22 1862. After a distinguished academic career he became in succession inspector-general of physical science in 1902, director of secondary education at the Ministry of Public Instruction in 1910, director of higher education in 1914 and rector of the Académie de Paris in 1917. In that capacity he received President Wilson at the Sorbonne on the occasion of his visit to Paris for the Peace Conference. He died in Paris March 9 1920.

POINCARÉ, RAYMOND (1860–), French statesman and writer (*see* 21.892). After the fall of the Sarrien Ministry in 1906 M. Poincaré ceased for some years to take an active part in politics. On Dec. 9 1909 he was made a member of the French Academy. In 1911 he was invited to join the Monis Ministry, but refused. His opportunity came at the beginning of 1912, and on Jan. 13 he became head of what was popularly known as the "great" or "national" Ministry, in which he also held the portfolio of Foreign Affairs. As Prime Minister Poincaré aimed at safeguarding the interests of France abroad, especially against the menace of the Triple Alliance, and at strengthening her at home by firm government and the restoration of social discipline. In this he was helped by the revival of a strong national feeling in France, provoked by the international crisis of 1911. The fact that he was a Lorrainer prejudiced public opinion in his favour, and his popularity was increased by his foreign policy—especially the successful establishment of the French protectorate over Morocco and the conclusion of the naval agreement with Russia. In Aug. 1912 Poincaré went to St. Petersburg to confer with the Tsar and his ministers about the Franco-Russian Alliance and the new developments of the Eastern question, a visit which countered the somewhat depressing effect in France of the meeting of the German and Russian Emperors at Baltic Port on July 4. The Balkan Wars, and Poincaré's attitude towards the problem raised by them, greatly increased his prestige; he declared on Dec. 4 to the Foreign Affairs Committee of the Chamber that he was determined to secure respect for the economic and political interests of France, not only in the Balkan Peninsula, but in the Ottoman Empire generally, and especially in Syria.

At the beginning of 1913 he became a candidate for the presidency. This action excited strong personal as well as political feeling, and his election was hotly contested, the second and third ballots showing a majority for his most serious competitor, M. Pams. On appeal to the National Assembly, however, he was ultimately elected by a majority of 187 votes over M. Pams, his inauguration taking place on Feb. 18 amid great demonstrations of popular enthusiasm. Two days later he showed that he intended to exercise the right of the President to address Parliament direct—a right which had fallen into desuetude—by sending a message to the Chambers, in which he stated that it was his function as President "to be a guide and adviser for public opinion in times of crisis" and "to seek to make a rational choice between conflicting interests." His activities as President were still directed to strengthening the internal and external position of France. In June 1913, after inspecting the fleet at Toulon, he paid a State visit to England (24–27), during which he enlarged on the necessity of the perpetual association of the two nations "for the progress of civilization and the maintenance of the peace of the world." In the autumn he made a motor tour of the south of France,—being greeted everywhere with popular acclamation, the bands playing the irredentist march "Sambre et Meuse,"—and attended the army manœuvres at Toulouse. His State visit to Spain followed in October.

The President's activity and enormous popularity roused the anger of the Opposition parties, and the Radical-Socialist congress at Pau, on Oct. 17, passed a resolution condemning "the aspirations of personal policy." This had no effect, how-

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ever, on public opinion, and Poincaré's popularity was undiminished during the months immediately preceding the outbreak of the World War. On the very eve of the war, immediately after the rising of the Chambers on July 15 1914, Poincaré set out on a State visit to Russia and the Scandinavian countries, arriving at Kronstadt on July 20. His visit to Sweden was, however, interrupted by the serious news from France, and on the 29th he was back in Paris. He now made a personal appeal to King George V. to use his influence in favour of peace, while the Ministry asked for the armed intervention of Great Britain. After the outbreak of war his activities were mainly directed to stirring up the patriotic spirit of the people, as in his messages to the Chambers of Aug. 4 1914 and Aug. 5 1915, or his speech on July 14 1915 on the occasion of the transference of the remains of Rouget de Lisle, the composer of the "Marseillaise," to the Invalides. On Oct. 4 1914 he also visited the French head-quarters.

After the conclusion of the Armistice Poincaré made a tour in Alsace and Lorraine, his official entrance into Metz taking place on Dec. 4 1918. On Jan. 18 1919 he opened the Peace Conference in Paris with a short speech, in which he emphasized "justice" as the guiding principle of the victorious Allies. His term of office expired on the following Feb. 18. He subsequently accepted the presidency of the Reparations Commission, which he resigned in May 1920 as a protest against what he considered to be the undue leniency shown to Germany. This became the text of a violent press campaign which he carried on, against the policy of the Supreme Council in general and of Mr. Lloyd George in particular (*see* FRANCE: *History*). During 1920 and 1921 it was Poincaré's influence that was mainly dictating the aggressiveness of French feeling in international politics; and during the latter part of Briand's premiership, culminating in Briand's visit to the United States for the Washington Conference at the end of 1921, it was Poincaré who was fomenting the criticism that French interests were being undermined. The result was seen when, in the midst of the Cannes Conference in Jan. 1922, the proposal for an Anglo-French treaty of defence led to Briand's hasty return to Paris to answer interpellations with regard to his policy in the Chamber, and to his sudden resignation on Jan. 13 without facing discussion on a vote of confidence. Poincaré was at once entrusted by President Millerand with the formation of a new Cabinet, which he completed on Jan. 15, and French policy under his premiership was now given a definitely Nationalist orientation.

Poincaré's published works include *Du droit de suite dans la propriété mobilaire* (1883); *Idées contemporaines* (1906); *Questions et figures politiques* (1907).

See Henry Girard, *Raymond Poincaré* (1913); *Raymond Poincaré, a sketch* (1914); *Larousse Mensuel*, No. 158 (1920).

POISON GAS WARFARE.—The use of poisonous gases in warfare, as started during the World War, was only made possible by modern progress in chemistry. From a purely objective point of view, and apart from all ethical considerations, it should be observed that fighting-men have, at some time or other, adopted any means of making war, however ruthless. Poisoned weapons and poisoned wells are as old as history. The ancient Greeks indeed used sulphur fumes, and the Byzantines "Greek fire"; and in mediaeval sieges carcasses of dead animals were thrown over the defences from mangonels, in order that their putrefaction might spread disease. Underground warfare in all times has been marked by attempts to drive the enemy from his galleries with smoke and suffocating fumes. The usages of chivalry, while prescribing courtesy to prisoners, imposed no limit on means of destroying life. Only in the 18th century, when war in western Europe became a very formal affair, did a tendency appear to set such limits. Both Louis XIV. and Louis XV. declined the use of "infernal liquids" offered to them by chemists. Later the tendency to impose moral restrictions became more definite. Lord Dundonald's proposal for the use of asphyxiating smoke-clouds at the siege of Sebastopol was rejected by the British Cabinet. In 1865 at Châlons experiments with asphyxiating shells were made on dogs before Napoleon III., who stopped the trials and declared that such barbarous means of destruction would never be employed by the French army because they were against the "law of nations." In the S. African War of 1899–1902, the Boers thought they were justified in complaining of the injurious effects of the gases given off by the British high-explosive shells. It was only indirectly that the Hague Convention limited the use of gas. It forbade, by Art. 23 (*e*), the use of weapons calculated to cause unnecessary suffering; "poison or poisoned weapons" by Art. 23 (*a*). A separate declaration had, some years before (July 29 1899), forbidden the use of projectiles whose "sole object it was (*qui ont pour but unique*) to spread deleterious or asphyxiating gases." The method which actually arose in the World War—that of a fixed apparatus which propels liquid gas in a jet—had apparently not then been generally foreseen. If it had been, the use of poisonous gases would, no doubt, have been more explicitly forbidden.

It is one of the ironies of history that the first great war after the Hague Convention should have witnessed its entire uselessness to limit human suffering. Gases of a nature to cause lifelong injury, liquid fire, molten metal, burning phosphorus—all were employed with a prodigality limited only by the inventive powers of the combatants.

There was, of course, no objection to the use of gases and substances of the lachrymator class. The object of these is to cause temporary incapacity by violent smarting of the eyes, sneezing or retching, while the effect passes off when the subject is removed from the radius of action of the gas. Probably the earliest example of this class is the Chinese "Stinkpot"; and it is interesting to note that as the Chinese were before the Western nations in the use of gunpowder, so they also were in this early form of what, in the World War, came to be known as "Chemical Warfare," a term which in itself is really too wide for "gas warfare," since chemistry enters into explosives also.

At the time of the Russo-Japanese War the subject of lachrymators was taken up by the Japanese, and later by the British War Office. It was also investigated by the French for police purposes. The British experiments covered a wide range of compounds based mainly on iodine, bromine and picric acid. The chief subjects of inquiry were effectiveness, keeping qualities and the effect of the liquid on the container. Nothing very highly effective was found, and it appeared that most of the liquids required a container of lead, glass or porcelain, on account of their action on steel or cast iron. The experiments were dropped some years before the World War, probably because, in the kind of warfare that was then anticipated, it did not appear that there would be much use for lachrymators.

In 1913 the question was submitted again to the British War Office. The Hague Convention was always kept in view, and it was considered that the term "deleterious" applied only to gases which caused permanent harm. As one chemist pointed out, poisons were prohibited by the convention, but disagreeable fumes were not. A few experiments were made with compounds of the lachrymator class in shells, and the question remained alive until in Sept. 1914, after the outbreak of war, it was decided not to use chemical shell of this type for the British army or navy.

Quite early in the World War stories began to be current on each side of the employment of gas shells by the other. In Dec. 1914, upon a semi-official suggestion from the British G.H.Q. in France, a section of the War Office, working with Sir William Ramsay's Chemical Sub-Committee of the Royal Society, took the question up again. By this time trench warfare was fairly established and the armies of both sides were immobilized in trenches, facing each other in some places at a distance of only a few yards. All possible means of trench fighting had to be considered, and among other things it was thought that, if a sufficient number of lachrymating grenades could be thrown from the British front trenches into those of the enemy, he might be forced to evacuate them temporarily, or might at least have his fighting power considerably reduced by being forced to the constant use of a protective mask.

In Jan. 1915, an idio-acetate compound was brought forward which caused such smarting of the eyes that it was impossible to

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remain in its neighbourhood. By that time catapults were available which could throw a 2-lb. projectile 200 yards, a distance which brought the enemy's trenches within range in many parts of the line. A tinned iron cylindrical grenade was therefore designed to hold 2 lb. of liquid, which by means of a 5-second time-fuze and detonator was made to burst and distribute the lachrymator in a fine spray. The British War Office and G.H.Q. approved of this grenade, and the manufacture was put in hand. At the same time many other substances were considered, mostly lachrymators and sternutators. Some of these compounds appeared to be very effective under experimental conditions, but were not so in the field.

While these modest tentatives were proceeding, always within the limits laid down by the Convention and the Declaration, the first German gas attack took place on the Ypres front on April 22 1915. This immediately altered the whole situation, as it was obvious that in using chlorine—an asphyxiant—the Germans had transgressed, if not the letter of the Declaration and the Convention, certainly their spirit. Accounts of the sufferings of those who had been exposed without protection to this new form of attack roused great indignation, but its effectiveness could not be ignored, and after a few days it was decided by the British authorities that preparations at least must be made to reply to the German gas offensive in the same manner. The section of the War Office that had been dealing with lachrymating grenades was instructed to take up the question, and with the aid of two or three chemists of the highest standing a small council was formed which sat continuously to discuss ways and means and consulted all the most prominent chemists and manufacturers. It soon became evident that the Germans had employed chlorine gas discharged under pressure from cylinders placed in the front line of trenches. A rapid review of all possible means of reply showed that chlorine was the easiest gas to begin with, but the position of Great Britain in this matter was very different from that of Germany. For the ordinary processes of the dye industry, the Germans produced in peace-time very large quantities of liquid chlorine. In England only one or two firms produced it, and that in very small quantities. Moreover, the available containers for transport of the chlorine were not only very few but were much too bulky and heavy for use in the field. The problem therefore was twofold: first, to install apparatus for an enormously increased supply of liquid chlorine, and secondly to design and manufacture suitable cylinders or dischargers for its use in the field. In both cases many initial difficulties were encountered, which were overcome in due course, and on Sept. 25 1915, at Loos, the first British gas attack with chlorine took place.

Meanwhile a very large range of possible gases had been passed under review with the object of discovering substitutes for chlorine. Obviously the thing to aim at was something which was more directly lethal than chlorine, and at the same time would cause less suffering by its effects. It was also realized from the first that the discharge of gas from the front trenches necessitated waiting for suitable weather conditions, which was very inconvenient for the arrangement of tactical operations; and it appeared to be necessary to release the gas in the enemy's lines, so as to be independent of wind, which could best be done from gun shells or trench-mortar bombs. The principle was approved and a new class of problems had now to be faced.

Effects of Gases.—At this point it will be convenient to consider the effects produced by different varieties of gases, and the methods of employing them.

When considered from the point of view of their physiological effect, war gases may be classed in two main divisions, (*a*) Lethal, and (*b*) Irritant. The lethals fall under the two heads: those whose action is instantaneous or practically so (specific), and those whose action is more or less delayed, and is generally of an asphyxiating character.

A gas is classed as immediately fatal when death follows exposure for a period of two minutes to a certain concentration (*i.e.* a certain proportion in the air breathed). A higher concentration may cause instantaneous death. The only known compounds which, in concentrations practically obtainable, produce immediate death, are those containing cyanogen. The chief disadvantage of these is that when the concentration is not sufficient to cause death they have no effect at all, or only temporary faintness, headache or heart trouble. The other lethal compounds may have immediate injurious effects, such as headache, nausea, etc., and in high concentrations may cause death in a short time. In concentrations which are not strong enough to kill, they may cause casualties, which have the disadvantage that as the action is delayed a man may be able to continue fighting for some time after exposure. Thus in the case of phosgene, a man who does not notice that he has been gassed may die suddenly as much as 48 hours later.

The irritant gases are divided into (*a*) Lachrymatory (affecting the eyes), (*b*) Sternutatory (causing sneezing), (*c*) Vesicatory (blistering).

Lachrymators, on account of the extreme sensitiveness of the eye, can produce an effect in extraordinarily weak concentrations, such as 1 in 1,000,000 parts, or even less. Protection can be given by well-fitting goggles, but goggles cannot be used when there is a chance of exposure to lethal gases, because they would interfere with the gas-mask. The presence of lachrymators therefore entails the wearing of the complete mask, with all its disadvantages. The principal bases for lachrymators are iodine and bromine.

The sternutators were originally considered from the point of view of putting a man temporarily out of action by a violent fit of sneezing. A more important use suggested itself later, namely, that a man could be prevented by sneezing from adjusting his gas-mask, and would thus be exposed to the action of lethal shell. Similarly, if a sternutator could be found to penetrate the gas-mask it would be impossible for the wearer to keep it on. Early in the war there were many reports of the intended use by the Germans of red pepper and capsicine. Many experiments were tried by the British with capsicine and similar agents, but they did not give good results. In the summer of 1917 the Germans introduced shells filled with diphenyl-arsenious chloride (Blue Cross shell). They used a great many of these, especially on the French front, but not with any great success. In view of their effect on the wearing of the gas-mask, these irritants require further investigation.

Vesicants are only practicable when they act in vapour form. In that case they are by far the most effective of all the irritants, as they attack the skin and all the mucous surfaces. Those first considered were effective only when they reached the skin as liquids, a condition difficult to secure, and they were therefore dismissed. But the German "mustard gas," also known as Yellow Cross and Ypérite (Sym. dichlordiethylsulphide), acting as a vapour, was immediately successful. It first appeared in July 1917. It attacked the skin through the clothing, causing burns and irritation which might last from a fortnight to two months. Acting on the eyes it caused blindness, usually temporary. Acting on the bronchial tubes it might cause bronchial pneumonia. It might affect the heart, and also the stomach, causing vomiting and diarrhoea. These effects were sufficiently serious, in view of the large numbers of casualties which were produced, although the proportion of fatal cases was small, being no more than about 3%. In this connexion it should be noted that substances of the irritant class may also be lethal in high concentrations, *i.e.* in concentrations higher than those necessary to produce the characteristic temporary disablement.

A very important consideration in the use of gas is what is known as "persistence." Cylinder gas, travelling with the wind, is effective over a particular area only while it passes; but liquid gas splashed on the ground in minute particles from a shell, or left in the ground by the smothered burst of a shell, may be effective for some time, and gases are classed as of "high persistence" or "low persistence" according to the time during which their effect remains. This depends on the rate of evaporation. A strong lachrymator may be effective on the surface for perhaps twenty hours; other irritants, such as mustard gas, may remain effective for days in suitable meteorological conditions. Left

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under the surface they may remain latent for still longer periods, and take effect when disturbed by digging. It will be understood at once that this is a question of great tactical importance. For instance, a bombardment with "high-persistence" shells of trenches shortly to be attacked would be an obvious mistake, since the attacking troops after capturing the trenches would not be able to occupy them. On the other hand, in a raid on trenches which it was not proposed to retain it would be correct to burst bombs of "high-persistence" gas in trenches and dug-outs. So also in using a gas barrage or in bombarding an area, high-persistence shells should not be used if it is intended shortly to attack over that ground. The use of vesicatory shells especially will deny a given area to both sides, or "nullify" it. Gas shell is now classified not according to its physiological effect, but according to tactical use, viz. as persistent or non-persistent, the former being used for neutralization (*e.g.* mustard gas) and the latter for surprise destructive bombardment (*e.g.* phosgene).

The questions may be asked—why use the irritant type of gases at all if lethals are available? and among the lethal gases, why not use only the most powerful, namely, those which produce immediate death? In both cases the answer is found in the question of quantity. The specific lethal gases will only produce their effect in very high concentrations, which means that a large number of shells must be used simultaneously over a certain area. Shells of other types, though they may not kill at once, will produce casualties in very much lower concentrations. The question of the number of shells to be fired to produce a given effect is of great importance, not merely from the point of view of expense and the call on manufacturing resources, but still more in the field, as regards the number of guns required to fire the shells, the exertion of the guns' crews, and the question of transport. Again, an effective lachrymator will produce an atmosphere that cannot be endured in one-thousandth part of the concentration which the lethal shell would require for its purpose. This is a matter of great importance, especially in neutralizing enemy batteries. Lachrymators rather went out of fashion towards the end of the war, not only because the great munition efforts of both sides had produced an enormous quantity of lethal shell, but still more because the neutralizing effects and harassing effects which were their *raison d'être* could be obtained better by mustard gas.

Vesicating shells, which are of high persistence and whose effect is often delayed, are specially useful against targets behind the front line. Although a trench or strong point which it is intended physically to occupy cannot be subjected to mustard-gas bombardments, the use of this substance in combination with an attack round the flanks proved very valuable in reducing defences which could not have been carried either by assault or by explosive bombardments. The possibilities also of mustard-gas barrages in defence are very great. They should be used against communications, depots, railway stations, and especially staff offices, telephone exchanges and everything that affects the enemy's organization. An entirely odourless vesicator and one which does not produce a smoke easily recognizable will be particularly effective in this way.

As a general rule both lethal and irritant shells should be used in scientific alternation. With lethals, of course, the object is to catch the enemy unprotected by his masks, and in order to get a good effect a large number of shells must be fired at once. Such effects may be specially aimed at when large numbers of troops are known to be concentrated in certain places, previous to an assault. But it is also an important object to force the enemy to wear masks as long as possible, not only to fatigue him, but to exhaust the protective powers of the mask. This can be effected with irritants, and after some hours of bombardment with these, fresh bursts of lethal shells may be tried.

Methods of Employment.—The study of the characteristics of gas-clouds is very complicated. The cloud may consist of true gas, or minute drops of liquid, or infinitesimally divided solid particles. The last are known as "particulate clouds," and in their behaviour resemble a colloid vapour. Their action has to be studied physically and electrically as well as chemically.

The production of cylinder clouds, of course, is simple. The critical temperature of the gas employed must be above normal temperature. The liquefied gas is filled into a cylinder with a nozzle on the principle of a soda-water syphon. The cylinder is placed in position in the trench, and the nozzle is provided with a short length of pipe, which is placed on the ground in front of the trench, and ensures that the gas on issuing is well clear of it. The valve being opened, the liquefied gas is discharged with some force, and as its evaporation causes a fall of temperature a heavy cloud is formed which travels with the wind. The necessary density of cloud is obtained by opening simultaneously a sufficient number of cylinders per unit of length of trench, other cylinders being held in reserve to continue the discharge for the time considered necessary. At first the cylinders were placed in groups against the front wall of the trench. This method had the disadvantage that a cylinder might be burst at an inopportune time by an enemy shell, and later the Germans placed their cylinders under the floor of the trench, protected by sandbags, etc., while the British placed theirs in chambers excavated at some depth below the parapet.

The earliest cloud discharges lasted only twenty or thirty minutes, or at most an hour, the necessary concentration being calculated at ten tons of the chemical per km. of front attacked per hour. By the end of 1916 the French were using 100 tons per km. per hour, and the emission was continued for three or four hours. In the course of 1918 the British Special Brigade was using 200 to 250 tons of gas per km. per hour, and keeping up the cloud for eight, ten or even fourteen hours. The transport of gas cylinders up to the front trenches was naturally extremely laborious. It was very difficult to avoid attracting the enemy's attention to the carrying and emplacement of them, and there was always the risk of cylinders being burst by the enemy's shell. The results that were achieved under such conditions testify in the highest degree to the devotion and courage of the troops employed. The enormous discharges of 1918 were effected by loading the cylinders on trolleys and running them up to the front trenches on light railways just before they were to be used. The nozzles were opened by an electric device.

On the other hand the use of gas in shells presented all sorts of difficulties from the outset. It was first necessary to find gases that could withstand the shock of discharge from the gun and the effect of bursting the shell. Some of the most lethal gases could not be utilized because they were chemically unstable, and were liable to become decomposed into their constituent elements by shock. The cyanide compounds were to some extent of this nature, so that the Germans never used them. The French discovered a stable cyanide compound in which they had considerable faith, and the British used them to a certain extent.

Some stable lethal gases were found in due course, in addition to the irritants, and a whole series of problems presented themselves. The first question was the possible effect of the gas on the material of the shell. Some gases, such as phosgene, had no action on steel or cast iron. Others required containers of lead or porcelain; the French had a very effective method of blowing a glass lining into shell. The methods of sealing the shells and of filling and closing them offered merely technical difficulties, though these were considerable. The most suitable means of opening the shell was the next question, which had to be first considered, and then practically tested. The first gas shell used by the Germans contained a large proportion of high explosive; it is not known whether the idea was to follow the Hague Declaration in that the sole purpose of the shell should not be to spread deleterious gases, or to have a "double-purpose" shell, destructive and toxic. The result, however, was to produce an inferior explosive shell, while most of the gas was dissipated by the explosion.

The British efforts were directed at first to getting the maximum amount of gas into a shell and releasing it with as little disturbance as possible. The gas-cloud would issue in the form of an oblate spheroid which travelled down the wind, gradually enlarging and being diluted by the air. Without wind the gas would remain on the surface, settling down in trenches or depressions of the ground. For opening with the least amount of

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disturbance cast-iron shells were indicated, as they required practically no bursting charge; but cast-iron shells have the drawback that they hold much less liquid than steel shell, because the shell wall has to be very much thicker to resist the shock of discharge. It was eventually found that not only every gas but every nature and every calibre of shell required a different bursting charge, and sometimes a different explosive. These all had to be determined experimentally. Later it appeared that certain liquids required a more powerful burster in order that they might be distributed in a fine spray. When a solid was introduced, in the shape of diphenylchlorarsine, a still more powerful burster became necessary in order that the solid might be atomized and dispersed as a cloud. Thus the German 77-mm. shell contained only 125 gr. of this solid enclosed in a glass container, the space between the container and the shell being filled with 600 gr. of explosive.

While the output of chemical shells remained very small the question of cloud formation by lethal shells was of high importance. Not enough shells being available to charge the whole atmosphere over a certain area with a fatal concentration, it was necessary to rely on the effect of each individual shell cloud, which ought to pass over a man or group of men while still at full strength. With the very large quantities of shell that were available later this question was of less importance, as it became possible to produce and maintain very high concentrations over a given area or length of trench. This was facilitated by bringing the larger natures of shell into service, and also by the use of Stokes' bombs and trench-mortar shells, but still more by the Livens projector.

Since gas shells were intended to be used without considering the direction of the wind, the possible effect of a bombardment on one's own troops had to be considered, and a further range of experiments became necessary. The kind of precautions required are indicated in an extract from German Army Orders of June 30 1918:—

The following regulations for gas bombardment are made known.

Minimum distance of the objective from our first line:—

(1) Wind normal or oblique towards the enemy: for all natures of gas shell the least distance must be 300 metres; below that distance projectiles fired short may fall in our lines. When the wind is steady and the ground favourable, this distance may be reduced if only a small number of projectiles are being fired.

(2) Still weather, or wind normal or oblique towards our lines:—

(*a*) Heavy bombardment (several thousand projectiles), ground favourable for the return of the gas towards our lines:—

Blue Cross shells (Diphenyldichlorarsine—sternutators) . . . 1,000 metres (offensive).

Blue Cross shells . . . 500 metres (defensive).

Green Cross shells (Trichlormethylchloroformate—lethal) . . . 1,000 metres.

Yellow Cross shells (Sym. dichlordiethylsulphide—vesicatory) . . 1,000 to 2,000 metres according to the number.

(*b*) Light bombardments (some hundreds of projectiles), when our troops have been warned and the ground is favourable:—

Gas shells of all natures: 300 to 500 metres. These distances are given for general guidance; they may be reduced or increased according to local conditions.

The influence of the state of the atmosphere and ground conditions on the use of gas is naturally of great importance. The first consideration is the wind. Lethal shells will produce the best effect with a wind of three miles an hour or less; with a wind of over seven miles they cannot be used effectively. Lachrymators can be used in higher winds up to twelve miles, but with diminishing effect. Heavy rain destroys gas effect. Dry weather and a bright sun tend to dissipate the gas quickly. The most favourable atmospheric conditions are little or no wind, moist atmosphere, and no sun. The night usually offers the best conditions for gas. As regards the effect of ground, it will be obvious that anything which protects the gas from the effect of wind assists concentration. Hollow ground, valleys, woods, areas covered with undergrowth, and villages make therefore good targets.

Field Organization.—The earliest British experiments on a field scale were made with extemporized appliances on the nearest open ground to the source of production of gases under trial. Some experiments not involving danger were made on a ground that had been acquired for flame-projector and explosive trials at Wembley, and at the Clapham School of Trench Warfare, but it was soon evident that a properly organized experimental ground was essential, and after much search a site was found at Porton near Salisbury. Here trenches and dugouts were made, artillery ranges prepared, and gradually a complete installation provided of laboratories, mechanical workshops, magazines, filling-rooms, gas-chambers, etc. It was now possible to experiment on a really scientific basis, while the ground available gave space for trial of many other trench-warfare requirements, among which smoke and incendiary shells and light signals were of great importance. Porton thus became the headquarters of the practical study of gas warfare. The laboratory experiments there were confined, however, to examination of the results of trials. Other laboratory work was done at the Imperial College, at Cambridge and other universities, and in private laboratories.

The first British experiments with gas-projectors showed the difficulties that were likely to arise with defective apparatus, or from changes of wind in the trenches; and it was realized at once that, for the handling of the new weapon, it was necessary to have some chemists in the front line who should be trained in the handling of the material, and who could also advise the troops on the effects of it. The suggestion of raising a Chemical Corps was put forward and approved; and as a result all the universities were invited to nominate students of chemistry, while at the front chemists were withdrawn from the ranks for the new corps. This was the beginning of the Special Brigade R.E. in which a certain number of selected students and officers already serving were given commissions, while others were appointed as non-commissioned officers to give them the necessary authority and position.

A certain number of officers and men were also appointed to it who were not chemists but had experience at the front. Thus the officer commanding the Special Brigade suggested working the men at cylinder emplacements in the trenches in pairs; one a chemist and the other an old hand from the infantry. The importance of having trained scientific men in the brigade was shown by the number of valuable suggestions that emanated from the officers, as well as by their extraordinary keenness and effectiveness in the field. After a short time selected officers from the brigade were appointed as chemical advisers at headquarters of armies and corps, and a central laboratory at General Headquarters was started for examining enemy gas and anti-gas appliances and dealing with urgent problems.

Organization in England.—In June 1915, upon the formation of the British Ministry of Munitions, the personnel hitherto engaged on chemical warfare was transferred to the ministry. The time had come for rapid expansion, and a Trench Warfare Department was created by the minister which was responsible for both design and supply, not only of chemical war material but grenades, trench mortars and projectiles, smoke shells, signals and the countless other requirements that modern trench warfare had made necessary. The staff, rudimentary hitherto, was increased in proportion to the requirements of experiment and manufacture, and a scientific advisory committee was formed of eminent specialists in chemistry, physics and physiology. This new department was unique in combining the functions of research, design and supply. The other departments of the ministry were concerned with supply only, in response to the demand of the War Office. It was decided after much discussion that this exception should be made for the Trench Warfare Department, because it was recognized that in dealing with so many entirely new products, the manufacture of most of which was attended by considerable danger, it was essential that the designers should be in the closest possible touch with the manufacturers, should be able to explain what was being aimed at, and should advise on difficulties as they arose. The resultant close contact enabled them also to modify their designs during manufacture when necessary; to take account of facilities for supply and manufacture; and to order supplies in advance as soon as a new production was foreseen.

There is no doubt that this was the right procedure, as was proved by the rate production up to the end of 1915. The weak

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points were that the department had to communicate with the front through the War Office, which caused delays and mistakes, and that defensive arrangements, the provision of gas masks, etc., so intimately connected with offensive research, remained with the War Office. But, for the rest, the department had only to obtain the approval of the War Office for new designs and material, with an indication of quantities to be provided, and could then make its own arrangements. To this, however, one very important exception had to be made; they were not allowed to design or manufacture gas shell, and as other branches were not in a position to design them this led to serious delays. These delays were accentuated by the fact that in 1915, when shells were scarce and the value of gas shell had not been proved, the authorities responsible for shell generally were very unwilling to allocate shells to gas.

Gas warfare both in France and Russia began with divided control, and as this gave very unsatisfactory results, in each country after some time a separate organization was formed with complete control of design and supply. In the autumn of 1916 for instance, when the British were scarcely beginning to produce gas shell, Russia with her poor manufacturing resources was already sending to the front a steady supply of 25,000 gas shells a week for field guns. The British on the other hand, having begun on the right path, had left it. Within the ministry, at the end of 1915, research and supply were separated. It was assumed that they would work together as closely as before; but in fact, the Supply Department immediately and inevitably drifted away, and not only lost the advantage of supervision by the designers, but began to research on its own account, thus causing overlapping and confusion. Early in 1916 a Department of Munition Design was formed, and the Trench Warfare Research Department passed under the control of that department. Their work was then much restricted, and was directed by a department which knew nothing of it, and which intervened between them and the War Office. The confusion and friction that followed had a serious effect both on progress and output.

In the summer of 1917 the large number of casualties caused by the German mustard-gas shells occasioned some anxiety on the British front, and it was asked why the British army had not something equally effective. The reason was that since 1915 research in irritants had been discouraged; and as the Chemical Research branch was not in direct touch with G.H.Q. the question had never been properly discussed. In the result, in Oct. 1917 the Chemical Warfare branch was reorganized and considerably expanded. It had more direct communication with the front, and the Defensive organization from the War Office was amalgamated with it. The Supply Department was however kept separate.

In April 1918 the Trench Warfare Supply Department was broken up. This was the opportunity to restore the supply of gas and gas shells to the Chemical Warfare branch, especially as they already had supply on the "anti-gas" side; but the manufacture of gas went to the Department of Explosives Supply, and the filling of shells and bombs to the Department of Gas Ammunition Filling. This continued until the Armistice.

Objects of Gas in Warfare.—It must be clearly recognized that in the use of gas a new weapon of war has been found, which supplements without displacing the existing arms. Explosive and shrapnel shell have their limits. A very small amount of cover will give entire protection against shrapnel, and deep dugouts will protect against the most powerful explosive shell. When the enemy has provided cover and such shell become ineffective, gas becomes effective. A gas heavier than air will settle in trenches and remain in them; it will drop down the approaches to the deepest dugouts and permeate them. According to the nature of the gas, whether lethal or irritant, the enemy, if unprovided with gas-masks, will then be either killed or driven up into the fresh air. In the latter case, he comes once more under the action of the ordinary artillery shell. If he has masks he can remain under cover, but the masks must be worn, not only until the bombardment stops, but afterwards until the shelter is cleared of gas.

In trenches also, and in the open, as long as there is gas, masks must be worn, and the troops fight under a heavy handicap. This condition may be kept up indefinitely with a slow bombardment of irritants and occasional bursts of lethals. In the case of a smoke-cloud discharged for eight or ten hours continuously the protection afforded by the mask with its refills will be exhausted, and the troops attacked have three alternatives: to counter-attack, which without prearrangement and the necessary supports is hopeless, to die at their posts, or to retire.

The effect of gas differs fundamentally from that of ordinary shell in its persistence. A bombardment with explosive shell is effective only while it lasts. The moment it is over troops can move freely over the area of bombardment. With gas, on the other hand, troops cannot cross the area without masks until the gas has been dissipated.

Again, a shrapnel bullet or splinter of explosive shell may hit or may miss; troops may pass through such a barrage with considerable losses, but still in sufficient numbers to attack. The gas cannot miss. If enough has been discharged over a certain area to give the necessary concentration, every man passing over that area without a mask will be affected.

In clearing up a captured line of trenches during an advance, gas bombs are most effective for bringing the enemy out of deep dugouts. For this purpose a non-lethal irritant of low persistence, which will penetrate the enemy's mask, may be used.

There is also the question of the effect of gas behind the lines. Such a discharge of cloud-gas as has been described may travel for miles before it is sufficiently diluted to lose its destructive effect. A long-range bombardment of an artillery or engineer depot will make it impossible for some days to handle the material without good protection.

That gas shell had a real military value as compared with ordinary shell is proved by the fact that both combatants used them so freely in the last year of the World War. Thirty per cent of the total American casualties were caused by gas, and no estimate can even be attempted of the general loss of efficiency brought about by the necessity for wearing respirators. Sillevaerts gives the following German order for the proportion of different shells to be used in the bombardment before the attack on the Aisne on May 27 1918:—

Object	Explosive	Blue Cross	Green Cross
1. Counter-battery and long-range bombardment	20%	70%	10%
2. Bombardment of infantry positions			
(*a*) Moving barrage	60%	30%	10%
(*b*) Back barrage	30%	60%	10%

Experience showed also that batteries attacked by gas shell were generally put out of action for several days.

Future of Gas Warfare.—Such then is the new weapon. Its potency is undeniable, as is the fact that it is effective where other weapons fail. The question is, will its use be continued? The answer, from a military point of view, may be found in the fact that, if one belligerent uses gas and the other does not, the former will in all probability win. Since experience has shown that conventions made in peace-time are not always respected when war comes, the argument that no nation can allow its existence to depend on the security of a convention prohibiting the use of such a weapon, is even strengthened by the fact that, after the lessons of the World War, nobody in 1921 could predict what further chemical or physical developments scientific investigation might produce in the future. Great advances might well be made in the discovery of gases that would penetrate any mask hitherto designed, and in the utilization of them. The nation that cares for its safety must therefore keep pace with such discoveries and with the means of protection against them. To prevent the production and the study of toxic gases is impracticable, because many of them are either necessary elements or by-products of manufactures essential to modern industries in peace-time.

As for the ethical side of the question, it must be considered dispassionately. Every new means of warfare, intensifying its

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effectiveness, has caused an outcry when first introduced. Gas warfare, *per se*, is not necessarily or exceptionally cruel. For instance, if it were conducted on both sides with cyanides, successfully adapted to war purposes, the resultant deaths would be the most merciful that history has ever known. It is to be noted that in the World War less than 3% of the total gas casualties were deaths, whereas some 20% of casualties due to other weapons resulted in death either on the field or in hospital. The use of gases may be guarded by future conventions so as to prevent unnecessary suffering, just as explosive bullets were barred. Thus chlorine might be forbidden, because there is no death more painful than that by suffocation. But the utmost that seems possible is to limit by convention the use of poison gases in such a way that a breach of the convention will not place the offending combatant in a definite position of superiority.

It is infinitely to be deplored that gas warfare was ever introduced. It certainly adds a new horror to war. It imposes fresh burdens on the soldiers, who may ultimately be forced to spend most of their time in gas masks, even when far behind the lines. The most terrible thing perhaps about it is that, since it is impossible to remove all non-combatants from a zone of war, and equally impossible to provide them with masks, thousands of them must inevitably perish. For this reason alone it would be well if gases were forbidden. To forbid them, however, is one thing; to prevent their use is another. And unless more effectual means than were within sight in 1921 can be devised to make this (or any other) form of warfare impossible, considerations of national security must inevitably prevail.

Gases used in the World War.—The following are some of the more important gases used during the World War:—

Cyanogen Compounds.—Effect, in concentrations of as much as 1 in 1,000, immediate death. In weak concentrations, giddiness, headache and pains about the heart, but ultimately complete recovery. Used by the French and the British in shells as a mixture of 50% hydrogen cyanide, with arsenic trichloride, stannic chloride and chloroform.

Chlorine.—Attacks the respiratory tracts, forming in contact with moisture hydrochloric acid which destroys the tissues. Has a reflex action on the system generally, causing vomiting and diarrhoea. In high concentration may cause immediate death by spasm of the glottis. Only used as cloud-gas from cylinders.

Phosgene (Carbonyl chloride).—A very dangerous gas because the effect is delayed, and the victim is often not aware that he has been gassed. May cause sudden death as much as 48 hours after exposure. Very much used both in shells, and with chlorine as cloud-gas.

Diphosgene (Trichlormethyl chloroformate).—Effect similar to that of phosgene. Much used in shells, both alone and with other gases.

Chloropicrin.—Acts on the respiratory system like chlorine but more strongly. Is also a lachrymator. Much used in shells generally in combination with other gases.

Bromine.—Action similar to that of chlorine. It can be used conveniently for gas-clouds on account of its high boiling-point, but it forms the basis of a large number of powerful lachrymators. It was much used by the Germans as a lachrymatory shell-filling in the form of benzyl or xylyl bromide and brominated ketones.

Ethyl iodoacetate.—British lachrymator. Very marked action on the eyes, ceasing the moment the neighbourhood of the gas is left. High persistence.

Bromacetone, Chloracetone and Brommethylethylketone.—Much used in shell. Powerful lachrymators, and asphyxiating or lethal in high concentrations. Moderate persistence.

Diphenylchloroarsine.—Solid, dispersed in clouds of fine particles. Cannot be kept out by ordinary masks. Powerful sternutator, producing also coughing and sickness; in strong concentration, causing insupportable headache. Much used in Blue Cross shells by the Germans.

Diphenylcyanoarsine.—Similar to diphenylchloroarsine, but with a more powerful action. It superseded the latter as a German Blue Cross filling.

Mustard Gas, Ypérite, or Yellow Cross.—(Sym. dichlordiethylsulphide). Vesicant. Attacks the skin even through the clothing with a blistering or burning effect. Affects all the mucous surfaces. Acting on the eyes causes blindness, usually temporary. Acting on the respiratory tracts may cause death by bronchial pneumonia. In favourable weather remains effective for several days.

Livens Projectors.—The use of lethal-gas shells, which require a very high concentration, implies the necessity of bursting a large number of shells simultaneously along a given length of trench or over a given area. With artillery shell this necessitates a concentration of every available gun within range on the point of attack, and needs a certain amount of preliminary arrangements. With Stokes or trench-mortar bombs whose contents are much larger, and especially with a Stokes gun which can be fired very rapidly, a smaller number of pieces can be used. But probably the most effective means of obtaining a high concentration was the projector devised by Captain Livens, R.E. This consisted originally in using an old gas cylinder, with its top cut off, as a mortar; a hole is dug in the ground and the projector placed in it, resting on the ground at an inclination of 45 degrees and pointing in the required direction; the breech of the cylinder is backed up with a strong base-plate about 12 in. square. The propelling charge is contained in a tin box placed at the bottom of the projector and divided into compartments; the propellent explosive is placed in the compartments in bags, the number of bags being varied according to the range required. The projectile is a steel drum with rounded ends, 21 in. in length and just fitting into the cylinder, which has a bore of 8 in.; within the drum is a central tube running down its length, about 1 in. in diameter, which contains the bursting charge. The projector is fired by an electric fuse, about 20 of them being connected up with an exploder. These 20 may all be placed side by side in the same trench, and will constitute a battery. By these means as many as 4,000 of these projectors have been placed in position behind the front trenches in a night and fired simultaneously. Naturally, neither range nor direction are very accurate, but they are sufficiently so to give a very high concentration of gas over a small area, in some cases sufficient to kill men even when wearing their respirators. These projectors proved so useful that they were employed also for incendiary and high-explosive charges, and were immediately copied by the Germans, who feared them more than any of the other chemical warfare methods of offence employed by the Allies.

Incendiary Materials.—The beginning of the war showed nothing particularly new or useful in the incendiary materials used by either side. Quite early in the war a German incendiary shell was found to contain white phosphorus and a very inflammable celluloid mixture. In England petrol bombs were tried and containers filled with rags soaked in petrol. The results were not important. Phosphorus by itself was not a reliable incendiary agent, though a shower of molten phosphorus descending from a shell burst in the air had a good moral effect.

The first demand for incendiary materials for the British army arose from the necessity of burning the long grass in No Man's Land during the summer of 1915, to prevent the enemy from using it for cover. To meet this demand a small catapult grenade filled with phosphorus and petrol was supplied, it being found that a small addition of phosphorus gave a more certain ignition of the petrol. Phosphorus, however, was far more useful as a smoke-producer than as an incendiary. A very important advance was made when a method of utilizing thermit in shell was discovered. Thermit is a mixture of iron oxide and aluminium which when ignited by a suitable primer burns with an intense heat, which has been estimated at 5400° Fahrenheit. It is used commercially for welding, and has been used in the army for such purposes as destroying guns, a small quantity of it being placed in the bore and ignited; the result of this is to make the gun useless, as when the thermit cools it is found to be firmly welded to the surface of the bore.

The ordinary ignition, however, is too slow for the purpose of an incendiary shell. Experiments were made with special ignition powders in Stokes shells but without good result. In Jan. 1916, however, thermit was tried with a bursting charge of ophorite which gave excellent results, the thermit being instantly raised by the discharge to melting-point so that when the shell was burst in the air it let fall a shower of molten metal. Ophorite was an explosive that had recently been discovered by Professor Thorpe, which while less powerful than the ordinary high explosives, had the advantage that it could be fired by a fuze without a detonator.

Thermit employed in low-velocity projectiles such as Stokes gun shells became a very valuable incendiary agent; with artillery shells it was not so useful, as satisfactory ignition was difficult to obtain.

Experiments were also tried with fine coal-dust distributed in the air but the results were not practical.

Anti-gas Defences.—About the end of March 1915, in consequence of the increasing rumours that the Germans intended to use poison gases, the British War Office asked Sir William Ramsay's committee to consider what gases might possibly be used, and what would be the best means of protection. Before the committee reported, the cloud attack of April 22 was made. The circumstances were explained to Sir William Ramsay by telephone, with the remark that the gas was probably chlorine, and the next morning he came to the War Office with several sample mouth-pads made of flannel or wool soaked in hyposulphite of soda. An appeal was made through the Press to British women to furnish 1,000,000 of them at once, and thanks to their response and the efforts of the Red Cross the necessary quantity came in two or three days, so that within a fortnight every man

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in the British army at the front was supplied with this form of respirator. Although rudimentary, it gave useful protection.

Meanwhile chemists and physicists were at work on both the French and British fronts investigating the facts and advising on temporary protection. The day after the first gas attack, instructions were issued to keep buckets of solution of bicarbonate of soda in the trenches; the men were to dip their handkerchiefs in the solution and tie them round their mouths in case of gas attack. More efficient respirators were considered, also the use of large fans for clearing the trenches of gas, and direct fighting of the cloud by spraying neutralizing agents into it. Thousands of Vermorel sprayers were sent out, for clearing trenches and dug-outs. The dispersal of clouds by shelling and by explosions was tried, also lighting fires in front of the trenches to heat the cloud and cause it to rise. None of these methods were really effective in stopping clouds, and attention was gradually concentrated on direct defence by masks.

The first improvement on the respirator, which was introduced in the War Office a few days after the attack, was known as the Smoke helmet or Hypo helmet, a kind of Balaklava helmet made of flannel or thin serge, covering the head loosely and reaching below the neck, round which it was tied. The eye-pieces were made of mica. This helmet was impregnated with hyposulphite, soda and glycerine solution, and carried in a waterproof bag. It gave satisfactory results for some time. Pending the complete supply, the increasing use of lachrymating shells by the Germans gave rise in June to a demand for goggles.

During 1915 the helmet was improved by the introduction first of phenates to protect against phosgene (when it is called the P helmet) and later by the further addition of Hyomine (when it was called the P.H. helmet), to ensure protection against phosgene and prussic acid. A respiratory valve and mouth-tube was also inserted in the P. and P.H. helmets, and this added to their comfort and efficiency.

As the use of other gases was foreseen, such as phosgene and hydrocyanic acid, a more effective protection than could be put into cloth became necessary. Thus the "box respirator" type was developed, and gradually issued during 1916. The general type of these consisted of a mask or face-piece into which entered a flexible tube issuing from a metal container which held chemicals, through which the air was breathed. In the earlier patterns the air passed through the tube into the space between the mask and the face; but as it is very difficult to get the mask to make an airtight fit round the face, the tube was extended and ended in a mouth-piece which fitted closely to the lips, while the nostrils were closed by a nose-clip. The container and mask were carried in a knapsack. The mica eye-pieces were replaced by celluloid, and eventually by triplex glass, which does not splinter when broken and remains airtight.

The introduction of a container for the neutralizing and absorbing agents gave free scope to chemists to provide against all kinds of poison gas. In this connexion it is worth recording that the British gas-mask did in fact give efficient protection from its introduction to the end of the war.

The containers were filled with alternate layers of charcoal and composition granules. The charcoal absorbed gases, and the granules, whose composition could be varied indefinitely, absorbed and neutralized them. The container had the further advantage that its contents could easily be renewed.

This type of respirator continued in use until the end of the war but was subject to continual improvement. No effort in this direction could be spared seeing that any defect in the manufacture or adjustment of the mask might mean death to the wearer. Constant progress was made with the British and French patterns, and the Americans when they entered the war took up the question very thoroughly. They, like the French, had the advantage that their chemical service was a separate branch of the army with the offensive and defensive sections working under the same head. Among other defects the air-tight fitting of the mask to the face needed a great deal of study and experiment. The eye-pieces gave trouble because moisture would condense on them both outside and in. This was partly cured by using a soapy solution on the glass. The whole apparatus had to be made as little cumbrous as possible, and so adjusted with its knapsack that it could be very quickly taken out and put on. The use of the mouth-piece and nose-clip was very trying when worn for long periods.

In 1918, the Tisset mask was introduced in France, which did away with the mouth-piece and met the difficulty of condensation by causing the cold air from the inlet-tube to pass across the eye-piece in entering the mask. This type, which was adopted and improved by the Americans, was known as a "single-protection" respirator. Its weak point is that if the face-piece is torn, or does not fit properly, protection is lost.

The provision of the charcoal for the containers opened up a wide field of investigation. For absorbent purposes a very dense charcoal was required. Experiments made in the United States showed that coconut-shells gave the best form of charcoal for the purpose, but their preparations were on such an extensive scale that they calculated that they would require a supply of 400,000 tons per day of coconut-shell, which were obviously not obtainable. After coconut-shells the best carbon was obtained from fruit-stones such as peach, cherry, etc., and Brazil and other nut-shells. Carbon obtained from hard wood, such, as the ironwood was of less efficiency.

The scale on which the United States worked is shown by the following figures given by Farrow of the production of protective materials up to the date of the Armistice, the great bulk of which were produced in the last four months of the war:—

Material.	*Production up to Nov. 11 1918.*
Respirators	5,276,515
Extra canisters	3,144,485
Horse masks	366,529
Bleaching powder (tons)	3,677
Extra antidimming (tubes)	2,855,776
Sag paste (tons)	1,136
Dugout blanket oil (gallons)	95,000
Protective suits	500
Protective gloves	1,773
Dugout blankets	159,127
Warning devices	33,202
Trench fans	29,977

The sag paste mentioned in this list was an ointment used for the skin to protect it against mustard gas, the protective suits and gloves being for the same purpose. The blankets, which were to seal the doors of dugouts, were made of specially woven cotton treated with a specially heavy oil. The warning devices were mainly watchmen's rattles and Klaxon horns.

From the beginning gas schools were established on all army fronts, where men were taught the use of the masks and made to enter gas chambers with masks on to get proof of the protection afforded. Similar schools were established by all the nations at their gas defence headquarters, where experiments could be tried. The result of such work is well shown by the following extract from Farrow's description of the American gas service:—

"There was a special field-testing section of the Gas Defence Division composed of about 150 men who were trained to the minute in field manœuvres and did most of their work in gas-masks. They were constantly in and out of gas with regular production and experimental masks. They played baseball in them, they dug trenches, laid out wire, cut wires, and fought sham battles at night, both with and without actual gas. The work of this section even went so far in the case of the later design as to include a test where six men worked, played and slept in the masks for an entire week, only taking them off for 30 minutes at each meal-time, and each day entering high concentrations of the most deadly gases without any ill effects whatsoever to the wearers. When it is remembered that eight hours was the limit of time which a strong man could wear the old-type mask, something of the efficiency of the new mask may be realized."

These of course are experimental results with selected men, which generally differ widely from those obtainable in the field. They only show the great improvement made in patterns of respirators before the end of the war. The fact remains that any efficient respirator is a source of fatigue as well as a great inconvenience. British experiments have shown that in hill-climbing with and without respirators, there is a marked difference in the increase of heart rates and rates of breathing under the former

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condition. Up to 1921 what had been done gave good protection with reduced inconvenience. But much yet remained to do; indeed, complete protection both at the front and in the rear areas might well be unattainable. (L. J.)

POLAND (*see* 21.902*).—The partition of Poland was the one great crime of the 18th century for which no redress was afforded by the settlement of Europe after the Napoleonic wars, and it eventually proved one of the causes of the World War in 1914, though the Poles had become apparently more or less reconciled by that date to working out their destiny under Russia, Prussia and Austria. In the earlier article their history has been sketched up to 1863, but it is necessary here to make some brief reference to former times as well as to give the outlines of its development from then up to 1914.

RUSSIAN POLAND.—"The insurrection of 1863," says Stanislaus Kosmian, "helped the greatest enemy of Poland and the Polish cause to success. On the ruins of the Polish revolution rose . . . the system of Russification in the Empire of the Tsar." Under the new name of the Governments of the Vistula the Polish provinces formerly known as "Congress Poland" or the "Kingdom of Poland" were placed in the hands of military governors whose duty it was to suppress every tendency towards Nationalism and to ensure complete subservience to Russia. Russian became the official language of the country and it was enforced in all public business. In 1869 it was adopted as the official language of higher and secondary education and in 1885 the use of the Russian language became compulsory in the primary schools. The publication of articles in Polish was forbidden and the teaching of the language was punished by fine and imprisonment. In 1876 Russification was extended to the courts of justice and Polish officials were replaced by Russians. It cannot however be said that the policy was consistently enforced; it was for instance mitigated under Count Berg who succeeded Milyutin in 1867 and devoted himself to conciliating Polish society, and again by Count Schuvalof and Prince Imeritinsky, successors to the Draconian Gen. Gurko who reigned from 1883 to 1894. Roman Catholicism was, however, from the first recognized as "the backbone of Polish Nationalism" and consistently attacked. At the outset the monasteries were closed, the ecclesiastical lands confiscated and the Union with Rome assailed by compelling Uniates to become Catholics. This religious persecution was carried on with very slight intermittence until 1905, when religious freedom was first permitted.

The most interesting feature in the process of Russification, however, was the attempt made to break the power of the old historic families and bring the peasants into close union with Russia. The emancipation of the peasants which had been urged before the revolution was effected by the Ukases of 1864. Each peasant, whatever his tenure had been, and the mass of the landless became freeholders, which was a constant cause of class friction, and they were allowed to retain their right of free access to the forests and pastures of the landlord. To the landlords compensation was given in the form of Treasury Bonds so that they might have a lasting interest in the maintenance and solvency of the Russian Empire. Village affairs were placed in the hands of a Commune (*Gromada*) consisting entirely of peasants, who from ignorance and inexperience soon fell under the influence and mastery of the officials; while the landlords were represented in the organization of the district.

The basic idea of the system was the accentuation of class divisions, for it was hoped thus to create a class independent of, and antagonistic to, the Polish landlord and bound by ties of gratitude to Russia. These hopes were not realized for it was these peasant communes which provided centres for the educational movement at the end of the century and foci for the spread of the idea of Polish nationality.

From the emancipation of the serfs can further be traced the economic changes which took place in the latter half of the 19th century. By the splitting-up into small parcels of the large estates an ever increasing class of peasant proprietors was instituted because the small freeholders, who included in their numbers members of the smaller gentry or *Szlachta*, as well as the former serfs, desired to increase their holdings and found themselves more and more able to pay the prices demanded by the landlords. Though the kingdom of Poland was and remains essentially an agricultural country, a great industrial change has also taken place. Whereas in 1863 the towns were still in a primitive state of development, by the end of the century great industrial centres had appeared. Competition with Russian industry was a different thing to competition with German industry, especially under the protection of the Russian tariff wall. Hence the growth of a strong middle class in which the Jews took a considerable part, some of the leading Jewish families even marrying into and being received as part of Polish society in Warsaw. The economic development became a strong bond of union with Russia and Polish textiles penetrated through the empire as far as Turkestan.

The practical exclusion of the Poles from the Russian army and administration threw back the abler and more ambitious of the upper classes among them on other employment, and strengthened this middle class and brought a new influence to bear on national life in Congress Poland. Hence practical economic reform improvement became the order of the day and the habit of theorizing on the subject of political independence fell into the background. But these improvements again could not long avoid a political aspect and hence the formation of Socialist and Democratic associations.

These Socialist societies, however, had always a Nationalist tendency because capital was largely in German and Jewish hands. The most noteworthy was the National Democratic party which came into existence before the end of the century, after several earlier revolutionary societies had failed, and set to work by means of private educational efforts to oppose Russification and definitely awaken the spirit of nationality. During the troubles which succeeded the Russo-Japanese War this party, under the leadership of M. Dmowski, formed "the army of the national movement" and in the First Duma held an important and in the Second a controlling position, but its influence was diminished by the reduction of the membership at the election of the Third Parliament. Outside Russia an important movement took place in 1908, thanks to the rise of the Neo Slav party, which aimed at effecting a reconciliation between Russia and Poland, and this platform was adopted at Pan Slav Congress held at Prague in 1908, for it was felt that the Poles would be the first victims of a victorious advance of Germany, now the most dangerous enemy (it was held) of the Polish cause.

The Russian Government was, however, recovering from the blows of the revolution of 1905 and unwilling to consider the grant of autonomy for Poland, and in the Duma even the support of the Constitutional Democrats was withdrawn when the Polish Club in the Austrian Reichsrat encouraged in 1908 the incorporation of Bosnia and Herzegovina with the Habsburg dominions. The failure of its plans caused the break-up of the National Democratic party. Its place was taken by Socialist societies antagonistic to Russia. Hence at the outbreak of the World War feeling in Russian Poland was divided.

PRUSSIAN POLAND.—The Congress of Vienna in 1815 had stipulated that the Poles should receive "a representation and national institutions." In the duchy of Posen the national rights of the Poles were recognized and for some years the policy adopted by Prussia was one of conciliation rather than oppression, while the needs of the country, such as those as to education and communications and the emancipation of serfs, were efficiently provided for. It was not till 1830 that any system of Germanization was introduced and even that was enforced with no great severity for the twenty years after 1851. But when Bismarck was able to turn his attention from Austria and France to Poland he found that under the mild rule that had prevailed the Poles had been able to develop a national movement which had indeed a parliamentary group in Berlin and had to be reckoned with in the Reichstag, but the strength of which lay in societies such as that founded by Marcinkowski in 1842 which had brought an educated class of Polish doctors, lawyers, merchants and tradespeople into existence. By means of propaganda this movement

** These figures indicate the volume and page number of the previous article.*

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had increased rapidly to a position more formidable than that previously engineered by the historic families and was in fact "undermining the foundations of the Prussian State." As a counter-stroke to an organization which he realized was strengthened and to some extent led by the priests, Bismarck in 1872 undertook the *Kulturkampf*, hoping thereby to crush out the growing conception of Polish nationality. The Archbishop of Gnesen-Posen, the chief leader of the Roman Catholic party, was imprisoned, the liberty of the pulpit was denied, the use of the Polish language was prohibited in the schools and attempts were made to forbid its use at public meetings. The *Kulturkampf* was continued till 1885 and in spite of its failures Bismarck's policy seemed assured of success when Dinder was appointed Archbishop of Gnesen and the onslaught of the schools began.

The history of Prussian Poland in later years turns to a great extent upon the economic question. The industrial development of Germany had brought about a great immigration of Polish labourers to work as agriculturists in eastern Germany and as miners in Westphalia. Bismarck descried danger here and after unsuccessfully trying to prevent it by expelling the immigrants essayed to counteract it by further Germanization of Poland. The appointment of the Land Commission in 1886 with £5,000,000 to buy land from Poles in Posen and W. Prussia and sell it to German colonists was the first step in the policy of German colonization which was pursued till the outbreak of the war. It is true that under Caprivi the severity of the anti-Polish policy was relaxed, but under Prince Hohenlohe it was reinforced and in 1894 the *Ostmarken Verein* was founded to obtain the trade of the eastern provinces exclusively for Germans and undermine the Polish element. Under Count Bülow the culminating point was reached in 1908 when the compulsory expropriation bill was passed with the bill prohibiting the use of Polish at ordinary public meetings. More colonists were now introduced and the sale of their land to Poles was forbidden. There were signs all through of the failure of this policy, such as the strike of the school children in 1906 against the use of the German language in religious instruction, and these signs were multiplied in the economic sphere. For here the Poles, acting on the principle that they would be masters when they were "better, more educated and richer than the Germans," had definitely set themselves to the task of defeating the Germans economically. The land that was bought for colonists was poor land and bought at high prices. The German colonists were boycotted to such an extent that they were forced to withdraw or become Polonized and the Polish position actually seemed to grow stronger as the legislation became more severe. The incorruptible Prussian official, the inexorable Prussian schoolmaster and the brutal Prussian drill sergeant had disciplined a talented people hitherto uncultured and rendered them capable of organizing and acting for themselves. By means of their coöperative societies which dealt with agriculture, finance, industry and commerce they obtained complete control of the resources of the country to the exclusion of the Germans and the Jews. They also founded unions of landowners, social, athletic and political associations. The heads of all these societies before the war formed a sort of secret Cabinet which exercised the chief power in Prussian Poland with a preponderating influence in the local Press, with power to control the supply of immigrant labour and secretly direct the boycott both of Germans and of Jews. In fact when victory came the assumption of political supremacy was not the first but the last step to complete independence.

The success of the Poles of Prussia may have been one of the elements which led Pilsudski to put his money on the wrong horse at the beginning of the World War, believing that Germany would be obliged to make of Poland a buffer State against the eternal menace of the Russian Empire.

AUSTRIAN POLAND.—The lot of the Poles in the Austrian Empire with its purely non-national basis was preferable to that under Prussia or Russia. In the former they had by fighting obtained a tolerable position. In the latter the severities were intermittent and could be mitigated by bribery. In Austria there was always a certain amount of *bonhomie* or *Gemütlichkeit* which made official harshness tolerable. The history, however, of Austrian Poland from 1863 to 1914 can be understood only by reference to certain governing facts, namely the imperialist opportunism of the monarchy and the racial problem presented by the rise of the Ruthenian movement in Galicia.

During the years immediately following the revolution of 1863, the Galician Poles, under the influence of bitter disillusionment, resolved to concentrate all their efforts not on recovering political unity with the boundaries of 1772, but on preserving and strengthening national unity within the Austrian Monarchy. German culture and the German language constituted the unifying and predominant force in the Habsburg Monarchy, but after the war of 1866 and under the constitution of 1867 Austrian Germans had to look for allies amongst the other nationalities. The Poles had to decide whether they would support the aims of the Federalist party with its disruptive tendencies or whether they would favour the German element and adhere to the Vienna Government. They followed the latter course and promised loyalty in return for practical concessions. Having 57 votes in the Reichsrat they were able to secure useful privileges for Galicia. In 1867 they obtained a special minister for Galicia in the Austrian Cabinet; a separate board for Galician education; the use of the Polish language in secondary schools; the use of Ruthenian being restricted to elementary schools; the use of Polish instead of German in administration and the law courts. In the following year Polish became the official language for the university of Cracow, whilst a year later it was enacted that Poles alone should be teachers in the universities of Cracow and Lemberg. From 1877 onwards the "Polish Club" in the Reichsrat became a governmental party and used all its influence to build up piecemeal the fabric of Polish autonomy in Galicia. On the whole the Poles did not use their power well. By the establishment of an academy of science at Cracow they did indeed encourage learning, but they did nothing to improve the economic condition of the people. The peasants remained ignorant and the towns were neglected. No Polish middle class was created and hence the Jewish element predominated in trade and commerce. Galicia was rapidly Polonized but only at the expense of the Germans and the Ruthenians, and on their oppression of these last the history of Austrian Poland up to and after the war to a great extent depends.

The Ruthenians have been described by Prof. Alison Phillips as a compact body of 30,000,000 occupying the country "from the north-eastern district of Hungary across the Carpathians and E. Galicia" and eastwards as far as the Dnieper. They were then ruled partly by Russia and partly by Austria, but have always been claimed by the Russians as part of their race. Indeed little doubt was expressed on the subject till a movement was started about the middle of the 19th century by certain Ruthenian scholars, who set out to prove they had a right to a separate national existence. The real impetus of the movement was economic and arose from the discontent of the peasant with the oppression of their Russian and Polish landlords. It was some 20 years before the importance of the danger of the movement was realized. From the Polish point of view it was dangerous because it challenged their supremacy in "the annexed provinces" in Podolia, Volhynia and Eastern Galicia. From the Russian point of view it was disastrous because it threatened to break up the Russian Empire. In Galicia, where in addition to the language the Greek Uniat Church formed a strong bond of union, the movement prospered in spite of the Polish efforts to suppress it, which were at first supported by the Austrian Government. This support continued as long as Austria desired good relations with Russia, that is until in 1884 it was desired to weaken the Russian colossus. Then concessions were made to the Ukrainians and the result was that in 1891 Ukrainophil deputies appeared in the Reichsrat with the development of an Ukrainian State within the monarchy inscribed on their banner. This policy had the effect of promoting a reconciliation between Russia and the Galician Poles, who thought it better that the Galician Ruthenes should be absorbed by Russia than that a Ruthene State should be set up at the expense of both Russians and Poles. To retain their ascen-

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dancy, therefore, the Poles proceeded to encourage the Russophil Ruthenians, with the result that the latter were successful in 1907 in the election which followed the establishment of universal suffrage in the Austrian half of the Dual Monarchy.

In 1908 the Neo Slav Congress definitely declared that Russian Neo Slavs and Poles should act in conjunction to suppress the movement, a decision which met with no approval from the Austrian Government because Russia and later Austria were then at daggers-drawn in the Balkans and a new viceroy was appointed in Galicia who was definitely anti-Russian. The culminating point was reached in 1914, when it was discovered that the Ukrainian party was and had been for ten years past in close touch with the Prussian *Ostmark Verein* which was opposed to everything Polish. The Galician Poles had realized the complete subservience of Austria to the German Emperor and this produced a great change in their attitude to the Habsburgs, so much so, that the murder of the Archduke was received with almost indecent expressions of satisfaction, because to him was ascribed the success of the Ukraine movement in 1913.

POLAND DURING THE WORLD WAR.—Thus the declaration of war in 1914 found the Poles with no definite national policy. The various political parties were united in that they had one common end in view, the restoration of an independent Poland, but their opinions were divided as to the means of attaining this end. In Galicia the majority of the Poles were pro-Austrian. In Russian Poland the National Democrats, under the leadership of M. Dmowski, were strongly in favour of working for an autonomous Poland under the Russian crown, and this policy seems to have been supported by the majority of the Russian Poles. In opposition to this party was a strong anti-Russian element, of which the most notable supporter was Pilsudski. Having been forced to flee from Russian Poland in 1907 Pilsudski had taken refuge in Galicia, where he had utilized the *sokols* (athletic clubs) and shooting clubs for the purpose of organizing an efficient military force to use against Russia in case of war. At the outbreak of war he mobilized his forces, as the Polish Legion, and, advancing across the border, seized Kielce. The actual military result was of no great importance, but "it soon became clear that his bold decisive action had powerfully impressed the national mind."

On Aug. 14, in answer to the anti-Russian campaign which the Germans had been organizing in Warsaw, the Grand Duke Nicholas issued a proclamation announcing Russia's intention of establishing a united Poland "under the sceptre of the Russian emperor," a Poland which was to be "free in faith, language and in self-government." By the National Democrats this proclamation was welcomed as being the first stage towards the fulfilment of their aims. By the followers of Pilsudski, however, the proclamation was received with no favour: proposals for conciliation with Russia tended only to emphasize Polish divisions.

Polish resistance to the Russians took a political as well as a military form. On Aug. 16 two existing Polish organizations, the Confederation of Independent parties and the Polish Military chest (*skarb*), were merged in the Supreme National Council of Galicia, which contained representatives of all parties in the Galician Diet and Reichsrat. Though the National Council was formed with the object of offering political resistance to the Russians, it was not altogether in agreement with Pilsudski and his legionaries. It was inclined to be monarchical whilst Pilsudski was Socialist Republican. Accordingly the Council laid down the following regulations: The Polish legions were to form a separate Polish command but to be subject to the Austrian Army Command. The Polish language was to be used. Legionaries were to take the Austrian Landsturm oath and F. M. L. Durski, a Pole in the Austrian service, was placed in command. Pilsudski, having taken the oath under protest, was given the command of the first regiment.

At first both the Austrians and the Germans distrusted the movement as they stood to lose should Pilsudski achieve the national independence for which he was working. Austria moreover was hostile to any idea of Polish union and to anything which might lead to increased autonomy in Galicia. Recruiting, therefore, was forbidden. Later the Germans, realizing that the strength of Russia would be decreased as the strength of the Polish legions was increased, allowed recruiting to take place among the Russian Poles.

The Galician situation, however, was somewhat changed by the Russian advance. On Sept. 2 Lemberg was taken by Russian troops and for the moment "the Austrian solution was at a discount." The divisions among the Galician Poles became apparent. By some, who had ties of blood and religion with the Russians, the invasion was welcomed and the new rule accepted with alacrity. The most noticeable effect of the pro-Russian sympathy is to be found in the dissolution of the E. Galician Legion, which took place in Oct. and which caused an estrangement between the Conservatives of the National Committee and the E. Galician Conservatives. Bobrinsky was appointed governor of Lemberg, his policy being that of systematic Russification.

In 1915 the Polish situation was again changed by the military campaigns. On June 22 Lemberg was retaken from the Russians and on Aug. 5 the Germans entered Warsaw: thus German power was established in Russian Poland and Austrian power reëstablished in Galicia. Among the Poles themselves, in 1915, party differences seemed to decrease. In Dec. the Radical Socialist elements formed a central national committee. It was composed of the Peasants' party; the Union of Workers; the Polish Socialist party and the Club of Polish Statehood (*Studnicki*). The aim of the league was to work for independence; it was dissolved in Feb. 1917.

By the beginning of 1916 the Polish Legion was well equipped and in June the brigades totalled 18,000. When the Polish independence parties at Warsaw asked for the nomination of Pilsudski as the commander-in-chief of a Polish army all the concessions previously granted by the Germans were withdrawn. Pilsudski then appealed to the Austrians. The Austrians' ideas with regard to Poland had undergone a slight change, and though suspicious of Pilsudski and his legionaries, the Government decided to encourage them in the hope that a union might be effected of the Polish kingdom and Galicia under Austrian protection. In July Pilsudski felt himself in a position to appeal for concessions regarding the substitution of Poles for Austrians as officers in the legion and for the use of the Polish uniform and colours. There was some delay in considering the question of these concessions and as a protest Pilsudski, together with other officers, retired. The Austrians did make and were prepared to adhere to certain concessions. They therefore negotiated with Pilsudski to withdraw his resignation. At this point, however, the German command interfered and Pilsudski was dismissed on the grounds of insubordination. In Oct. the legions were withdrawn from the front.

The Germans and Austrians were in the meantime trying to arrive at some satisfactory solution of the Polish question. The tendency of the Poles themselves was on the whole pro-Austrian, this tendency being strengthened by the union of the province of Chelm (Kholm) to Poland. The first solution proposed by the Germans was that of an independent Polish state under a Habsburg king. This state was to consist of Russian Poland, Galicia, and those parts of Posen where the Poles exceeded 65% of the population. This solution the Austrians would not accept. It was not clear how much of Poland the Germans were willing to give up, but it was clear that their sacrifice would not be so great as that of the Austrians who were to lose all Galicia. The solution proposed by the Austrians was that of a genuinely independent Poland consisting of Galicia and Russian Poland. This new Poland was to be a third co-equal state with Austria-Hungary. The German Chancellor then issued new proposals and after a Polish deputation had been sent to Berlin to discuss the terms an agreement was brought about and the result was the Decree of Independence of Nov. 5. By this decree the Polish districts "snatched from Russian power" were to form an independent state which was to have a hereditary monarchy and a constitution. The organization, training and command of the Polish army were to be settled by mutual agreement.

From the point of view of the Germans the Polish state was to be closely united to the Central Powers, "especially in military

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matters." Their ultimate aim was to secure additional manpower against Russia. This settlement was not welcomed by Austria. She "had accepted unwillingly the German scheme as to Poland . . . but she hoped by her scheme of Galician autonomy so to embarrass the German settlement as to revive the Austrian solution which Berlin had rejected." [1]

The independence of Poland was acknowledged on Dec. 20 by a joint Allied note and later in 1917 it was acknowledged by the Revolutionary Government in Russia.

The first attempt of the German Government to organize the new state was not successful. General von Beseler (primarily a *savant* and geographer), who as military governor held the chief power, issued a decree arranging for the election of 70 members of the Diet in the German sphere of occupation; eight members of the Council of State were to be chosen by these 70, whilst four others and the chairman were to be chosen by the governor-general; all resolutions of the Council of State were subject to the assent of the two governors-general. The unpopularity of this proposed organization was so great that certain modifications were introduced, and the following scheme adopted: the two Governments were to nominate immediately a council of 25, 15 from the German sphere and 10 from the Austrian; they were to elect their own chairman; they had power to regulate internal affairs and economic reconstruction and were to coöperate in the formation of a Polish army. The Council was composed eventually of 11 Conservatives, but no National Democrats, 8 of the Central party (pro-Austrians) and 6 of the Left (Socialists). It was liable to be over-ruled by von Beseler.

The powers of the Council were fairly extensive. "Education and justice were handed over to them practically without reserve; and for the first time for many years the native tongue was again heard in the schools and in the courts of law. Local representative bodies were called into being in the towns and in the country; and in Warsaw the municipality received control of all the public services, including police, prisons, posts (municipal), public sanitation and hygiene." [2] The finances were handed over to the Council "except in so far as the costs of the occupation" were concerned. A Minister of Political Affairs was appointed but he might hold official relations only with the Central Powers.

One of the first problems facing the new Council in 1917 was that of the economic reconstruction of the country. In his *History of the War*, John Buchan gives the following description of the condition of Poland under the German domination—"The German policy demanded a wholesale destruction and . . . Poland was methodically laid waste. . . . Only blackened ruins marked the site of villages, and since the German army ate up all supplies, famine stalked through the land. . . . The material damage can scarcely be estimated . . . all labour and industry have been swept away." In addition to the devastation, the currency was depreciated and the Customs, which might have provided revenue, were to go to Germany and Austria.

The Council was responsible for the drawing up of a constitution. A committee was formed in which all shades of opinion were represented. It was decided that a Ministry and a Senate should hold office until a genuine National Assembly could be established. As regards political matters the Council demanded that there should be a regent: that they should be given more control over local government: and that existing ordinances should be modified. These demands were not accepted by von Beseler.

The chief question which occupied the Council was that of the army. Pilsudski was attempting to raise a strong national army which would give the Council more chance of enforcing its decisions, but he was not prepared to raise it for German use.

The meeting of Council in which the political demands were formulated took place on May 1. Only unimportant concessions in education and justice were made, therefore on May 17 the Council suspended its functions, though through German intimidation it was forced to resume them on June 9. At the beginning of July three resolutions were passed: proposals for a regency, a Cabinet and a Senate were accepted; a military oath was to be taken exacting loyalty to the Central Powers and to the future king of Poland (thus excluding a republic); and a recruiting appeal was made. These resolutions proved the submission of the Council to Germany, and in protest Pilsudski and five of his supporters resigned.

After the passing of these resolutions on July 3 the Council was discredited. It had failed to cope satisfactorily with the economic crisis and it had failed to produce a practical settlement with regard to the army. As matters stood the army could be used against the Russians but not against the Austrians or the Germans. Finally the Council was discredited by the attitude of the Austrian Poles. The Government had delayed the grant of increased autonomy to Galicia and on May 28 the resentment of the Galician Poles culminated in a conference of Polish members of the Galician Diet and of the Austrian Reichsrat, in which they declared that "the desire of the Polish nation was to have restored an independent and united Poland with access to the sea." On July 30 Polish discontent was further increased by the arrest of Pilsudski, and a month later the Council resigned.

After the failure of the Council a regency project was introduced. By this scheme there was to be a regency of three, a Cabinet and Premier and a Council of State. The Premier and the Council of State were to be chosen by the Regency Council subject to the approval of the Central Powers. The functions of the Polish authorities were limited to education, justice, public welfare, agriculture, and finance as far as it concerned the departments assigned to their care. They might legislate on matters handed over to them but the German and Austrian governors-general had the right of veto within a fortnight of the completion of the bill. The regency had no control over the army.

Such was the position of the Polish Government at the beginning of 1918. The German domination seemed more complete than it had ever been before. In 1916 the Poles could extract concessions from the Germans in view of the fact that their help was needed against the Russians. That help was no longer necessary, therefore concessions were no longer forthcoming.

When the negotiations opened at Brest Litovsk the Polish Government asked the Central Powers to admit its representatives. In spite of "weighty declarations" made at Berlin the demand was ignored and the Poles were excluded from the conference. On Feb. 9 the Treaty of Brest Litovsk was signed. As far as Poland was concerned the important clause of the Treaty was that which ceded Chelm to the Ukraine. On Aug. 17 1917 the Provisional Government of Russia had recognized Ukrainian autonomy. The Ukrainian state was composed roughly of the following territory: the western parts of the Governments of Lublin and Grodno, and the whole of the Governments of Kiev, Poltava, Kherson, Volhynia, Kharkov, Podolia, Yekaterinoslav, and Chernigov and excluded the Austrian Ukraine. On Nov. 20 1917 the Ukraine declared itself to be a republic and on Jan. 11 1918 the delegates of the Ukrainian Republic were formally recognized at Brest by the Central Powers. The territory of Chelm, which was ceded to the Ukraine at this Treaty, had been handed over to Poland by Austria only in June 1916, but its ownership had been disputed for many years and it had already before been in the possession of the Poles.

As a protest against the lack of consideration shown them at Brest the Cabinet, under Kuchazewski, resigned and the Poles issued a formal protest against the violation of their rights. This, however, made little difference to the German policy, which demanded that Poland should "completely give over all those greater hopes which might be inconvenient to Germany." This policy was emphasized later in the year when Adml. von Hintze in a speech to the Reichstag proposed an economic union with Poland on the basis of a Customs union or *Zollverein*, that is to say on the basis of free trade between Poland and Germany.

In April the Poles made a statement of their programme at the Congress at Rome. They declared their aim to be "Reunion into one independent state of all the Polish lands, including those which the Central Empires are refusing to restore to Poland and those which they are bestowing as largess on their vassals." It

[1] Nelson's *History of the War*, xviii., 123.
[2] Butler's *The New Europe*, p. 113.

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was not, however, until the autumn that it seemed possible for them to achieve the end at which they were aiming. In Oct. it became clear that the union of the Poles no longer depended on the wishes of Vienna and Berlin, but rather on the will of the Polish people. In the same month a national Polish Diet was convoked, and in Austria all the Polish parties left the Reichsrat and formed the National Council in Cracow, until there should be "a freely elected Parliament of a United and Independent Poland." On Nov. 10 Pilsudski, having been released from Germany, arrived in Warsaw and the Council of Regency proclaimed that the German occupation had ceased to exist.

AFTER THE ARMISTICE.—The predominating figure in the evolution of the new Polish state was that of Pilsudski, who, on the abdication of the Council of Regency, took the Government of the country into his hands and succeeded in overcoming the internal and external dangers which faced the country after the German collapse.

Pilsudski was by birth a Lithuanian Pole. In 1885 as a student of medicine at Kharkov University he became connected with the Socialist movement and three years later was banished for complicity in the attempt on the life of Alexander III. though in reality he had been strongly opposed to the plot. In 1893 he returned to Poland and became one of the chief founders of the Polish Socialist party in Russian Poland. The aim of this party was the independence of Poland. In 1900 he was arrested on account of his socialistic writings but he escaped to London, after simulating madness, and two years later returned to Poland. At this time he and his associates "adhered to Socialism because they recognized in it the only powerful revolutionary and democratic force of our time and their supreme aim was, by revolutionary means to win Polish Independence."

In about 1904 Socialism in Poland became a wide popular movement. Pilsudski was responsible for organizing the military element in the new party. Primarily this took the form of the "Fighting Organization" but later systematic military instruction was given by means of Rifle Clubs, with the object of establishing a force which would be used in armed revolution against Tsarist Russia. The war gave them their chance and at its outset they fought against Russia, for "the fight against Tsardom had become to them a second nature." In 1915, however, Pilsudski stopped recruiting for his Legions, his aim being not to raise an army which was to be used for the purposes of Germany and Austria, but one which would ultimately become the army of an independent Poland. With this object in view Pilsudski created the "Polish military organization." This organization was carried on secretly and was concerned chiefly with spreading propaganda in favour of a struggle for a Poland independent both of Russia and of the Central Powers. In 1916 after conflict with the Austrian commanders Pilsudski sent in his resignation. The Austrians refused to allow his resignation but when he withdrew his brigade from the front without any previous warning, the Germans insisted upon his dismissal.

After the declaration of Polish independence Pilsudski was called upon to help in the formation of a Polish army, but this he refused to do, on the principle that a Polish army must not be formed without a true Polish national Government to direct it. In the summer of 1917 he demanded concessions from the Germans, and, in view of the feeble attitude taken up by his colleagues, he withdrew from the Council, at the same time ordering his followers in the Legions to refuse to take the oath. As a result about four-fifths of the Legion were disbanded. He was arrested subsequently by the Germans and imprisoned at Magdeburg. During his imprisonment the Polish military organization continued to develop secretly and when Pilsudski was released by the German Revolution in Nov. 1918 this organization formed the basis of the Polish army.

When Pilsudski returned to Poland in Nov. he found the country confronted with serious dangers. There was no effective Government, the Council of Regency having been dependent upon German control; the anarchy in Russia threatened to spread into Poland, and finally the danger was augmented by the 30,000 rebel German troops which were still in the country. On Nov. 14 the Council of Regency abdicated, leaving the supreme power in Pilsudski's hands. His first work was to establish an army on the foundations laid by the Polish military organization. Through the prompt formation of the army the danger from the German troops was removed and the Bolsheviks were temporarily held back. Pilsudski's next work was to constitute a Government. "Only a Left government," it was well said, "with a programme of constructive democratic reform, could retain authority in the State. Pilsudski therefore formed the Labour Government of M. Moraczewski, and so forced the Left in this critical hour to undertake positive work instead of fruitless opposition and chaotic revolt."

At the end of 1918, therefore, Pilsudski had become the head of the Polish State. The fundamental principle which underlay his policy throughout this period was that of pushing on the Polish State in the "path of modern organic social and political life." He realized that it was social reconstruction, not social unrest, which would consolidate the new state and enable it to hold its own against the anarchic elements which threatened its existence. In the *New Europe* in June 1920 Pilsudski's achievements were thus described: "Socialist, agitator and Leader: Brigadier-General in the Austrian Army: Head of the Polish State: the changes are kaleidoscopic. He has now undoubtedly ranged behind him the great majority of the Polish people, including some of his old enemies, the National Democrats; and this success is one of the greatest tests of his ability, because Poland contains at least a score of political parties."

The first political event of importance in 1919 was the formation of a new Cabinet under M. Paderewski. At the beginning of the year there had been elements of discord between the Government at Warsaw and the Polish National Council which had been formed during the war in Paris, and of which M. Paderewski was the most prominent member. At the beginning of Jan., however, an agreement was made and when M. Moraczewski resigned his office as Premier, Paderewski succeeded him. The chief difficulties which faced the new Cabinet were that of the Bolshevik advance and the economic condition of the country of which the worst feature was famine.

At the beginning of Feb. a general election for a Constituent Assembly was held, and resulted in a victory for the non-Socialist parties, supporting Paderewski. The actual figures are reported to have been: Ministerial party 400, Socialists 80, and Jews 15.

In the summer of 1919 Paderewski, as Premier, was responsible for laying the Treaties of Peace before the Polish Parliament. The terms concerning Poland were briefly as follows:—Poland received the larger part of Posen and part of W. Prussia. A plebiscite was to determine the settlement of Masuria and Upper Silesia. Danzig was to be a free city under the protection of the League of Nations. This city was to be included within the Polish customs frontiers and its foreign relations and the protection of its citizens abroad were to be entrusted to Poland. "Poland also received the right of freely using and of developing and improving all water-ways, docks, and wharfs within the territory of the free city; and the control and administration of the Vistula river, and, subject to some restrictions, of the railway, postal and telegraph systems of Danzig." The actual details were to be settled later by a treaty between Poland and the free city. A provisional boundary was laid down between Poland and Russia, roughly corresponding to the course of the Vistula. In addition to these territorial changes, it was agreed to embody in "a treaty with the Allied and Associated Powers such provisions as may be deemed necessary by the Powers to protect the interests of inhabitants of Poland who differ from the majority of the population in race, language or religion," and also "such provisions as they may deem necessary to protect freedom of transit and equitable treatment of the commerce of other nations."

The clauses concerning Danzig, and the plebiscites for Masuria and Upper Silesia could not fail to be met with disfavour in Poland as the territories were claimed as being Polish either historically or ethnographically. Moreover, the Poles resented the suggestion that they would oppress the national minorities in the country, and felt that the inclusion of this clause was unnecessary.

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In spite of these objections, the Peace Treaty was passed by the Parliament on Aug. 1 by 285 votes to 41.

At the end of Nov. a bill was drafted with proposals for a new constitution. It was proposed:—that the vote should be given to all citizens of both sexes over 21; that the National Assembly should be elected every four years; that there should be a bicameral form of Government, the Senate being quite small; that the President should be elected every seven years and that his powers should be considerable. The actual constitution was not finally drawn up, however, until March 1921.

In Dec. a political crisis took place, resulting in the resignation of M. Paderewski. It was decided by the Allied and Associated Powers that Eastern Galicia should be given autonomy for 25 years under the protection of Poland, after which settlement was to be made by plebiscite. Although the majority of the inhabitants of Eastern Galicia were Ruthenians the Poles claimed the territory and this decision of the Powers caused an outcry in Warsaw. Paderewski's explanations carried no conviction and he was forced to resign. On Dec. 15 it was announced that M. Skulski would form a Ministry.

During 1919 the Poles, with Gen. Pilsudski as their commander-in-chief, were engaged in three wars. Two of them, with the Ukrainians and the Czechoslovaks, were not of great importance. Hostilities were started with the Ukrainians on account of the disputed territories in Galicia. At the beginning of the following year a settlement was made after which the Poles and the Ukrainians joined forces to fight the Bolsheviks. The dispute with the Czechoslovaks was also on the subject of disputed territory. The duchy of Teschen, though small, is valuable because of its coking-coal and thriving industries, and for this reason both Poles and Czechs were anxious to possess it. In the summer of 1920 the dispute was settled by a decision of the Council of Ambassadors, which awarded to the Czechs the whole mining region and the chief railway running through the territory. As a result the town of Teschen is cut in two.

The third and most important war was that with the Bolsheviks. The war was caused by the German troops evacuating the eastern territories in a way which was contrary to agreement and which allowed the Bolsheviks to occupy the territory before the Polish troops could be brought up. The local population in the occupied zones appealed to the Poles for aid and, as a further advance seemed imminent, the Poles were forced to fight. The Poles have been accused of entering into this war with the Bolsheviks with imperialistic and aggressive aims. It seems clear, however, that this was not the case. The Polish army was small and was engaged in hostilities elsewhere and the financial and industrial condition of the country was such that unnecessary war would not be undertaken.

The policy of the Allies throughout 1919 was vacillating. At first direct military intervention was attempted but was given up. Later ammunition and war materials were sent to Denikin and Kolchak. Finally the " barbed-wire " policy was suggested, in which Poland was to play a leading part among the states which were to act as a barrier round Russia. This policy, however, lasted only 28 days.

In the autumn the Bolsheviks were prepared to make peace, on Poland's terms, and an armistice was suggested. M. Paderewski was advised by the Allied Powers to refuse these terms and to continue fighting. By the end of the year no further negotiations had been proposed.

During 1920 Poland " served as the centre of the resistance to the spread of Bolshevism," and her political history is very much bound up with her military history. In the spring there were some more peace negotiations, but as before these came to nothing. On April 27 a strong Polish offensive was begun, chiefly to the S. of the Pripet marshes. The Poles advanced rapidly, capturing guns and war material, and on May 8 they entered Kiev. The Bolsheviks, owing to the defeat of Kolchak and Denikin, were now able to concentrate all their forces against Poland and in May opened a counter-offensive campaign. There was serious fighting between the Dnieper and Dvina and the Poles were forced to retreat.

In June a change of Government took place, a non-party Government being formed by M. Grabski. In view of the continued retreat of the Poles the Premier was sent to the Spa Conference to ask for help from the Allied Powers. In July Lord Curzon, as representative of the British Government, proposed negotiations on the basis of the acceptance of the provisional boundary laid down by the Peace Conference, corresponding roughly to the boundary of the Governments of the Vistula. On July 20 these terms were refused by the Bolsheviks.

In Warsaw another change took place in the Government, a War Cabinet being formed, which consisted of M. Witos, M. Daszynski, M. Grabski, M. Skulski, with Prince Sapieha as Foreign Minister. The policy of the new Cabinet was " to defend the full independence of the Polish Republic and conclude a just and lasting peace."

The Bolshevik advance had, in the meantime, been steadily continuing and by Aug. 14 they were within 12 m. of Warsaw. Even if Warsaw had fallen it is possible that the Poles might have made a successful resistance, based upon the western province of Posen, which is in many respects the most important province of the new state. The end of July and the beginning of Aug. saw further attempts for peace. On July 30 Polish officers were allowed to cross the Russian lines to conclude an armistice but they were forced to return with nothing accomplished as they were not authorized to sign the preliminaries of peace with which the Bolsheviks presented them. At the beginning of Aug. a peace conference at Minsk was arranged. As made known to Mr. Lloyd George the chief terms proposed by the Bolsheviks were: the reduction of the Polish army to 50,000, together with a small civic militia; the surrender by the Poles of all arms and war materials with the exception of those necessary for the reduced army; and the demobilization of all war industries.

Owing to Russian procrastination the peace conference was not held until Aug. 17, by which date the military situation had changed with remarkable rapidity. The Russians had advanced too fast and too far and were not prepared for any sudden counter-offensive. When Gen. Pilsudski, therefore, organized a general counter-attack the Bolshevik armies collapsed and retreated in disorder. By Aug. 21 the Poles had entered Brest Litovsk.

When, on Aug. 17, the conference opened at Minsk it was discovered that there was a difference between the terms actually offered by the Bolsheviks and those previously transmitted to Mr. Lloyd George. The terms relating to the civic militia were considerably enlarged. It was in reality to take the form of a force of armed trades-unionists, 200,000 strong and organized after the regular Soviet pattern. In short it was an attempt to foist Bolshevism on to Poland. The military situation, however, made it impossible for the Russians to enforce their terms.

In Sept. negotiations were moved to Riga, where on Oct. 12 the final treaty was signed. In the N. Poland obtained direct access to Lettland on the Dvina above Dvinsk. The Poles obtained Baranovichi, Pinsk, Kovel, Rovno and the whole extent of the Baranovichi–Rovno railway. With these boundaries the area of the new state is about 148,000 sq. m., and the population about 30 millions, but of this no accurate estimate can be yet formed. Poland ranks as the sixth state of Europe in size and population, and is by far the most important of the new states which the war has produced in eastern Europe.

In addition to the war with the Bolsheviks Poland was concerned with other foreign affairs. The treaty between Poland and Danzig was signed in 1921 but in the meantime there was " an unhappy amount of friction between the Poles, the Germans of Danzig and the British High Commissioner representing the League of Nations." The Poles in Danzig were frequently mobbed and in the summer of 1920, during the crisis in the Bolshevik war, guns and war material sent from the Allied Powers were held up in the port by the people of Danzig.

After Sept. 1920 there was friction with Lithuania. When the Bolsheviks retreated from Vilna both the Poles and the Lithuanians claimed the city, the Poles on the grounds of the language and population, the Lithuanians on the grounds of historical tradition. The Lithuanians at first took possession of

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Vilna but later Zeligowski with an army of White Russians turned out the Lithuanians and established an independent Polish Government.

THE JEWISH QUESTION.—One of the most important questions to be considered by the new Polish State is that of the Jews. Numerically they form roughly one-seventh of the population. In Warsaw a third of the population are Jews: in many provincial towns four out of every five inhabitants are Jews and in some nine out of ten, and of these the vast majority are Eastern Jews who in language, religion and customs differ from the population. Their language is Yiddish, a Middle-High German dialect; for the purposes of writing, Hebrew characters are used. Their dress is peculiar to themselves and their unclean habits and low standards of conduct "are neither European nor modern." The Western Jew is the more civilized type which is generally found in western Europe, speaking the language and conforming to the habits of Western civilization.

The Eastern Jew is essentially a business or commercial man, but rarely a producer. He is usually a middleman or intermediary. In towns the majority of the shops are owned by Jews, but they are a race apart, hated and despised by the rest of the population, devoted to their religion, which is a primitive type of Judaism.

The Jews have been settled in Poland between 800 and 1,000 years so that they can hardly be considered "strangers" in the land, in fact the Slavs cannot be considered very much more native than they. It was not, however, until about 20 years ago that the present quarrel between the Jews and the Poles began. The Tsarist Government drove the Jews out of Russia but gave them exceptional advantages in Poland. These Litvaks (as they were called) openly professed themselves the partisans of Russia and founded the Jewish press which set to work openly to fight against Polish autonomy. The Poles attacked the Jews before the war by means of a national boycott, the only means by which one subject race could attack another. During and after the war the hostility to the Jews was increased by the fact that in the German occupation the Jew was the willing tool of the invader, and by the close connexion between the Jews and Bolshevism. The hostility to the Jew was marked in 1918 and 1919 by excesses in which some 200–300 have in fact been killed, but which have been enormously exaggerated by the Jewish press.

The following recommendations for the future treatment of the Jews in Poland were made by Sir Stuart Samuel in his report on his mission to Poland (Cmd. 674, 1920):—That the Polish Government be urged to carry out the clauses of the Minority Treaty of June 28 1919, in a spirit of sympathy with its Jewish subjects. That a genuine and not a "masked" equality be accorded to the Jewish population of Poland. That all outrages against the person and property of the subject, irrespective of race or religion, should be promptly punished and the names of the delinquents published. That the Jews in E. Galicia be restored to their official positions in the same manner as non-Jews have been. That no restrictions should be placed upon the number of Jews admitted to the universities. That a decree be published declaring boycotts illegal, and ordering all publications advocating boycott to be suspended. That all prisoners in internment camps be brought to immediate trial, and that humane treatment be assured to all interned prisoners. That facilities be afforded for the introduction of new industries into Poland with a view to converting a larger proportion of the Jewish population into producers. That the British Government should assist Jews wishing to emigrate from Poland by providing facilities to proceed to countries such as Palestine, Canada, S. Africa, Algeria and S. America, or any other country desiring to receive them. That banks be established possessing the confidence of the Jewish public, so that money might be deposited therein instead of being carried on the person or concealed in dwellings. Finally, that the desirability of a secretary who understands and speaks Yiddish being added to the staff of H.M. Legation at Warsaw be considered.

Capt. Peter Wright, in his very valuable and interesting report states (Cmd. 674, 1920, pp. 17–36) that the great majority of the poor Jews are of the Eastern type and extreme orthodoxy (Chassidin). They form an immense mass of squalid and helpless poverty and Capt. Wright's only recommendation is that the richer Jews should study the condition of the poor Jews who either trade as small middlemen, as hawkers or touts, or labour as unskilled, or almost unskilled, and fill the sweating dens as sweaters or sweated when they emigrate. They are driven into all sorts of illicit and fraudulent practices and in England, in the East End of London, too large a proportion of convictions for such offence can be laid to their account. They are unfit for the modern economic world for want of education and for Western society because of their habits and want of cleanliness. They are devoted to their strange old religion but as they grow rich their piety, as the Chief Rabbi told Capt. Wright, is destroyed by wealth and they take too little interest in their poorer brethren. No one who knows Poland can be surprised at the Polish attitude or the desire of the Poles to be rid of this corrupting influence.

POLAND IN 1921.—It was still impossible in the autumn of 1921 to make any final or definite statement with regard to the boundaries of Poland; as regards Lithuania the situation remained unsettled, and it was only in Oct. that a decision favourable to Poland in respect to Upper Silesia resulted from the award of the League of Nations (*see* SILESIA).

Working on the principle of national rights it was attempted at the Peace Conference to make the boundaries of Poland conform to ethnographic divisions. A commission was appointed, under M. Cambon, which was to deal with the Polish question and submit drafted proposals to the Supreme Council. The first report of the commission concerned the western boundaries, the proposals being as follows:—The larger part of Posen and Upper Silesia should be transferred to Poland, "leaving Germany the western, predominantly German-speaking districts of both territories." According to the German census of 1910 the Poles formed about 65% of the population in the two areas ceded to Poland. In addition Poland was to be given "the central and eastern zones of the province of West Prussia, including both banks of the lower Vistula and Danzig," though racially the latter was distinctly German. The settlement in the case of the district of Allenstein, that is to say the southern zone of E. Prussia, was to be referred to a plebiscite.

These proposals were not accepted without modification, as it was urged by Mr. Lloyd George that they were terms to which the Germans would never agree. In the first place a modification was made with regard to the territory round Marienwerder on the E. bank of the Vistula. Instead of being transferred to Poland outright this territory was to be subjected to a plebiscite. More important, however, was the change introduced in the matter of Danzig. It was decided that Danzig and the small adjacent district were to form a free city under the protection of the League of Nations. Poland received the right of freely using all the waterways, docks and wharfs and was to have the control and administration of the Vistula river. Later a third modification was made with regard to Upper Silesia, when it was decided that in this territory too there should be a plebiscite.

The results of the plebiscite in the Marienwerder and Allenstein districts were in favour of Germany, a result which was largely due to the number of Germans who were imported into the territory. The plebiscite in Upper Silesia was likewise in favour of Germany as a whole, though in many districts there was an immense Polish majority.

The southern boundary of Poland is that of Galicia. In the N.E. the boundary between Poland and Lithuania was still unsettled in 1921 and the Poles were still in possession of Vilna, the capital of Lithuania.

With regard to the eastern boundary between Poland and Russia nothing definite could be settled at the Peace Conference as there was no recognized Russian Government with which to carry on negotiations. In order to facilitate the work of the Warsaw Government in organizing local administration in the part of Russian Poland which was certain to be ceded by Russia, a provisional eastern boundary was proposed which would include all the territory which might be regarded as having "an indisputably Polish ethnic majority." All the territories to the W. of this line were to belong unconditionally to Poland, whilst the territories to the E. were to be settled by future negotiations with Russia. Roughly speaking this provisional boundary corresponded to the old boundary of the Governments of the Vistula. This provisional boundary has since become known as the "Curzon Line." When the Poles appealed, in the summer of 1920, for help against the Bolsheviks an attempt was made by the British Government to secure peace. Lord Curzon, acting on behalf of the Government, proposed the acceptance of this line as the basis of the peace terms. The Poles being unwilling to sacrifice lands which were inhabited by an incontestably Polish population would not agree to this settlement and were later, at the Treaty of Riga, able to conclude peace with the Bolsheviks on more advantageous terms.

As finally settled at Riga on Oct. 12 1920 the line of the eastern boundary is as follows: Starting from the border of Latvia the line takes a south-easterly direction to Dzisna (Disna), thence S. passing very slightly to the W. of Dokszyce (Dokshitsi); it passes some 30 km. W. of Minsk and, farther S., 90–95 km. E. of Pinsk; it proceeds almost due S. and then slightly S.W. to Ostrog; for

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some 40 km. it continues in a south-westerly direction and then goes almost due S. again till it reaches the river Zbrucz; the boundary follows the line of this river until it reaches the Dniester, which separates Poland from Rumania.

Constitution.—Poland is a Republic. The legislative power is given to a Diet and a Senate, which are summoned, adjourned and dissolved by the President. The Diet is composed of paid members elected for five years, upon a system of proportional representation. Suffrage is universal—all who enjoy full civic rights and who are over 21 being qualified to vote, but, since voting is personal, soldiers on active service are excluded. Citizens over 25 are eligible for election to the Diet with the exception of members of the Civil Service, who cannot be elected for the district in which they hold office. The minimum age for voting in senatorial elections is 30, whilst no one under 40 is eligible for election.

Bills go to the Senate after being passed by the Diet and if no objection is raised within 30 days the bill becomes law. Amendments are considered and voted on by the Diet. With regard to finance—a budget is fixed each year for the following year; taxes and customs duties can be established only by law and a supreme court of control superintends the management of state finance.

The executive power is exercised by the President and a council of ministers who are responsible for his official actions. He is elected for seven years by the National Assembly, that is, the Diet and Senate acting together. Laws are to be signed by him and by the President of the Council and the minister concerned. The President has the supreme power in the army, except in time of war when the Minister for War is responsible for all military affairs. The President can declare war and make peace only with the consent of the Diet. He has the right of pardon.

For purposes of administration Poland is to be divided into palatinates, districts and urban and rural communes, these forming the units of local government. Economic autonomy is established by means of chambers of agriculture, commerce, industry, etc., which will together form the Supreme Economic Chamber of the Republic, the competence of which required further legislation.[1]

Judges are nominated by the President whilst justices of the peace are popularly elected. Judges can be removed from office only in certain legal cases and following a judicial decision. All citizens are equal in the eyes of the law, protection of life, liberty and property being assured to all inhabitants. State protection is given to labour and insurance for unemployment, illness and accident is guaranteed. Roman Catholicism is the recognized religion of the country but others are allowed provided they are in accordance with the law.

Land must be cultivated from the point of view of public utility. The law is to decide to what extent citizens and independent associations may cultivate the land and exploit its mineral wealth, and in what cases the state may repurchase property to improve the value of its production.

Poland in 1921

Population.—It was still impossible in 1921 to give any accurate statistics with regard to the Polish population of Poland, etc., since the establishment of the new state. The following are the statistics of 1910.

Russia:—	
Kingdom of Poland	9,100,000
Lithuania and Ruthenia	2,438,000
Empire	460,000
	11,998,000
Austria Hungary:—	
Galicia	4,672,000
Spioz Orava, etc.	200,000
Teschen	235,000
Bukovina	36,000
Other provinces	36,000
	5,179,000
Germany:—	
Posen	1,291,000
W. Prussia	604,000
E. Prussia	286,000
Silesia	1,338,000
Westphalia, etc.	580,000
	4,099,000
Different countries of Europe	100,000
Europe	21,376,000
Outside Europe:—	
N. America	3,100,000
S. America	100,000
Other parts of the globe	30,000
	3,230,000
Grand total	24,606,000

[1] A law was passed by the Diet in 1919 providing that the state should buy land from the nobles and distribute it to the Polish peasantry. Owing to the want of money the law has hitherto been in suspense. The execution of this law might eventually fall under the Chamber of Agriculture.

Economic Development.—In considering the economic development of Poland the following territories are included: the kingdom of Poland, parts of E. and W. Prussia, Posnania, Silesia and Galicia.

Agriculture.—The majority of the people of these lands, with the exception of Silesia, were engaged in agriculture before the war; the percentage being 56·6 in the kingdom of Poland, 54·1 in Posnania, 49·9 in W. Prussia, whilst in Galicia there were 71 agriculturists per square kilometre.

Arable land predominated. The most important crops were rye, oats, barley, potatoes, wheat and sugar-beet. Agriculture was most highly developed in Prussian Poland where the latest agricultural implements and scientific manures were employed. The breeding of domestic animals, especially horses, showed distinct progress before the war. In the kingdom of Poland pig-breeding was particularly encouraged. Cattle and pigs were most numerous in Posnania and W. Prussia while in Galicia the horned stock were well up to the average for Austria in general.

Of the percentage of area under forest, there was in the kingdom of Poland in 1909 some 18%, in Galicia (1912) 25%, in Posnania 19%, W. Prussia 22% and in Upper Silesia 28%. In E. and W. Prussia more than half the forest area belonged to the state, in Posnania about a third, in Silesia only about 12 per cent.

The kingdom of Poland had 17 agricultural syndicates in 1909, for selling agricultural products and buying machinery, manures, etc., the most important of these being the Central Society of Agriculture, founded in 1907. These societies were most developed in Prussian Poland, particularly in Posnania, where in 1913 there were 388 Polish agricultural societies. There were also numerous coöperative societies. Galicia also possessed agricultural, coöperative and mutual insurance societies.

Minerals.—The most important production in Galicia was that of petroleum, which was estimated, in 1914, as being 3% of the world's output and 9% of that of Europe, including Russia. The petroleum industry has attracted an abundant flow of international capital and has thus been able to adopt every device for profitable exploitation.

The chief coal-fields are those of Silesia where the production in 1911 was some 36 million tons, while that of Galicia was 1½, and that of Poland 5¾ million tons. Other notable mineral industries are those of iron, zinc and lead.

Manufacture.—Of industrial workers Upper Silesia possessed the largest number: 47·7% of its population were engaged in industry (1907). In the kingdom of Poland this proportion was only 15·4% (1897), in Galicia 8·8% (1900), Posnania 23·4%, W. Prussia 24·1% (1907). In the kingdom of Poland the most important industry was the textile, which occupied about 150,000 workers. Cotton manufactures were the most important, wool being second. Before the war this industry was handicapped by the high tariff charged by the Russian Government for the transport of raw material. Second in importance was the metallurgical industry, the most important manufactures being machinery, boilers, materials for bridge building, nails, wire and sheet iron. The manufacture of machinery was of considerable importance in Silesia but less developed in Galicia.

Of other industries that of the potato by-products is most important. More than a quarter of the potatoes produced in Posnania and the greater part of those of Galicia were used for the making of alcohol. Before the war the wood industry was in a poor condition owing to severe German importation duties on manufactured wood, but these duties encouraged the development of the saw-mill industry in Prussian Poland. The coastal fisheries of E. and W. Prussia are of considerable importance; likewise the pond fisheries in Poland, but fishing is generally only a subsidiary occupation.

The industry of Poland was very much influenced by the Jewish population. In the kingdom of Poland before the war nearly 15% of the population was Jewish and the following trades were more or less in their control: leather goods and the boot trade; stocking industry; manufacturing of the so-called "astrakan" caps; malt refuse breweries and small mead breweries; manufacture of paper tubes for cigarettes; and potato starch.

Towns.—The chief towns in the kingdom of Poland were Warsaw, Lodz and Sosnowice—which had over 100,000 inhabitants. The principal towns of Galicia are Lemberg (206,000), Cracow (154,000), Przemysl (54,000) and Kolomea (44,000). In 1910 E. Prussia had five towns with a pop. of more than 20,000: Königsberg, Tilsit, Memel, Allenstein, Insterburg. There were in W. Prussia three towns with upwards of 20,000 inhabitants: Danzig, Thorn and Graudenz. In Posnania there is an unusual number of small towns, but there are only nine with more than 10,000 inhabitants; the most important are Posen (154,811 in 1910), Bromberg (70,000), Schneidemühl (27,504), Lissa (17,156). Silesia has seven towns with a pop. of more than 50,000: Breslau (537,000), Görlitz (86,000), Königshütte (72,000), Liegnitz (69,000), Beuthen (67,000), Gleiwitz (64,000) and Zabrze (59,000).

Communications.—Of the natural water-ways in Poland the Vistula is the most important. It has 21 tributaries, of which the total length, with that of the river itself, amounts to 7,770 kilometres. In 1864 a convention was made between Russia and Austria for the regulation of the course of the river; in Austria 64·47% of the work was completed by 1909, in Poland 39·7 per cent. Thus in Poland the Vistula is almost impossible for regular steamer traffic.

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The Niemen is navigable from about halfway between Grodno and Kovno to the Prussian frontier. The Pilitsa is navigable for rafts from a point near Novo Radomsk to its junction with the Vistula, so for a small portion of the year is the Bug from the point where it first touches Poland and likewise the Narew for a considerable distance. The Oder affords the products of Silesia an outlet not only to Stettin near its mouth, but also to Berlin and Hamburg with which it is connected by an extensive system of water-ways. The Dniester is used in Galicia only for rafting timber. The chief canals are the Dnieper-Bug Canal; the Augustowo Canal, uniting the Vistula to the Niemen through the Narew; and the Bromberg Canal, uniting the Brahe to the Netze and thus the Vistula to the Oder. Of these the latter is the only canal navigable for large boats and steamers. As regards railways, in 1912 the kingdom of Poland had 2·9 km. per sq. km., the Polish provinces of Prussia had 9·27 km. and Galicia (1911) 5·24 kilometres. As the railways were constructed for the most part from a strategical point of view, industry did not benefit so much from them as it might otherwise have done. The poor railway system between Russia and Danzig was one of the causes of the decline of the trade of that port.

Trade.—With regard to commerce—the kingdom of Poland was closely attached to Russia by the protectionist system introduced in 1877 and this made trade with other countries difficult. The interchange of goods with Russia was about 2½ times greater than that with other countries. The following were the chief exports: textiles, three-quarters of which went to Russia, though trade with countries further E., notably Persia and Mongolia, was increasing; clothing and boots, which found their chief markets in Russia; horses, poultry and eggs. The chief imports of the kingdom of Poland were:—raw wool and cotton from overseas and from Russian Turkestan; iron ore and pig-iron from Russia; cattle from the steppes; and flour from Russia. In 1909 over 1·4 million q.m. of Russian flour was imported, this forming a formidable competitor to Polish milling thanks to special transport rates.

Galicia was united to the fiscal territory of Austria in 1784 and her commercial interests were generally subordinate to the will of the more powerful states of the west. The principal customer of Galicia was Germany. In 1909 the exports of Galicia to Germany amounted to 10·6 million q.m.; the imports from Germany to 6 million q.m. The chief exports were salt and petroleum and wood. The chief imports were:—textiles to the value of about 300 million francs; iron and iron goods from Germany; coal, of which 7½ million q.m. was imported in 1908.

The industry of the Polish provinces of Prussia began to decline after they were assimilated to the German hinterland. On the other hand, the protective custom tariff acted beneficially on agriculture and the trade in provisions. The principal customers of Posnania were the other states and provinces of Germany. The chief exports were sugar, alcohol and cereals. There were exported annually from 1885–1908 250,000 q.m. of wheat, 2,000,000 q.m. of rye, 410,000 q.m. of barley and 210,000 q.m. of oats. The rye was sent to Bohemia, Austrian Silesia and the kingdom of Poland, rye meal to Scandinavia, Belgium, Holland and Finland. Except for the products of local agriculture and forestry these provinces were entirely dependent on outside sources.

Coöperative credit societies developed vigorously and by 1913 they had together over 75,000 members and deposits of over 202 million francs. The Coöperative Societies' Bank, founded in 1910, formed a financial centre for the societies. With regard to savings banks, by the end of 1912 there were in Galicia 53 banks with deposits amounting to 336 million francs. In Prussian Poland coöperative societies were established on the principles of Schulze-Delitzsch and on the Raiffeisen system—after 1900 buying and selling societies were founded. The Polish credit institutions in Prussia, deriving their capital solely from Polish sources, had at disposal the sum of 498,631,000 francs.

The war left Poland in "a pitiable economic situation." The country was devastated in the first years of the war and then its resources were drained by the German occupation. The mobilization of Polish industry depends on currency stability, improved transport conditions and an abundance of available coal. The following statistics show the number of industrial workers employed before the war and on Jan. 1 1920:—

	Before the war	Jan. 1 1920	Per cent as compared with pre-war figures
Mining	28,300	36,900	130
Metallurgical	18,650	5,450	29
Metal	52,415	7,151	14
Mineral	40,900	12,200	30
Textile	168,016	38,900	23
Paper	7,000	4,000	57
Chemical	8,550	3,220	38
Tanning	8,020	2,614	32
Provisions	33,200	14,370	43
Wood	9,540		
Total	374,591	124,805	34

It will be seen that the coal industry has, in spite of housing and provisioning difficulties, increased from the pre-war standard. The production of coal in Congress Poland and Galicia does not suffice to cover the requirements of the countries at present constituting the Polish State. The Reparations Committee assigned to Poland only 250,000 tons of coal per month from Silesia; and the Polish Coal Sub-Committee has granted a lump sum of 450,000 tons of coal. This lack of coal is one of the most serious hindrances to the reorganization of Polish industry.

The oil industry was not much devastated by the war, but for the first five months of 1919 the Boryslaw-Truskawiec basin and that of Bikhov were under Ukrainian administration, and oil had to be used instead of coal for working the shafts. In 1920 about half the textile industry had been mobilized and many factories started in Lodz and also in Czenstochowa, Kalisz and Bielsk. In 1919–20 the output of sugar scarcely amounted to 65% of the expected output, *i.e.* instead of 500,000 q.m. only 350,000 q.m. were produced. The iron foundries came to a standstill during the war and no plant was left without some essential part wanting. In July 1919 the first blast furnace started work and by the beginning of 1920 a few others were in working order. Steel production is hampered by lack of coal.

Finance.—The revenue of the Russian Treasury of the Kingdom of Poland in 1912 amounted to about 609 million francs and the expenditure amounted to about 371 million francs. From 1905 to 1912 inclusive, the excess of receipts over expenditure in the Kingdom amounted to 1,034 million francs. State officials administered the finance of 116 towns in the Kingdom of Poland. The revenue of Warsaw according to the budget of 1914 was 39 million francs. The rural communes possessed a limited autonomy. In Galicia the largest item contributed to the Austrian State was from the taxes on consumable articles and monopolies. The total receipts were 42·37 francs per inhabitant and the expenditure 26·90 francs per inhabitant. As regards the finance of Galicia as an autonomous province, in 1911 the expenditure amounted to 66 million francs, derived mainly from taxes on articles of consumption and provincial surtax on direct contributions. In the 74 autonomous districts the income amounted to 12 million francs, derived from the surtax on direct contributions and the tolls of the districts. The budget of Lemberg was over 11 million francs and that of Cracow nearly 9 million francs. In Prussian Poland the finance of the Empire was based on indirect contributions, customs yielding the largest return. In Prussia direct contributions played the most important part, the income tax producing 9 million francs in Posnania in 1911, and 7 million francs in W. Prussia. The total of the autonomous taxation of the province, districts and communes amounted to 24 francs 35c. per head in Posnania and to 30 francs 01c. in W. Prussia.

In the Kingdom of Poland the chief bank was the State Bank. In 1914 there were 38 private branches accredited to it, five branches of Petrograd large banks and five branches of the Riga Bank of Commerce. In Galicia the most important were the Austro-Hungarian Bank, with 13 Galician branches and 20 branches of Vienna and Tchek Banks. Branches of the Reichsbank and of large German Banks protected the German element in Russian Poland. In addition to these there were joint stock banks for credit for short periods. In the Kingdom of Poland there were nine; the deposits amounted to over 296 million francs in 1914. In Galicia the Mortgage Bank was the largest joint stock bank, which in 1912 discounted bills of exchange for 178 million francs. In Prussian Poland the most important was the Bank of the Federation of Coöperative Societies, which had a capital of 29 million francs in 1916. Credit for long periods depended, in the Kingdom of Poland, on the Land Credit Society and the Peasants' Bank; in Galicia, on the Land Credit Society and the Commission of Rentengüter, and in Prussian Poland chiefly on coöperative credit societies.

Finally Poland was in a crippled condition financially. The mark which was at 40 to the pound sterling in 1919, touched a new low record on June 28, 1921—namely 6,400 to the pound, and after that fell for two days to 9,000 to the pound. This rate of exchange prevented Poland from trading internationally and consequently hindered her economic reconstruction. On July 30 the Polish budget for 1921, the first real balancing of expenditure and revenue produced by any Polish finance minister, was presented to the Diet and showed a deficit of 80,000,000,000 marks (the exchange on that day being about 8,000 to the £) for Russian and Austrian Poland without the Polish part of the Austrian duchy of Teschen. The former Prussian provinces which only came under the Ministry of Finance on Sept. 1 1921 have a surplus of 6,000,000,000 marks which reduces its national deficit to 14,000,000,000 marks.

The Ministry of War was responsible for 30% of the expenditure, railways for 21% of the expenditure and food supplies for some 10%. But it may be said that the existing low rate of exchange gave no real indication of the prosperity of the country. Polish indebtedness was not great (about £6,600,000 at the exchange of July 30 1921), the productive capacity of the country was increasing, and the harvest prospects were excellent.

REFERENCES.—The one indispensable introduction to things Polish for English readers is the little volume entitled *Poland* in the Home University Library by Prof. Alison Phillips. In that admirable summary there are but two lacunae. The Exodus to Paris after 1830 and the Jewish question are not adequately treated, but it

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contains a good bibliography for beginners, to which there are only a few additions to be made:—Geoffrey Drage, "Pre-war Statistics of Poland and Lithuania," published in the *Journal of the Royal Statistical Society* (March 1918); Bruce Boswell, *Poland and the Poles* (1920); Ralph Butler, *The New Eastern Europe* (1919); Erasmus Pilz, *Poland* (1916); Askenazy, *Danzig and Poland;* Bass, *The Peace Tangle* (1921); Mandell House Seymour, *What Really happened at Paris* (1921); Pernot, *L'épreuve de la Pologne;* Report by Sir Stuart Samuel on his Mission to Poland (Cmd. 674), 1920.

(G. Dr.)

POLICE (United States).—An interesting recent development as regards police in the United States has been the establishment in certain states of a state police, sometimes called constabulary. This body acts under state rather than local authority, is usually organized on a military basis, is widely distributed for patrol duty, but can be quickly mobilized for emergencies. Such forces are of special service for protecting life and property in country districts, made accessible to robbers and assassins by the introduction of the automobile. Since the adoption of national prohibition much of their time has been spent in suppressing illegal liquor traffic.

The largest state police force is that of Pennsylvania, consisting in 1920 of 415 officers and men. It was organized in 1905 somewhat after the model of the Canadian Northwest police. It is composed of five troops with posts in different parts of the state. Detachments are sent out to the 40 stations and from the stations small patrols operate in every direction. The posts and stations are in constant communication, and help can be rushed immediately to any point. They are empowered to make arrests for any violation of the law; at the same time they act as fish and game wardens and as fire patrols. When practicable they coöperate with the local authorities in preserving order. In some states their powers are somewhat restricted; in New York they cannot enter a city to suppress a riot unless so ordered by the governor or on request of the mayor with the approval of the governor. But in any state they may pursue a criminal and arrest him anywhere. In Pennsylvania applicants for appointment who have served in the army, navy or militia are given preference. The recruit serves a probation period of four months and makes a study of the state laws. The period of enlistment is two years. Another type of state police is seen in South Dakota, where the sheriffs and deputy-sheriffs form a state constabulary "for the purpose of detecting crime, apprehending criminals, suppressing riots, preventing affrays, and preserving and enforcing law and order throughout the state." In Idaho all state, county and municipal officers form a state constabulary under the direct control of the commissioner of the department of law enforcement. A third type is seen in the Massachusetts District Police, consisting of a detective and an inspection department. Appointments are made by the governor and his council. At the governor's command they suppress disorder anywhere in the state. They do not maintain a patrol. In 1920 a state police, or constabulary, was maintained in 12 states: Massachusetts, Texas, Connecticut, Pennsylvania, Nevada, New York, South Dakota, Michigan, Idaho, New Mexico, Tennessee, and West Virginia. At that time several other states were considering the establishment of such forces.

A special committee on state and metropolitan police, appointed by the American Institute of Criminal Law and Criminology, in a report submitted in 1920 urged active coöperation "in educating the people, and especially the Legislatures of their respective states, with respect to the nature, methods, and value of a state police force."

See this committee's report, "Metropolitan and State Police," in the *Journal of the American Institute of Criminal Law and Criminology*, vol. xi., No. 3 (Nov. 1920). An excellent account of the largest and best organized of the state police forces is given by Katherine Mayo in *Justice to All: The Story of the Pennsylvania State Police* (1917), with an introduction by Theodore Roosevelt.

POLLIO, ALBERTO (1852–1914), Italian general, was born at Caserta on April 21 1852. Before he was nine years old he entered the Naples military college, and he received his commission as a sub-lieutenant of artillery in April 1870. He served with distinction in various posts, and in June 1908 he was appointed chief of the Italian general staff, a position which he retained till his sudden death on July 1 1914. Pollio acquired a wide reputation as a writer on military subjects, his chief works being on Waterloo and Custozza. Both these books were translated into various languages.

POOR LAW, in the United Kingdom (*see* 22.74).—During the decade following the publication of the Royal Commission's Reports in 1909 the English Poor Law system underwent some minor administrative reforms. The commissioners had laid bare many crying scandals, and their reasoned indictment of the whole system aroused immediate and wide-spread interest. An agitation was set on foot, and actively prosecuted for several years by the partisans of the Minority Report, who demanded the complete abolition of the Poor Law. Many M.P.'s, irrespective of party, were pledged to this, and the public generally was prepared for drastic legislation. It was expected that the Government would presently take the matter up, when the outbreak of the World War in 1914 shelved the question. Meanwhile the Reports and the agitation begun in 1910 could not be entirely ignored by the Poor Law authorities themselves. Mr. John Burns, the President of the Local Government Board, though a staunch defender of the Poor Law, was bound to admit that some amendments were necessary. But these, he claimed, could be carried out by his own department. What was wanted was not, as he put it, "reform by revolution, but revolution by reform in administration." The administrative revolution, however, did not produce any startling changes. A new Relief Regulation Order was issued, which did a little to improve the administration of outdoor relief, but left the fundamental objections untouched. Another Order (Poor Law Institutions Order 1913) was designed to consolidate the regulations governing indoor relief. This, too, effected slight improvements in classification, the quality of the nursing service, the paupers' dietaries and so on. It also insisted on the removal of children over three years of age from the general mixed workhouse into separate institutions or quarters. But many of the boards of guardians were apathetic, or openly defiant of the central authority, and a steady pressure was required to reduce the numbers of these children, whose condition had been shown by the Royal Commission in 1909 to be peculiarly scandalous. During the war this pressure was relaxed, and in 1921 there was still a residue of children between 3 and 16 years of age (besides the infants under 3) living in the general workhouse wards. In 1911 a Boarding-out Order emphasized the need of closer supervision and more adequate allowances for the pauper children lodged in private houses with "foster-parents." There was also an attempt made to deal with the problem of vagrancy in London, by putting all the casual wards of the Metropolis under the control of the Metropolitan Asylums Board, coöperating with the police and various philanthropic agencies. And rather late in the rest of the country most of the boards of guardians combined in county vagrancy committees, for the better coördination of their treatment of the tramps. "Way-tickets" and bread-stations were established, a number of casual wards were closed, and expenses were pooled. But these reforms scarcely amounted to a revolution, either in their conception or in their effects.

Of the later developments only two are of any importance. The Representation of the People Act 1917 removed the disfranchisement which had been one of the chief stigmata of pauperism. Hitherto the receipt of parish relief (other than medical relief only) "within the twelve months next preceding the last day of July in each year" had disqualified a man or woman from being registered as a voter. Now anyone may vote, provided he is not actually an inmate of a Poor Law institution at the moment of the election. In 1919 the Local Government Board ceased to exist, and was succeeded as the central Poor Law authority by the newly created Ministry of Health. This change made no outward difference, but it was generally taken to foreshadow a thorough reform of the Poor Law system, and the Ministry of Health Act 1919, sect. 3 (3), actually contains the significant words: "in the event of provision being made by Act of Parliament . . . for the revision of the law relating to the relief of the poor and the distribution amongst

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other authorities of the powers exercisable by boards of guardians." The removal of the pauper disfranchisement was in harmony with the growing democratic spirit of the time, and reveals clearly the enormous change in thought since the setting-up of the "New Poor Law" in 1834. The same softening tendency appears also in the trivial, but significant, alteration of the name of the workhouse: the workhouse is now officially known as "the institution," though the word "workhouse" must be retained for certain legal purposes.

Meantime, a different sort of reform was proceeding from outside the Poor Law, by the increasing inroads of the local authorities into the field of the guardians. On the removal of the "pauper disqualification" in 1911 many thousands of the destitute aged became entitled to old-age pensions and so passed out of the Poor Law. Similarly the National Health Insurance Act took a vast number of patients, or potential patients, from the Poor Law medical service. And later Acts, empowering the local health authorities to set up maternity and infant clinics, to provide midwifery, to supply milk to expectant and nursing mothers, to treat venereal disease or tuberculosis, have still further diminished the scope of the Poor Law. All this, however, desirable as it might be from the point of view of social progress, could hardly be regarded as "Poor Law reform" save in an ironical sense. In point of fact, it served to reinforce more and more strongly one of the principal charges made by the Royal Commission in 1909. For it meant in practically every department an increase of administrative disorder—overlapping, multiplication of machinery and waste. In the case of every class of the pauper host, infants, children of school age, the sick, the feeble-minded, the aged, the able-bodied, there is now at least one, and generally more than one, other authority set up as a rival to the board of guardians. There is little, if any, coördination between the work of the medley of public bodies engaged in giving various forms of assistance out of the rates and taxes. They are in many cases dealing on different lines, and for different reasons, with different members of the same family. So far as the Poor Law Guardians are concerned, it is often a mere matter of chance whether it is they or the local health or lunacy or education authority who become responsible for a sick or feeble-minded person or a school-child. And as regards the aged, it was found that at the beginning of 1920, out of a total of 46,846 paupers over 70 in England and Wales, no less than 9,345 were old-age pensioners, two-thirds of them receiving outdoor relief and the other third in institutions.

When, in the latter period of the World War, public attention was directed to the problems of social reform that would have to be solved after the peace, this question of "public assistance" inevitably bulked large. In July 1917 the Ministry of Reconstruction appointed a "Local Government Committee" to consider and report upon "the steps to be taken to secure the better coördination of public assistance in England and Wales and upon such other matters affecting the system of Local Government as may from time to time be referred to it." Its report—popularly known as the Maclean Report, from the name of the chairman, Sir Donald Maclean, M.P.—was presented at the end of 1917. Subject to reservations by certain members of the committee, it was unanimous on the main point. The existence side by side, it declared, of the boards of guardians on the one hand, and the county, municipal and other health and education authorities on the other, produced both overlapping functions and areas and conflicting principles of administration.

"The resulting confusion has been aggravated by the growing popular prejudice against the Poor Law—a prejudice which does less than justice to the devoted work of the Guardians, and the continuous improvement in poor-law administration, especially in respect of the children and the sick. For the last decade Parliament has been unwilling to entrust the Boards of Guardians with new functions, and the provision for new services has had to be made by other Local Authorities—in some cases new Local Authorities—often to the increase of the confusion and overlapping. Further, the classification by institutions and the specialized treatment of recipients of assistance almost necessarily involve an enlargement of existing areas of administration."

The committee, therefore, recommended the abolition of the boards of guardians and the Poor Law unions. The scheme advocated may be summarized as follows:—

1. All the functions of the boards of guardians should be transferred to the councils of counties, county boroughs and boroughs or urban districts with populations exceeding 50,000.
2. Provision for all the sick and infirm (including the aged requiring institutional care, and maternity and infancy) should be made by these authorities under the Public Health Acts suitably extended.
3. The Ministry of Health should have power to put any borough with a population over 10,000 or any urban district with over 20,000, in the position of an autonomous health authority, with such reservations as might be desirable.
4. The children should be dealt with by the local education authorities, the mentally deficient by the local lunacy authorities.
5. Every county or county borough (or borough or urban district council with a population over 50,000) should set up: (i.) a prevention of unemployment and training committee (on the lines of the education committee, and including representatives of employers and trade unions); (ii.) a home assistance committee (on the lines of the education committee) to enquire into the economic circumstances of all applicants for public assistance, to supervise them, to administer all relief given in the home, to recover expenses of maintenance, treatment, etc., and to keep a private register of all such applicants and their families and of the assistance given.
6. County councils should appoint committees for districts or combinations of districts, to which various functions of the home assistance committee and the prevention of unemployment committee would be delegated. Such district committees would consist of: (*a*) members of the county council; (*b*) borough or district councillors; (*c*) persons experienced in the work to be done.
7. London should have a special scheme, in which the functions would be divided between the London County Council and the metropolitan borough councils. The borough councils would appoint home assistance committees, and would also be responsible for vaccination and registration of births and deaths. The London County Council would, through its appropriate committees, exercise the rest of the functions transferred. It would also appoint a central assistance committee, which would lay down a policy and rules of local administration for the home assistance committees in the metropolitan boroughs.
8. Poor Law officials should be transferred to the local authorities (provided both they and the local authorities agreed), and compensated for any pecuniary loss incurred by the change.
9. The cost of all functions transferred should fall on the new authority (the county, county borough, borough or urban district, and in London mainly on the county, but partly on the metropolitan borough).

Scotland, of course, was outside the committee's reference. But if their proposals were adopted, a Scottish scheme on similar lines would undoubtedly follow.

These recommendations were an endorsement of the principles advocated by the Royal Commission in 1909. The Maclean Report was, indeed, a compromise between the majority and minority of the Royal Commission, though leaning more heavily to the side of the minority, who, unlike the majority, had insisted above all on the abolition of the *ad-hoc* destitution authority. And the importance of the new recommendations was enhanced by the fact that they marked the actual reconciliation of the two parties, since Lord George Hamilton and Sir Samuel Provis, who had signed the Majority Report in 1909, and Mrs. Sidney Webb, who had signed the Minority Report, were unanimous on the Maclean Committee. The Government eventually pledged itself to legislate on the lines of the Maclean recommendations at the first opportunity. But no opportunity had been found by the session of 1921.

The Poor Law system, therefore, then remained still in theory as it was in 1834, when the famous "principles" were established—first, that relief should not be offered to able-bodied persons and their dependents except in a well-regulated workhouse; and, secondly, that the lot of the able-bodied should be made "less eligible" than that of the independent labourer of the lowest class. These principles had already worn very thin by the beginning of the 20th century, and the Royal Commission in its investigations from 1905 to 1909 discovered a wide-spread laxity. Nevertheless, whether the administration was, or is, lax or strict, its character is inevitably fixed by the fact that the Poor Law deals with the destitute. It is true that the guardians are entitled to interpret "destitution" fairly broadly—to treat it, in fact, as meaning "necessitous"; but in practice this amounts to little. Generally speaking, relief is only given to those who are in a grave state of want. This fact, with its natural consequences, especially in the domain of public health, has

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been increasingly emphasized in recent years. And there is no doubt that it has been one of the chief reasons why public opinion has favoured the sapping of the Poor Law by the local authorities, who are under no such restriction and are better able to apply preventive rather than palliative treatment. But the large increase of public assistance by these other bodies, while adding to the administrative confusion, still leaves a huge volume of pauperism and a huge expenditure by the Poor Law guardians.

The following figures show the total number of persons in England and Wales in receipt of Poor Law relief of all kinds on Jan. 1 of each year:—

1900	803,247	1917	637,327
1905	924,630	1918	586,785
1910	935,738	1919	554,617
1914	761,578	1920	576,418
1915	762,060	1921	663,667
1916	684,549	—	—

None of these figures of course represents the complete total of pauperism in any one year, for they only relate to one day, and allowance must be made for many other individuals—amounting to several hundreds of thousands—who will receive relief at one time or another during the twelve months. The figures do, however, afford an accurate basis for tracing the movements of pauperism. It will be seen that between 1910 and 1914 there is a large decline. This is mainly due to the causes noted above—the removal of a great number of the aged and of the sick from the Poor Law. On the declaration of war in Aug. 1914 there was a sharp rise in pauperism, owing to the rapid and widespread dislocation of industry. Within three weeks of the outbreak of hostilities the total of persons in receipt of relief was over 40,000 higher than that for the corresponding date in 1913, and a month later it had risen by another 115,000. Very soon, however, there began an equally rapid recovery, and with the absorption of men into the army or munition work and the influx of women into industry, pauperism declined month by month. Many of the workhouses and infirmaries were taken over by the War Office for military use, their inmates being moved to other buildings or boarded out in neighbouring unions. The volume of pauperism continued to fall progressively till the end of the war, under the influence of such causes as enlistment, the unsatisfied demand for labour of all sorts, both of men and women, the generally high rates of wages, and the steady income drawn from separation allowances and pensions by poor people whose earnings had previously been precarious or inadequate. Nevertheless, there was a permanent residue of sick and infirm, feeble-minded, aged and children. After the Armistice in Nov. 1918 the figures began to mount again. Demobilization brought in its train a renewal of unemployment, together with industrial disputes and reduced earnings. Throughout 1919 and 1920 the rise continued until, at the beginning of 1921, when the whole country was involved in a serious trade depression, the total was approaching the pre-war level.

The movement of Poor Law expenditure during the first twenty years of the 20th century shows little fluctuation; it increased continuously, as the following figures indicate:

Total Expenditure on all Poor Law Services in England and Wales.

1900	£11,567,649	1917	£16,187,748
1905	13,851,981	1918	17,039,623
1910	14,849,584	1919	18,423,883
1915	15,804,073	1920	23,501,241
1916	16,085,586		

The reason for the paradoxical increase of expenditure on a decreasing number of persons during the war is, of course, to be found in the rising cost of maintenance, including food, fuel, medicine, salaries and so on. The average cost of maintaining a pauper in the general workhouse before the war was 13s. 8½d. per week in London and 10s. 10½d. elsewhere (1910). In 1918 it was 18s. 5½d. in London and 20s. 3½d. elsewhere, whilst the weekly cost of maintenance in the infirmary was 37s. 6½d. in London and 30s. 4½d. elsewhere. In 1919-20 the cost had mounted to 24s. 5½d. in London and 25s. 6d. elsewhere for maintenance in the workhouse, and to 46s. 7½d. in London and 40s. 3d. elsewhere for maintenance in the infirmary. In Scotland the figures, both of persons relieved and of expenditure, pursue much the same course, though they are naturally much smaller since the population of Scotland is less than one-seventh of that of England and Wales. In May 1920 the total number of legal poor of all classes in Scotland was 87,868. The majority were on outdoor relief. 16,175 were insane, maintained in asylums, lunatic wards or private dwellings. Of the sane, between 8,000 and 9,000 (including nearly 800 children) were in the poorhouses. The Scottish Poor Law expenditure for 1918–9 amounted to £1,667,536 and for 1919–20 to £2,093,523. The weekly cost of maintenance in the poorhouse in 1920 averaged about 23s per head. (C. M. L.)

POPPER, DAVID (1846–1913), Bohemian violoncellist (*see* 22.91), died in 1913.

PORTER, BENJAMIN CURTIS (1843–1908), American painter (*see* 22.113), died in New York City April 2 1908.

PORTER, HORACE (1837–1921), American diplomatist and soldier (*see* 22.116), died in New York City May 29 1921.

PORTO RICO (*see* 22.124).—Important developments in the affairs of Porto Rico—political, economic, social—took place in the decade 1910–20. Politically, the organic law was first amended and later materially changed. Economically, the agriculture and commerce of the island underwent notable increase. Socially, there was progress in the betterment of living conditions, in the spread of elementary education and in the reduction of poverty and disease. The Act of Congress approved April 12 1900 (the Foraker Act), under which the island had been administered for the first decade of its existence under the American flag, was amended by the Act of Congress approved July 15 1909 (the Olmsted Act). In so far as supervised by the United States, Porto Rican affairs were placed under the jurisdiction of an executive department to be designated by the president, the War Department being subsequently designated. To prevent recurrent deadlocks over the insular budget, provision was made that if the legislature failed to pass the appropriation bill for an ensuing fiscal year, the sums authorized for the current year should be deemed to have been appropriated and might be lawfully expended. Far more thorough-going were the changes effected by the passage of the Act of Congress approved March 2 1917 (the Jones Act). By its provisions citizens of Porto Rico are deemed and held to be citizens of the United States.

Six executive departments are constituted: justice, finance, interior, education, agriculture and labor, and health. The governor, the attorney-general and the commissioner of education are appointed by the President of the United States, subject to the approval of the U.S. Senate; the heads of the remaining departments by the governor of Porto Rico subject to the approval of the insular Senate. The law-making power is vested in a legislature consisting of a senate of 19 members and a house of representatives of 39 members, all elected by manhood suffrage for a term of four years. Acts of the legislature may be vetoed by the governor; but his veto may be overridden by a two-thirds vote. The President of the United States may nevertheless interpose a final veto. Matters relating to franchises and concessions are vested in a public service commission consisting of the heads of the executive departments, the auditor, and two elected commissioners. A resident commissioner to the United States, paid by the Federal Government, is elected by popular vote for a term of four years; he represents the island in the House of Representatives, with voice but without vote, and is recognized by all departments in Washington.

The economic experience of the years 1910–20 was the increased and more profitable production of sugar, tobacco, coffee and fruits, consequent in the first instance upon duty-free access to the American market, and aided by the completion of insular projects of irrigation. The increase of exports was accompanied by larger imports, by a reversal of the island's adverse trade balance, and by an appreciable though unequal diffusion of gain among the island's population, the growers of sugar and tobacco being specially benefited. The commerce of the island trebled in the decade, the combined value of imports and exports rising from $78,705,364 in 1911, to $247,199,983 in 1920. This amazing growth was uneven. The activity of 1911–2 was followed by reaction in 1913, accented by the dislocations consequent upon the outbreak of the World War. War demand for the island's staples made itself sharply felt in 1916–7 with some arrest in 1918–9. In 1920 came sensational developments, exports rising from $79,496,040 in the preceding year to $150,811,449, and imports from $62,400,360 to $96,388,534. The factors directly responsible were the world's runaway markets in sugar and to a less absolute degree in tobacco and coffee. Sugar exports in tonnage were actually less in 1920 than in 1916 and 1917; the price per ton rising from $75.81 in 1911, to $136.77 in 1919, and to $235.88 in 1920.

The visible trade balance in favour of the island rose from a previous maximum of $27,780,417 (1916) to $54,422,915 in 1920. The great bulk of this trade, 90% in 1920, was with the United States.

There was marked improvement during the decade in the island's material equipment. New schoolhouses were erected, and additional roads and bridges constructed. Even the remoter towns of the interior had in 1920 waterworks and electric-lighting plants, made possible through loans from the insular treasury. The increase in private wealth was reflected in the erection of many attractive residences, while the development of commerce and agriculture stimulated the extension of bank and transportation facilities. The basis of the insular revenue system remained the measure put into

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operation with the establishment of civil government under the American flag (the Hollander law), as modified and adapted to meet changing conditions. Ordinary expenditures for the fiscal year 1920 were $7,258,970.57, as compared with $3,685,613 in 1911. The total assessed valuation of all property for purposes of taxation in 1920 was $264,235,686, as compared with $133,817,931 in 1911.

The pop. of the island in 1920, despite appreciable emigration to the United States and Santo Domingo, was 1,299,809 (an increase of 181,797 in the decade), with a density distribution of 378·4 per square mile. In consequence of this continued growth, education and health remain grave problems. The total enrolment in all schools supported by public funds was 184,991. Of the 228,829 children of compulsory school age (8–14 years) only 61% attended school. The death-rate for 1920 was 23·33 per 1,000 inhabitants as compared with 24·97 in 1911. But in 1920, tuberculosis, malaria and uncinariasis (hookworm), together with infant mortality, still accounted for 60% of the total death-rate. The enquiries of a commission sent by the Rockefeller Foundation upon the request of the insular authorities confirmed the opinion that about 90% of the people of the island were infected with uncinariasis. "Our population is one of the densest on earth," the insular commissioner of health, himself a distinguished Porto Rican, wrote in 1920. "More than 70% are in the country, badly housed and fed, ill in health and ignorant of the first principles of hygiene. Until the people have learned to preserve and protect their health and have more ample means to provide better houses and food so as to reduce their miseries, no positive result, no recompense for all our efforts, can be obtained."

The governors were George R. Colton, 1909–13; Arthur Yager, 1913–21; E. M. Reily, 1921– . (J. H. Ho.)

PORTUGAL (*see* 22.134).—The effects of the Portuguese Revolution of Oct. 1910 fell most heavily on the poor of the country districts, who suffered from the loss of charities sustained by the expelled religious bodies and of the care of the sisters of charity, and from the exile of many of the richest families and the transference of capital abroad. In consequence, emigration in the years preceding the World War increased to an unprecedented extent, rising from 6·83 per 1,000 in 1910 to 14·85 per 1,000 in 1912. In one district, that of Braganza (Bragança), it rose to 6% of the population. In the towns unrest was less passive and discontent with the working of the Republic was prevalent; lavish promises had aroused impossible hopes among the people, and by many the Republic was regarded as but a first step towards a more Radical workmen's republic. Socialism and syndicalism developed rapidly. The right to strike at 24 hours' notice, conceded on Dec. 7 1910, was followed by strikes of all kinds, including several serious railway strikes. The disorders culminated in the demonstration against Parliament on Aug. 2 1911 and the general strike at Lisbon on Jan. 31 1912, when the city was placed under martial law and over 1,000 workmen suspected of syndicalism were arrested. The new governing class, largely composed of professional men, chiefly lawyers and journalists, had not the necessary authority to prevent excess.

The Provisional Government of the Republic consisted of Dr. Theophilo Braga, President, Dr. Antonio José de Almeida (Home Affairs), Dr. Afonso Costa (Justice), Col. Corrêa Barreto (War), Dr. Amaro Azevedo Gomes (Marine), Dr. Bernardino Machado (Foreign Affairs), Dr. Basilio Telles and, later, Dr. José Relvas (Finance), Dr. Antonio Luiz Gomes and, later, Dr. Brito Camacho (Public Works). It lasted till Aug. 24 1911.

The Constitution.—On March 18 1911 the new electoral law came into force. It gave the vote to all Portuguese over 21 years of age who could read or write, including priests and officers of the army or navy, but excluding naturalized Portuguese, officers on the active list and persons proscribed politically. Lisbon and Oporto (voting on the proportional system) were to return ten deputies each, the other districts four and the colonies one each. By a modification of Jan. 11 1915 Lisbon received 20 deputies, Oporto 10, the remaining constituencies between 1 and 4 each. By a decree of March 11 1918 universal suffrage for all citizens over 21 was established, but illiterates (75% of the pop.) were again disfranchized in 1919. By the law of 1918 the number of deputies was reduced to 155, returned by 51 constituencies, of which Lisbon returned 14, Oporto 6. The representation in the Senate, consisting of 77 members, was made regional and professional. By a decree of April 26 1918 soldiers and sailors on active service were allowed to vote. In the elections held on May 28 1911 many of the candidates were nominated by the authorities without opposition and, even where there was an election (in 28 out of 50 districts), the Government candidates were returned without difficulty, no Royalists offering themselves.

The Constitutional Assembly was opened on June 19 1911 and a decree was passed declaring the monarchy abolished and the House of Braganza forever banished from Portugal. On Aug. 20 the new constitution was voted. It provided for two Chambers, that of the Deputies, consisting of 163 members to be elected every three years, and the Senate, consisting of 71 members. The President of the Republic was to be elected by both chambers for four years and could not be reëlected. His salary was fixed at £3,600, with £1,200 for expenses. On Feb. 19 1920 he was given the right to dissolve parliament, after consulting a special council appointed for this purpose.

The first President under the new constitution was Dr. Manuel de Arriaga (born in 1840, at Horta, in the Azores), who, on Aug. 24 defeated the Radical candidate, Dr. Bernardino Machado, by 121 votes to 86, the Conservative candidate, Senhor Braamcamp Freire, having withdrawn. The members of the first Constitutional Ministry were: Dr. João Chagas, premier and minister of Home Affairs; Dr. Augusto de Vasconcellos (Foreign Affairs); Dr. Duarte Leite (Finance); Gen. Pimenta de Castro (War); Senhor João de Meneses (Marine); Dr. Celestino de Almeida (Colonies); Dr. Diogo Tavares de Mello (Justice); Dr. Sidonio Paes (Public Works). The Government was opposed by the Radicals under Dr. Afonso Costa and faintly supported by the other groups—the Evolutionist followers of Dr. Almeida, the Unionist followers of Dr. Brito Camacho and the Independents. One of the first measures was to vote the payment to each deputy of 17s. for each sitting of the assembly.

Church and State.—The anti-clerical policy of the Provisional Government had entailed serious difficulties. The bishops signed a pastoral letter of protest and on March 8 1911 the bishop of Oporto was removed from his see, with a pension of £240. The religious orders had been expelled by the decree of Oct. 8 1910, their property confiscated and the convents closed. By that of Oct. 22 the teaching of religion in the primary schools was forbidden. Marriage of priests became legal. The decree of separation between Church and State was drawn up, under the date of April 20 1911, by Dr. Afonso Costa, then Minister of Justice. It granted full liberty of conscience to all Portuguese citizens. The Roman Catholic religion ceased to be that of the State, which recognized all creeds as of equal authority, making no payment for their support. Among other proscriptions, public worship was to be open to the public and was held to include religious instruction, public or private. The congregation might only contribute to the expenses of their worship through the *misericordias* or other Portuguese charitable institutions. The churches were declared inalienable without the consent of the Minister of Justice and might be expropriated at any time. Local authorities were given full power to restrict or forbid processions, funerals or other external acts of worship. An inventory was to be taken (June–Sept. 1911) of all Church property, including churches and cathedrals, which became the property of the State. The clergy were granted a salary under certain conditions and all ecclesiastical property was made liable to taxation. The priests were forbidden to wear the cassock except at services. No foreigner or naturalized Portuguese might take part in any service except in the case of international agreement or ancient custom. Papal edicts might not be promulgated in Portugal without the consent of the Government.

This decree, in a country where over 90% of the inhabitants were Roman Catholic, was considered to be the subjection of the Church to the State rather than its separation, and contributed towards alienating the north of Portugal from the Republic. The patriarch of Lisbon and the bishop of Guarda published a pastoral letter forbidding the clergy to accept salaries from the State. For consistent opposition to the law of separation the bishop of Guarda and the patriarch of Lisbon were banished from their dioceses for two years.

The value of the Church property confiscated was £6,000,000. Owing to official protests on behalf of some of the foreign congre-

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gations a promise was made to revise the law of separation, a promise only partially redeemed in 1918. Claims for compensation were referred to the Hague Tribunal by an agreement signed July 31 1913 by Great Britain, France and Spain, the only countries which accepted arbitration. The claims, including those of Italy, Belgium and Germany, amounted to £2,000,000. By the award given Sept. 5 1920 Portugal was condemned to pay £21,800 to Great Britain and £80,000 to France.

After the promulgation of the law of separation, and the Pope's encyclical of May 23 1911, *Jamdudum in Lusitaniâ*, relations between Portugal and the Vatican were broken off, and the Portuguese Legation at the Vatican was suppressed July 10 1913. The law was extended in Nov. 1913 to the Portuguese colonies, where the discouragement of Portuguese missions later gave rise to serious fears of the denationalization of the colonies through the activity of foreign missionaries. When Paes subsequently became president, one of his first acts was to redress some of the grievances suffered under the law of separation, and, by a decree of Dec. 22 1917, banishment imposed on the priests was annulled and the Cardinal Patriarch returned to Lisbon. In May 1918 conversations between the Papal Nuncio and the Portuguese Minister at Madrid resulted in a visit of the former to Portugal and he was received by President Paes, who informed him of the intention of the Government to send a Portuguese representative to the Vatican. Monsignor Locatelli was appointed Papal Nuncio in Portugal in April 1919. Relations with the Vatican were maintained after President Paes' death, and in 1919, and again in 1920, the Pope wrote Cardinal Mendes Bello and the Portuguese prelates congratulating them on the improved religious conditions.

The Royalist Invasions.—The main event of Senhor Chagas' premiership was the first Royalist invasion, commanded by Capt. Henrique Mitchell Paiva Couceiro. Small Royalist risings had been suppressed during the summer of 1911, but Capt. Couceiro still threatened the northern frontier. Representations were made by the Republic to the Spanish Government, which was itself suffering from the action of Portuguese Republicans in Spain. The Spanish authorities seized 4 Krupp guns and 1,000 rifles at Orense, and the German steamer "Gemma," with rifles and ammunition, was detained at Corcubión. The steamers, "Foam Queen" and "Arizona," with war material, ostensibly bound for Bahia Blanca, were detained by the customs authorities of London and Barrow in August. Couceiro crossed the frontier on Oct. 3 at the head of about 1,000 men, not a quarter of whom were armed with rifles. He advanced in the direction of Braganza and took the small town of Vinhaes, but evacuated it on Oct. 6 and, after maintaining himself for a fortnight in the hills, recrossed the frontier. A Royalist rising in Oporto, timed to coincide with this invasion, was brought prematurely to a head by Carbonario agents on Sept. 29, and this prevented the north from rising, except in the case of a few isolated villages.

King Manoel and the Pretender Dom Miguel met at Dover on Feb. 6 1912 to concert on common action, and the Royalist cause was strengthened by the great wealth of the Miguelists. On July 7 Couceiro again crossed the frontier, with a slightly larger force, but most of his arms and ammunition had been seized in Belgium and Galicia. The Royalist attacks on Valença and Chaves failed, and within a week they returned to Spain. Royalist risings in the northern provinces were speedily suppressed, and great excitement prevailed in the south, where the Carbonarios discovered a Royalist plot at Torres Vedras. D. João de Almeida and other prisoners-of-war were tried by court-martial and confined in the Lisbon Penitenciaria.

The Political Trials.—The arrests after the invasions of 1911 and 1912 were very numerous. Special tribunals were set up in Lisbon and Oporto in Jan. 1911 to try cases of political conspiracy, and in July 1912 Parliament voted still more stringent laws of defence. All persons suspected of reactionary opinions, religious or political, were in danger. Thousands of innocent persons were summarily arrested without the formulation of any definite charge and were confined for months in subterranean dungeons.

The chief instrument of this widespread system of espionage and terrorism was the organization of the Carbonarios. This secret society, the *Jov. Port.* (Young Portugal), founded or revived by Senhor Arthur Duarte da Luz e Almeida, forced through the Revolution of 1910 before the politicians were prepared for it. It assumed the functions of an unofficial police force and at times proved itself strong enough to attack the Republican Government and the army. Its members, who carried arms, were Republicans of the most extreme type; many had also joined its ranks in order to gratify some personal dislike or to secure the rewards given to successful informers. It was thus a body composed of dangerous fanatics. Completely blind to the political embarrassments which its actions might bring upon the Republic, it arrogated to itself the right of summary arrest. Senhor Chagas estimated that on Oct. 23 1911 there were 2,000 political prisoners awaiting trial, of whom 700 were innocent.

So notorious was the barbarity with which suspects were treated that a committee of prominent British residents was formed to investigate and, if possible, alleviate their condition. Several Portuguese Republican newspapers and prominent Conservative Republicans corroborated the findings of the British committee and diplomatic representations followed. But reforms were opposed by the Carbonarios and the Radical Republicans, and some of the worst outrages were committed under the weak Government which succeeded that of Senhor Chagas in Nov. 1911, with Dr. Augusto de Vasconcellos as premier, and under the third Coalition ministry formed by Dr. Duarte Leite in July 1912. One of the worst features was the intimidation of justice, the law courts being frequently filled with Carbonarios.

Hopes of improvement vanished when the Government resigned in Dec. 1912, and, after various attempts on the part of President Arriaga to form a moderate ministry, Dr. Afonso Costa, the Radical leader, came into power in Jan. 1913. In March of that year Adeline, Duchess of Bedford, with expert knowledge of prisons, visited the prisons of Lisbon, and meetings of protest against the treatment of the prisoners, held in London, advocated a general amnesty. Under the pressure of public opinion, the Minister of Justice in Jan. 1913 introduced a bill modifying the Penitenciaria régime, and in Feb. of that year 600 political prisoners and common criminals were excused from wearing the convict's hood, a pardon was granted to 300 prisoners, but the general amnesty was delayed till Feb. 1914.

The situation had become one of growing unrest and strikes were frequent. In April 1913 an attempted ultra-Radical *coup d'état*, in which a portion of the army and navy were implicated, was quelled and part of the crews of the "Vasco da Gama" and "S. Gabriel" were transported to Angra in the Azores. In June the Government decreed the suppression of the Lisbon Syndicalist Club. In July a movement similar to that of April was marked at Lisbon by attacks on the military barracks and was followed by numerous arrests. In Oct. 130 Republican prisoners were transferred to the fortress of Elvas, and a Monarchist movement at Lisbon and Oporto led to redoubled Carbonario activity. The amnesty bill became law on Feb. 22 1914 and in all about 1,300 prisoners (of whom over one-third had not been tried) and 1,500 exiles benefited by it, excluding Paiva Couceira among others. The courts martial, which had been active during two years, were abolished by a decree of Aug. 19.

Dr. Afonso Costa, who gave much of his attention to finance, resigned on Feb. 9 1914, and Dr. Bernardino Machado became premier and was in office when the World War began.

On Dec. 13 1914 Dr. Machado was succeeded in the premiership by the Democrat, Senhor Victor Hugo de Azevedo Coutinho, President of the Chamber of Deputies, with a view to holding the elections which were fixed for March 7, but the Government's purpose was prevented by a military movement, and President Arriaga appealed to Gen. Pimenta de Castro to constitute a government representative of a wider body of opinion in the country; he formed a ministry on Jan. 28, 1915. The action of the new Government was conciliatory and had the support of the moderate Republicans led by Dr. Antonio José de Almeida; the country's foreign policy remained unchanged, but the activity of the Carbonarios was checked, the so-called Committee of Public Safety abolished and the refractory municipal councils dissolved.

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The general election was now fixed for June 6 1915. In April an amnesty emptied the prisons. The Democrats were, however, able to count on the support of the marines and on May 14 the sailors mutinied, shot the captains of the "Almirante Reis" and "Vasco da Gama" and bombarded Lisbon, about 100 persons being killed. Pimenta de Castro resigned on May 15, and was arrested next day and transported to the Azores. The revolutionary committee nominated Senhor Chagas as premier, but on May 16 he was shot at and wounded in the train, on his way to Lisbon by Senator João de Freitas, who was killed. Chagas resigned on May 24 and was succeeded by Dr. José de Castro.

In a message addressed to Parliament Arriaga resigned the presidency as from May 29 (he died on March 5 1917); and after a short interim presidency under Dr. Theophilo Braga, he was definitely succeeded as President on Aug. 6 1915 by Dr. Bernardino Machado. The Government resigned in June, Castro again becoming premier, but he resigned in Nov. and Dr. Costa returned to office.

The Revolution of Dec. 1917.—On Dec. 5 1917 a revolution directed against the internal policy of Costa and the Democrats broke out at Lisbon. The rebels entrenched themselves in the Parque Eduardo VII. and their artillery opened fire upon the fleet. After two days' fighting, Gen. Norton de Mattos and Capt. Leotte do Rego took refuge on board a British ship in the Tagus. Dr. Costa and Dr. Soares were arrested; President Machado was placed under arrest, and on the 15th was conducted to the frontier. Vice-Adml. Machado dos Santos was released from prison and, with Maj. Sidonio Paes, the leader of the movement, and Capt. Feliciano Costa, formed a revolutionary committee. A provisional government was now constituted, Maj. Paes becoming President and Minister for War and Foreign Affairs. The Radical sailors mutinied on Jan. 8 1918 and bombarded Lisbon, but the movement was easily quelled, and several hundreds were deported to Africa. On Jan. 12 Paes left for the north, and at Oporto was received enthusiastically, as also on his return to Lisbon. A visit to the south in Feb. was equally successful.

In March 1918 Paes reconstructed his ministry, and the elections, on an enlarged franchise, were held throughout the country on April 28. The election of the President was held by universal suffrage on the same day. Paes was elected by over half a million votes and was proclaimed President on May 9. The Powers recognized the new régime, and on May 27 Great Britain raised her legation in Lisbon to the status of an embassy. The President opened Parliament in July. In Oct. a new Government was formed. Under a new system the President became also premier and ministers were called secretaries of state.

The first anniversary of the revolution was celebrated with national rejoicings on Dec. 5–8 1918. But on Dec. 14 President Paes was shot at the Rocio station by José Julio da Costa, and died a few minutes later. On Dec. 16 Adml. João de Canto e Castro was provisionally elected president, and in Jan. 1919 Senhor Tamagnini Barbosa formed a ministry, reviving the office of premier.

The Oporto Monarchy.—The Radical and Carbonario elements, which had hoped to benefit by President Paes' murder, rapidly became impatient, and a Democrat rising now broke out at Santarem, but the town was besieged by Government troops and the rebels surrendered. On Jan. 19 1919 the monarchy was proclaimed at Oporto, Braga and Viseu, Capt. Paiva Couceiro becoming regent and acting also as premier and minister of finance. At Lisbon the Royalists occupied Fort Monsanto and bombarded the city, but they were overcome without difficulty by the marines and Carbonarios. A considerable Republican army was sent against Oporto, but, though part of the regular troops drafted from Lisbon deserted, the Royalist forces were weak and did not reach Aveiro. The fighting during the three weeks of civil war was not of a serious character. A counter-revolutionary movement at Oporto in Feb. led to the restoration of the Republic, and the main result of these ill-timed risings was to fill the prisons and bring the Radicals into power. At Lisbon the marines and Carbonarios, in Feb., demanded government by "soviets" and the abolition of the official police. Severe street fighting and serious outrages occurred, including the burning down of a block of government offices in Black-Horse Square and of the Limoeiro prison. This had the effect of forcing the new authorities to copy the disciplinary methods of President Paes.

Government by Groups.—Senhor José Relvas became premier on Jan. 27 1919, and was succeeded in March by the Democrat, Dr. Domingo Pereira. It now became possible to hold the elections, and in May a Radical majority was returned. On June 1 Adml. Canto e Castro announced his intention of resigning the presidency, the candidate of the Democratic party, Dr. Antonio José de Almeida, being subsequently elected President on Aug. 6. On June 28 the Democratic Col. Sa Cardoso constituted a more stable ministry, which lasted till Jan. 7 1920. There followed a succession of short-lived ministries, under Senhor Fernandez Costa, Dr. Domingo Pereira, Col. Antonio Maria Baptista, Dr. Ramos Preto, Senhor Antonio Maria da Silva, Senhor Antonio Granjo (July to Nov. 15), Dr. Alvaro de Castro, and Lt.-Col. Liberato Pinto (Nov. 29 to Feb. 1921); and on March 2 1921 a new Coalition ministry (composed of Democrats, Reconstituents, Dissidents and members of the Popular party, all offshoots of the original Republican Democrat party) was formed, under the premiership of Dr. Bernardino Machado. A military pronunciamento on May 20 caused the resignation of Dr. Machado. He was succeeded by a Liberal ministry under Dr. Barros Queiroz, who dissolved Parliament and held a general election on July 10.

The absence of a firm guiding hand had been especially felt after the murder of President Paes, and successive governments seemed to lose control over the finances. No government was strong enough to raise an internal loan, to revise the system of taxation or levy a war-profits tax, and, while the taxes were paid in worthless paper money, the Government had to buy wheat and pay the service on the debt in gold. Social unrest was chronic in March 1920; there was a general strike of civil, and post and telegraph, servants; a railway strike which began on Oct. 1 1920, lasted 70 days; and a newspaper strike in 1921 for over two months. The Royalists showed themselves willing to exchange revolutionary for constitutional opposition, and King Manoel had constantly deprecated any revolutionary movement in view of the grave crisis through which the country was passing. The death of his uncle, the Duke of Oporto in 1920, left King Manoel without an heir to the throne. D. Miguel, Duke of Viseu, and his father D. Miguel, Duke of Braganza, renounced their right to the throne of Portugal in favour of D. Duarte Nuno, the younger son of the latter, born Sept. 23 1907.

The World War.—At a special joint sitting of both Chambers on Aug. 7 1914 Portugal proclaimed her loyalty to the British Alliance, and on Nov. 23 formally committed herself to participation in military operations. She served the cause of the Allies effectively by furnishing munitions, guns, and a division of artillery, and acted in close coöperation with Great Britain. In Oct. a Portuguese military mission arrived in London and a commercial mission followed in November. On Sept. 11 the first expedition of Portuguese troops left for Africa under the command of Colonels Alves Roçadas and Massano de Amorim, and fresh contingents followed at intervals, 40,000 troops in all being despatched for the defence of the colonies. Germany had not waited to be at war with Portugal in order to attack them. As early as Aug. 24 1914 a raid was made on the Portuguese post of Maziwa on the northern frontier of Mozambique. On Oct. 19 the Germans attacked Naulila (on the Angola frontier), where more serious fighting occurred two months later, and on Oct. 30 they stormed the fortress of Kwangar and put the garrison to the sword. On April 11 1916 Portuguese troops occupied Kionga (S. of the Rovuma River), which Germany had seized in 1894, and on May 27 they crossed the Rovuma River. They were still coöperating with the British in rounding up the Germans when war ended.

The British Government had deprecated any unnecessary intervention of Portugal in the war, but agreed to the requisitioning of German ships lying in Portuguese ports, and this was carried into effect in Feb. 1916. Consequently, Germany retaliated by declaring war on Portugal on March 9, and the declaration of

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war between Portugal and Austria followed on March 16. The Government resigned in order to make way for a national ministry, constituted on March 15 under Dr. Almeida. Capt. Leotte do Rego was appointed commander-in-chief of the naval division. French and British military missions arrived in Lisbon in March, and a British naval mission arrived in April. In June a first division of 20,000 men was concentrated at Tancos, where training began. Of the Germans in Portugal many had already left and 400 were interned. German submarines were active off the coast of Portugal during the autumn, many ships being sunk in 1917; Ponta Delgada was attacked by one on July 4 1917, and attacks were also made on Funchal and Cabo Verde in December.

On the declaration of war in March 1916 the few Royalist journals still permitted to appear in Portugal made patriotic declarations, and a message from King Manoel in Nov. exhorted his followers to set country above party. In Dec. a revolutionary movement was suppressed at Thomar and its leader, Machado dos Santos, imprisoned. In April 1917 Dr. Costa formed a new ministry. By a decree of Jan. 17 1917 Gen. Fernando Tamagnini de Alorn was given command of the Portuguese Expeditionary Force, and by July there were over 40,000 Portuguese troops on the western front, with 20,000 in Portugal ready to reinforce them. On April 9 1918, on the river Lys, the Portuguese contingent were subjected to a formidable attack by the Germans, and they were compelled to fall back, leaving a large number of prisoners. Subsequently Portuguese troops took part in the victorious entry into Lille.

Dr. Egas Moniz (later replaced by Dr. Afonso Costa) was appointed to represent Portugal at the Peace Conference, and in Jan. 1919, at the instance of Great Britain, the number of delegates to the Conference was increased to two. Portugal came out of the war with a crushing debt, but her colonies were assured to her, and her economic future was promising. The Peace Treaty was ratified on March 30 1920. At the Spa Conference in July 1920 Portugal secured 0·75% as her share of the indemnity from Germany, and also received Kionga.

Legislation.—One of the first decrees of the provisional government (Oct. 29 1910) ordained that press offences should be tried before a jury, but the liberty of the press under the Republic was more nominal than real and no Royalist or clerical newspaper was left long unmolested. The law of divorce (Nov. 4 1910) allowed, among other grounds for divorce, insanity, a long term of imprisonment, desertion, inveterate gambling and mutual consent. Gambling, at first legalized, was totally prohibited in 1919. Duelling was forbidden in Jan. 1911. On May 30 1911 Greenwich time was officially adopted, all clocks being advanced 37 minutes at midnight on Dec. 31 1911. In Sept. 1911 the Marconi system of wireless telegraphy was adopted. On June 14 1913 Portugal and Great Britain signed an agreement regulating the opium monopoly in Macao and Hong-Kong. On Aug. 15 1914 administrative and financial autonomy was given to the colonies. The employment of native labour in the Portuguese colonies was regulated by a very elaborate decree of Oct. 14 1914, modifying and developing the law of May 27 1911 and the decree of Oct. 1 1913.

Legislation on the subject of education was voluminous, but comparatively little was achieved to replace the schools of the expelled religious orders. By the decree of March 29 1911 primary education became neutral, laic and compulsory. Each parish was to have at least one boys' and one girls' school, the cost to be shared between the State and the town councils. In the two following years 991 new schools were decreed, but in March 1913 556 were still non-existent. The sum of £40,000 destined in 1913 for the building of primary schools, was apportioned among 180 schools. By a decree of Sept. 11 1913, in order to encourage industrial education and relieve the lyceums of Lisbon, Oporto and Coimbra, the number of students admissible to these latter was limited to a total of 4,850. Secondary education was remodelled by decrees of July 14 and Sept. 8 1918. In May 1914 a military school of aeronautics was created. Other decrees dealt with agricultural credit (1914), accidents to workmen (1913 and 1914) and work of minors and women (1915). On March 9 1918 a Ministry of Agriculture was created, but the decrees stimulating production were of a tentative and contradictory character. Uncultivated land has to pay a small tax per acre and becomes the property of the State if still uncultivated in 20 years from 1911. In March 1921 a much-needed bill was introduced providing for the building of new roads and for the repair each year of 312 miles of existing roads during 1922–31.

Defence.—On Jan. 19 1911 a commission appointed to reorganize the navy recommended the acquisition from Great Britain of three battleships of the dreadnought type, similar to the "Minas Geraes" of the Brazilian navy. This recommendation was adopted in the new naval programme submitted by the Minister of Marine in Dec. 1911, which involved the purchase of 3 battleships of 20,000 tons each, 3 scouts of 3,000 tons, 12 torpedo-boats of 820 tons and 6 submarines. On May 1 1912 a bill was introduced fixing the naval force at 4,500 men, as compared with 5,687 in 1910. On Jan. 27 1913 a commission was appointed for the creation of a naval arsenal on the S. bank of the Tagus.

Finance.—The average annual revenue from 1907–8 till the revolution (1910) was £14,456,000, and the average deficit £500,000. After the revolution special attention was given to finance. A committee appointed to examine into various loans made by the State to the House of Braganza assessed the total to June 18 1912 at nearly £800,000, of which £720,000 had been advanced to King Carlos, £24,500 to the Duke of Oporto and £16,400 to Queen Amelia. The Government decided to reimburse itself from King Manoel's property in Portugal.

The budget for 1911–2 showed a deficit reduced to £435,000, but an increased expenditure of £1,026,800. The deficit for 1912–3, estimated at £710,000, was converted into a surplus of £33,400 in August. The 1913–4 budget showed a total revenue of £15,178,843 and a surplus of £195,778, of which £111,800 was destined for the new naval programme. These figures were obtained by adding to the debt. On Aug. 31 1913 the debt stood at £145,917,500, an increase of £1,596,000 over its amount on Dec. 31 1912. In presenting the 1915–6 budget, with an estimated deficit of £2,120,400, it was decided to separate ordinary and war expenditure, but in practice, although two budgets were presented, the expenditure was not kept strictly separate. The double budget of 1916–7 provided for an ordinary expenditure of £17,220,000, with £403,400 deficit, and a war expenditure of £15,000,000. The war added an average of £20,000,000 yearly to the debt, which reached £227,000,000 on July 1 1918. Portugal was further indebted to Great Britain to the extent of £16,000,000 advanced for expenses at the front and £2,000,000 for war expenses in Portugal. The 1920–1 budget, presented in Feb. 1920, before that of the previous year had been voted, showed a revenue of £26,581,000 and a deficit of £25,555,000, an increase of £7,333,000 over the deficit of the previous year. It was proposed to extinguish the deficit by a reduction in the cost of the civil service and a war-profits tax, calculated to yield £22,222,000, but the Government fell before the proposals could be carried into effect. In Dec. 1920 heavy property and industrial taxes were imposed. By the 1921–2 estimates, presented in Jan. 1921, the deficit was increased to £58,888,000 on a total expenditure of £106,610,000. At the end of 1920 the debt was unofficially estimated as follows: external £53,777,000, floating £123,939,000, internal £325,333,000—total £503,049,000. The paper currency, which at the end of 1910 stood at £16,000,000 (at par of exchange, namely, 4,500 reis = £1), had risen to £82,361,000 in Dec. 1919, and to £118,361,000 in Sept. 1920. A further increase of £44,444,000 was voted by Parliament in Dec. 1920. In that month the 3% external debt was quoted at 22. The agio on gold, which was 5 in Oct. 1910 and 16 in Aug. 1914, exceeded 1,100% in Feb. 1921, but fell to half that amount a few months later. The floating debt, which immediately before the war was £19,555,000 (at par of exchange), stood at £119,555,000 on Dec. 31 1919. The heavy depreciation in the exchange, however, must be allowed for.

In Feb. 1921 the Banco Nacional Ultramarino became the sole agent of the Royal Bank of Scotland and of some English banks.

Commerce.—Portugal's foreign trade, which in 1913 had reached £22,094,500 in imports and £11,355,000 in exports, further expanded during the World War, and in 1917 amounted (at par of exchange) to £37,391,700 imports and £19,121,500 exports. The trade between Portugal and her African colonies almost doubled between 1911 and 1917. In 1917 5,860 ships of 4,906,599 tonnage entered Portuguese ports, as compared with 10,638 of 24,368,120 tonnage in 1913. The total tonnage of German ships seized in 1916 was 242,441, of which 157,333 were handed over to the Allies. Portugal lost 28,637 tons of shipping by enemy action, and her merchant shipping at the end of 1918 stood at 100,000 tons.

A treaty of arbitration for five years, between Portugal and Great Britain, was signed at London on Nov. 16 1914. The commercial treaty between the two countries, signed at Lisbon on Aug. 12 1914, became effective on Sept. 23 1916.

Foreign Exchange.—After the war serious efforts were made to grapple with the problem of the exchange, which was aggravated by the decree of May 31 1919 placing the financial agency at Rio de Janeiro in private hands. A decree of April 27 1918 provided that when the exchange was at 29⅛, 50% of the customs duties should be paid in gold at that rate and 50% at par, until the exchange reached 38³/₃₂, when the whole of the duties was to be paid in gold at par. A decree of Feb. 4 1920 totally prohibited a large number of imports, thus depriving the exchequer of an important source of revenue. Neither the Banking Consortium (Jan. 10–May 26 1920) nor the attempt to fix the rate of exchange officially, was effective in preventing a further rapid depreciation in Portuguese money, owing to the almost complete absence of gold (the reserve having fallen to under 2% in 1920) and to decreased production. As a result of the cost of labour and the fixed price of bread, cultivation of wheat diminished steadily from 1918, its best year. In 1918 the 248 million kgm. produced fell short of requirements by 56 million kilograms. The most important export trade—wine—suffered during the war from trans-

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port difficulties and, later, from the reduced demand in Great Britain and the loss of the markets of the United States, Canada, Russia and Norway. The wine trade attained its maximum in 1919, when the cost of transport fell from £15 to £4 a pipe and Great Britain imported 12,458,220 gallons. In 1920 Great Britain imported only 5,914,575 gal. and a huge stock was left on the hands of the merchants. Portuguese manufacturing industries, which expanded considerably during the war, despite the coal shortage, were similarly affected by decreased demand in 1920, for which the expansion of colonial trade did not entirely compensate.

Population.—The pop. of Portugal numbered 5,547,708 in 1911, not including the inhabitants of the Azores and Madeira, which amounted to 412,348 in the same year. The pop. of the chief towns (1911 census) were: Lisbon 435,399, Oporto 194,099, Setubal 30,346, Ilhavo 14,130, Póvoa de Varzim 12,115, Tavira 11,665, Faro 12,680, Ovar 11,416, Olhão 10,890, Viana do Castello 10,486, Aveiro 11,523, Loulé 19,688, Coimbra 20,581, Evora 17,901, Covilhã 15,745, Elvas 10,645, Portalegre 11,603, Palmella 13,318, Torres Novas 13,961.

Literature.—Literature in Portugal from 1911 to 1921 was marked chiefly by the death of prominent men of letters—of philologists, Gonçalvez Viana (1914), Epiphanio Dias (1916), Julio Moreira (1917) and Adolpho Coelho (1919); critics, Ramalho Ortigão (1917) and D. Maria Amalia Vaz de Carvalho (1921); novelists, Fialho de Almeida (1911), Abel Botelho (1917) and Teixeira de Queiroz (1919); the dramatist Marcellino Mesquita (1919); poets, Antonio Feijó (1917), João Penha (1919) and Gomes Leal (1921). But although the revolution was followed by no great literary revival, most useful work was accomplished, including much-needed and important reprints and editions of the classics. Among these may be mentioned the scholarly editions of Dr. J. J. Nunes and of Dr. Esteves Pereira, who in 1918 published the *Livro da Montaria* of King João I. from the original manuscript. Valuable material for the future historian of Portugal was brought together by the researches of several scholars, among whom Mr. Edgar Prestage specialized on the 17th century. The *Revista de Historia* has been published regularly since 1912. Senhor J. Lucio de Azevedo followed up his *Life of Pombal* with notable studies on Antonio Vieira. Dr. Leite de Vasconcellos' invaluable *Revista Lusitania* reached its 20th volume in 1917. In poetry a national tendency set in which is strongly marked in Dr. Lopes Vieira's *Ilhas de Bruma* (1917). The veteran poet, Senhor Guerra Junqueiro, published *Poesias Dispersas* in 1920. In the field of essay the glowing style and national fervour of Senhor Antero de Fiqueiredo in *Leonor Teles* (1916), *Jornadas em Portugal* (1918), *Recordações e Viagens* (2nd ed. 1916), and other works, are notable. The growing interest in Portuguese literature in England was marked by the foundation of a chair of Portuguese literature at King's College, London, in 1917.

BIBLIOGRAPHY.—For general study of the country see L. Poinsard, *Le Portugal Inconnu* (1911); A. Marvaud, *Le Portugal et ses Colonies* (1912); G. Diercks, *Das Moderne Portugal* (1913); A. F. G. Bell, *Portugal of the Portuguese* (1915); G. Young, *Portugal: An Historical Study* (1916); Bento Carqueja, *O Povo Portugues* (1916) and *O Futuro de Portugal* (2nd ed. 1920); Ezequiel de Campes, *A Conservação da Riqueza Nacional* (1917); Capt. B. Granville Baker, *A Winter Holiday in Portugal* (1912); A. F. G. Bell, *In Portugal* (1912); G. Diercks, *Portugiesische Geschichte* (1912); A. Herculano, *Historia de Portugal*, illustrated edition in 8 vols. (1914–6); H. da Gama Barros, *Historia da Administração publica em Portugal nos seculos XII. a XV.* (3 vols. 1895–6 and 1914); Dr. Mendes dos Remedios, *Historia da Litteratura Portugueza* (5th ed. 1921); F. de Figueiredo, *Historia da Litteratura Romantica Portugueza* (1913), *Historia da Litteratura Realista* (1914), *Historia da Litteratura Classica* (1917), dealing with the 16th century, and *A Critica Litteraria como Sciencia* (3rd ed. 1920). What purports to be a summary of the literature of Dr. Theophilo Braga consists of 4 vols.: *Edade Media* (1909), *Renascença* (1914), *Os Seiscentistas* (1916), *Os Arcades* (1918). (A. F. G. B.)

PORTUGUESE EAST AFRICA, or MOZAMBIQUE (*see* 22.163).—As the result of the World War in what was formerly the German territory adjoining, Portuguese East Africa has become bordered landward entirely by British, or British administered, territory. In 1919 "the Kionga triangle," some 400 sq. m. in size, and including the southern shore of the estuary of the Rovuma, was transferred to the province—having been part of German East Africa. The pop. in 1918 was roughly estimated at 3,000,000 to 3,500,000; no systematic census had been made and the inhabitants in areas not controlled by the Portuguese were not included. Europeans, exclusive of troops, numbered some 12,000; Asiatics (mainly Indian traders) 15,000–18,000. Lourenço Marques, the capital, with suburbs had about 20,000 inhabitants of whom 5,500 were white (700 being British).

Products and Trade.—An increase in the area under sugar, greater attention to the plantations of coco-nut palms (for copra), the introduction of sisal growing (from German East Africa) and the cultivation of maize for export were directions in which endeavours were made to increase the resources of the province in 1911–21. The sugar plantations were mainly in the region between Beira and the Zambezi, a region governed under charter by the Company of Mozambique, in which British capital was largely interested. Between 1911 and 1919 the area under sugar trebled and the output reached 35,000 tons yearly. Most of it was produced by the Sena Sugar Co. and shipped at Beira. Sisal was cultivated mostly in the Quilimane area; in 1916 the export was 2,200 tons of fibre.

Before the World War trade was mainly divided between British, Portuguese and Germans; the Germans financed the Banyans (Indian traders) who retailed "Kaffir truck" to the natives, a business worth £250,000 or more a year. In return the natives sold, principally, ground nuts of which some 2,000 tons were exported annually. North of the Zambezi German merchants had nearly all the trade, both import and export, and had begun to oust even the Banyan. In the S., at Delagoa Bay and Beira British, firms held over 50% of the trade. The war eliminated the German trader.

No uniform system of trade statistics was adopted in the three administrative areas into which the province was divided. The following figures are approximations to accuracy:—in 1911 imports £8,250,000, exports £2,250,000. The imports include some £6,800,000, in and out transit trade through Delagoa Bay and Beira. For 1913 the imports (excluding transit trade) were given at £2,053,000; exports at £2,720,000. Portuguese figures for 1917 (excluding Beira) gave the imports at £2,800,000; the exports at £1,500,000, not reckoning transit trade or reëxports.

The imports for local use were mainly textiles, provisions and machinery. Large quantities of wine, "vinho colonial," are imported from Portugal for native consumption—in 1913 the amount received at Lourenço Marques alone was 1,620,000 gallons valued at £105,000. In 1920 alcohol was declared by the high commissioner of Mozambique to be the curse of the province. The great bulk of the trade was in transit to or from the Transvaal, Rhodesia or British Nyasaland. The import of most direct benefit to the province was coal from the Transvaal. From 1912 onward Lourenço Marques became important both for the export and bunkering trade. (For the relations of the province with the Transvaal *see* DELAGOA BAY.)

Communications.—During 1910–20 several short lines of railway were built from the seaports. The largest scheme was to connect Delagoa Bay and Inhambane. This line with a total length of 280 m. was planned in independent sections, and 160 m. had been completed by 1916; the central section had not been built in 1920. The building of a railway (about 170 m. long) from Beira to the Zambezi, opposite Chindio, was begun in 1920 under a guarantee of the British Nyasaland Protectorate, its object being to afford that protectorate an ocean gateway. From Chindio a railway, completed in May 1915, goes to Port Herald where it connects with the Shire Highlands railway. A route for a railway from Port Amelia to Lake Nyasa was surveyed in 1912. The line would have been built by a German company but for the outbreak of the World War. Up to 1921 a few miles only of rails had been laid from Port Amelia. Wireless telegraph stations have been erected at Delagoa Bay, Inhambane and Mozambique town.

Finance.—Revenue was obtained chiefly from a hut tax, customs and taxes on emigration, *i.e.* a poll tax paid to the provincial authorities for natives recruited for the Transvaal gold mines and other work. In 1913–4 revenue and expenditure were budgeted for £1,312,000; in 1917–8 at £1,809,000. "Cost of administration" was given as the chief item of expenditure, not unnaturally, as in 1917 there were over 10,000 persons in Government pay.

History.—The efforts made by chartered companies and reforming governors to develop the province left its vast natural resources up to 1920 scarcely touched. The Portuguese lacked capital with which to undertake large operations, the settler class was not on the whole of a satisfactory character, the administrative system was very defective, and up to 1914 the interests of the province were entirely subordinated to the assumed interests of Portugal. In that year following an agitation in which the then governor-general of the province, Senhor de Magelhãs, took the lead, Mozambique was granted partial autonomy and in 1920, when Dr. Brito Camacho was appointed high commissioner, further reforms were enacted. The general trend of events during 1910–20 was to show the province as of value chiefly as a passage-way to and from the Transvaal, Rhodesia and British Nyasaland. Partly because of the necessity of keeping this passage-way open it was in this period that Portuguese authority was first made fairly effective throughout the province. Moslem chiefs along the coast in the region opposite Mozambique Island were subjugated by 1910, after a four years' contest, and the hinterland tribes then submitted with little resistance. The occupation of the interior of Portuguese Nyasaland, begun in earnest in 1909, met, however, with strong opposition from the natives and was not completed till 1912, when Mataka, the most powerful opponent of the

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Portuguese, fled across the Rovuma into German territory. In 1915 there was a widespread revolt in the Zambezi valley and farther S., which was not fully suppressed till the end of 1917.

The paramount economic interests of Great Britain in the southern part of the province, including the delta of the Zambezi, were recognized in the Anglo-German draft agreement prepared in 1913–4, but not signed owing to the outbreak of the World War. By that agreement the part of the province N. of the Liconga (Licungo) river (which reaches the sea over 100 m. N. of the Zambezi delta) was to be in the economic sphere of Germany (*see* AFRICA: *History*). The larger part of this northern area was governed, under a charter, by the Nyasa Company. That company, for lack of funds, had done little to develop its territory. In 1914 German capitalists succeeded, through a neutral intermediary, in obtaining control of the Nyasa Co. and by the aid of a German directorate they sought to acquire political control, and advance the scheme for the creation of a German Mittel-Afrika. The World War put an end to this design.

Early in 1917 German raiding parties entered Portuguese territory and in Nov. of that year Gen. von Lettow Vorbeck, to escape capture crossed into the province from German East Africa, carrying on the war there for nearly a year (*see* GERMAN EAST AFRICA). Von Lettow helped to prove the natural resources of the regions he traversed, while aerial reconnaissances by the British gave material for mapping.

See *A Manual of Portuguese East Africa* and *Portuguese Nyasaland*, both British Admiralty publications (1920); *Mozambique*, a handbook issued by the British Foreign Office (1918–9)—all with bibliographies; *The South and East African Year Book and Guide*, ed. by A. S. and G. G. Brown (London yearly); the *Anuario Colonial* and *Rivista Colonial*, both Lisbon publications. (F. R. C.)

POTIOREK, OSKAR (1853–), Austro-Hungarian general of artillery, was born at Blieburg, Carinthia, in 1853. He graduated from the Engineers' Academy as lieutenant in 1871. His career was chiefly spent on the General Staff, of which he was one of the most distinguished representatives. He held there the important post of Chief of the Section of Operations, later that of Deputy to the Chief of the General Staff, Count Beck. After Beck's retirement he was in command of the III. Corps, in 1911 Army Inspector and Governor (*Landeschef*) in Bosnia and Herzegovina. As such, he was officially responsible for countenancing the fateful visit of the heir to the throne to Serajevo, out of which the World War ensued. In the offensive taken by Austria against Serbia in the winter of 1914, which eventually broke down after great initial success, his judgment was also found wanting.

POULTRY (*see* 22.213).—During 1900–20 there were many changes and developments in the poultry industry, as carried on in Great Britain. New breeds were evolved or imported, while some of the older breeds have diminished in popularity and, except for small numbers kept by persistent breeders, have almost died out. Far more striking, however, has been the rapid evolution of the present-day utility breeds, the extension of public "laying trials" and the development of extensive commercial egg farms and breeding farms, accompanied by new mass methods of hatching, rearing, feeding and housing. The agriculturist has shown slowly increasing interest in poultry-keeping as a business branch of farm operations, and there has been a notable expansion of poultry-keeping by residents in urban and suburban areas. The view so strongly held for many years by the majority of people—who thought about the matter at all—that poultry-keeping was not a practicable commercial proposition except as a small side-line, and in circumstances where waste food for the birds was available at little or no cost, has been very much modified, for the reason that poultry-keepers, who have derived the main portion of their livelihood over a period of years from one or more branches of the industry, have so obviously increased in numbers. In addition numerous authentic instances of profitable results obtained from poultry-keeping as a subsidiary occupation have been made public. Hence in recent years increasing numbers of people have turned their attention to poultry-keeping, and in several instances the capital involved in well-known poultry farms amounts to several thousands of pounds. So far successful British poultry farming comprises one or more of the following branches:—Breeding laying strains of poultry; the production of exhibition stock; the sale of day-old chicks, eggs for hatching and stock birds; the production of eggs and poultry for consumption. The production of table poultry is in practically every case a subsidiary branch, and was particularly so during the war owing to the scarcity of feeding-stuffs.

It is not possible to form any reliable estimate of the value of the poultry-stock-breeding industry in the United Kingdom, as no complete figures are available. Every experienced observer knows, however, that the increase in the demand for and supply of eggs for hatching, day-old chicks, and pure-bred stock birds, has been very considerable during the past few years. Nor can any reliable estimate be made of the growth of table poultry and egg production, since there are insufficient data upon which to base an estimate. It is possible, however, to make a rough estimate of the total annual value of table poultry and egg production.

In 1908, in connexion with the Census of Production Act of 1906, the Board of Agriculture and Fisheries published a poultry census for Great Britain showing that the number of poultry kept by occupiers of agricultural holdings exceeding one ac. in extent was 36,728,000. In its report, however, the Board draws special attention to the limitation of the scope of the returns to holdings exceeding one ac., and points out "that poultry are very largely kept by cottagers and persons who do not come within the definition of agricultural holdings, while a further very large poultry population would no doubt be enumerated if the returns were extended to the towns."

In addition to obtaining this census, each occupier was asked to state the number of home-bred poultry of each description sold during the preceding twelve months, and special schedules were issued to all occupiers returning not less than 50 fowls or 10 ducks, geese or turkeys, asking for the number of males and females, respectively, hatched before 1908, the number of eggs produced, sold for consumption, or sold or used for hatching, and the number of young and adult birds sold. As a result the report states that there were 15½ million adult hens on farms in Great Britain in 1908, that the average annual egg yield per hen was 72, and that the total value of the output of eggs and poultry was calculated to be about £5,000,000. The report, however, emphasizes the fact that this sum "takes no account of poultry kept by cottagers, residents in towns and others not within the scope of the Agricultural Returns. The aggregate production thus excluded must be very large, though again it may be assumed that the greater part of it is consumed by the poultry-keepers themselves."

Since 1908 no poultry census figures for Great Britain are available, but interesting deductions may be made regarding British production by examining the returns published for the years 1908 and 1918 by the Irish Department of Agriculture regarding the Irish poultry industry. The Irish returns refer to all agricultural holdings including labourers' cottages built under rural housing schemes and are thus more comprehensive than those for Great Britain, though like the British returns they apparently take no account of town poultry-keepers. The number of such poultry-keepers in Ireland, however, would be insignificant as compared with the number in Great Britain. The total number of poultry in Ireland in 1908 is given as 24,031,095. The report estimates the average annual egg yield of Irish hens as 100, and calculates the total value of Irish poultry production in 1908 at £5,290,000. Of this amount £3,526,000 was stated to represent the value of the exports, £1,764,000 the value of the home consumption.

In 1918 the Irish returns give the total number of poultry in Ireland as 24,424,230, and state that the value of the exports of eggs and poultry was £18,352,578. No figures are given regarding the value of the home consumption, but in view of the value given in this connexion in 1908 it may be fairly assumed that £4,000,000 represents a reasonable estimate. Thus a total production value of £22,352,578 is arrived at for the Irish poultry industry in 1918. Now it is difficult to believe that the average yield of hens in Great Britain is less than that of their sisters in Ireland, and it is certain that the average price realized by British producers for their eggs and poultry have been greater than those obtained by Irish producers. Hence, if the incomplete British census for 1908 be taken, and even if it be assumed that there was no increase in the numbers in British poultry between 1908 and 1918, the total value of the produce from the 36,728,000 poultry in Great Britain would amount to approximately £33,000,000 for 1918, if calculated on the same unit production value as the Irish figures. But unit production value is almost certainly higher in Britain, if only on account of higher prices, and the total of £33,000,000 takes no account of the value of the produce of the large numbers of poultry kept in Great Britain by dwellers in urban and suburban districts. What this value may be can only be estimated, but it is practically certain to be well over £4,000,000 annually. A final estimate of £37,000,000 is thus arrived at as the value of British egg and poultry production in 1918, and if to this figure be added the corresponding one for Ireland a total of roughly £60,000,000 is obtained for the United Kingdom.

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It is interesting in comparison to note that, according to an answer given by Sir R. Sanders for the Minister of Agriculture in the House of Commons on Feb. 24 1921, the estimated value of the total wheat crop of the United Kingdom in 1920 was £31,000,000. Also in a recent Report on the Trade in Imports and Exports at the Irish ports it was stated that the value of the Irish eggs, poultry and feathers exported was in one year greater by about £13,000,000 than the store cattle trade and nearly equal in value to the export in fat cattle.

There is a further important aspect of the effect of the demand for table eggs and poultry in the United Kingdom in the national finances, viz. the large sums paid annually to foreign countries for supplies to supplement the insufficient home production. Tables 1 and 2 show the annual quantities and values of these imports for the years 1913, 1919 and 1920:—

TABLE 1.—*Imports of Eggs, in Shell, into the United Kingdom.*

From	1913		1919		1920	
	Quantity	Value	Quantity	Value	Quantity	Value
	Gt. Hundreds		Gt. Hundreds		Gt. Hundreds	
Russia	11,453,277	£4,745,229	Nil	Nil	9,183	£ 14,420
Denmark	4,264,943	2,296,843	1,638,067	£2,776,116	3,939,437	7,032,357
Germany	513,740	215,816	Nil	Nil	6,960	11,112
Netherlands	977,350	490,717	620	1,180	48,474	73,748
France	702,281	326,102	6,584	7,065	15,160	24,836
Italy	845,789	420,914	Nil	Nil	Nil	Nil
United States	5,869	2,894	1,408,606	2,205,092	331,185	553,211
Egypt	1,096,539	356,627	758,728	930,674	566,498	597,208
Canada	1,950	957	1,476,962	2,230,422	807,281	1,478,933
Austria-Hungary	883,651	375,943	Nil	Nil	7,984	14,457
Sweden, Belgium, Portugal, Spain, Rumania, Turkey, Asiatic, Morocco, China, Other British Possessions, Other Foreign Countries	834,561	358,560	354,828	462,777	1,338,104	1,778,814
Total	21,579,950	£9,590,602	5,644,395	£8,613,326	7,070,266	£11,579,096

TABLE 2.—*Comparative Imports of Poultry in Cwt.*

From	1913	1919	1920
	Cwt.	Cwt.	Cwt.
Russia	119,944	8	66
France	31,175	3,083	27,112
Austria-Hungary	26,674	Nil	1,396
U. S. A.	54,242	100,859	9,872
Other Countries	46,430	43,617	56,018
Total quantities	278,465	147,567	94,464
Total values	£954,540	£1,527,992	£817,872

The figures in Tables 1 and 2 show that in 1920, as compared with 1913, the total value of imported eggs and poultry had increased from £10,545,142 to £12,396,968, whilst the total quantity had decreased in the case of eggs from 21,579,950 great hundreds to 7,070,266 great hundreds: and in the case of dead poultry from 278,465 cwt. to 94,464 cwt. Thus, reckoning that the eggs averaged 14 lb. per 120, the imports in 1920 were less by 90,685 tons than in 1913, whilst the imports of dead poultry were less by 9,200 tons. It appears, therefore, that the total annual value of the eggs and poultry consumed in the United Kingdom had in 1920 reached the following approximate huge sum:—

British production	£37,000,000
Irish "	22,352,578
Imported	12,396,968
Total	£71,749,546

From the foregoing it would seem that the opportunities for increasing the production of eggs and poultry in the United Kingdom were in 1921 greater than ever. Russia, the largest supplier in pre-war days, had practically ceased her exports, whilst Italy and the countries formerly included in Austria-Hungary would probably take some years to recover their former exporting capabilities. Much must depend, however, upon the capacity of the British people to adopt efficient methods of cheaper production. There is little doubt that the majority of British consumers would prefer to eat fresh British eggs and poultry rather than those of foreign origin, preserved or otherwise, provided the price of the home article is not too high. It is largely a matter of cost of production and methods of marketing.

One of the most interesting developments in poultry-keeping of recent years has been the growth of stock poultry farms whose main object is the production of pure-bred poultry of heavy laying capacity. This development was no doubt primarily due to the increasing appreciation shown by poultry-keepers of the commercial importance of high egg yield, and the consequent demand for stock, specially selected and bred for this quality. A great stimulus was given to this development by the introduction of public *laying competitions*, the object of which was to test the egg-producing capacities of various breeders' birds and also to gain information regarding the relative fecundity of existing strains and breeds. The introduction of these laying competitions in England was due to the enterprise shown by the Northern Utility Poultry Society of Burley, Lancashire, and the Utility Poultry Club (now the National Utility Poultry Society), and at first competitions were conducted over four winter months, commencing in October. Thus the productive capacity of the birds was tested at the time of the year when eggs are most difficult to obtain, and competing breeders were compelled to hatch their birds early if they wished them to obtain a good place in the trials.

The introduction of these competitions marks an important epoch in the history of the poultry industry, as attention was thereby focussed upon the great variation in fecundity of various strains and breeds, whilst the commercial importance of high egg yield was forcibly demonstrated. For the first few years trap-nests were not used, records of the egg yield of each pen of four birds being taken. In 1902, however, trap-nests were introduced and the individual records were taken. In 1912–13 the competitions were extended to twelve-month periods, and a grant in aid of this work was given to the Utility Poultry Society in conjunction with the Harper Adams Agricultural College, Newport, Salop, by the Board of Agriculture and Fisheries. It was no doubt realized by the Board that the educational value of these competitions was very great. Not only was information obtained regarding the relative productivity of different birds, " strains," and breeds, but also regarding size and colour of egg, comparative seasonal production, period of brooding, cost of food per bird and net cost of egg production, value of different systems of housing, feeding, and general management. In fact it is open to question if the full educational value of laying competitions or trials had in 1921 been fully exploited.

The National Utility Society continued to organize trials annually, and after 1916–17 these were carried out for the Society by the Great Eastern Railway Co. at Bentley, Ipswich. This Company in conjunction with the Utility Duck Club also arranged in 1921 a laying trial for ducks. The trap-nesting arrangement for these birds is very ingenious as the ducks are enticed into the nests by regularly placing the food in small pens in front of the nests, but inside the

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traps. Only one duck can obtain admission to each pen or nest, and as the birds are plainly marked with distinctive rings very little handling is necessary.

Several other public laying trials were being conducted in 1921 in various parts of the United Kingdom: at Burnley, Lancashire, by the Northern Poultry Society; at Newport, Salop, by the Harper Adams Agricultural College; at Wye, Kent, by the South Eastern Agricultural College; at Birmingham by the Midland Fur and Feather Federation; at Trowbridge by the Wiltshire County Council; and in Ireland at Cork by the Irish Department of Agriculture. In the case of the trials at Newport, Wye and Trowbridge, financial assistance to the work is given by the Ministry of Agriculture.

As a brief indication of the results obtained at a few of the laying competitions the accompanying tables are instructive. (Tables 3 and 4 have been compiled by Mr. H. E. Ivatts, late Hon. Sec. of the National Laying Trials.)

Up to the 1916–17 competition awards were granted upon the basis of the market value of the eggs laid with a varying discount penalty up to 20% upon eggs weighing less than 2 ounces. Subsequent to 1916–17 the competitive value of a hen's production was determined in accordance with the following rule:—

"For the purpose of the test the eggs laid by each hen will be assessed and recorded according to their weight as first or second grade eggs. First grade eggs shall be those weighing two ounces or more. Second grade eggs during the first ten weeks shall be those weighing less than 2 ounces but not less than 1⅞ ounces, and for the subsequent period of the test not less than 1¾ ounces. Second grade eggs shall be accepted as of equal value to first grade eggs, but not more than 100 eggs shall be credited to the score of any hen in Sections 1 to 5, and in the case of Section 6 (Championship) 200 eggs."

The 1915–16 trials held by the Utility Society have a special interest, as 42 of the competitors' pens were retained for a second year in order to ascertain the yield of these birds for their second year. Table 4 shows the results obtained.

The stimulus given by laying trials to the breeding of highly fecund strains of poultry has been enormous. Not only has the spirit of competition set up by the trials urged breeders to devote much time and thought and energy to their breeding operations, but the fact that a win in a public competition is of great value as an advertisement led to the keenest efforts being made by competitors to obtain a high position in the prize list. It is perhaps not too much to say that success in the trials has been in several cases the foundation of many present-day successful stock poultry farms. Ordinary poultry-keepers wishing to buy birds either as a beginning or to improve existing stock apply to a large extent to successful competitors in the laying trials, and a considerable foreign demand at highly remunerative prices is not infrequently the direct result of success in the trials. This is certainly a mark of progress in the egg-producing industry as a whole, in the same way that the increasing demand for pedigree milking stock by the dairy farmer is an indication of progress in the dairying industry. A word of caution, however, may not be misplaced. There may be a danger in focussing attention too strongly on the development—possibly the abnormal development—of one function, or producing weaknesses in the bird in other directions. There is a certain risk of sterility, high mortality in rearing chickens and general lack of constitution in the adult stock. The really skilled breeder will know how to avoid these dangers, but nature is inclined to be severe on attempts to develop abnormal capacity in any one direction. Our knowledge of the laws of heredity is still very incomplete in spite of the considerable amount of empiric knowledge possessed by some of our present-day breeders. No doubt Mendel's discoveries and the investigations made by Bateson, Punnett, Pearl and others may give material assistance to the elucidation of the many problems involved in the inheritance of fecundity, but in the meantime stock breeders and commercial egg farmers would do well to remember that high individual egg yield may possibly be obtained at too high a cost in other directions and that high resistance to disease, low chicken mortality, and reasonably sized eggs are also matters of considerable importance.

The type of bird bred by the breeder of pedigree layers has drifted further and further away from the standard set up by the specialist exhibition clubs. So much is this so, that in the case of several breeds, particularly White Leghorns and White Wyan-

TABLE 3

The gross production and general averages, etc., of the National Utility Poultry Society's twelve-month competitions during eight years. The Championship Section was instituted in 1918–19, and each pen consisted of 10 pullets instead of 5 as in the ordinary section.

	Total No. of Pullets Entered	Per Cent White Wyandottes	Per Cent White Leghorns	Total Eggs laid	Per Cent Grades of Eggs		Total Average per Pullet	Per Cent Pullets laying over 200	Per Cent Pullets laying under 140	Best Pens Average per Bird	Worst Pens Average per Bird	Food cost per bird	
					1st	2nd						s.	d.
1912–13	600	33	18	91,115	76·4	23·5	151·9	15	40	231	87	7	11
1913–14	300	48	15	56,184	90·2	9·7	187·2	43	17	223	102	7	0¼
*1914–15	300	30	38	50,562	87·4	12·5	168·5	19	21	212	124	8	10¾
1915–16	600	29	29	98,898	65·5	31·5	164·0	24	26	252	78	11	6
1916–17	354	30	30	52,438	58·8	41·2	148·1	8·4	42	249	89		
1917–18	575	32	41	84,477	75·4	24·6	142·2	..	..	233	63	Not Reported	
1918–19	720	31	48	112,162	84·4	13·6	155·7	..	..	204	81		
1919–20	1,440	30	39	231,777	78·6	21·2	163·3	10·1	25·62	207	72		
*Ten months only.					Championship Section								
1918–19	100	30	70	18,209	87·1	12·9	182·0	28·0	14·0	203	171	.	.
1919–20	120	33·33	58·3	22,320	73·3	26·7	188·8	47·5	14·1	215	184	.	.

TABLE 4

Two-Year Egg-Laying Competition at Harper Adams Agricultural College, Newport, Salop, 1915–17. Each pen held 6 birds.

No.	1st Year		2nd Year		2 Years' Total		Score Value		
	Eggs	Avg.	Eggs	Avg.	Eggs	Avg.			
	Section 1. White Leghorns								
1	1,353	225	829	138	2,182	363	£18	10	7¾
2	1,265	210	720	120	1,985	330	16	1	7¾
3	1,125	187	745	124	1,870	311	15	17	2¾
4	1,196	199	686	114	1,882	313	15	12	10¾
5	1,092	182	811	135	1,903	317	15	12	7¾
6	1,261	210	619	103	1,880	313	15	7	2¾
7	1,225	204	655	109	1,880	313	15	3	7¾
8	1,118	186	665	110	1,783	296	14	6	7¾
9	1,003	167	688	114	1,691	281	14	0	1
10	948	158	679	113	1,627	271	12	19	0
11	1,091	181	503	84	1,594	265	12	17	7¾
12	1,087	181	452	75	1,539	256	11	18	1¾
13	1,449	241	837	139	2,286	380	19	2	4¾
14	1,086	181	658	109	1,744	290	14	6	11¾
	Section 2. White Wyandottes								
15	1,068	178	933	155	2,001	333	£17	9	8¾
16	1,177	196	755	125	1,932	321	17	0	7¾
17	968	161	823	137	1,791	298	15	3	6¾
18	1,071	178	707	117	1,778	295	14	19	5
19	1,042	173	706	117	1,748	290	14	10	2¾
20	997	166	722	120	1,719	286	14	4	7¾
21	938	156	706	117	1,644	273	14	3	0
22	905	150	719	119	1,624	269	13	8	9¾
23	949	158	549	91	1,498	249	12	10	5¼
24	1,513	252	809	134	2,322	386	19	10	9
25	1,169	194	846	141	2,015	335	17	8	8¾
26	1,109	184	841	140	1,950	324	17	3	11¼
27	1,210	201	798	133	2,008	334	17	2	5¼
28	1,168	194	604	100	1,772	294	15	11	10
29	1,093	182	733	122	1,826	304	15	10	4
	Section 3. Buff Plymouth Rocks Rhode Island Reds, White Orpingtons, Buff Orpingtons Barred Plymouth Rocks								
30	899	149	896	149	1,795	298	£15	9	6½
31	777	129	811	135	1,588	264	13	11	9½
32	1,000	166	534	89	1,534	255	13	1	7½
33	1,084	180	465	77	1,549	257	13	0	0¾
34	1,029	171	559	93	1,588	264	12	13	4
35	751	125	574	95	1,325	220	10	19	3½
36	977	162	285	47	1,262	209	10	14	6½
37	773	129	372	62	1,145	191	9	9	0½
38	732	122	388	66	1,120	188	8	18	1½
39	471	78	455	75	926	153	7	5	10½
	Section 4. Light and Red Sussex								
40	915	152	752	125	1,667	277	£13	19	8¾
41	988	164	631	105	1,619	269	13	12	5¾
42	892	148	623	103	1,515	251	13	1	5¼

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dottes, the birds which win in laying competitions are of a type distinctly different from exhibition specimens and are indeed given a distinguishing designation such as Utility White Leghorns in contrast to Exhibition White Leghorns. Apparently the heavy layer develops a type of her own and if, as appears probable, the future demand for stock poultry should be increasingly for birds whose useful qualities, whether for egg or flesh production, have been highly developed, it is obviously desirable that British breeders of exhibition and utility poultry should take counsel together and if possible frame their breed standards to meet present-day requirements. Otherwise, confusion is likely to increase with resulting loss of trade both at home and abroad.

The Irish Department of Agriculture have held annual eleven-month laying trials in Ireland since 1913, and, as the results are published in a form which facilitates comparison, Table 5 is of interest:—

TABLE 5.—*Comparison of Results.*

Eleven Months ending Aug. 31	No. of Pullets	No. of Eggs Laid	Average No. per Bird	Average Value per Bird	Cost of Food per Bird	Average Price of Eggs per Dozen	Return per Bird over Cost of Food
				s. d.	s. d.	d.	s. d.
1913	318	38,199	120·1	11 2·3	5 8	13·05	5 6·3
1914	282	39,216	139·0	13 3·6	5 8·3	13·77	7 7·3
1915	264	39,764	150·6	17 6	7 0·5	16·75	10 5·5
1916	297	49,830	169·5	23 0·5	8 11·8	19·58	14 0·7
1917	210	36,660	174·6	32 7·2	13 10·7	26·89	18 8·5
1918	210	36,106	171·9	47 4	16 6	39·66	30 10·1
1919	306	55,124	180·0	53 3·4	20 0	42·59	33 3·4
1920	354	65,840	185·98	53 9	19 3·9	41·62	34 5·1

Most of the so-called "commercial egg farms," which have become more in evidence of recent years, are stocked with Utility White Leghorns, White Wyandottes, or Rhode Island Reds. The main business of these farms is to produce eggs for consumption though most of them do also a certain amount of trade in supplying eggs for hatching, day-old chicks, and stock birds. One of the largest British commercial egg farmers, however, who maintains a flock of 5,000 layers and rears some 5,000 to 6,000 chickens every year, states that nine-tenths of his produce is sold for direct consumption and that he regards the hatching egg and stock cockerel trade as comparatively unprofitable and troublesome. All hatching and rearing on this particular farm are done with broody hens, no incubators or foster-mothers being used, and this has been the practice for many years. It has proved commercially successful in this particular case, though other egg farmers use mammoth incubators and pipe brooder houses or anthracite stove hovers with apparently successful results. There is little doubt that the capacity for rearing large numbers of chickens with a low percentage of mortality is the crucial test of the commercial egg farmers' skill and management, and much has yet to be learnt regarding the rearing of chickens in large flocks. Considerable differences of opinion exist as to the comparative merits of pipe brooder houses, anthracite stove hovers, brooder houses with small portable oil hovers, outdoor portable brooders, and natural methods. When the pipe brooder system as practised in America was first tried in England many failures were recorded. Since then, however, improvements have been introduced and there is some evidence that the improved form of pipe brooder house may yet become popular in Britain. At least one large breeder has erected a brooder house of this type with a capacity of from 3,000 to 5,000 chickens and excellent results have so far been obtained. The anthracite stove brooder is now in use in considerable numbers, but opinions vary widely as to its efficiency in rearing a high percentage of vigorous well-grown chickens.

Methods of housing and feeding hens kept principally for table-egg production vary considerably. The usual practice is to keep the birds in comparatively large flocks of from 150 to 400 and to house them in open-fronted scratching-shed houses, the original type of which was probably introduced from America. These houses are not uniform in type, some being 14 ft. deep with special back ventilation whilst others are built only 9 ft. deep and depend for ventilation entirely on the open front. In Lancashire the open-fronted house is very little used, a span-roofed type with windows low down near the floor being preferred. The amount of run provided for the birds also varies. One well-known poultry farmer maintains 400 layers to the ac. but divides the acre into two portions, and whilst the birds occupy one portion forage crops, such as thousand-headed kale, which the birds later on consume, are grown on the other portion. On another farm the laying-houses are so placed on the farm and the wire fencing so arranged, that the birds can be given access to arable fields, fruit gardens or pasture, as the crops and the season permit.

In methods of feeding, too, there is also wide variation. The dry mash method is practised on certain farms whilst on others the wet mash method is preferred or a combination of the two. On some well-known egg farms large quantities of cooked vegetable food are regularly fed to the layers, whilst on other farms very little green food is given beyond what the birds gather for themselves on their runs.

From all this it will be gathered that methods are far from being standardized in the poultry industry, and this is indeed not a matter for surprise when the recent development of poultry-keeping as a business is considered. Unlike agriculture, which is man's oldest industry and has been for many years investigated both from the scientific and practical aspect by some of the best brains, there has been little scientific or even practical investigation into poultry-keeping methods in the United Kingdom. For the novice therefore, who may well feel doubtful as to the best system to adopt, the soundest procedure is probably to obtain information as to the methods practised on several successful poultry farms and then to adopt a method which appears to combine the good points of several.

The keeping of poultry in England by urban dwellers, with gardens or even small backyards, and by allotment holders, received a great stimulus during the war, owing to the falling-off in supplies of imported eggs and the necessity for converting all the edible household and garden waste material into human food. It was soon realized that a limited number of laying hens could be maintained under intensive conditions in small backyards and gardens, at comparatively low cost. The necessary labour could be provided within the family, and first-class eggs produced at the point of consumption at much lower outlay than that involved in purchasing inferior shop eggs. Furthermore, eggs so produced were actually on the consumers' premises. Difficulties and expenses of transport did not affect the supplies, provided a limited amount of additional feeding-stuffs could be obtained to supplement the household and garden waste material. This development in urban poultry-keeping would no doubt have proceeded much more rapidly than it actually did had the supply of chickens, pullets, and hens been greater. Unfortunately, however, poultry-breeders were unable to obtain supplies of feeding-stuffs freely and hence were obliged to restrict their breeding operations. Consequently the demand for laying stock by town dwellers could not in many cases be satisfied, or was met by supplies of old hens which gave disappointing results. In any case urban poultry-keeping has taken a firm hold, so much so that local sanitary authorities and town property owners are showing concern as to possible interference with the amenities of properties in urban areas, and local by-laws and clauses in leases which were more

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or less ignored in many cases during the war are now being strictly enforced. It is to be hoped that town poultry-keepers will so regard the requirements of hygiene and sanitation in thickly populated areas that no serious cause for complaint with subsequent restrictive action on the part of local authorities may arise, as undoubtedly "backyard" poultry-keeping can give powerful assistance in reducing the necessity for large importations of foreign eggs.

For backyard, allotment and garden poultry-keeping the intensive system of housing is usually adopted, though in some cases where sufficient space is available open or covered runs for the birds may be provided in addition to the house. Under the strictly intensive system the birds are permanently confined to the house which should afford four or five sq. ft. of floor space to each bird. It is essential that the floor of the house be kept dry and some 4 in. to 8 in. of bedding should be provided amongst which grain should be scattered from time to time so as to induce the birds to take necessary exercise by scratching amongst the litter for the grain. The intensive house is usually of a lean-to open-fronted type so designed as to admit as much sunlight as possible on to the floor in the winter months and yet to keep out rain, snow and wind. It may be built of wood,—¾-in. tongued and grooved match-boarding is often used,—asbestos sheeting, or even mainly of felt. As a backyard or garden poultry house is often of a more or less permanent nature it is usually more economical in the long run to use sound materials which are likely to need little repairing. A house of this type, which should be high enough to permit of easy cleaning, may be built for six or eight hens in quite a small backyard, and provided it is kept quite clean and no male birds are kept no offence is likely to be caused to neighbours even in a crowded city district. In circumstances such as these, however, it is inadvisable to attempt hatching and rearing, and the egg supply is likely to be more satisfactorily maintained if fresh pullets are purchased at the end of each summer and the hens disposed of which have been kept intensively for about a year, and have temporarily ceased laying and commenced to moult.

If space permit a covered run may be provided adjoining the house, but the floor material, especially if of soil or sand, must be kept scrupulously sweet and clean. The top surface should be raked off and renewed from time to time and occasionally a little disinfectant powder may be sprinkled in the run. Extra accommodation of this sort is, however, not really necessary for laying stock kept under proper intensive conditions for one year only, and most backyard poultry-keepers with limited space at their disposal will find an intensive house constructed on sound lines most suitable for their purpose.

The Sussex poultry-fattening industry, which had become of considerable importance in the three south-eastern counties prior to the war, has become almost extinct owing to the high price, and the difficulty in obtaining supplies, of the Sussex ground oats which were invariably used for cramming the birds. Apart from the fact that it was considered uneconomical in war-time scarcity to use concentrated feeding-stuffs for the production of the highly finished, crammed Surrey fowl, supplies of store chickens were difficult to obtain, feeding-stuffs were very short and were rationed, and, owing to the shortage of fresh meat, chickens found a ready market in almost any condition. Thus the old Sussex fattening industry gradually died out, though of course chickens continued to be reared as far as conditions would permit and were marketed as a rule without cramming or special fattening.

There have been some indications of a revival of the cramming practice, but Irish supplies of store chickens having been diverted for direct sale in London and elsewhere, and poultry-raisers having accustomed themselves to selling their birds for direct consumption without additional fattening, it may be that any general revival of cramming will be long deferred. Much will depend upon the public demand and this will no doubt revive to an increasing extent if supplies of the former high-quality crammed chickens become greater. The practice of trough feeding chickens in fattening coops for a week or so in order to give them a little extra finish is still continued to a certain extent during the late summer, and this practice has much to commend it. Less skill is required than in cramming; it is more economical of feeding-stuffs, and though the chickens cannot be as highly finished as by the crammer, good-quality table birds can be produced which are readily saleable at satisfactory prices.

Like the Sussex cramming industry, the old-established Aylesbury duck-fattening industry, as well as duck-fattening farms outside Buckinghamshire, became practically extinct during the war, but duck farms were bound to reappear as feeding-stuffs became cheaper and more plentiful. In 1921 the tendency appeared to be to keep the lighter breeds of ducks, such as the Indian Runner, the Khaki Campbell, and the Buff Orpington, for egg production rather than for table purposes, and much attention has been drawn to this aspect of duck-keeping owing to the laying competition for ducks conducted by the Great Eastern Railway Co. with the Utility Duck Club.

For many years the poultry industry received little recognition or assistance from the state authorities in the United Kingdom. Considerable changes in this respect, however, have been in evidence during recent years. State aid has been mainly directed to educational activities, and there are now few counties which do not possess an instructor in poultry-keeping, whose duties consist in giving instruction in this subject by means of peripatetic lectures, classes, and visits to poultry-keepers. Most of the agricultural colleges, dairy institutes and farm institutes also provide regular instruction in poultry-keeping to their pupils, and in some instances—such as at the Harper Adams Agricultural College, Shropshire; the Lancashire County Council School at Hutton; the Glasgow and West of Scotland Agricultural College Poultry School at Kilmarnock, etc.—courses of training are provided for students desiring to specialize in poultry-keeping.

Poultry-breeding centres have been established by the Board of Agriculture in coöperation with local authorities in almost every district in the United Kingdom, for the purpose of distributing good pure-bred utility poultry—usually by the sale of eggs for hatching or day-old chicks to smallholders, cottagers and allotment holders. This scheme has met with much appreciation and success. Table 6 shows the number of distributing stations established in England and Wales and the numbers of eggs and chicks distributed since 1919:—

TABLE 6.—*Distribution Stations.*

	Egg Stations	Egg & Chick Stations	Chick Stations	Incubating Stations	Total	Total Eggs	Distribution Chicks
1919	156	..	3	4	163	52,980	2,974
1920	122	39	8	4	173	141,611	20,934
1921	138	84	9	4	259[1]	..	..

[1] Includes 24 stations which undertake distribution of ducks' eggs.

It is significant of the interest now taken by the State in the development of the poultry industry that the Ministry of Agriculture and Fisheries has created a separate Small Livestock Branch, on the staff of which technically qualified officers were appointed. One of the chief duties of the branch is to supervise the poultry educational work of local authorities in respect of which grants in aid are made by the Ministry. It is the duty of the technical head of the branch to advise the Ministry on matters relating to the industry.

Valuable work is done in Britain to assist the poultry industry by poultry societies and clubs, such as the National Utility Poultry Society, the Poultry Club, the Northern Utility Society, the Scientific Poultry Breeders' Association, the Midland Fur and Feather Federation, and many others. These clubs organize lectures, demonstrations, laying competitions and shows, and do a great amount of voluntary work in an advisory capacity. In 1920 a central organization known as the National Poultry Parliament was set up mainly through the efforts of Mr. Edward Brown, F.L.S., who was unanimously appointed the first president. This poultry parliament, which meets once or twice a year to discuss questions relating to the industry, is representative of societies, clubs, educational authorities and institutions and trading organizations. The parliament has appointed a smaller executive body known as the National Poultry Council, and one of the first important steps taken by the council was to set up a national examination board to conduct an examination and to award to successful candidates a national diploma, which is intended to be in the main a standard qualification for persons desiring to obtain appointments as instructors in poultry-keeping. (P. A. F.)

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United States

Profound changes took place in the American industry between 1900 and 1920. In 1900 " breeding-birds " and meat were the principal objects of poultry raising and furnished most of the profit. Eggs at that time were a by-product. Conditions had so changed by 1920 that eggs were the principal money producer and meat and breeding birds were the by-products.

Many factors contributed to this change. There had been a greater increase in the population especially in the cities, than in the number of hens kept. Consequently there was a greater demand for meat and eggs, especially eggs. Cold storage facilities and improved shipping methods had raised the average quality of the product marketed and by more nearly equalizing the supply and price, had increased the demand. The spring flow of eggs after the introduction of storage became profitable, although formerly it often had resulted in loss. The per capita consumption of eggs and poultry flock decreased because of the increase in price. The increase in price affected the consumption of meat more than of eggs because substitution of other meats was possible. Eggs, quickly and easily cooked, digestible, containing concentrated vitamines, clean, imparting their flavour and preserving qualities to cakes and pastries, remained in strong demand even at high prices.

During 1920 the total value of products placed the industry among the few of those connected with farming from which the 1920 return exceeded a thousand million dollars. The 1920 census showed more farmers reporting poultry than any other single crop, even apart from the large quantity of poultry raised in towns and villages not covered by the census reports.

Table 7 shows that, relatively, poultry-keeping rapidly declined in the east during the decade 1909–19. The west, especially the Pacific Coast states, continued to increase. The decline in the east was due largely to the high price of feed and the difficulty of obtaining it, particularly during 1917 and 1918, and the decrease in farm population and the number of farms. Opposite conditions obtained in the west. While feed was higher it was easily obtainable and relatively cheaper because of the freight congestion. During the decade there was an increase in the number of farms and farmers in the west particularly on the Pacific Coast. The poultry farms in New England that were making a specialty of producing meat were to a large extent put out of business owing to the increased cost of feed and labour without a proportionate increase in the price of meat during 1917 and 1918. The same was true to a lesser extent of the specialized egg farms and farm flocks in New England and the North Atlantic states. These farms had not returned to normal when the 1920 census was taken, but at the close of 1921 a rapid development was under way.

The general depression in the industry from 1916 to 1919 primarily affected those who were obtaining comparatively poor egg production due to faulty methods of management or to poorly selected or poorly bred stock. The poultrymen who obtained high egg yields made greater profits than for the years 1910–1915. This condition drew the attention of poultry-keepers to the necessity of getting a good egg yield and led to systematic breeding and selecting for egg production. Many farms, particularly those in the northwest, have bred their birds to the point where they are getting an average egg production of over 200 eggs per hen from large flocks of birds. From 1900 to 1915 an increasing number of commercial poultry farms were established primarily to produce eggs. These took the place of the broiler farms, which had been mainly failures. Through these farms and the value of the produce, poultry became a business or industry rather than a side-line for farmers' wives or a hobby for fanciers.

Perhaps the most rapid change that took place in the industry during the period 1910–20 was that in 1910 but few baby chicks were sold, but in 1921 millions were sold to the advantage of the breeder, the hatchery man and the farmer raising the chicks. If the rate of increase of the chick hatcheries for 1918–21 should be maintained until 1930 comparatively few hens then would be used for hatching, and comparatively few hatching eggs would be sold except to the hatcheries.

TABLE 7.—*Chickens on Farms in the United States, 1920 and 1910; and Eggs Produced and Chickens Raised, 1919 and 1909 by Geographic Divisions (from 14th Census Report).*

Division	Chickens on Hand		Chicken Eggs Produced[1] (Dozens)			Chickens Raised[2]			Chickens and Eggs[3]		
	Jan. 1 1920	Apr. 15 1910[4]	1919	1909	Increase Per cent	1919	1909	Increase Per cent	1919	1909
United States	359,537,385	280,340,959	1,656,267,200	1,574,979,416	5·2	473,923,935	460,605,709	2·9	$1,047,989,919	$509,195,232
Geographic Divisions:—										
New England	5,803,507	6,840,404	37,631,896	54,668,994	−31·2	8,477,360	10,756,947	−21·2	32,513,758	22,517,029
Middle Atlantic	27,452,439	24,448,840	151,453,438	159,465,468	−5·0	31,059,165	34,070,656	−8·8	108,751,458	59,034,629
East North Central	84,516,275	69,471,093	400,445,456	389,256,925	2·9	99,251,552	98,895,698	0·4	249,814,285	123,210,787
West North Central	105,348,098	85,192,266	474,659,948	442,167,894	7·3	126,630,427	118,998,060	6·4	270,158,753	129,830,507
South Atlantic	36,407,610	25,626,503	144,662,300	134,289,761	7·7	65,374,047	65,058,950	0·5	110,631,263	50,959,642
East South Central	34,091,878	24,495,050	138,152,110	127,308,625	8·5	51,071,455	55,683,712	−8·3	85,188,095	41,412,242
West South Central	39,918,963	29,176,267	157,369,356	163,644,118	−3·8	58,051,184	54,701,253	6·1	97,156,410	44,077,140
Mountain	9,524,240	5,467,234	51,786,515	35,233,191	47·0	13,069,329	8,426,039	55·1	39,635,751	12,955,691
Pacific	16,474,375	9,623,302	100,106,181	68,944,440	45·2	20,939,416	14,014,403	49·4	63,140,146	25,197,565

[1] The figures for both 1919 and 1909 include estimates for farms reporting chickens on hand but no eggs produced. The returns for 1909 included all eggs produced. To obtain figures for chicken eggs alone, deductions have been made for eggs produced by ducks, in proportion to the number of ducks on hand in 1910. Eggs from fowls other than chickens and ducks are considered negligible.

[2] The figures for both 1919 and 1909 include estimates for farms reporting chickens on hand on the census date but no chickens raised during the preceding year. The returns for 1909 included all kinds of fowls raised. To obtain figures for chickens alone, deductions have been made for fowls other than chickens, in proportion to the number of such fowls on hand in 1910.

[3] The products shown for 1919 include chicken eggs and chickens only, while the 1909 figures include the products of all kinds of poultry.

[4] Chickens 3 months old and over.

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In 1900 there were few colleges or experiment stations in America teaching poultry raising or experimenting with it. By 1920 all the states were teaching and most of them were doing experimental work. Colleges and experiment stations have been of great assistance to farmers and poultrymen in showing them better methods. Egg-laying contests have shown the value of breeding for high production and of strains rather than breeds so far as egg production is concerned. The first egg-laying contest in America was at Storrs, Conn., under the supervision of the Connecticut Agricultural College in 1911–2. There were more than 10 contests in the United States and 10 in Canada in 1921–2. The highest average production in any contest was obtained by the Western Washington Experiment Station at Puyallup, Wash., for the year 1920–21. The 365 birds in the contest averaged 214 eggs per hen. The pen of five single-comb White Leghorns which led the contest and made the American record layed 1,384 eggs or an average of 276·8 eggs per hen.

During 1910–20 ornamental breeds and bantams so decreased that in 1921 few commercial breeds were maintained on a large scale. The chief breeds were White Leghorns, Barred Plymouth Rocks, Rhode Island Reds and White Wyandottes. There were also fairly large numbers of Anconas, Buff and White Orpingtons, Brown Leghorns, White Plymouth Rocks, Buff Wyandottes, Black Minorcas, Black Langshans and Light Brahmas.

Table 8 shows that imports and exports of eggs and egg products greatly increased from 1910 to 1920, the imports more rapidly than the exports, so that the United States seemed likely to become on balance an importing nation. The exports for 1920 consisted largely of shell eggs and went to Cuba, Canada, Mexico, Panama, England and Scotland. A considerable proportion of the eggs that went to Canada replaced Canadian eggs shipped to England. As Canada has a grading law, its eggs were exported to better advantage. The imports were mostly egg products from the Orient, particularly from China. In 1920 the imports consisted of 1,348,383 dozen of shell eggs, of which over 70% came from the Orient. The egg products amounted to 24,091,098 pounds, of which over 90% came from the Orient. Beginning about 1918 the large packing and egg handling houses began establishing egg-breaking and packing facilities in China and South America, so that in 1921 the imports seemed likely to continue to increase for some years unless tariff changes affected conditions. (O. B. K.)

TABLE 8.—*U.S. Exports and Imports; Eggs (Shell) and Egg Products, Fiscal Years 1910–20*

	Exports	Imports
1910	$ 1,264,043	$ 166,859
1915	5,083,825	1,236,889
1920	19,459,187	9,250,021

POWER, SIR WILLIAM TYRONE (1819–1911), British soldier and administrator (*see* 22.224), died July 24 1911.

POYNTER, SIR EDWARD JOHN, BART. (1836–1919), English painter (*see* 22.239), died in London July 26 1919. In 1919 he retired from the presidency of the Royal Academy, and was created K.C.V.O.

PREECE, SIR WILLIAM HENRY (1834–1913), British electrical engineer, was born in Wales Feb. 15 1834 and educated at King's College, London. He became a civil engineer but in 1853 joined the Electric and International Telegraph Co., whence in 1869 he reverted to the civil service. In 1877 he was appointed electrician to the Post Office, in 1899 engineer-in-chief and, after his retirement, consulting engineer. He was a pioneer of wireless telegraphy and his early experiments are described in 26.530. He died at Penrhos, Carnarvon, Nov. 6 1913.

PRESSENSÉ, FRANCIS DE (1853–1914), French politician and man of letters, was born in Paris Sept. 30 1853, the son of Edmond de Pressensé (*see* 22.299). He was educated at the Lycée Bonaparte, and at school had a brilliant career, earning many distinctions. He served on General Chanzy's staff during the war of 1870 and was taken prisoner at Le Mans, but after the war entered the public service. After a short period at the Ministry of Public Instruction, he entered the diplomatic service, and was appointed first secretary at Washington. In 1882 he returned to France and took up journalism. He was a contributor to many journals, including the *Revue des Deux Mondes* and the *République Française*, and in 1888 became foreign editor of the *Temps*. On the rise of the Dreyfus question (1895) de Pressensé identified himself with the cause of the prisoner. He wrote in support of General Picquart, and in consequence of his advocacy of Émile Zola's cause was struck off the roll of the Legion of Honour. This led to his resignation from the *Temps*, and he came forward as a socialist politician, being in 1902 elected socialist deputy for the Rhone. He was prominent in the debates on the question of the separation of Church and State, and a bill brought in by him formed the basis of the one finally carried by M. Briand. He died in Paris Jan. 19 1914.

De Pressensé published many articles of the greatest interest in the *Temps*, the *Revue des Deux Mondes*, *Aurore* and *Humanité*. He also produced *Le Cardinal Manning* (1896), an interesting study, and a work on Home Rule, *L'Irlande et l'Angleterre depuis l'acte d'union jusqu'à nos jours, 1800–1888* (1889).

PRETORIA (*see* 22.309).—Pop. (1911), whites 35,942, coloured 18,732, total 54,674; in 1918, whites 41,690. About a mile from the centre of the town on a commanding position on the slopes of Meintjes Kop are the Union Government Buildings, the finest public offices in South Africa. They were built 1910–3, from the designs of Herbert Baker, at a cost of £1,800,000, and consist of three main portions; a large central semicircular colonnaded building flanked east and west by rectangular blocks. At the junction of each wing with the central section is a domed tower 180 ft. high, and at the end of each wing is a projecting pillared pavilion. A feature of the building is the long low roof, with projecting eaves. The space enclosed by the building is laid out in terraces culminating in an open amphitheatre, in the centre of which is a stone rostrum. The buildings are of South African freestone, on a foundation of Transvaal granite. The laying out and planting of the terraced gardens was not completed until 1920. The principal approach lies 12 ft. below the main terrace, is 80 ft. wide and is planted with trees. Another road leads to the suburb of Bryntirion, where are Government House and the residences of ministers.

The foundation stone of Government Buildings was laid in Nov. 1910 by the Duke of Connaught, and the first public ceremony in the amphitheatre of the building was held in 1915 to celebrate General Botha's conquest of South-West Africa. In 1913 a statue of President Kruger was unveiled in the town. In April 1918 Pretoria became the headquarters of the newly created university of South Africa. One of its constituent colleges, the Transvaal University College (incorporated 1910), is situated in Pretoria.

The State Library and Museum (built 1913) are in Market Street. The former Transvaal Government Buildings, facing Church Square, which is the business centre of the city, are used by the Provincial Council. The Law Courts (completed 1914) are on the north side of the square; the Post Office (completed 1912) faces Church Square and Church St.

The municipality, which owns the sanitary, water, electric and tramway services, spent between 1902 and 1919 a sum of £1,675,000 on improvements, including the provision of a water sewerage system, electric tramways, parks, an open air swimming-bath and a golf course, reputed one of the best in South Africa. The rateable value of Pretoria in 1918 was £7,438,000, its revenue £366,000, and its indebtedness £1,716,000.

PRICES.—In the following article, which should be read in connexion with those under COST OF LIVING and WAGES, the changes in prices of commodities during the years 1910–20 are considered with special reference to the United Kingdom. An account of the American system for controlling prices in the United States is appended.

(I.) *Wholesale Prices in General.*—The movement of wholesale prices in general is measured by the method of index numbers. The prices of commodities for which definite market quotations for definite grades exist are selected as typical in their changes of prices in general, a year or longer period is chosen as base, the price of each commodity is equated to 100 at the base period and the price in other years expressed proportionately, such numbers being called price ratios. (Thus if the price of wheat in the base period was 60s. and in another year 45s., the price ratio in the latter year would be written as 75.) Then *either* factors are chosen expressing the relative importance of the commodities as deter-

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mined by the total sum spent on them in a period or some other criterion, and each price ratio is multiplied by the corresponding factor, the sum of the products is divided by the sum of the factors and the resulting quotient is the index number of wholesale prices for that year; *or* the more important commodities are represented by two or more price quotations and the resulting price ratios are simply averaged to obtain the index number. There are many variants of method and there has been much controversy on every detail of the process; in fact, however, the precision of the result depends not to any great extent on the particular method followed, but principally on (i.) the number of independent prices included and (ii.) on the dispersion of the various price ratios in the year to which the index number refers, so that when prices are moving on the whole in the same proportion the index number is more accurate than when some are moving rapidly upwards and others are stationary or falling. In normal times when changes are moderate it has been shown both from theoretical considerations and by comparing the numbers obtained by various methods that the precision of the method is high, but during the war period the movements were rapid and unequal, the conditions of accuracy were lost and no very precise measurement could be obtained. The object of the method of index numbers is to average away the variations due to the special conditions of supply and demand of particular commodities, and to obtain a resultant which measures the effect on prices of general causes, such as the supply of currency.

It is found in practice that the necessity for restricting price quotations to those of commodities for which the same grade and quality is in the market in large quantities through a long period of years restricts the choice greatly, and limits it to raw materials or articles in an elementary state of manufacture. In some cases the price used is based on the average value of all grades of the commodities (*e.g.* of wheat, of tea, of coal), imported or exported, but this introduces a possibility of error since the average may change owing to a change in the relative quantities of high and low grades independently of any change in price. The three index numbers of wholesale prices in use in the United Kingdom are the Board of Trade's, the *Economist's*, and the *Statist's* (formerly Sauerbeck's); the first uses average values to some extent and applies factors to the price ratios to allow for the relative importance of commodities, the second and third use market quotations of definite qualities of goods and take a simple average of the price ratios.

Table I. exhibits the general movement in the twelve years before the World War, and shows how little the variation of method affects the result in this period. The year 1903 is taken as the starting point, since it is after the great fall of prices ending in 1896 and the subsequent rise and the inflation of 1900–1, and may be regarded as a normal year.

TABLE I.—Movement of wholesale prices in the United Kingdom 1903–13. (In each case the index number of 1913 is equated to 100.)

Year	Board of Trade Index No.	Sauerbeck's Index No.	*Economist* Index No.
1903	83	82	79
1904	84	83	81
1905	84	85	81
1906	87	91	88
1907	91	94	93
1908	89	86	83
1909	90	87	84
1910	94	92	90
1911	94	94	95
1912	99	100	108
1913	100	100	100
1914 Jan.–June	—	97	96

Sauerbeck's index numbers for 1903 on the same basis for separate groups of commodities were:—Vegetable food 90; animal food 85; sugar, tea, coffee, 86; minerals 74; textiles 79; sundry materials 83. Wholesale prices had therefore been rising from 1902–13 (with a short inflation and depression in 1906–8), but tended downwards in the first half of 1914.

TABLE II.—*Statist* monthly index numbers. Average Jan. to July 1914 taken as 100.

End of	1914	1915	1916	1917	1918	1919	1920	1921
Jan.		117	150	193	225	233	298	239
Feb.		122	154	199	227	227	317	220
March		126	158	205	228	224	316	215
April	100	128	163	209	230	224	323	206
May		130	164	212	231	235	316	196
June		129	159	218	233	242	311	189
July		129	158	214	233	250	309	—
Aug.	106	130	163	213	237	258	308	—
Sept.	108	131	163	214	239	260	302	—
Oct.	109	133	173	219	239	272	291	—
Nov.	108	137	183	222	237	280	272	—
Dec.	111	143	187	225	237	285	252	—
Average for year—								
Statist		131	164	212	233	249	301	—
Economist		128	167	212	234	244	298	—
Board of Trade		127	164	214	235	261	327	—

Immediately after the declaration of war in 1914 prices began to rise, and with certain interruptions continued to mount up till the spring of 1920, when the index numbers reached their maximum (*Statist* 323, end of April; *Economist* 326, end of March; Board of Trade 357, average of July). Till Oct. 1917 the increases showed a remarkable regularity averaging 2% monthly, equivalent cumulatively to 27% per annum; on this scale the index in the successive Octobers would reach in 1914 106, in 1915 135, in 1916 171, in 1917 217 and in 1918 258, numbers which (except the last) are in close agreement with those shown in the table. This was, however, a definite seasonal movement superimposed on this regularity; in the first three or four months of each year prices moved up with special rapidity, while in the summer the increase was slackened and in some cases was replaced by a fall. The check in the increase in the summer of 1917, following a specially rapid rise, is attributable to the control of prices which by that date was general. From Aug. 1917 prices continued to rise in spite of control till Sept. 1918, but the rise in these 13 months aggregated to only 13% (239 against 213). After the Armistice prices fell slowly for five months, during the season in which in previous years the increase had been specially rapid, but expectations of a permanent fall were not realized; in the year beginning April 1919 the index rose from 224 to 323 or 44%.

From the beginning of the war till July 1919 the *Statist* and *Economist* index numbers are in close agreement, except that the *Economist* shows a more rapid rise for twelve months from Oct. 1916 and less increase in the late autumn of 1917, but there is disagreement as to the dates and amount of the increase after July 1919. At that date the three index numbers agree in estimating the whole increase in five years at 148, 149 or 150%. The following table shows the divergence in subsequent months:—

TABLE III. Monthly index numbers, July 1919 taken as 100.

	Board of Trade	*Economist*	*Statist*
1919			
July	100	100	100
Aug.	106	101	103
Sept.	110	102	104
Oct.	115	105	109
Nov.	120	108	112
Dec.	123	114	114
1920			
Jan.	127	120	119
Feb.	131	127	126
March	133	130	127
April	133	128	129
May	132	128	126
June	140	122	124
July	144	122	123
Aug.	135	120	123
Sept.	137	119	120
Oct.	134	111	116
Nov.	129	102	108
Dec.	125	92	100

The earlier agreement is more remarkable than the later discrepancies, for the conditions of accuracy named above were not present during the war when prices were moving rapidly and quotations for the usual qualities of goods were often

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TABLE IV.—Index numbers of wholesale prices.

	United Kingdom	Canada	U.S.A.	France	Italy	Japan	Sweden	Netherlands	Denmark	Norway	Australia
	Statist	Official	Bradstreet's	Statistique Générale	Bacchi	Bank of Japan	Svensk Handelstidning	Official	Finanztidende	Okonomiks Revue	Official
1913	100	100	100	100	100	100	100	100	100	—	—
1914	101	100	97	103	95	95½	116	106	134	100	100
1915	126	109	108	141	133	97	145	149	149	—	141
1916	159½	134	130	190	200	117	185	233	206	—	132
1917	206	175	172	263	306	148½	244	298	284	—	146
1918	226½	205	204	341	409	196	339	398	292	—	170
1919	242	216	204	358	366	239	330	306	340	—	180
1920											
Jan.	289	248	227	489	504	301	319	293	—	334	203
Feb.	306	253½	226	525	556	314	342	289	—	344	206
Mar.	308	258	225½	557	619	322	354	290	—	351	209
April	313	261	226	591	679	301	354	296	—	354	217
May	306	263	216	553	659	272	361	297	—	371	225
June	301	258	211	495	615	248	366	297	383	384	233
July	299½	256	205	498	613	239	363	301	385	411	234
Aug.	298	244	196	504	632	235	365	290	394	418	236
Sept.	293	241	184	528	660	231	362	288	398	427	230
Oct.	282	234	171	504	662	226	346	283	403	422	215
Nov.	263	224½	148	463	658	221	331	260	374	404	208
Dec.	244	214	138	437	634	206	299	233	341	377	197

The prices are of course measured in the currency of each country. In every case there is a fall in the last months of 1920.

unobtainable. It is important to emphasize this uncertainty, for it is the fact that exact measurements of general price changes cannot be made in times of disturbance, and indeed it is difficult even to define the quantity we wish to measure; tendencies can be observed clearly, but only rough measurements can be made and fine comparisons lead to error. The maximum level was reached in March 1920 by the *Economist* index number, in April by the *Statist*, in July by the Board of Trade. By Dec. 1920 the Board of Trade index was back at the level of the beginning of 1920, that of the *Statist* at the level of July 1919, and that of the *Economist* at the level of May 1919. The difference is mainly due to the varying proportions given to cereals and textiles, which had fallen rapidly, and to meat and minerals which had fallen little in the three numbers.

Table IV. (from the *Monthly Bulletin of Statistics of the Supreme Economic Council*, vol. ii., No. 5) shows the index numbers for several countries.

(II.) *Wholesale Prices of Selected Commodities.*—When we come to commodities separately, the measurements can be made more exactly subject to the two following qualifications. During the war period the ordinary sources of supply were so disturbed that pre-war kinds and qualities were no longer in the market (in the *Economist* index number only 19 out of the 44 quotations included were not subject to some modification of kind); and a statement of prices is generally taken as meaning the price at which a purchaser can obtain the goods he desires and at which a merchant is willing to sell, but in the time of control and rationing these conditions did not obtain, and the price was fixed by other conditions than those which influence a free market.

Table V. is based on the prices tabulated in the *Journal of the Royal Statistical Society*, July 1920, pp. 640–5, by the editor of the *Statist*. The index numbers have been recast, the average price in 1913 being taken as 100 for each commodity; the totals have been obtained by grouping together the separate entries on the same plan as in the original, but the change in base year affects the results, which thus differ from those given in Table II. in the same way as if the weights had been changed.

It is at once evident that the various prices have not followed the same course; the extremes in 1919 are tin, whose price rose only 28% in 6 years, and Russian flax, where the rise is 323%. This great divergence of itself shows that the general index number cannot have great precision; but in the absence of means of improving it, we cannot do better than take this number (shown in the line " Grand Total " in Table V.) as measuring the general inflation of wholesale prices.

The prices as recorded are the resultants of at least five nearly distinct forces, viz. the general inflation of prices, the conditions of supply and demand for the separate commodities, the control of supply, the control of prices, the change of quality. In 1915

TABLE V.—*Statist* index numbers. Averages for each year.

	1913	1915	1916	1917	1918	1919	1920
Vegetable food							
Wheat							
English Gazette	100	170	184	239	229	229	253
American	100	164	185	229	215	205	253
Flour, Town made white or G.R.	100	160	172	192	153	153	216
Barley, English Gazette	100	137	189	238	217	278	330
Oats, English Gazette	100	162	180	270	258	274	301
Maize, American mixed	100	175	223	304	332	334	383
Potatoes, good English	100	120	197	239	183	254	311
Rice, Rangoon	100	162	206	309	320	313	501
Total	100	156	192	252	238	255	319
Animal food							
Beef: Carcase, London Central meat market.							
Prime	100	134	150	194	191	200	231
Middling	100	139	157	206	211	220	257
Mutton: Carcase, London Central meat market.							
Prime	100	121	151	185	176	184	233
Middling	100	126	154	195	196	203	258
Pork: Carcase, London Central meat market	100	129	160	200	234	233	306
Bacon, Waterford	100	121	143	192	237	248	311
Butter, Friesland	100	118	161	181	208	212	253
Total	100	127	154	193	208	214	264
Tropical food							
Sugar							
West-Indian*	100	151†	255†	332†	347	404	611
Beet*	100	180†	239†	267†	279	361	689
Java	100	172	244	301	327	400	687
Coffee							
East India*	100	97	96	117	159	180	183
Rio*	100	84	94	109	130	215	210
Tea							
Congou, common*	100	167	160	338	418	270	225*
Indian, good medium†	100	127	130	185	194	182	114
Average Import*	100	122	125	162§	166	171	165
Total*	100	143	182	241	269	300	432
Total Food	100	143	186	228	233	250	322

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TABLE V.—*Continued.*

	1913	1915	1916	1917	1918	1919	1920
Minerals							
Iron							
Scottish Pig*	100	109	137	146	154	215	326
Cleveland Pig*	100	112	142	154	163	235	357
Common Bars	100	136	177	177	181	249	366
Copper							
Chili Bars	100	107	170	183	170	135	143
English Tough Cake†	100	112	182	185	171	135	153
Tin, Straits	100	82	91	118	165	128	150
Lead, English Pig	100	125	170	169	169	154	209
Coal							
Wallsend in London	100	143§	128§	128§	156	211	149
Newcastle Steam†	100	136	266	194	216	293	332
Average Export	100	122	177	193	219	331	572
Total	100	118	150	160	174	205	276
Textiles							
Cotton							
Middling American	100	84	128	236	318	280	330
Fair Dhollerah	100	77	123	240	301	259	248
Flax							
Petrograd*	100	176	226	333	353a	353a	353a
Russian, Average Import*	100	161	207	368§	379	423	837
Hemp							
Manila, Fair roping*	100	120	172	266	313	185	207
Petrograd, clean*	100	159	187	278	439	388	385
Jute, good medium	100	80	117	149	148	189	169
Wool							
Merino, Port Philip*	100	119	182	258	262	372	444
Merino, Adelaide*	100	114	174	245	247	338	337
English, Lincoln half-hogs	100	140	162	169	152	183	178
Silk, Tsatlee	100	89	148	195	234	236	351
Total	100	112	156	214	269	272	320
Miscellaneous							
Hides							
River Plate, dry*	100	105	119	162	163	182	166
River Plate, salted*	100	116	139	167	149	206	192
Average Import price*	100	116	135	180	185	198	233
Leather							
Dressing hides*	100	147	145	179	168	187	223
Average import price*	100	113	140	179	170	211	370
Tallow, town	100	108	138	181	242	255	218
Oil							
Palm	100	98	126	130	127	197	198
Olive	100	104	120	234	400	404a	404a
Linseed*	100	122	167	228	257	375	356
Linseed*	100	126	176	247	288	306	345
Petroleum, refined	100	105	141	190	252	204	298
Soda, crystals	100	102	166	189	174	249	317
Nitrate of Soda	100	110	156	217	237	216	215
Indigo, Bengal	100	486	486	373	327	332	527
Timber							
Hewn, average import*	100	147	205	244	268	344	400
Sawn, average import*	100	150	236	333	430	369	416
Total	100	148	182	217	247	268	312
Total Materials	100	129	165	201	234	252	304
Grand Total	100	135	170	212	234	251	312
Silver†	100	86	114	151	172	207	223

*The entries in these cases of similar commodities are averaged before inclusion in the index numbers.

†These commodities are not included in the *Statist* index numbers.

‡Comparative values.

§Approximate prices. *Nominal prices.

and 1916 the principal increases may be traced to the diminution or difficulty of supply (cereals, sugar, flax) or to acuteness of demand (wool) or to both (timber). In 1917–8 the prices of nearly all commodities whose supply was threatened or for which the demand was increased were controlled. The quality was changed definitely in the case of flour and indirectly when the prices are averages of several grades as in the cases of meat, flax, leather and timber.

Food.—The price of wheat rose immediately after the beginning of the war, and with it the prices of flour, oats, maize and rice. The prices were checked by the establishment of a government system of purchase at the end of 1916 and by the control of the prices of home-grown cereals in 1917; with this system flour of mixed materials was substituted for wheat-flour and the product sold at a price kept constant and relatively low, by the help of a subsidy beginning in the autumn of 1917. In the case of wheat and flour the subsidy and control continued till the beginning of 1921 but the prices rose; the prices of other cereals increased very rapidly from the autumn of 1919. An attempt was made to control the consumption of oats in 1917–8, otherwise cereals were not rationed. The wholesale price of potatoes was fixed from time to time, the Government undertaking to make good growers' losses, but the price was changed so frequently that the control had little effect.

Early in the war the price of imported meat increased more rapidly than that of home-killed, till in 1917 there was little difference between their retail prices. On the whole the price of meat increased less than that of commodities in general. Prices were fixed in Aug. 1917 and consumption was rationed early in 1918; after the Armistice control was gradually relaxed; but prices of beef and mutton changed very little during the two years after the first fixing of them. The prices of Irish bacon quoted are hardly typical; in 1917 a great quantity of American bacon of inferior quality was bought by the Government, who had difficulty in selling it at a price which covered the cost. The demand for high-class bacon could not be met, and its price after 1917 rose more rapidly than that of butcher's meat. The line in the table relating to imported butter is perhaps misleading since the supply was insignificant, and its inclusion unduly depresses the average; for the records of milk and its products we must depend on retail prices. Taken together the prices of animal food increased at a lower rate than the general average of prices except in 1916–7.

The price of sugar was of course dominated by the cutting off of the continental supply, and its increase was greater than that of any commodity always obtainable included in the table. The Government took over the whole supply at the beginning of the war and issued it at a fixed price; the control continued till 1921. There was no shortage of supply of coffee nor of tea (except in the autumn of 1917), and their prices rose relatively little.

When all food prices are grouped together as in the table, it is seen that they rose till 1917 more rapidly than the average for materials, but that the increase from 1913 to 1918, and to 1919 was the same in the two groups.

Materials.—The prices of different kinds of coal increased at different rates prior to the general control of coal mines which took effect early in 1917; with the stoppage of export of coal the supply was adequate even for the increased use in the manufacture of pig-iron, and the restriction in consumption from 1917 was only necessary to economize labour in the mines. For domestic and manufacturing use the price rose but slowly till 1919 and generally less than for goods in general. Iron and steel began to come under control as early as June 1915 with the initiation of the Ministry of Munitions, and their use was severely restricted for all civil purposes, so that there was no free market for more than three years. The prices were actually fixed in Nov. 1917, a government subsidy being given to steel and to pig-iron makers to meet any extra costs. The subsidies were withdrawn early in 1919 and the price of pig-iron rose from £4 15s. to £8 a ton, the pre-war level having been £2 11s. Reconstruction and repairs, for many years in arrear, caused a great demand for iron and steel, and in July 1920 pig-iron was 320% and steel rails were 283% dearer than in 1914; prices fell slowly in the autumn of 1920 (Birkett: "Iron & Steel Trades during the War," *Statistical Journal*, May 1920). Copper, tin and lead showed no special inflation and were relatively cheap in 1919.

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Cotton followed an exceptional course. With the cutting off of Germany from the market the price fell considerably in the first months of the war and was below the pre-war level till nearly the end of 1915. Presumably in consequence of the restriction of shipping, a rapid rise began in the autumn of 1916, and at the date of the Armistice cotton was at three times its pre-war price; then there was a perceptible fall for some months, but this was followed by a great increase, the reason of which has not been explained, which brought American cotton early in 1920 to more than four times its cost in July 1914; the reaction from this inflation gave the first indication in 1920 that the general index number was about to move downwards. Both yarn and piece goods rose more rapidly than raw cotton, especially in 1919–20.

The price of wool also fell after the outbreak of war, but the great demand for the Allied armies soon turned the scale and English wool especially became rapidly dearer in 1915. From June 1916 the Government took steps to assume ownership of all the wool it required and to control the rest; the distribution to manufacturers and prices was arranged by an intricate system involving the Government, wool-brokers and manufacturers (Zimmern: *Economic Journal*, March 1918). The price was very high in 1917–8 and rose rapidly in 1919 when the civilian demand for replenishing their wardrobes and households was acute, and the prices of yarn and manufactured goods outpaced even raw materials. There was no definite fall till 1920. As regards flax, the cutting off of the Russian supply and the Government demand for linen in airships caused linen to be practically unobtainable by civilians, and the shortage naturally continued long after the war. Jute and silk were less affected.

The variations in the movements shown under the heading "Miscellaneous" can in general be explained by known conditions of supply and demand. The supply of petroleum proved to be sufficient for war needs. The *Statist* index number is vitiated by the exclusion of rubber. Owing to the development of plantations before the war the supply was even excessive; the price was rarely more than 20% higher than in July 1914 and after the Armistice was lower.

(III.) *Retail Prices of Food in the United Kingdom.*—Accurate and useful statements of retail prices are in general only obtainable with respect to food, in part because most attention has been directed to recurrent and necessary domestic expenditure, in part because it is less easy to define the unit of purchase in the case of clothes and manufactured goods. The cost of other necessary items of expenditure is considered in the article COST OF LIVING, and this section deals with food alone.

The following tables show the average prices paid by the working classes in the United Kingdom, the result of the monthly collection of information by the Ministry of Labour (formerly by the Board of Trade) published in each issue of the *Labour Gazette*, and described in detail in the issue of March 1920. The general movement in retail prices was similar to that of wholesale, that is, a nearly regular increase (23% cumulatively per annum) took place for three years after the outbreak of war, then for more than a year the rise was checked by control and rationing; there was a temporary fall in the spring of 1919, followed by a rise which became rapid in the summer and autumn of 1920 and a fall after Nov. 1920.

TABLE VII.—Average of Retail Food Price-Changes in the United Kingdom as computed in the *Labour Gazette*.
(The average on the 1st or 2nd of each month is expressed as a percentage of the average in July 1914.)

	1914	1915	1916	1917	1918	1919	1920	1921
January	—	118	145	187	206	230	236	278
February	—	122	147	189	208	230	235	263
March	—	124	148	192	207	220	233	249
April	—	124	149	194	206	213	235	238
May	—	126	155	198	207	207	246	232
June	—	132	159	202	208	204	255	218
July	100	132½	161	204	210	209	258	220
August	—	134	160	202	218	217	262	—
September	110	135	165	206	216	216	267	—
October	112	140	168	197	229	222	270	—
November	113	141	178	206	233	231	291	—
December	116	144	184	205	229	234	282	—
Average for year	—	131	160	198	215	219	256	—
Wholesale food index* (*Statist*)	—	*142*	*173*	*225*	*231*	*245*	*308*	—

*Second quarter of 1914 taken as 100.

Table VII. shows the average of the movements as combined from the data in Table VI. (together with the prices of fish and eggs) by the Ministry of Labour, each item being given the importance estimated from a pre-war standard budget of expenditure. For the relation of this computation to the cost of living *see* COST OF LIVING. Except for making facile generalizations the detailed table is more important than the summary.

The price of bread rose intermittently, but on the whole rapidly till Sept. 1917, when its price was exactly double that of July 1914. The rate of extraction of flour from grain was controlled from the autumn of 1916, and government regulation flour containing an admixture of wheat, maize, rice and other cereals in varying proportions alone was used in the three years 1917–8–9, and during this period the price is not that of a commodity of constant quality. In Sept. 1917 the Government fixed the price at 9d. for the 4-lb. loaf, became the sole purchasers of the necessary cereals, regulated the price to millers and bakers and met the deficit by a subsidy. The price was raised to 9½d. in Sept. 1919 to meet bakers' increased expenses, and at subsequent dates again raised with the increasing price of wheat till it reached 1s. 4d.; when wheat fell in the latter part of 1920 the subsidy was gradually reduced to zero and the price of bread maintained; in 1921 the price fell, and was 1s. 1½d. from April to July. Flour followed nearly the same course as bread.

The retail prices of *meat* were determined by the wholesale prices already discussed. Imported meat remained for three and a half

TABLE VI.—Average Retail Prices in the United Kingdom of the Principal Foods as recorded* at the beginning of each month in the *Labour Gazette*.

	1914		1915		1916		1917		1918		1919		1920		1921
	July	Dec.	June	Dec.	June	Dec.	June	Dec.	June	Dec.	June	Dec.	June	Dec.	June
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s d.	s. d.	s. d.	s. d.
Bread . 4 lb.	5¾	6½	8	8	8¾	10	11½	9	9	9	9	9½	1 0½	1 4	1 1½
Flour . lb.	10½	1 0	1 3	1 3½	1 4½	1 7½	1 10	1 4	1 4	1 4	1 4	1 4	1 11	2 6½	2 0¾
Beef															
British lb.	8	8¼	11¾	11¾	1 1¾	1 1¾	1 4½	1 3½	1 3½	1 5½	1 3½	1 6	1 6	1 9	1 8¾
Imported lb.	6	7¼	9	9¼	11½	11	1 1¾	1 1½	1 3½	1 5½	1 1½	1 2¾	1 0¾	1 0¾	1 0
Mutton															
British lb.	8¼	8¾	10¾	11	1 1½	1 1¾	1 5½	1 3	1 3	1 4¾	1 3¼	1 5¼	1 5½	1 11	1 10
Imported lb.	5½	6½	8	8¼	11¼	11	1 2	1 1½	1 3	1 5¼	1 1	1 0	10½	11¾	11
Bacon lb.	11¼	1 0	1 1½	1 2½	1 3½	1 5½	1 8½	2 2½	2 3	2 3	2 3	2 4½	2 6	2 9½	2 2½
Milk . qt.	3½	3½	3¾	4½	4½	5¼	5½	6¾	5½	8½	6½	10¾	7¾	10¼	7¼
Cheese															
Imported lb.	8¾	9½	11½	11¼	1 1¼	1 2½	1 7½	1 4¾	1 5	1 8	1 6	1 6	1 8½	1 9	1 7½
Butter . lb.	1 2¼	1 3½	1 4½	1 7	1 7	2 0	2 0	2 4½	2 5½	2 6	2 6	2 6½	2 11¼	3 3½	2 2
Margarine lb.	7¼	7¼	7¼	7½	8¼	8¾	11¾	11½	1 0	1 0	11¾	1 1	1 2	1 1¾	9
Sugar . lb.	2	3½	3½	4	5½	5½	5½	6	7	7	7	8	1 2	10	1 7¾
Potatoes 7 lb.	4¾	4	4¾	4½	½	10¼	11¾	6¾	7½	7¼	8¾	10½	1 3½	11½	8¾
Tea . lb.	1 6½	1 8¾	1 11	2 3½	2 3½	2 3½	2 8	3 1½	2 8	2 8	2 6½	2 9¼	2 10½	2 8½	2 6½

*The prices from Dec. 1914 to Dec. 1918 are calculated from the percentage changes recorded.

NOTES.—The prices of meat are the means between two entries in each case and not the average prices of the carcases. They should only be used for comparative purposes, and not taken to be the average price of all meat bought.

In general the records are the average for the commodities as bought in shops and stores used by the working class.

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years at 2d. or 3d. a lb. lower than British meat, but since the price of the latter was nearly doubled, the percentage increase of the former was much greater. The Ministry of Food fixed wholesale prices and the retailer's margin in September 1917 and subsequently the distinction in price between British and imported meat was removed. Rationing was gradually introduced, and was nearly universal from April 1918 to May 1919. Purchasers were restricted also to the kind of meat that was available from time to time. During the period of control and till the summer of 1920 prices fluctuated little, but after control was removed imported meat became cheaper than British, and with a rise in the latter in 1920 the pre-war proportion between the two was nearly restored. Home meat was at its maximum (at about two and a half times its pre-war level) in the autumn of 1920 and did not fall at all considerably till after May 1921.

Prior to 1914 the corresponding numbers, for London only, are 1910 and 1911 98, 1912 and 1913 103. (*See* article COST OF LIVING for further analysis, and for comparative figures for other countries.)

The price of *bacon* rose rather more slowly in the opening years of the war, but rapidly in the summer of 1917 till it was 140% above the pre-war price. In Nov. 1917 importers' and dealers' prices were fixed, and in July 1918 the regulations extended to retail prices; during this period large supplies of generally inferior bacon were received from America, and rationing was only necessary for a few months. The price after being stationary for two years rose during 1920 till it reached three times the level of July 1914.

After 1915 the price of *milk* was markedly seasonal, while before the war it was generally retailed at the same price nearly all the year round. No change took place till the autumn of 1915, when the price rose 1d. a qt., and in the following autumn another ½d., and in neither case was there a fall in the spring; in the autumn of 1917 it reached nearly twice the pre-war price, and in subsequent years fell in the spring and rose in the winter to successively higher points, the maximum (10¾d.) being reached in Jan. 1920. Maximum prices were in force from the autumn of 1917 till Jan. 1920, but they were not reached in all localities. The great rise in the price of milk must be attributed to the high cost of cattle food, which was very scarce in the period of restricted imports; elaborate arrangements were made to increase the supply by curtailing the consumption of cream and the manufacture of butter and cheese. Milk was not rationed except by informal local arrangements. Not much attention should be paid to the prices of *butter* and *cheese* after 1916, since during a long period they were not freely obtainable, and the Government having taken control distributed them at prices which would meet their cost. Butter was rationed with margarine.

The price of *margarine* rose little till 1917, while its consumption increased greatly owing to the want of butter. A shortage of supply was felt suddenly at Christmas 1917, and the Ministry of Food took control and presently assumed ownership of the supply of its constituents and the factories in which it was made. The quality was greatly improved, as compared with that in 1914, and its importance as food became very great in view of the difficulty of obtaining sufficient fatty substances from other sources. The price was fixed in Nov. 1917 at 1s. (1s. 4d. for oleomargarine) and changed little till the end of 1920. In May 1919 the price was left free.

The whole supply and distribution of *sugar* was taken over by the Government at the beginning of the war and control was continued till 1921. Sugar was distributed through the ordinary channels in such amounts as were available and traders began early to ration their customers. Official rationing (generally at 8 oz. per person) developed in 1917 and its success encouraged the Government to develop the general scheme of rationing meat, fats and some other foods in 1918; rationing of sugar gradually became obsolescent in 1919. The price rose considerably at irregular intervals as shown in the table till in Jan. 1920 it was seven times as dear as before the war.

Potatoes became dear after 1916 and afterwards fluctuated strongly upwards in sympathy with other agricultural produce and the price of manures, and in relation to the supply of each season. The high prices, however, were not universally felt owing to the development of the cultivation of private allotments especially early in 1918.

The supply of *tea* was ample except for a short period in the autumn of 1917. At that date the Government took control of the supplies and provided a uniform blend to be retailed at 2s. 8d. per lb. The rise in price was less on the whole than that of any other commodity shown in the table.

Other less important foods often showed a greater increase in price than those already named, especially since there was a run on them during the time of restriction and shipping facilities were given rather to the more necessary imports. Eggs in particular became scarce and dear owing to the failure of the European supply and the scarcity of poultry food.

No general comparison of wholesale and retail prices is possible, for want of adequate records of the wholesale prices of manufactured goods and of retail prices of articles other than food. In the case of food, however, the figures are sufficiently typical and accurate to allow of a general comparison, but not to permit accurate detailed measurements. The two index numbers shown depend on nearly the same range of foods, but the bread subsidy lowers the retail prices by about 10 points in 1918–20.

TABLE VIII. Wholesale and retail prices of food. (*Statist* and *Labour Gazette* index numbers.)

Year	Quarters	Wholesale (*Statist*)	Retail (*Labour Gazette*)
1914 . .	1st & 2nd*	100	100
	4th	118	116
1915 . .	1st	134	123
	2nd	144	130
	3rd	142	136
	4th	144	143
1916 . .	1st	159	148
	2nd	173	158
	3rd	169	164
	4th	195	183
1917 . .	1st	218	192
	2nd	232	201
	3rd	221	203
	4th	222	206
1918 . .	1st	230	207
	2nd	227	208
	3rd	234	221
	4th	247	231
1919 . .	1st	236	221
	2nd	233	207
	3rd	244	218
	4th	264	234
1920 . .	1st	292	234
	2nd	328	253
	3rd	326	268
	4th	290	284
1921 . .	1st	246	250

*July 1914 for retail prices.

In Table VIII. the retail prices for the first quarter of each year are the averages for the 1st of Feb., March, April and so throughout the year. Wholesale and retail prices include those of controlled goods, and in the case of wheat, flour and bread are affected by the bread subsidy. The table shows that retail prices rose in sympathy with wholesale prices during the first three years of the war, but the rise on the whole was less, and the accelerated rise in the spring of each year was only marked in wholesale prices. As prices became more and more rigidly controlled in 1917, and some commodities were rationed in 1918, wholesale prices fell or remained nearly stationary, while retail prices rose very slowly.

(A. L. Bo.)

PRICE-CONTROL IN UNITED STATES.—During the World War price-fixing agencies in the United States were numerous, and the arrangements made were often informal. Many prices were controlled indirectly; but when this control was to any degree international the result was a "fixed price."

Prices were more or less formally fixed by various departments or branches of the U.S. Government for at least 110 important products, each of which required a separate price-fixing operation. This was exclusive of repetitions or renewals at later periods, which often involved as much work and study as the original decisions. The following is a partial list of products for which prices were fixed by some government agency or sanction. They are arranged in general in the order in which the prices were fixed, although no pretence to accuracy in this regard is claimed. Food products are not covered in detail, and no attempt has been made to mention them in order:—

Hides
Coal, bituminous
Coal, semi-bituminous
Pig iron
Steel plates
Steel, structural
Wheat
Ship timbers
Pine, yellow
Steel billets
Sugar
Sardines
Bar iron
Pipe, cast-iron
Castor oil
Aluminium
Coal, anthracite
Coke
Copper
Molasses (imported)
Manila fibre
Retail lumber (eastern cities)
Platinum
Hemlock
Pine, white
Spruce, eastern
Paper, newsprint
Manganese ore
Copper, ingot, electrolytic
Copper wire
Iron ore
Nitric acid
Cotton linters
Cotton goods
Cotton yarns
Denims (Mass.)
Drillings (Mass.)
Ginghams, (Amoskeag)
Print cloths
Sheetings, bleached
Sheetings, brown
Hemp

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Steel rails	Sashes and doors	Tickings (Amoskeag)
Nickel	Linters (munition)	Flour, wheat
Tin plate	Quebracho extract	Rice
Wire, barbed, galvanized	Cement, Portland	Building tile
	Sulphur	Crushed stone
Wire, plain, annealed	Rubber	Sand and gravel
	Wool	Lead
Ammonia	Acetate of lime	Charcoal
Douglas fir	Quicksilver	Leather, sole
Arsenic	Iridium	Glycerine (dynamite)
Ammonium sulphate	Hogs	Cottonseed meal
	Leather, harness	Cottonseed oil
Alcohol, wood	Prunes, California	Wool grease
Acetic acid	Raisins, California	Burlap
Nitrate of soda	Carbon tetrachloride	Tin, pig
Silver	Formaldehyde	Tree nails, locust
Zinc, grade "A"	Chlorine gas, liquid	Cotton compress rates
Zinc, sheets and plates	Toluol	Birch logs
	Phenol	Brick, common
Binder twine	Picric acid	Wallboard
Castor beans	Sulphuric acid	Food products

Without attempting a complete list, it may be stated that food products whose prices were regulated included flour, bread, sugar, live stock, meat, poultry, dairy products (including retail milk prices), oleomargarine, cottonseed and its products, canned foods, dried foods, rice and rice flour, feeds and coffee. The prices that were first formally fixed by the Government fall chiefly in the basic raw-materials group. A more shortsighted policy might have begun by regulating prices of articles which figure most conspicuously in public consumption.

In some cases prices were fixed for Government purchases alone, for example, nickel, quicksilver, sulphuric acid, cement, New England spruce and other lumber. In others the prices were fixed for the Government and made available to the public in a contingent way; for example, in the case of hemlock lumber it was provided that any quantity of the commodity which, in the judgment of the lumber director of the War Industries Board, could be released for the commercial market might be sold to the public, subject to the maximum price fixed for the Government. In still other cases—for example, copper and raw sugar—purchases by the Allied Governments were included in the scope of price-fixing for the U.S. Government; and in a few instances, as purchases for the use of the railways of the United States, the prices were specifically fixed, although they did not apply to the public. Prices were sometimes fixed for single branches of the Government, as in the case of oil products for the navy and cow-hide splits for the quartermaster's corps of the army. Prices were even fixed by the U.S. Government to apply to purchases by the Allied Governments only, as was the case with fuel oil, gasoline and kerosene.

The President, however, early took a firm stand for the principle that prices charged by producers should be the same to the public and to the Government, and, with the exception of prices on certain purchases made by Government departments, rapid progress was made during 1918 in carrying out this policy. Thus the prices fixed for pine, fir lumber and cement, which at first applied only to direct Government purchases, were extended to the public. It proved to be highly important as a practical matter that prices under similar conditions of purchase should be the same to all. The existence in the commercial market of prices that were higher than those paid for Government purchases made it difficult for the Government to secure prompt deliveries. Moreover, such a situation often defeated the purpose of price-fixing, because large purchases might be made by private concerns producing more or less directly for the Government.

The period of price-fixing began about the middle of 1917, and came to a nearly complete standstill with the signing of the Armistice. Among the earliest commodities to be affected by the price-fixing activities of the Government were lumber, coal, wheat, sugar and canned foods. Lumber prices for the Government alone were fixed by arrangement with the Council of National Defense on June 18 1917, and approved by the Secretary of War; coal prices for the navy were fixed on June 19 1917. The Food and Fuel Control Act on Aug. 10 1917 set a minimum price on the wheat crop of 1918. Bituminous coal prices at the mine were fixed by executive order on Aug. 21 1917. Nine days later came the President's announcement of a $2.20 basic price on wheat "to be paid in Government purchases." The price of copper was fixed in September. Relatively few prices were fixed after Nov. 1918, although those fixed prior to that time extended well over into 1919. Prices, as fixed, were allowed to expire in spite of the fact that in several important cases the representatives of the industry concerned asked that the existing price be continued. On Dec. 11 1918 the War Industries Board issued a statement to the effect that, since it would cease to function after Jan. 1 1919, no new price agreements would be entered into by the Price-Fixing Committee and that all prices theretofore fixed would be allowed to expire by limitation. Several commodities, the cost of which had not been immediately ascertainable, had been taken in large quantities by the Government at prices subject to later determination. For example, during the latter part of Jan. and the early part of Feb. 1919, the Price-Fixing Committee of the War Industries Board fixed prices on common brick and on wall board. Inasmuch as the Food and Fuel Administrations depended for their powers upon the Act of Aug. 10 1917, which applied "during the war," they functioned longer, but became practically inoperative early in 1919.

Of the various agencies through which prices were fixed the following are without doubt the most important: Congress, which by direct legislation fixed a minimum price for wheat and for silver; the President, acting under authority granted by Congress, who fixed prices for coal and wheat; the War Industries Board, created by the President July 28 1917, under authority from Congress, which Board through its Price-Fixing Committee fixed numerous prices from Sept. 1917 to Nov. 1918 (as late as Jan. and Feb. 1919 several cases of price-fixing for commodities bought at tentative prices were awaiting cost determination); the U.S. Food Administration, established in Aug. 1917, which fixed prices of hogs, meat, flour, sugar, binder twine, etc.; local food administrators and sub-agencies, such as the Sugar Equalization Board and the U.S. Food Administration Grain Corporation, which fixed many prices; the U.S. Fuel Administration, established in Sept. 1917, which fixed prices of coal, coke, etc.; the War Trade Board, which fixed prices of rubber, quebracho extract and manila fibre; the Federal Trade Commission, which fixed the prices of newsprint paper; the Emergency Fleet Corporation of the U.S. Shipping Board, which fixed the price of ship timbers and locust tree nails; the U.S. Shipping Board which fixed ocean freight rates; the International Nitrate Executive Committee, which fixed the price of nitrate of soda; the Food Purchase Board, which fixed prices of canned foods, etc., for the army and navy; various army and navy departments, which fixed prices of gasoline and fuel oil, zinc oxide, automatic sprinklers, sashes and doors, castor oil, etc.; the Appraisal Boards of the army and navy, which fixed prices in cases of dissent from prices named in commandeering orders; and the U.S. Railroad Administration, which took steps to fix reasonable prices of locomotives and cars. As time went on a tendency toward greater uniformity and centralization of procedure developed within the price-fixing mechanism. This tendency was seen in an increasing amount of work thrown upon the War Industries Board and the Federal Trade Commission, the former naming a price based largely upon the cost findings of the latter.

In initiating price-fixing no systematic plan was followed and prices were at first fixed sporadically. Various Governmental powers were resorted to and were applied by numerous agencies, using diverse means for carrying out the decisions or agreements which they reached. In some cases prices were fixed under special authority, conferred directly by Act of Congress, and limited by the provision of such Act to specified commodities. Thus by section 14 of the Act of Congress of Aug. 10 1917, already referred to, the President was empowered to fix "a reasonable guaranteed price for wheat." Accordingly on Aug. 30 the President, acting upon the recommendation of a committee appointed by himself, promulgated a price of $2.20 per bus. for No. 1 northern spring wheat at Chicago. The same law, commonly known as the Lever Act, authorized and empowered the President to license importers, producers or distributors of "any necessaries, in order to carry into effect any of the purposes of this Act"; and, if he found unreasonable any storage charges, commissions or profits, to revoke licences and make findings as to reasonable profits, etc. Section 10 of the Act authorized him to requisition necessary foods, feeds, fuels and other supplies. Section 11 gave him

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power to purchase and sell at reasonable cash prices wheat, flour, meal, beans and potatoes. The power under this Act ran to the President, and the Fuel Administrator and Food Administrator acted under "executive orders." On the other hand, the War Industries Board acted under less specific authority proceeding from the general war powers of the President. Thus the prices fixed for steel, copper, lumber and other commodities by the Price-Fixing Committee of the War Industries Board were in theory approved by the President before being publicly announced. In some cases, however, such as retail lumber prices in certain eastern cities, the prices were announced without formal approval by the President.

The means of enforcing prices when "fixed," whether determined by the price-fixing agencies or reached by agreement with the producers, were various, ranging from appeals to the patriotism of the trade to commandeering orders. In most cases there was in the background the possibility of the Government's taking over the industry; and in not a few the army or navy did commandeer plants or stocks of merchandise. In such cases a price was named which was subject to adjudication, first by the Board of Appraisers and then, upon appeal, by the courts. On Dec. 24 1917 all wood chemicals (acetic acid, alcohol, etc.) were commandeered for a period of six months and later the commandeering order was extended to cover the second half of 1918. Apart from purchases on army or navy account, however, price-fixing was effected chiefly by "licences" and control of "priorities." The Food Administration and the Fuel Administration, under the Act of Aug. 10 1917, put in force extensive systems of licensing, under which unlicensed producers and distributors were not allowed to engage in business, and licences were revoked, if the regulations were disobeyed. The War Trade Board also licensed importers of certain articles on condition that the prices which it fixed should be observed. The administration of priorities proved to be a major element in the price-fixing programme, and involved many important questions. Toward the end of 1917 a priorities division was established within the War Industries Board and a priorities commissioner placed at its head. Representatives of the Fuel Administration, the Railroad Administration, and the U.S. Shipping Board were placed upon a Priorities Committee. The War Trade Board, the Food Administration, and the army and navy were also represented. The Price-Fixing Committee of the War Industries Board and the Priorities Committee worked in harmony. This was of the utmost importance, as it made possible a substantial degree of unity of policy among the different Government purchasing departments; and, through the power of the Priorities Committee over fuel and transportation, pressure could be brought to bear upon a recalcitrant business concern for the purpose of compelling it to adhere to fixed prices. The Priorities Committee undertook whenever necessary to administer priorities in the production of all raw materials and finished products, save food, feeds and fuels. The distribution of fuel was, of course, under the supervision of the Fuel Administrator, and transportation service under the U.S. Railroad Administration, but the Fuel and Railroad Administrators were guided largely by the "preference list" issued by the Priorities Committee and by the recommendations of the division chiefs of the War Industries Board, and on the whole came to work in close relation to the committee's general policy. The Priorities Committee, then, exercised a general function of adjusting production to the needs of the nation at war by allocating the limited supplies of fuel and basic raw materials, and its powers were sometimes used as a club to reinforce the authority of the Price-Fixing Committee in particular cases. The Army and Navy Appraisal Boards were called to pass on prices in the case of commandeer orders issued for the requirements of those departments. When a commandeer order was to be issued the practice developed of having the chief in charge of that division of the War Industries Board which dealt with that commodity approve the order in which the price was named. If, as was frequently the case, the producers of the commodity were not satisfied with the price, the matter was brought before the Appraisal Board. It is important to observe that those members of the Price-Fixing Committee who represented the army and navy were also members of the appraisal boards of these two departments.

Various methods of applying price control were tried. Prices may be fixed both directly and indirectly. As a rule, each commodity the price of which it was desired to fix was taken up directly and a specific price made for its purchase; but in some cases reliance was placed upon indirect control of the price of one commodity through direct control of the price of another. A most interesting and important phase of indirect price-fixing activities lay in the attempts to restrain prices by controlling consumption, as in the cases of tin, platinum, coal, sugar, wheat and meat. These efforts culminated in rationing in the case of sugar and the requirement of purchase of substitutes in the case of wheat or flour. Steps were taken, also, to prevent waste and to improve methods of production, for example, cleaner threshing of wheat. Most of such "conservation" measures are to be approved without reserve. Closely connected with the conservation phase as seen in control of demand, rationing, etc., were stabilization and pooling. But pooling, while partly used to facilitate rationing (as in the case of sugar), may also be used to keep prices up, either locally or throughout the entire market. In at least three cases, wheat, sugar and tin, the Government entered upon a pooling programme for the purpose of stabilizing prices. Stabilization is a term which implies mixed motives, a considerable part of its purpose commonly being to maintain or keep up prices, at least in a part of the field. This was the case with the Sugar Equalization Board and the tin pool, and the Government's Grain Corporation.

The degree of precision with which prices were fixed varied widely from commodity to commodity, ranging from a loosely determined maximum price to a careful determination of the definite price to be charged for a particular commodity in the case of a particular purchase. As a rule, only maximum prices were fixed, although in a majority of cases the price named as a maximum was the one which actually prevailed. This was not infrequently taken for granted by the price-fixing agency. In some important cases, however, the actual market price fell below the maximum named by the Government. This was true of zinc plates and sheets and certain kinds of lumber. Also, in the case of rubber, a price was named by the War Trade Board as a maximum, which was considerably higher than the market price. As has been already noted, a minimum price was fixed for wheat, the reason being that it was desired to guarantee the market in this case and thus encourage production. The price of hogs was fixed on the basis of a positive minimum after the failure of the attempt to maintain the price on the basis of a fixed ratio to corn. Wheat also furnishes a case in which both a maximum and a minimum price were specifically fixed. Obviously a result similar to that obtained by naming a price may be gained by limiting profits or gross margins. Thus, an effort was made to restrict the profits of the meat-packers to 2½% on sales, and in the case of the five largest packers a maximum margin on meat of 9% on investment was named. The flour millers were limited to a profit of 25 cents per barrel. Dealers in cotton-seed and peanuts, both ginners and others, were limited, beginning July 1 1918, to a margin of $3.00 per ton over cost (not replacement value). This method was also largely used by the Fuel Administration in an attempt to regulate the price of coal to consumers, and in Sept. 1917 this agency announced its plan for fixing the maximum gross margins of retail dealers in coal and coke. Each dealer was authorized to add to the average margin for 1915 between his delivered cost price of coal or coke and the price charged consumers, 30% to cover increased expenses provided the gross margin thus arrived at did not exceed his average for July 1917. Fixed rates of commission or margins of profit were imposed also on dealers in newsprint paper, retail lumber and other commodities.

In addition to the above methods, there was the attempt to fix retail prices directly by publishing fair prices, as was done for groceries by the local "price interpreting boards" set up by the Food Administration. Price-fixing by restricting margins passed into the realm of hopes and aspirations in such cases as the earlier regulation of the lake-forwarders by the Fuel Administration, and the cotton-ginners by the Food Administration, for in these cases the producers were merely urged to charge "reasonable" prices. Much the same may be said of the somewhat tentative moves made by the Oil Division of the Fuel Administration toward fixing the price of petroleum and its products. In July 1918 the Oil Director made some proposals with regard to fixing the differential between the prices of crude and those of refined products; and in Aug. he announced a plan to stabilize the price of crude oil, stating his belief that this would prevent radical changes in the price of refined products. It does not appear, however, that the plan had any appreciable effect.

From the foregoing it would appear that there were three chief types of price-fixing:—(1) *maximum prices*, in the case of basic staples which had wide public interest, often recognized as "pegged" prices when any scarcity or rapidly advancing cost existed; (2) *definite prices*, (*a*) to encourage production by guaranteeing returns, (b) Government purchases (direct or indirect) in the nature of single transactions; (3) *margins*, (*a*) absolute amount per unit, (*b*) percentage on sales, cost, or investment; this method being used when it was desired to cover the distribution of products, the marketing of which was not integrated with manufacture. The minimum price, strictly speaking, was the exception, but is logically associated with the definite price, which is both maximum and minimum.

Another distinction of some importance in fixing prices depended upon the place at which the price named was to apply. Some prices were made on an f.o.b. factory basis, while others were on a delivered basis. The practice prevailing in the industry was partly followed. The tendency, however, was to fix prices on an f.o.b. factory or mill basis, a natural tendency when the price is based on cost. In a majority of cases, prices came to be made f.o.b. the producer's plant. In many cases, however, prices were quoted f.o.b. some market basing point. This was notably true of copper, which was always quoted f.o.b. New York, although the metal was secured from mines in Michigan, Montana and Arizona, and refined at various seaboard points. In the case of commodities produced in several competing areas there was often a tendency to quote prices on a delivered basis. Prices delivered were fixed for New England spruce,

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Pennsylvania hemlock, cement, hollow building tile, iron and steel scrap, and oil products for the navy. The situation in the case of hollow building tile furnishes some explanation of this tendency. The chief producing area for this commodity was centred in Ohio, while there were other producing territories in the south, in New Jersey and elsewhere. In order to stabilize market conditions and to divide the market, the representatives of the industry desired to fix prices on a delivered basis. In this way, by fixing a delivered price sufficiently low, the low-cost producers in Ohio were prevented from coming too far east with their product; while, if the price had been fixed f.o.b. the plant, there would have been no limit to the area covered by the low-cost producer, except cost of freight and desire for profit. Had the war continued much longer, there can be little doubt that adjustments in railway rates would have become an important part of the price-fixing programme. Special railway service was given in a number of instances as a direct part of price-fixing, as, for example, the arrangements made to furnish transportation to the Douglas fir lumber mills for the purpose of relieving them of accumulations of low-grade lumber. In the case of price-fixing for manganese ore produced in the United States, an integral part of the scheme was the application of special railway rates.

When a controlling part of the supply of any given product is produced by concerns which are not completely integrated, especially as to the earlier stages of the industry, it is practically necessary, in price-fixing, to control the price of the chief semi-finished products; but when a controlling proportion of a product comes from producers who are more or less completely integrated, this necessity does not exist, although some protection may be required for independent producers in the earlier stages. Also when the object is to protect the consumer of products which are distributed by separate wholesale and retail agencies, it is necessary to control the wholesale and retail prices as well as the price f.o.b. factory or mill.

Prices were fixed for various periods of time, but in general it may be said that on account of changing conditions the periods were short. Perhaps the period most frequently chosen was three months. A much shorter period would have created too much risk and uncertainty in marketing, to say nothing of the strain upon the price-fixing machinery; while a longer period was not, as a rule, desired by the representatives of the industries, especially during a period of increasing costs. Various exceptions might be cited, such as the case of wheat, in which the price was fixed for the crop of a given season. The prices of meat and coal were fixed for indefinite periods, and the same was true of manganese ore. Various bases for determining the reasonable maximum price to be fixed were used, but it may be said that, on the whole, the prevailing tendency was to fix prices on the basis of cost, a reasonable allowance being added for profits. In this connexion the Federal Trade Commission did important work in ascertaining from the books of the producers the actual cost of production and the investment.

In the ordinary case of price-fixing, the gist of the method used by the Price-Fixing Committee was as follows:—First, some estimate was made of the probable quantity of the product wanted, which, of course, involved a knowledge of the stocks on hand. Second, the quantity which each producer could turn out was ascertained. Third, each producer's cost of production was computed for the most recent period available. Fourth, the average investment involved in the production of the commodity was determined and reduced to the basis of investment per unit of product. The first three of these items bear directly upon the determination of the representative or marginal producers for price-fixing purposes. The fundamental question in fixing prices that are based on cost, is the determination of what may be called the "marginal cost." This cost may be explained as follows: it is frequently the case that when the several individual costs for a group of producers are accurately ascertained and are ranged in their order from low to high, there will be a variation among them of 100%, the high cost being double that of the low cost. Ordinarily the bulk of the production comes from those producers whose costs are below the average, though this is not always the case. It does not follow, however, that the average cost gives the basis for a fair price. If 25%, or even 10%, of the production comes from high-cost producers and the entire output is needed, the average cost cannot be the basis of price. It is true that in many cases prices were fixed on the basis of average cost, both by the War Industries Board and by other price-fixing agencies; but as time went on methods were perfected, and the practice of taking a "representative cost" developed. This representative cost was very similar to what the economist calls the marginal cost, meaning the cost at which the highest-cost producer is able to produce without loss at a given price.

Of the conditions which facilitate the determination of a reasonable marginal cost for price-fixing, a knowledge of the requirements of the market, or in war-time a knowledge of the needs of the Government and its agencies, is most important. Price-fixing in the United States was handicapped by uncertainty as to the quantity which it

Yearly and Quarterly U.S. Fixed Prices, 1913–8.

Year	COAL, bituminous per ton	COPPER, electrolytic per lb.	LUMBER, Southern yellow pine timbers 6 in. x 8 in. x 16 ft. per M.	PIG IRON, Bessemer per ton	SUGAR, fine granulated in bags or barrels	FLOUR, standard patent bar. 196 lb.	BEEF, fresh native carcass (Chicago)	WOOL, Ohio fine unwashed per lb.	LEATHER shoe upper 2nd grade per sq. ft.
1913	$1.18	$0.15	$14.46	$17.13	$0.0428	$4.58	$0.1295	$0.238	$0.194
1914	1.16	.13	12.87	14.89	.0471	5.09	.1364	.250	.209
Quarters									
First	1.16	.14	13.21	15.04	.0389	4.57	.1300	.229	.205
Second	1.17	.14	13.42	14.90	.0395	4.55	.1322	.248	.205
Third	1.16	.12	13.14	14.90	.0583	5.34	.1402	.271	.218
Fourth	1.16	.12	11.71	14.71	.0523	5.86	.1435	.251	.215
1915	1.13	.17	12.90	15.78	.0556	6.66	.1289	.300	.205
Quarters									
First	1.16	.14	11.64	14.56	.0538	7.34	.1229	.298	.214
Second	1.12	.18	12.21	14.61	.0585	7.39	.1214	.291	.201
Third	1.11	.18	12.46	15.91	.0546	6.22	.1330	.301	.200
Fourth	1.14	.19	15.31	18.03	.0552	5.74	.1375	.308	.204
1916	1.24	.28	15.76	23.88	.0688	7.26	.1382	.352	.275
Quarters									
First	1.17	.26	15.92	21.61	.0610	6.32	.1375	.328	.216
Second	1.20	.28	15.21	21.95	.0729	6.05	.1388	.335	.246
Third	1.21	.27	15.21	22.05	.0696	7.37	.1388	.351	.265
Fourth	1.40	.31	16.71	29.93	.0712	9.26	.1375	.396	.375
1917	2.07	.29	21.75	43.60	.0771	11.39	.1672	.664	.385
Quarters									
First	1.47	.33	17.42	36.48	.0686	9.29	.1431	.485	.428
Second	2.40	.32	22.14	47.18	.0788	13.57	.1606	.598	.410
Third	2.24	.27	23.89	53.51	.0797	12.39	.1762	.745	.355
Fourth	2.17	.23	23.53	37.25	.0814	10.34	.1888	.750	.350
1918	2.56	.24	25.51	36.66	.0779	10.14	.2213	.740	.359
Quarters									
First	2.20	.23	25.14	37.25	.0735	10.15	.1750	.750	.351
Second	2.71	.23	25.92	36.21	.0730	9.79	.2227	.746	.350
Third	2.67	.26	25.42	36.60	.0769	10.39	.2423	.746	.360
Fourth	2.67	.25	25.57	36.60	.0882	10.21	.2450	.720	.375

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was desired to have produced, which uncertainty was in some cases due both to ignorance of the available stocks and to uncertainty as to future requirements. While prices were generally fixed on the basis of cost, there were necessarily many exceptions. Sometimes no costs were available. Sometimes cost was only partly available as a basis, as in the case of "joint products" and of products for which complete cost data did not exist. Sometimes, again, no effort was made to use cost, as in the case of substitutes whose prices were fixed on the basis of the commodity in the place of which they might be used. In a few instances the price was fixed without regard to cost, merely on the basis of preëxisting prices, such prices being taken for what was presumably a normal period. Perhaps the chief difficulty in most cases was to ascertain a fair return on investment. This phase of the matter was never satisfactorily dealt with by any U.S. price-fixing agency during the war. The Federal Trade Commission in connexion with its cost findings frequently reported to the Price-Fixing Committee of the War Industries Board a figure representing the investment, but time did not permit the careful investigation that would have been necessary to ascertain the actual money invested, nor was the attitude of the price-fixing agency, as a rule, one which favoured the strict construction of "investment." In general, it may be said that in a majority of the price-fixing operations of the War Industries Board, some consideration was given to the estimated investment, and that in such cases the figure used was one which lay somewhere between the book value claimed by the companies concerned and the actual net investment made. On the other hand, a majority of the price-fixing operations of such agencies as the Food Administration appear to have been made on the basis of a margin (interest and profits) per unit of product, determined upon with reference to past experience. And of course, exceptions to any usual practice were at times necessary.

In general there were three chief purposes in fixing prices: (1) to secure production of needed commodities; (2) to prevent social unrest by checking profiteering, coördinating food prices and wages, and stabilizing industrial conditions; (3) to assure Government economy of purchase. The greatest success was attained with regard to the first purpose. The accomplishment of the second, which was more vague, is difficult to measure, but appears considerable. The most that can be said concerning the third is that things might have been worse had there been no price-fixing.

The table on page 148 shows the yearly and quarterly average prices of important articles whose prices were regulated.

On the whole, it may be said that price-fixing in the United States suffered from the lack of a programme. No adequate study was made of interrelations between commodities or of the various complicated factors affecting demand and supply. No general principles were formulated. Too frequently, each step was taken up as a separate proposition. Much trouble would have been saved by a better understanding among the different price-fixing agencies and by the adoption of certain broad fundamental principles, such as the basis for determining marginal cost and the basis for determining investment. There should have been a general board of strategy to supervise the entire price-fixing programme and to coördinate it with the Government's fiscal arrangements and with the various steps taken to control the production and consumption through priorities and rationing. Some progress was made in this direction, but it remains true that the price-fixing operations were not sufficiently correlated with taxation and borrowing (inflation) on the one hand, and with rationing and priorities on the other. (L. H. H.)

PRINCE EDWARD ISLAND (*see* 22.344).—The pop. of this Canadian province in 1911 was 93,728, having sunk from 109,078 in 1891. It is the most densely populated province in Canada, with 42·92 persons to the square mile. In 1911 the origin of the people was: Scots 36,772; English 22,176; Irish 19,900; French 13,117; all other nationalities 1,763. Charlottetown, the capital (pop. 11,198 in 1911), standing on one of the best harbours in America, is celebrated as the birthplace of the Canadian Confederation, the first conferences having been held there in 1864.

The Legislative Assembly is composed of 15 councillors elected on a property qualification, and 15 members elected on a popular franchise. The Executive Government consists of nine members.

The superintendent of education acts as secretary to the board and administers the system through school inspectors. In 1920 there were 468 schools, 597 teachers, and a total enrolment of 17,861 pupils; the expenditure was $268,547 in 1919.

Prince Edward Island has been aptly described as the garden province of the Dominion, more resembling an English shire than a Canadian province. The population is almost entirely agricultural, and practically the whole island has been cleared and brought under cultivation. The soil of the island is best suited for oats and potatoes, which are the staple crops. Wheat is grown for local purposes only. Maize, for fodder, and barley are grown. Cattle and hogs flourish. The total value of field crops in 1920 was $18,530,400. Poultry-raising and dairying are extensively and profitably carried on. Beef and bacon, as well as fruit, poultry, butter, cheese, eggs and potatoes, are exported in large quantities to neighbouring provinces, Newfoundland and the New England states. Coöperative dairying was begun in 1891 and the growth of the industry has been rapid. A new source of revenue began in 1910 with the breeding of black foxes and the industry of fur-farming was developed. About $10,000,000 had already been invested in this industry in 1918, in which year the sale of fox pelts realized over $750,000. In 1919 300 fur ranches sold skins and live animals to the value of $1,500,000, and in 1920 there were approximately 11,000 pairs of black foxes on the ranches of the island.

The once celebrated Malpeque oyster has almost become extinct through disease. The lobster industry is also on the decline. The value of the fisheries in 1919 was $1,536,844, the catch including cod, herring, mackerel, oysters and lobsters. The men employed in the industry numbered about 6,000.

No mining is carried on. Manufacturing is connected chiefly with the preparation of foods such as butter and cheese. Pork-packing and lobster-canning are large and growing industries. The value of manufactured products was $3,136,470 in 1911.

The strait of Northumberland separates Prince Edward Island from the mainland, the distance across varying from 9 to 31 miles. At the narrowest point a railway-car ferry established in 1918 by the Dominion Government connects the Canadian National railway system of the mainland with that on Prince Edward Island, and affords continuous connexion summer and winter across the strait. This is the principal highway of transportation to and from the island province, but the ferry service is occasionally interrupted by ice and the substitution of a tunnel has been advocated. (W. L. G.*)

PRINCETON UNIVERSITY (*see* 22.347).—In Sept. 1910 President Wilson accepted the Democratic nomination for governor of New Jersey and resigned the presidency of the university. In Jan. 1912 Prof. John Grier Hibben, of the faculty, was elected president. His administration was marked by further development of student self-government, the conducting of discipline and general student activities and the regulation of athletics being in 1921 shared by undergraduate representatives and university officers. Especial attention was paid to the scientific safeguarding of student health and physical fitness by careful periodical examinations and required supervised athletics. The potential effectiveness of the alumni organization was increased by the formation of a National Alumni Association, whose working administrative centre was the Graduate Council of about 100, representing the graduate classes, the alumni associations, and different regional districts of the country. The national character of the university was expressly recognized by the addition of regional trustees to the governing board, and also by the establishment of a large number of regional competitive scholarships.

On the scholastic side, the entrance requirements and the undergraduate curriculum were completely revised. To put the university into closer touch with American secondary education, especially the high schools, Greek was no longer required (although strongly advised) for the A.B. degree. The Litt.B. degree was discontinued. The elective principle was broadened so as to bridge the gaps between preparatory school and college, and underclass and upperclass years, giving the student in his underclass years a broad general training in subjects deemed fundamental to real education, and in his upperclass years requiring him to follow continuous work in one of three divisions of studies, the literary-philosophical, the historical-economic, or the mathematical-scientific. The regulations governing admission to the graduate school, and in particular to candidacy for the competitive fellowships, the awards of which depend entirely on scholarship and ability, attracted to the school an increasing number of select advanced students in liberal studies. The erection of the residential graduate college in 1913 rendered permanent what had previously been an experimental and, in America, an unique feature of the Princeton graduate school, namely, the provision of adequate living quarters for graduate students, who there shared a common scholarly life amid attractive conditions. The graduate college accommodated in 1921 about 100 students.

During the World War over 5,000 undergraduates and graduates were in Service; about 3,000 receiving commissions, and 284 receiving 293 decorations and citations. The honour roll of those who gave

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up their lives numbered 149. The entrance atrium of Nassau hall was converted into a memorial to these men, and a scholarship has been founded in memory of each. During the war nearly half of the faculty was on leave of absence, either in military and naval service, or in the scientific war service of the American, British or French Governments. The student body was cut more than half; buildings were occupied by a Government school of aviation and a naval paymasters' school, while the laboratories were turned over to Government use. With the institution of the student army training corps, and the naval training unit, virtually the entire university and its equipment were devoted to national purposes, the number of civilian students being about 75, rejected from service for physical disabilities. After the return of peace, effort was concentrated on increasing the inadequate endowment of the university, and the sum of over $8,000,000 was raised. A bequest from the late Henry C. Frick, not yet received in 1921, was expected to amount to about $5,000,000. In the year 1920–1 the faculty numbered 213, the undergraduate body 1,814, the graduate students 149, as against, in 1909–10, 169 faculty members, 1,266 undergraduates and 134 graduate students. Besides the graduate college, which includes the Cleveland tower, a national memorial to President Grover Cleveland, a trustee of Princeton, the buildings erected beween 1912 and 1921 were Holder hall (a dormitory), Madison hall (the university dining halls, where all underclass men are required to take their meals), Cuyler hall (a dormitory), the Palmer Memorial football stadium, and the University boat house (headquarters of the rowing activities of the university). In May 1920 Dickinson hall and Marquand chapel were destroyed by fire. (V. L. C.)

PRISONERS OF WAR (*see* 28.314*).—The procedure laid down by international agreement for the treatment of Prisoners of War under the Hague regulations was tested during the World War under unprecedented difficulties. These arose not only from the passions and prejudices inevitably engendered in the course of such a vast conflict between the entire manhood of the nations concerned, but also from the facts that unexpectedly large numbers of combatants were taken prisoners, and that the captors had to deal with men of different nationalities, of varying characteristics and with widely different views as to the accommodation and food requisite for a prisoner of war.

Probably few people realized during the war how vast was the number of combatant prisoners taken by one side or the other, or how small was the proportion of the British prisoners to the whole number. Though the final figures cannot be given otherwise than approximately, it is certain that they amounted to several millions. To name only the principal belligerents (excluding Russia), Great Britain claims to have taken just under half a million, France just over that number, Italy nearly one million, Germany two and a half millions and Austria nearly one and a half millions. With regard to Russia the numbers have never been even approximately ascertained, but some idea of them may be gathered from the fact that Austria alone admitted to having lost to the Russians not less than one and a half millions. To the list must be added the prisoners captured by the Americans (48,000 in number), and by the Turks, Bulgarians and the other lesser belligerents. Of this vast host only about 200,000 (probably not much more than 2%) were British, and about 185,000 of these were in the hands of Germany.

When it is further remembered that sometimes in the course of a single operation tens of thousands of men, many of them wounded, were added to the number captured earlier, it will be understood how great was the strain placed on the captors' resources in the matter of transport, care and feeding. Moreover, prisoners were taken in almost every part of the globe in every kind of climate, and in conditions in which the means of supply and transport varied from being comparatively complete to being almost non-existent. Even if all the belligerent Governments had been actuated by the most earnest desire to apply strictly the provisions of the Hague Convention it was inevitable that there should be much suffering and, owing to the difficulty of effective supervision, cases of cruelty and ill-treatment at the hands of individuals.

It must be recognized that, speaking generally, the administrative problems in relation to the treatment of prisoners were not so serious in Great Britain as in most of the belligerent States, but it is satisfactory to be able to record that they were humanely and for the most part satisfactorily solved as they arose. It is on the other hand unfortunately true that, quite apart from the misery inseparable from prolonged confinement, numbers of British prisoners underwent gratuitous and grievous suffering, especially in territory merely occupied by the enemy and at some of the working camps in Germany, in Bulgaria and in Turkey.

While something is said below with regard to the treatment of prisoners by the Bulgarians and Turks, it is impossible here to attempt to deal with the whole area of hostilities and with the multitude of questions relating to prisoners which arose between the belligerents. This article, therefore, will deal chiefly with the lot of prisoners in Great Britain and Germany, and the application of the Hague regulations in those countries.

Though discussions arose as to the position of such persons as reservists and officers of merchant ships, prisoners of war may be divided into two main classes: (1) Civilian, (2) Combatant.

(1). *Civilian.*—It is quite certain that the framers of the Hague Convention had not in view the treatment of persons other than combatants, but such large numbers of civilians were interned during the war that the arrangements made for them must shortly be considered.

The internment of civilians in both Great Britain and in Germany was, as a system, possibly due to two accidental but different causes. In Great Britain it arose first from the wide-spread belief, justified probably only in a relatively small number of cases, that the German civilian population in England were either spies in the service of the German Government or an advance guard of a German army of occupation. After this feeling had died down, and release from internment had become general, the system had again to be resorted to after the sinking of the "Lusitania," largely in deference to wide-spread indignation at that outrage and for the protection of the Germans themselves. Even then, however, internment was not general. Every enemy alien had a right to have his case dealt with by an advisory committee, of which Mr. Justice Sankey was chairman and Lord Justice Younger was a member, and by this committee many exemptions were granted.

In Germany, on the other hand, the internment of civilians—ultimately much more indiscriminate than in the United Kingdom—resulted from popular indignation in Germany at the entry of Great Britain into the war.

Thus it was that in both countries—in England by end of Oct. 1914 and in Germany by Nov. 1914—nearly every male enemy national of military age was interned, and the system, as applied to civilians, became established in both countries, although its working in Great Britain was later modified in the manner referred to above.

Accommodation.—The accommodation in both countries was bad in the beginning. In Great Britain some prisoners were at first placed on board ships, but this was found to be unsatisfactory for many reasons. Considerable numbers of aliens were sent to the Newbury race-course, where they lived in loose boxes without any beds and without any adequate sanitary or cooking arrangements; as numbers increased tents were added and various improvements made, but the place was never satisfactory, and it was closed soon after the weather broke in the autumn. It is only mentioned because it seems more than probable that, characteristically enough, Ruhleben (itself a race-course) was selected by the Germans for the internment of British civilians as a reply to Newbury. The problem of finding adequate accommodation was difficult in England where there were eventually some 29,000 Germans interned out of a considerably larger number not interfered with. In Germany the difficulty must have been even greater, as in addition to two and a half million combatants there were nearly 112,000 civilian internees of different nationalities to be provided for; of these only between 5,000 and 6,000 were British.[1]

[1] There were in addition to German civilians interned in England a comparatively small number of internees of other nationalities and nearly 20,000 more in other parts of the Empire. The whole of the prisoners in German hands were of course confined in Germany or the occupied districts.

** These figures indicate the volume and page number of the previous article.*

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After the early unsatisfactory camps in England were closed, civilians were confined in large institutions of different kinds, but eventually far the largest number was placed in the Isle of Man, where there was created at Knockaloe a huge camp containing at last some 23,000 prisoners. There were also two "privilege camps" at Douglas and Wakefield, where those possessed of means could, upon payment, secure a certain amount of privacy and comfort, and employ as their servants other prisoners desirous of earning a little money. There was also Islington Workhouse, perhaps the best place of all, where enemy civilians with British-born wives, or some other claim to consideration, were interned.

In Germany the lot of those who were first arrested was worse than in England. They were cast into the ordinary prisons and treated like convicted criminals. After no long time, however, most of them were transferred to Ruhleben, which, with the exception of Schloss Celle, where a certain number of elderly civilians, whose status was somewhat uncertain, were placed, became the place of confinement for all British civilians.

Ruhleben was a race-course near Berlin, with stables, grandstand and all the usual appurtenances of a race-course. The prisoners were housed in the loose boxes and attics without at first any beds, though eventually ships' berths were fitted, six to a box. As the numbers grew, huts were added. The washing and sanitary arrangements, at first rudimentary only, were never satisfactory. No arrangements were made by the Germans for the housing of the prisoners according to their vocational or social affinities—a real boon in the case of civilians. They were allowed, however, ultimately to some extent to sort themselves.

Management.—At first in both countries the camps were conducted on military lines, but eventually the interned persons were left to manage the internal affairs of the camps very much by themselves. A camp captain was elected by them, and captains of huts or other divisions. The camp captain was the official medium of communication with the authorities.

Work and Recreation.—It was recognized in both countries that civilians might not be forced to do any work beyond what was necessary for the orderliness of the camp. This was a doubtful privilege, and the prisoners' want of occupation led to difficulties in maintaining discipline. In the latter stages of the war, at all events in England, a small proportion of prisoners volunteered to work in order to escape the ennui of camp life, and for some 1,500 out of the whole number, useful work was found, mainly in agriculture. No British civilians did any work outside the camps in Germany.

But much was done by the prisoners themselves. Workshops were organized and equipped with the assistance of the Y.M.C.A. (British and American), and other similar organizations. The difficulty in England was to find a market for the produce of the workshops, owing to the objections raised to the prisoners competing with British workmen. This was overcome by sending the articles manufactured to neutral countries.

Besides this form of manual occupation, classes were formed and lectures delivered, and students were enabled to continue their studies so far as their circumstances permitted, and a small number were employed in administrative work.

Medical Care.—Provision was made in England for the civilian prisoners by small hospitals in each place of internment, for the treatment of minor and urgent cases, while some who had been residents in Great Britain before the war were treated in outside institutions.

At Ruhleben a lazaret to which any prisoners could go was established at the Emigrants' Railway Station, close to the camp. The place had previously been used by a low class, and was filthy. The sanitation was bad, and the accommodation of the roughest description, while the attention given to the patients was, to say the least, perfunctory; a doctor came once a day, and there were no nurses or orderlies. After the first disorganization was remedied, there was what was called the Revier Barracke, with a waiting and consultation room, in which the doctor examined those requiring advice. The place had accommodation for emergency cases and those suffering from accidents, and persons were kept under observation till it was decided what should be done with them. From here patients were drafted either to the lazaret above mentioned, or to Dr. Weiler's Sanatorium outside but near the camp, established at the suggestion of the American ambassador for the better treatment of the prisoners, in return for a substantial payment made either by the British Government, or by the patients themselves.

Besides these there was the Schonungs Barracke, a place for convalescents and the ailing. Though the building was provided by the German Government, the place owed its existence and all its amenities to the self-denying labours of Mr. Lambert, himself a British prisoner. It proved a real home of rest for those who were not ill enough to require hospital treatment.

One great defect in the arrangements made for the sick prisoners here was that the German Government, as in the camps where combatant prisoners were confined, provided no diet suitable for them. The ration was the same as for men in good health. A proper diet was provided in Dr. Weiler's Sanatorium in return for the substantial payment made by or on behalf of the patients, and in the Schonungs Barracke by Mr. Lambert with the assistance of friends in England.

Lastly, one further fact should be mentioned. In a few exceptional cases persons were allowed to proceed to places far removed from Berlin to complete "cures" which had been interrupted by the outbreak of war.

The position with regard to the care of sick civilian prisoners may be summed up as follows: The German Government provided some, but inadequate, accommodation for the very poor, and did not put any great obstacles in the way of prisoners who could themselves afford, or for whom the British Government or others were willing, to pay for better treatment.

(2). *Combatant Prisoners.*—In considering the application of the Hague Convention to the combatant prisoners, it is impossible to deal with all the subjects mentioned in it. It is proposed to deal at length only with the principal matters, viz. accommodation, food, the application of the military law of the captors, and after touching on a few less important subjects, to consider how the great general principle enunciated in Article 4, that prisoners must be "humanely treated," was acted on.

Accommodation.—German officers in Great Britain were interned in large country houses and public institutions adapted for the purpose, to which, as necessity arose, additions were made, usually in the form of wooden huts. The necessary furniture and everything reasonably required for messing, as well as fuel and light, was provided free of charge. In Germany, however, the housing was in many cases bad and unsuitable. British officers were confined in the casements of fortresses, as at Ingolstadt; in the men's barracks, as at Crefeld; in disused factories as at Halle, or in huts which had been previously occupied by the rank and file of other nations, as at Holzminden. The best accommodation was in some of the hotels, as at Augustabad, where, until the place became crowded, conditions were comfortable. The British prisoners had to provide, at their own expense, cutlery and everything required for the table, as well as fuel and light, which last caused considerable hardship in winter, for some of the camps were established in summer resorts slightly constructed and at a high altitude.

The actual position of the German places of confinement was undoubtedly chosen in some cases with ulterior objects in view. Thus, the quarters provided right in the middle of the Badische Anilin und Soda Fabrik at Ludwigshafen, and in the centre of Karlsruhe, were undoubtedly chosen in the hopes of warding off air attacks on those places or for the purpose of involving nationals of the raiders in the results.

The men's camps fall into two classes—the large main camps and the working camps.

In both countries the arrangements in the main camps were similar. The camps consisted of groups of huts, either attached to some barracks or similar place, or quite independent, with the necessary cook-houses, baths, latrines and administrative block, all surrounded by a barbed wire fence. There were frequent and justifiable complaints of overcrowding in the German

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camps. At Wittenberg, for instance, there was, when the camp was full, a population of from 15,000 to 17,000 on an area of about 10 acres. There was usually a building set apart for religious services and recreation in the form of concerts and theatrical performances. The sleeping accommodation consisted of bunks arranged in two or sometimes three tiers. The camps were divided by barbed wire into compounds containing about 1,200 prisoners—camps within a camp.

Working Camps.—The housing of the prisoners sent out to work is more difficult to deal with comprehensively, for it depended so much on the locality and nature of the work, quite apart from the goodwill or otherwise of the employer. According to the German regulations, there ought to have been five cubic metres of internal capacity for each prisoner of war. This regulation was by no means always observed. The accommodation provided in Germany varied from a single very-well-lit and ventilated bedroom in a farm to crowded filthy quarters in verminous draughty buildings in mines, quarries and brickyards. In the larger working camps, buildings were sometimes erected for the express purpose of housing the prisoners, and, though not infrequently overcrowded, were generally suited for this purpose. These buildings were sometimes of brick, more usually of wood, set up somewhat above the ground level. In E. Prussia, however, and in a few other places, a construction common in the neighbourhood was used. The huts were sunk into the ground and were in fact something like large lined dugouts roofed over. They were not satisfactory for considerable numbers, but had the advantage that they were in that bleak district warmer in winter than if they had been erected wholly above ground. In other cases, the prisoners lived in the quarters which at many mines and large industrial works the employers provided for their own bachelor workmen. Such quarters were usually satisfactory. The situation of these quarters, of course, depended on the conditions existing locally, and the nature of the work. In mines they were usually in the mine compound, in some places they were situated at a distance from the actual place of working, and thus was added to the day's labour a walk of occasionally as much as 5 km. each way—a serious addition if the work was severe. But in the majority of cases there were no workmen's quarters, and it was impracticable to build barracks for only a few prisoners. Accommodation was then provided in village recreation halls, inns, theatres and similar places. They were not well adapted for the purpose, but where a little goodwill was shewn on both sides, were often made reasonably comfortable.

In a few cases, at Kiel and elsewhere in that neighbourhood, the prisoners lived on board ship where the accommodation, according to the neutral reports, seems to have been satisfactory.

In the places dealt with above, good provision was usually made for bathing, personal washing and laundry; in many mines and industrial works the men were able to get a hot shower-bath daily. In some places, on the other hand, the quarters provided were disgusting. To take two instances out of many which might be given. At Fangsläuse, attached to Döberitz, where the men were engaged in refuse sorting, the barracks consisted of a wooden building divided into two rooms, which were very dirty, in a verminous condition, and overrun with rats and mice. There were no arrangements for bathing or washing; the only opportunity the men had for washing being afforded by a canal near by. At another place, a coalyard, the men were housed in an archway under one of the main lines running into Berlin, and bathing arrangements were *nil*.

In Great Britain, prisoners of war sent to work were either housed by the military authorities or, in some cases, when engaged in agriculture, by the employer, who was bound to supply housing accommodation, straw for filling palliasses, cooking utensils, crockery, facilities for washing and artificial light. As in Germany, it was not always found possible in England to house prisoners near their work. Any time required to reach and return from their work in excess of one hour was deducted from the hours of labour. One rest day a week was allowed in both countries.

Work.—The construction placed during the World War by the belligerents upon Article 6, which enables the captors to employ the labour of prisoners of war and to authorize them to work for the public service or private persons, probably caused more ill-feeling than any other cause, for the result was to reduce hundreds of thousands of men temporarily to virtual, if not nominal, slavery. In the war of 1870-1 the Germans took some 400,000 French as prisoners. They were permitted, but in no way forced, to work in factories and elsewhere. During the World War, with many exceptions, it is true, practically all able-bodied prisoners, except officers and non-commissioned officers, were ultimately forced to work.

Early in 1915 the British prisoners in German hands were invited to volunteer for work outside the main camps. They refused almost to a man. Then by degrees pressure was applied, and soon men who refused were punished for their refusal, and, eventually, as mentioned below, a formal pronouncement on the subject was made by the German Military Courts.

Meanwhile, a question arose as to the employment of non-commissioned officers. As early as February 1915, the German Government suggested certain privileges for superior non-commissioned officers, and eventually an agreement was come to, that non-commissioned officers should not be compelled to work, except as superintendents, unless they volunteered to do so. A camp was formed for non-commissioned officers at Grossenweder Moor, in the notorious X. Army Corps district, and steps were taken to obtain volunteers for work by withdrawing all privileges and forcing the men to march on parade for nine hours a day. The men did not volunteer and eventually the conditions were improved.

The question of the nature of the work which could be properly demanded of prisoners of war was early found to be a difficult one. In a war of nations such as the World War every able-bodied man replaced by a prisoner is a potential soldier, and, in these circumstances, any work in the enemy country might be said to be "indirectly connected with the operations of war," especially in cases in which the prisoner was engaged in any step in the manufacture or transport of any one of the multitude of articles necessary for an army in the field.

The position first taken up by the German authorities was that so long as prisoners did not actually handle the finished product—arms, ammunition and such like—there was no infraction of the rules of international law. This, however, did not really cover the whole ground, and the matter was eventually formally considered by the German Military Courts, and the following principles were laid down:—

(1) The work on which a prisoner of war may be employed can only be judged on the merits of each particular case.

(2) It is illegal to employ prisoners of war in the manufacture of munitions intended for use against their native country or its allies.

(3) They may be employed in agricultural or forestry work, as well as on military property, *e.g.* the improvement of parade and drill-grounds and of rifle ranges.

(4) They may be employed on preparation work, *e.g.* the transport of coke or of ores for the manufacture of shells, because there is no *direct* connexion between such work and military operations.

(5) They can only claim exemption from such work as stands in *direct* relation to military operations in the area of hostilities.

These principles were accepted by the British War Office and the commanders-in-chief of the British armies, and seem on the whole to have been fairly acted on by the German authorities except behind the lines on the eastern and western fronts, though in some cases individual commandants attempted to force men to take part in the actual manufacture of such things as shells, parts of fuzes and the like.

There seem to have been a large number of them employed in labouring work, handling the actual material for guns, shells, etc., in places where munitions were made, and some cases in which they had to take an active part in the manufacture of the finished article certainly did occur. At Krupp's Germania wharf at Kiel, prisoners were employed in riveting ships, including the outsides of submarines, while at Mannheim a number of British were made to work in the manufacture of sulphuric acid in the middle of a large munition factory.

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The authorities naturally reserved to themselves the right to say what work the prisoners could be forced to do, but, at all events in the early years of the war, they promised to give to the prisoners certificates that they had been forced to do the work to which they objected in order to protect them against proceedings in their own country. The promise seems to have been very seldom kept.

Setting aside work directly or indirectly connected with the operations of war there seems to have been no kind of work which prisoners were not called on to perform. They were employed in every kind of manual labour, including work in mines, from skilled engineering to scavenging. This last seems to transgress the principles laid down in the German War Book, that "these tasks" (to which prisoners can be put) "should not be prejudicial to health nor in any way dishonourable."

In Berlin prisoners were sent to work in a slaughterhouse; at three places they were obliged to do scavenging in the public streets, while at two places at Kiel, and at four places near Berlin they had to collect and sort the rubbish of the town. The visitor of the protecting Power says in his report of one of the places at Kiel where only British prisoners were employed, "the work the prisoners are called on to perform is of a particularly revolting character."

In Great Britain, the principles above stated having been accepted, prisoners were employed in accordance with them, but none were employed in mines, nor were such degrading tasks as scavenging and refuse-sorting imposed on them. A large number were employed in France in various capacities not directly connected with the operations of war, and, after the Armistice, in general salvage work.

The organization of the working camps was much the same in both countries. Each working camp was connected with a main camp, which was the centre for all administrative purposes and upon its books the prisoners were borne.

In Germany the working camps were divided into three classes:—(*a*) those which the representative of the protecting Power might visit freely and see the men at their work and in their quarters; (*b*) those in which he might see them in their quarters but not at work; and (*c*) those in which he was admitted neither to the work nor to the quarters but was allowed to see one or more prisoners outside. It has been suggested that this classification was due to the influence of some of the great industrial magnates who objected to their works being visited by outsiders, but, however this may be, the third class was a very small one, and the prohibition with regard to the second and third classes does not appear to have been very strictly enforced.

Pay.—The provisions of the Hague Convention with regard to pay are too vague to be of any real value.

In the II. Army Corps district the German regulations, which may be taken as typical, seemed to contemplate a payment by the employer of the customary local wages, of which the military administrative department took three-quarters for board, lodging, guarding, etc., and the prisoner was credited with one quarter, which he received in token money. In practice, a prisoner working on the land generally himself received 30 pf. a day, in mines from 75 to 90 pf., and in industrial works from 50 pf. to even several marks a day. In some cases a premium was paid to prisoners who did more than the minimum.

Prisoners of war in British hands, when employed by the Government, received the same rate of pay as that given to British soldiers as working pay. When employed by private persons or corporations the employer in England was obliged to pay the full current rate of wages to the Government by whom the prisoner was paid. Piece-work or task-work was adopted where possible and extra pay given where the task was exceeded. The rates were so adjusted that a man of moderate industry could earn the equivalent of time-work earnings, and a very industrious man could earn more. Time-work was paid at rates which ranged according to circumstances from 1s. 4d. to 8d. a day. These sums were credited to the prisoner, but power was reserved to the commandant to decide the amount actually issued to the prisoner.

Food.—Article 7 imposes on the captor State the duty of maintaining its prisoners, and provides for their being treated as regards rations, quarters and clothing on the same footing as its own troops. This article is difficult to understand; it is not clear whether prisoners are to have the same rations as soldiers in the field or at home; or whether they are to be placed in barracks with the same space and conveniences as the captor's soldiers. How this last matter was actually dealt with has been already explained. Whatever may be the true construction of the article, none of the belligerents observed the letter of it with regard to food. Difficulties arose, not merely from the steadily decreasing supplies, owing to the submarine war on one side and the blockade of Germany on the other, but also from the difference in the kind of food appreciated by the subjects of the two countries. At a time when the Germans interned in England were receiving the full peace-time rations of the British soldier, they were complaining of the insufficiency and unpalatable nature of the food. On the other hand, the British prisoners—even when supplies were sufficient in Germany—complained of the brown or black bread, and of the soup, which is liked by the continental working man.

In England, after a short time, no rations were issued to officers. Canteens were established, and subject to regulations for the prevention of undue luxury, the German officers could provide such food as they wished, which was prepared for them by cooks of their own nationality.

In Germany it was different. Rations were issued, though not always partaken of. The British officers, at all events after the war had continued for some time, lived almost entirely on supplies obtained from home. The rations in Germany were issued according to a scale based upon a scientific analysis of the composition of the food given, which showed a daily average in grammes of albumen, fat and carbo-hydrates, and the number of calories. These, as determined by the Kriegs ministerium for the last week in Sept. 1916 at Parchim Camp, averaged daily 75·6, 24·5, 368·4 and 2,019·4 respectively.

It perhaps throws some light on the sufficiency of this ration that in July 1918, nearly two years later, it was agreed between the representatives of Great Britain and Germany, who met at The Hague, that the combatant prisoners of war should receive as far as possible the same allowance of rationed articles of food as the civil population, and that in no case should the daily calorific value fall below 2,000 calories for non-workers, 2,500 for ordinary workers, and 2,800 for heavy workers.

It may be doubted, however, whether at any time in German camps the prisoners received even these moderate amounts of food; and as the supplies became more difficult to obtain, they probably received considerably less, even in the working camps. Even if they did, such things as fish roe, soya flour, soya oil, buckwheat and "blutwurst" do not appeal to a British soldier, however admirable they may be from a scientific point of view as articles of food, especially when they are all boiled together and given in the form of soup.

In England the scales were not drawn up in exactly the same way. If we take the principal articles of food, up to the middle of 1916 the German prisoners received a daily ration of 1½ lb. of bread, 8 oz. of fresh or frozen meat or 4 oz. of preserved, 2 oz. of cheese and 1 oz. of margarine. By Dec. 1917, the ration had been much reduced. The bread ration was 13 oz., for 4 oz. of which broken biscuit was substituted when obtainable. Meat was given on three days a week only, but a ration of 10 oz. of herring was added on two days. The 2 oz. of cheese and 1 oz. of margarine were given till Oct. 1918, when both were reduced. In the case of non-workers, the bread in Oct. 1918 was reduced by a quarter of a pound, the cheese omitted, and the margarine further reduced. In England, as in Germany, the prisoners had to share in the privations of the civilian population.

In both countries the rations were supplemented by parcels of food which were sent to the prisoners. At first they were sent from England by individuals and associations, but before long great abuses arose. Some British prisoners received large numbers of parcels, not infrequently far beyond any possible require-

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ments. Others received nothing, and there can be no doubt that in not a few cases gross fraud was practised on sympathetic persons. Early in 1915 the Prisoners of War Help Committee was established in London. It tried to coördinate the work of the different associations and individuals, but failed as it had no powers, and was dissolved in Sept. 1916, when the Central Prisoners of War Committee of the British Red Cross and Order of St. John was officially established and without its authorization no individual or body could send a parcel to a prisoner.

Amongst its functions were (1) to authorize committees, associations and approved shops to pack and despatch parcels to prisoners of war, (2) to control and coördinate the work of all such committees, associations and shops, and (3) to act as a care committee for all prisoners who for any reason were without a care committee, for all civilian prisoners, and, after Oct. 1917, for all officer prisoners.

Under the presidency of Sir Starr Jameson, Bart., and, after his death, of the Earl of Sandwich, the committee of which Sir P. D. Agnew was vice-chairman and managing-director, not only organized the whole of the despatch of parcels of food and other things to the prisoners of war by 181 care committees, 81 local associations and 67 shops, but packed and despatched parcels to individual officers and men, numbering, at the date of the Armistice, no less than 47,500. Three parcels of 11 lb. weight were sent each fortnight to every prisoner and contained, together with 13 lb. of bread sent once a fortnight from Copenhagen or Berne, sufficient, without other food, to maintain a man doing reasonably hard work. Officers did not come under the scheme till the autumn of 1917.

At first the scheme was very unpopular, because it interfered with the power of individuals to send what they liked to their friends, and in April 1917, a Joint Committee of both Houses of Parliament was appointed to enquire into it. The report was published in June of that year, and while paying a high tribute of praise to the work accomplished made certain suggestions which did much to allay the discontent, as they provided for the introduction of the personal touch into the parcels. In its main features the scheme continued till the end of the war.

Besides the despatch of parcels to individuals the Committee sent food, either in bulk or in the form of emergency parcels, to the larger camps in Germany, for newly captured prisoners.

Though it is obvious that the despatch of parcels of food on the great scale indicated above relieved the German Government of a very great responsibility, yet it must be recognized that credit is due to the German nation for the fact that all but a small percentage reached the addresses to which they were sent, notwithstanding that they contained articles unobtainable in Germany, except by the very rich.

Though it is true that the parcels arrived, it is also true that in some camps the German commandants as a punishment delayed or prohibited for some days or even weeks their issue to the addressees, and that there were complaints as to the way in which the censoring of the contents of the parcels, necessary of course to prevent the introduction of prohibited articles, was carried out. Latterly, however, in all good camps the parcels were opened in the presence of the addressee, and the tinned food was stored and not opened till it was required.

Owing to the increasing shortage of food in Germany, and to the fact that the rations in England for a long time were maintained at a reasonable level, the number of parcels sent to German prisoners was far smaller than that sent to British prisoners. At first a considerable amount of food was sent into the German prisoners' camps in England from their relations and friends residing in Great Britain, but when the shortage became acute it became necessary to prohibit this practice.

The Hague Convention also requires the captor to treat his prisoners as regards clothing on the same footing as his own soldiers. The German Government claimed that it strictly observed this article and forbade the sending of clothing by the British Government. The article was not observed at all in some German camps, and great trouble was caused by the claim, in at all events some army corps, that boots were part of a soldier's military equipment, and that the captors were entitled to take them. The clothing in any case supplied by the Germans was quite insufficient, and arrangements were made by which an adequate supply was despatched according to a regular scale. Some of it went astray and some was stolen, although a good proportion reached the addressees. In England clothing was issued when necessary to enemy prisoners, other than officers, on a regular scale, which provided for them having a sufficient change of clothing, while in both countries officers made their own arrangements for the supply of the necessary clothing.

Application of the Military Law of the Captors.—Article 8 enacts that prisoners of war are subject to the laws, regulations and orders in force in the army of the captor State, a provision which gave rise to a good deal of trouble, owing, in England, to the difficulty of carrying it out strictly—while in some cases, as in Bulgaria, punishments were allowed—such as flogging—for ordinary breaches of discipline—which were quite alien to British ideas of what is permissible.

The German military law is in general far more severe than the British, and there is this further great difference, that in Germany officers as well as men may be summarily sent to cells or awarded other severe punishments for trivial offences, while in the United Kingdom, strictly, any offender above the rank of private should have been tried by court-martial, a provision amended during the war by the substitution of military courts.

In another respect the German code is more severe in that all sentences of arrest involved solitary confinement, while one of close arrest, which was limited to four weeks, meant that the prisoner was confined in a dark cell, with a plank bed and bread and water diet, though these aggravations of the punishment were omitted on the fourth, eighth and subsequently every third day, the prisoner receiving the ordinary camp diet on these days.

One punishment officially termed "field punishment," but more generally known in England as the "post punishment," caused a great outcry in that country and much resentment among British prisoners in Germany. It is provided in the German *Manual of Military Law* that the punishment is to be inflicted in a manner not detrimental to the health of the prisoner, who is to be kept in an upright position with the back turned to a wall or a tree in such a manner that the prisoner can neither sit nor lie down. These last words were construed to mean tying the prisoner to a post; sometimes his feet were placed on a brick which was removed after he was securely tied, and sometimes his hands were secured above his head. Apart, at all events, from these aggravations, this punishment was in strict accordance with the military law of the captors; indeed it corresponds to the field punishment No. 1 authorized by the British military law and described in the rules for field punishment for offences committed on active service made under Sec. 44 of the Army Act. These rules authorize the keeping of the offender in fetters or handcuffs or both, and when so kept he may be attached by straps or ropes for a period or periods not exceeding two hours in any one day to a fixed object during not more than three out of four consecutive days nor more than twenty-one days in all.

In Germany all prisoners are liable to be treated as "in the field," *i.e.* on active service.

In one respect, viz. the punishments for attempted escape, the German military law was less severe than the British, the greater severity of the latter having apparently arisen from a misunderstanding of the expression "peines disciplinaires" in the second paragraph of the 8th Article of the Hague Convention. This seems to have been understood on the Continent as a punishment which could be awarded summarily: that is, arrest, open, medium or close, for a period not exceeding six weeks. In Great Britain the punishment was limited to 12 months' imprisonment; in Germany it was far less for the simple offence, though it was frequently added to by the addition of charges for damaging Government property, and the like. The matter came under discussion between the British and German Delegates at The Hague in 1917 and 1918, and an agreement was arrived at by which the punishment for a simple attempt to escape was to be limited to fourteen days, or if accompanied with offences relating

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to the appropriation, possession of or injury to property to two months' military confinement.

In addition to the summary punishments, there were, of course, in both countries the punishment of death and imprisonment, which could only be inflicted by court-martial. In some cases the German code lays down minimum punishments of great severity, and in many of those cases, in which the infliction of very severe punishments properly raised a great outcry in England, the German court-martial had no option but to pass them. The British military law on the other hand has only one offence —murder—for which there is a fixed punishment; for others it is " such less punishment as is in the Act mentioned."

In one respect the prisoners of both countries never were satisfied. Neither understood or appreciated the procedure of the other. The British never understood the long delays, sometimes it is to be feared deliberate, which occurred in bringing them to trial for alleged offences, and during which they were kept under arrest, nor, owing to their ignorance of the German military code, could they understand the very severe sentences necessarily passed by courts-martial (which seem usually to have been conducted with fairness), nor the right of the prosecutor to appeal against a sentence which he considered to be inadequate.

On the other hand, the Germans never appreciated the British procedure, nor could they understand the absence of any right of formal appeal from a sentence, for which ample provision is made in Germany, even against the award of a disciplinary punishment, a right which, oddly enough, by Sec. 52 of the Regulations relating to it, the accused shared with the prosecutor " only when the sentence has been carried out."

Parole.—Articles 10, 11 and 12 deal with the subject of parole. In the World War no combatant prisoners, with one exception, were allowed to leave Germany or Great Britain on parole, or to reside outside the camps. The only cases in which questions arose were with regard to the temporary parole given when officers left their camps for a walk, and the parole given by those who were interned in neutral countries. According to the custom of the British Army no officer ought to give his parole, it being his duty to escape and rejoin his unit if he can, nor can anyone below the rank of officer give a parole. In both countries, however, officers were eventually allowed to go out for a walk in parties accompanied by an officer, each giving in writing a temporary written parole that he would not attempt to escape, nor during the walk make arrangements to escape, nor do anything to the prejudice of the captor State. The parole was given on leaving the camp and returned on reëntry.

The case of those interned in neutral countries was different. The British officers of the Royal Naval Division interned in Holland after the fall of Antwerp were permitted to choose their own residence in Groningen on parole, the men being interned close by. This privilege was withdrawn for a time, and the officers were interned in a fortress, but it was restored later.

As time went on, the Netherlands Government permitted officers to return to England and Germany on parole, on proof of the serious illness of a near relative, a concession which was afterwards extended so that regular periods of leave were enjoyed by both officers and men, the former giving a formal parole and the latter a promise to return on the expiration of their leave, while the British Government gave its assurance that the men would not be employed on any work to do with war, and would return at the end of their leave. Similarly, the Danish and Norwegian Governments granted leave to British and German combatants interned in their countries.

No parole seems to have been taken from those officers who were interned in Switzerland or Holland under the agreements made in 1917 and 1918 with the German Government.

Relief Societies.—Article 15 deals with societies for the relief of prisoners. An immense amount of valuable work, impossible here to particularize, was done by such societies. The American branch of the Y.M.C.A. especially did much for the prisoners in England and Germany, being permitted to work on the following conditions, substantially the same in both countries.

A building or tent might be erected in the camp with the consent of the general officer in command of the district or army corps, but nothing might be sold in it nor could any one be employed there other than a prisoner. A member of the association might visit the camp once a week for a definite time. He might hold services, provide materials for games, entertainments and employment, arrange instructional courses, provide books (subject to censorship) and writing materials other than writing paper and envelopes. Nothing might be given to or received by a prisoner without the commandant's consent.

Recreation.—No express provision is contained in the Hague Convention relating to the occupation of prisoners in their leisure time, but much of the good work done by the societies had to do with the recreation and education of prisoners. In both countries, and in nearly all camps, provision was eventually made for sufficient space for recreation and exercise, but this was not the case at first. At Halle, for instance, a German camp for officers, established in a disused factory, the only place for exercise was the space enclosed by the three buildings, in which some 500 officers lived. It measured about 100 yards by 50, and in winter was a morass of water and mud; in summer deep in dust. In some of the men's camps the space was very confined, and organized games of any kind were impossible. But later things improved, and in most provision, sometimes at the prisoners' expense, was made for sufficient room for tennis, football and other games.

In England, facilities were provided by the War Office. To take two typical instances, it may be said that at Donnington Hall for German officers, there was a considerable space in front of the house, and at Dorchester, for men, there was a large field where any games could be played.

As time went on, walks outside the camp were permitted for officers on their giving a temporary parole, and in Germany, in some of the larger working camps, the men were allowed out for walks on Sunday.

With regard to educational facilities, in England both officers and men made their own arrangements, as they did in Germany, with the full concurrence of the authorities. At Münster, for instance, the general officer commanding excused all students from work, and much was done by some of the prisoners in the organization of classes and lectures. The neutral organizations, such as the American and Danish Y.M.C.A.'s, also did a great deal in this direction, as did certain of the German civilians in the neighbourhood of the great camp at Göttingen. Professor Stange and some of his colleagues interested themselves in the prisoners and organized the educational work in the camp, and he himself had an office there where he was accessible to prisoners, and assisted them with his advice on educational matters. He used even to obtain the requisites for games through the Red Cross in Switzerland. Unfortunately for them, all the British prisoners were ultimately removed from Göttingen, which had become something of a model camp.

Some of the larger employers were also very considerate in this respect, providing recreation halls and fields for playing games, and even musical instruments. At Mulheim the Dutch visitor found the employers had paid the expenses of the prisoners' Christmas festivities.

Letters.—Article 16 was observed by both countries, except that at one time in some of the camps in Germany customs duties were charged on the contents of parcels, but this seems to have been due to some misapprehension, and was soon abandoned. Prisoners were as a rule allowed to write two letters a month and a postcard every week, and, in addition, a postcard in the prescribed form acknowledging the receipt of a parcel. But later in the war a " first capture postcard " was introduced, by which on a printed form a prisoner was allowed to notify to his relatives his capture, his state of health and his address.

Pay.—Article 17 provides for officers receiving the same rate of pay as officers of the corresponding rank in the army of the captors. This provision was not observed by the German Government, who paid subalterns 60 marks a month and other ranks rather more. Accordingly, the British Government

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declined to carry out the terms of the article and paid the German subalterns 4s. a day and other ranks 4s. 6d., naval officers being paid according to their relative rank. Out of this an officer was required to pay for his food, laundry and clothing, a deduction being made if he was in hospital (where, of course, he was provided with everything necessary). By an arrangement made later the German Government was allowed to make a small addition to these daily rates of pay. Medical officers employed in the care of sick and wounded prisoners of their own nationality received the full pay of medical officers of corresponding rank in the army of the captors.

Religious Exercises.—Article 18 is designed to secure to prisoners complete liberty in the exercise of their religion, and during the World War no real complaint was made on either side.

In the United Kingdom German pastors who had been resident in the country were allowed to hold services in the camps, but difficulties arose and the permission was withdrawn. Thereupon some pastors elected to be interned, with a view to ministering to the prisoners. Later, however, the permits were issued in a modified form, and English and American clergy and laymen and members of the Danish and Swiss Student Christian Movement were allowed to visit the camps, the necessary funds being provided by the American Branch of the Y.M.C.A. The Roman Catholic prisoners were usually attended by the priest of the district in which the camp was situated and every facility was given to them. Where no German-speaking priest was at hand the Cardinal Archbishop of Westminster charged the German priests of his archdiocese to visit the camps every now and then in order to enable the prisoners to go to confession and to hear a sermon in their mother tongue.

In Germany, at first, the Rev. F. Williams, who had been in charge of the English Church in Berlin, was allowed to visit the different camps and hospitals. But this permission was withdrawn and the prisoners were left to conduct their own services, to which, except at Grossenweder Moor, no objection was raised. A few British chaplains were captured, and did good work until they were repatriated. Great assistance was given also by the American branch of the Y.M.C.A., and by Archdeacon Nies, an American clergyman at Munich, until the United States came into the war.

The German clergy also did what they could for the prisoners in many camps and hospitals. Some of them were spoken of very warmly by the British prisoners.

The needs of the Roman Catholics were more easily met owing to the presence among the French prisoners of many priests who did excellent work, and the Bishop of Paderborn (afterwards Archbishop of Cologne) did much for the prisoners. Moreover, Father Crotty was sent from Rome and was permitted to minister at Limburg and Giessen, partly perhaps because he was an Irishman, and it was hoped his influence might be useful to the Germans.

In the German working camps there was no regular provision for religious services, though Mr. Williams seems to have visited some of the larger places, and in one district a German pastor is said to have travelled around the small camps and ministered to the prisoners. There was a standing order of the Kriegsministerium that, at all events in the country districts, the prisoners should be allowed to attend the local churches. This, though of value to Roman Catholics, was not much use to the Protestants, owing to the difficulties of language.

At Zossen the Germans built a mosque for Mahommedan prisoners, and generally arrangements seem to have been made to avoid hurting religious and caste prejudices.

Medical Treatment.—Up to this point an attempt has been made to show how the provisions of the Hague Convention were applied in Great Britain and Germany. But this Convention does not deal with everything which affects the well-being of prisoners of war. The Geneva Convention of 1906 requires the belligerents to respect and take care of the wounded and sick without distinction of nationality, and leaves them at liberty to agree for the restoration of wounded left on the field, the repatriation of wounded after rendering them fit for removal or after recovery, and for handing over the sick and wounded to a neutral State to be interned by it till the conclusion of hostilities. What was in fact done must be considered under three heads: the attention given (1) in the regular hospitals, (2) in the main camps and (3) in the working camps.

Hospitals.—In Germany at first there seem to have been inadequate arrangements made for the reception of seriously wounded prisoners, but later well-arranged and well-equipped hospitals were available, the principal being in Berlin, at Cologne and Paderborn, though of course there were a large number elsewhere. As time went on and the pressure on Germany became more and more acute, the supply of medical requisites became deficient, bandages were made of paper, drugs and anaesthetics were less plentiful, but, though naturally British prisoners would fare worse than the wounded Germans, there is no evidence that the former were intentionally deprived of anything necessary for them if there was an adequate supply.

The conduct of the German doctors to the prisoners in the regular hospitals is one of the bright pages in the sad history of the World War, and is worthy of their great profession. Most of the returned British prisoners reported that the doctors were kind and humane, while many of them spoke of them in warmest possible terms and told how the doctor had said that when a prisoner was wounded or ill he no longer looked on him as an enemy, or how, though he hated the English, he did his very best. There were exceptions, who formed a very small minority. The large majority of German doctors worked hard, often with infinite kindness, in the interests of those in their charge, and unreservedly placed such knowledge and skill as they possessed at the disposal of the prisoners.

The nursing in Germany was carried out by orderlies, by trained nurses or by sisterhoods. It seems to have varied very much. In some cases it was good and kind, in some indifferent, and in some rough and bad. But there appears to be no reason to think that in any case it was intentionally less good than circumstances permitted.

Main Camps.—The same satisfactory account of the medical arrangements in the main German camps cannot be given, even after the first disorganization was overcome. There was in each camp a lazaret providing accommodation for a number proportionate to the number for which the camp was designed, but the arrangements were often very incomplete.

There seem to have been a large number of Russian doctors employed in the German camps, while in a few, for short periods, English medical officers were employed—though in all cases a German seems to have been responsible. The nursing was in the main done by prisoner orderlies, many of whom of course were quite untrained, though they seem to have done their best. It is impossible to generalize as to the conduct of the German medical staff in hundreds of camps over a period of four years, but the general impression produced by the evidence is that the staffs were humane and did all they could.

There is reliable evidence that the nature of the food provided in the German camp hospitals, as distinguished from the regular hospitals, where, until supplies became very short, it seems to have been satisfactory, was quite unsuited for invalids. A sick prisoner was a non-worker, and therefore received the ordinary camp ration, less 10 per cent. This was even the case in the typhus camps, where the requisite milk and light food for the fever-stricken patients had to be provided by the British and Allied medical officers themselves.

There seems to have been insufficient care, at all events in the early stages of the war, to prevent the spread of tuberculosis by the segregation from the healthy of those suffering from that disease. Later, however, steps were taken to effect this, and more than one place was established exclusively for tuberculous patients, while the arrangement made for their internment in Switzerland did still more to deal with this evil.

It must not of course be said that this mingling of the sick and healthy was deliberate. It was probably due to want of thought, an excuse which cannot be made for the policy adopted by the German Government of mixing all the Allies together,

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although this was bound in the circumstances to lead to an excessive amount of illness. This policy was quite deliberate. Mr. Gerard, the American ambassador to Germany, in 1915 raised the question with the German authorities with regard to officers, and reported: "I was told that this was a political move ordered for the purpose of showing to the French, British, Belgian and Russian officers that they were not natural Allies." The commandant of the Gardelegen camp tried to enforce the observance of this regulation during the height of the typhus epidemic at that camp, but his direct order was deliberately disobeyed by the British doctors, with excellent results.

Though this policy did not produce any ill effects upon the health of the prisoners in the officers' camps in Germany, its results, assisted by the insanitary condition of many of them, were disastrous in the main men's camps. Typhus is endemic in Russia, and the Russian prisoners, herded together with those of other nationalities, spread the disease till in some camps appalling epidemics were produced. At Ohdruf, Langensalza, Zerbst, Wittenberg and Gardelegen the fever raged with great virulence. At Wittenberg the camp was overcrowded and insanitary, the washing arrangements were nothing more than troughs in the open, which, with the supply pipes, were during the hard winter of 1914 frequently frozen. In these circumstances, a serious epidemic broke out in Dec. 1914. As soon as this was recognized, the whole German staff, military and medical, left, and never came inside again till Aug. 1915, by which time all the patients were convalescent. For his services in combating the epidemic Dr. Aschenbach, the German principal medical officer, received the Iron Cross. Many Allied and British medical officers had been improperly detained in Germany after their capture, and were dispatched to take the place of the German doctors, who (it is charitable to believe, in obedience to superior orders) had deserted their charges. In Feb. 1915, six British medical officers were sent to the camp which they found in a state of misery and disorganization. Of the six, three died of the fever, as did several French and Russian doctors. Notwithstanding the fact that there seem to have been ample supplies of medical necessaries available, the difficulty of obtaining sufficient drugs and dressings was extreme. There was not even any soap till one of the British doctors obtained a supply at his own expense from England, nor, till April 1915, were beds or bedding for patients requiring hospital treatment improvised in one of the barracks. There were between 700 and 800 British prisoners among at least 15,000 in all, who, incredible as it may seem, were confined in an area not exceeding 10½ acres. Of the British about 300 were attacked by the disease and 60 died.

At Gardelegen the same story was repeated. As soon as it was apparent in February 1915 that something was wrong, captured medical officers were dispatched to Gardelegen, where the conditions were favourable for the propagation of disease. Though there were empty huts in the camp, the commandant refused to allow them to be used, and the prisoners' rooms were very overcrowded, the nationalities, as usual, being all mixed up together. To each company of 1,200 men was allotted for washing one outdoor trough, which was often frozen, and there was a small hut containing at the most thirty showers for 11,000 men. The place was bitterly cold, the heating arrangements entirely inadequate, consequently the huts were kept closed, and the atmosphere therein became foul. Four days after the arrival of the Allied medical officers every German had left the camp, and the commandant, standing outside the barbed wire, informed the medical officers that no person or thing was to pass out, and that they were responsible for the discipline and general internal arrangement of the camp, and for the care of the sick. Dr. Wenzil, the German principal medical officer, left the camp with the rest, but soon afterwards died of typhus. His two successors never came inside the camp. But the third, Dr. Kranski, a civilian, came in March and devoted himself seriously to the welfare of the camp, and, though he took no part in the care of the sick, did much to improve the sanitation, and in that way to aid the medical men in their work. It is unnecessary to go through the whole story of the struggles to obtain the barest requisites in the way of food, drugs, dressings or furniture. The plague was stayed after four months, during which over 2,000 cases were treated out of 11,000 prisoners, the mortality being about 15% of those attacked. Of the 16 Allied medical officers, 12 took the disease and 3 died, while of 10 French priests, who devoted themselves to the care and nursing of the sick, eight were attacked and five succumbed.

The epidemics at Wittenberg and Gardelegen in these circumstances of gratuitous suffering and official callousness made a world-impression never likely to be entirely effaced, but it is only just to add that the German authorities, having learnt their lesson at the cost to others of so much suffering and death, did their best, too late indeed, to remedy the defects, and Gardelegen and Wittenberg eventually became, if not model, at all events fairly satisfactory camps.

German Working Camps.—In mines and large industrial places, there was generally a small sick-bay containing from two or three beds up to perhaps a dozen, in charge of a German Sanitäter. There was no resident doctor, but a civilian practitioner called in well-managed camps daily, in others at intervals varying from twice a week to four weeks. In case of accident he was summoned as soon as the *Feldwebel* in charge thought fit. In the smaller camps reliance was placed simply on the local practitioner, which ordinarily was sufficient provision, though in some places, such as the large land reclamation camps in Hanover, the nearest doctor might live at any distance up to 20 kilometres. A prisoner seriously ill or injured was either taken to the hospital at the main camp to which his commando was attached, or sent to the local hospital, military or civil.

The real defect in the medical arrangements in these places was that too much power was left in the hands of the person in charge to decide whether a man reporting sick should see the doctor or not. The regulations in the II. Army Corps district provided that there must be a clinical thermometer in each commando, and the guard was to be instructed in the use of it. No prisoner was to be sent to work who had a temperature above 38° (100.4° Fahrenheit). This seems to have been construed as meaning that the prisoner was to be sent to work unless he could show that temperature. Armed with his thermometer the *Feldwebel* in charge often declined to allow the prisoner to see the doctor. The test was in some cases sufficient, in many it was no test at all, and the results were sometimes fatal.

British Medical Arrangements.—In the United Kingdom the arrangements for the treatment of sick and wounded prisoners did not differ in essentials from those made in Germany. At first there were no special hospitals for them, but in Sept. 1915 a large hospital was opened at Dartford. This accommodation, however, soon became insufficient, and at the time of the Armistice there were seven hospitals entirely set apart for prisoners. In addition to these large hospitals there was a hospital with beds to the number of about 2% of the prisoners, for the treatment of minor and urgent cases; while in the working camps the services of the local practitioner were given as required. In exceptional cases prisoners requiring special treatment were sent to an ordinary military or civil hospital.

Repatriation.—Closely allied with the matter of medical treatment is the question of repatriation and internment in a neutral country. As early as Jan. 1915, an agreement for repatriation of incapacitated officers was made. There was at first no agreement as to the degree of incapacity sufficient to entitle an officer to repatriation, but in August of that year an agreement was arrived at, which was slightly amended in October. It included 13 injuries or complaints entitling a person to be repatriated, which may be summed up as being such that the person was permanently, or for a calculable period, unfit for military service in the army, or in the case of an officer or non-commissioned officer, from service in training or office work.

But besides this direct repatriation of totally incapacitated persons, many prisoners were sent to Switzerland or Holland.

In the spring of 1916 an agreement was made with the German and Swiss Governments by which prisoners whose disabilities fell within an agreed schedule but were not sufficient to

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justify direct repatriation should be transferred to Swiss custody. They were selected by mixed travelling boards composed of Swiss medical men and medical officers of the captor State, those selected being afterwards examined by a Control Board, whose decision was final. After the Conference at The Hague in 1917, these travelling boards were abolished, and the first selection made by the camp medical officer, an arrangement subsequently modified at the meeting of 1918.

The guiding principles for internment in Switzerland were stated in 1917 as follows:—

"The following shall be interned:—(1) Sick and wounded whose recovery may be anticipated within a year, and whose cure will be more speedily and surely brought about by the facilities obtainable in Switzerland than by a prolongation of imprisonment. (2) Prisoners of war whose health in the opinion of the medical authorities appears to be seriously menaced either physically or mentally by the prolongation of captivity, and who would probably be saved from this danger by internment in Switzerland."

If the person's disabilities increased so as to bring him within the category entitled to direct repatriation, he was to be sent home.

In 1917 the Netherlands Government offered to receive in all 16,000 persons, British and German, divided into three categories: (1) invalid combatants (7,500); (2) officers and non-commissioned officers who had been in captivity for 18 months (6,500); and (3) invalid civilians (2,000). This offer formed the basis of the agreement made between the British and German Governments at The Hague in June 1917. By that agreement the schedule of disabilities for the invalids was the same as in the case of Switzerland, except that the British Government insisted with the assent of Switzerland that tuberculous patients should go to that country. Much resentment was felt in consequence of the exclusion of privates who had been 18 months in captivity from the benefit of this agreement. But the British delegates were powerless. Every attempt to induce the German delegates to agree to their inclusion was vain.

The provisons of the agreement arrived at in 1917 were largely extended at a further meeting in 1918, by which all warrant and non-commissioned officers, as well as men who had been prisoners of war for more than 18 months, should, with exceptions, be repatriated, head for head and rank for rank.

General Treatment.—So far an attempt has been made to show how the principal articles of the Hague and Geneva Conventions relating to prisoners of war were applied in Great Britain and Germany during the World War. It remains to be considered how far the over-riding principle laid down in Article 4 of the Hague Convention was observed. That article requires first, that prisoners must be treated with humanity; and second, that all their personal belongings, except arms, horses and military papers, shall remain their property.

With regard to the second requirement charges were made against both armies that this obligation was not observed, and it cannot be doubted that on both sides the wounded were sometimes on their first capture relieved of valuables. But this was not due to any official action; it was due to the unauthorized and wrongful acts of individuals. In respect of one matter only was there anything which could be treated as an authorized disregard of this article. British prisoners often had their boots taken from them by the Germans, either at first capture or later even in the camps in the interior of Germany. This was justified by the Germans on the ground that a man's boots were as much a part of his military equipment as his arms, and that therefore they were entitled to take them away. This claim seems only specious; the practice it sought to support or excuse certainly had the most cruel results in many cases, as men were forced to go about without any covering on their feet, or, if the boots were replaced, as they sometimes were, by wooden clogs, the men suffered much, especially during the winter or in mines from that unaccustomed footwear. However, in other respects this part of the article appears to have been fairly observed, though a somewhat liberal construction was placed on the expression "military papers" by both sides.

We turn now to the other part of the article, which enjoins that the prisoners must be treated with humanity. There existed during the war much misconception with regard to the treatment of prisoners in Germany, partly owing to the fact that only stories of horrors were published in England and the Allied countries, partly owing to the prominence given to this subject as a method of Allied war-propaganda, in the dramatic form of cinematograph films, and notably in the pictures relating to the work of Mr. Gerard, the American ambassador.

Some of the stories thus circulated were untrue. As an instance, it may be recorded that every story as to the tattooing of prisoners by the Germans, to which great prominence was given, pictures of the alleged victims being produced in the cheap illustrated papers, was, as far as possible, carefully investigated and was in no case shown to have any foundation. But the stories had their effect, for an idea got abroad that a prisoner once in the hands of the Germans was subject to every kind of indignity and cruelty.

It is possible now to weigh all the evidence, and express a judicial conclusion unaffected by the passions of war. The materials for doing so are ample. In the summer of 1915 a committee, presided over by Lord Justice Younger, was appointed by the British Government to enquire into the treatment by the enemy of British prisoners of war. As far as possible, each escaped or repatriated prisoner was examined by a person experienced in taking evidence, and arrangements were also made by the committee for examining the prisoners interned in neutral countries. In all, over 3,500 persons who had been prisoners in Germany, including 445 officers and 90 medical officers, were examined by this committee during the war, and most of their statements were printed and all indexed. After the Armistice the committee was asked to arrange that every returned prisoner should have an opportunity of making any complaint he wished. A questionnaire was carefully prepared and handed to every returned prisoner on his arrival at one of the dispersal camps to which all prisoners were sent before being allowed to return home. Each company of returning men was addressed by the person in charge of the investigation, and he impressed on the men the importance of stating frankly whether there was any complaint that they desired to make, and, if so, what it was. The result was remarkable. Out of not less than 170,000 forms issued only some 59,000 were even returned, and of these only about 22,000 contained information of any value whatever.

While this information was being collected, the then Attorney-General, Sir F. E. Smith (afterwards Lord Birkenhead), appointed a further committee to enquire into the breaches of the laws of war, the sub-committee dealing with prisoners being under the presidency of Mr. Justice Peterson. This sub-committee carefully considered the whole of this mass of evidence, and, in addition, the reports, nearly 2,000 in number, of the American and Dutch representatives who visited the camps. The German military law was also carefully studied.

Information was thus obtained with regard to 57 camps for officers and 78 main camps for men, besides the working camps, the number of which, shown by lists (admittedly not quite complete) from time to time furnished by the German authorities to the Netherlands minister, was 7,157. There were certainly not less than 7,500 places in all where one or more British prisoners were at one time or another confined, in addition to the camps on the eastern and western fronts, which are left for separate consideration.

The result of the investigation was that complaints, some uncorroborated, some trivial and some very serious, were received as regards 929 places, in only 349 of which—rather less than 5% of the whole—did a first study of the evidence seem to call for further examination.

It is clear, therefore, that no general charge of inhuman treatment is well-founded; it is, however, true that, apart altogether from the camps on the eastern and western fronts, there were actually, if not proportionately, a large number of cases in which the German treatment of British prisoners was certainly bad, and, in some cases, very bad.

To form a just estimate of the gravity of the situation so disclosed, consideration must be given to the differences of the

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military law and disciplinary practice of the two countries, and to the personal characteristics of the two peoples. With regard to the former, it is not necessary to repeat what has been said before about the severity of the German military law, and in actual practice the officers and non-commissioned officers in the German army are accustomed, apparently without lawful authority, to ill-treat their men physically in a way which would not be tolerated in England. Moreover, the German is naturally more amenable to strict discipline than the average Briton. Much of the ill-treatment complained of in the camps resulted from one or other of the causes above indicated; for the rest a disregard of the German military law or the regulations made for carrying that law into force was the main contributing cause.

In this connexion the attitude of the civilian population cannot be ignored. The anger aroused by the entry of Great Britain into the war induced on the part of German men and even German women cruelties which any decent person must look upon with disgust. It was inevitable that the passage of wounded prisoners from the battle-front to the interior of Germany should be attended with suffering. But that men grievously injured should be subjected to insults and physical ill-treatment is horrible, and that women bearing the Red Cross should throw water on men crying in agony for a drink, or should show to famished men soup and then pour it on the ground rather than allow them to partake of it is conduct almost incredible in its brutality. But such things occurred, not once or twice, but frequently in the early months of the war, and even later the conduct of civilians outside the prisoners' camps is worthy of the severest condemnation. Happily, however, passions were allayed, and after the first year of the war prisoners passed through from the front without being subjected to the insults and ill-treatment which unhappily were common at first.

Again, it was inevitable that, owing to the state of unpreparedness and want of experience of all the belligerents, much discomfort and suffering should be caused to those captured early in the war. This is passed over as being practically unavoidable, and in what follows, unless otherwise clearly stated, the conditions recorded are those after the organization was or ought to have been fairly complete.

Officers.—The treatment of officers in a camp depended very much on the commandant, and, to some extent, on the personality of the general of the army corps district in which the camp was situated. As officers were under no obligation to work, one grievance which was so fruitful a cause of trouble in the men's camps did not exist in their case.

In some camps where, as at Crefeld, the commandant was a gentleman, no valid complaint can be made of the treatment. In others, especially in the X. Army Corps district, where the malign influence of Gen. von Hänisch was paramount, some of the commandants were neither gentlemen nor capable of understanding the feelings of gentlemen, and there was continual trouble. At Clausthal and Holzminden, of which the two brothers Niemeyer were commandants, the state of affairs was intolerable. There were continual arrests for trivial offences and endless pinpricks on both sides. But, worse than this, the guards had orders to use their bayonets and rifles without adequate cause. On one occasion an officer, for looking out of a window, was shot at by order of the commandant at Holzminden, but fortunately not hit. At Strohen, another camp in this district, two officers were seriously wounded in a bayonet charge ordered personally by the commandant because a knot of them had gathered near a prohibited part of the camp.

One matter gave rise to much resentment. It was right and proper for the Germans to make occasional strict searches in view of the continual attempts to escape; but their method of carrying them out with detectives from Berlin assisted by police dogs which prowled round the completely stripped officers was offensive in the extreme.

But these were exceptional places and incidents. In general, the officers commanding were gentlemen, who treated their charges with courtesy and consideration, though in most cases there was occasional friction owing to the propensity of the young officers to attempt to escape, and, in some measure perhaps, owing to the inability of German officers to understand the exuberance—even in captivity—of British subalterns.

Men in the Main Camps.—In the main camps the treatment on the whole seems to have been reasonable, and in some cases more considerate than might have been expected. There was the usual trouble from the enforcement of a discipline far more severe than that to which the prisoners had been accustomed in their own army; from the violence with which the German non-commissioned officers treated offending prisoners, and, up to quite late in the war, from the use of savage police dogs in the camps, which the German Foreign Office declared to be "a military necessity, in view of the large number of prisoners of war in Germany," adding that, "having regard to the inferior number of prisoners in England no comparison can be drawn between conditions in the two countries." Trouble, and even loss of life, was caused by the too frequent use of firearms in some camps, as, for instance, at Wittenberg, where on one occasion men were ordered to return to their huts on a given signal and the laggards were fired on. But such incidents were not general, and occurred only in camps where the commandant was quite unfit for his post. In most cases the prisoners were treated fairly, if strictly; in a few, of which Friedrichsfelde may be taken as an example, at all events in its later stages, everything seems to have been done to make the prisoner's lot as little irksome and unpleasant as possible. An exception must be made in the case of Langensalza, where the treatment was from first to last rough in the extreme, a roughness which culminated just after the Armistice in the shooting by the guard, hurriedly called upon the scene, of a number of prisoners who were pulling down a building, a proceeding condemned by the German Court of Enquiry as a breach of Article 4 of the Hague Convention.

Working Camps.—Still leaving out of consideration the camps in the occupied districts on the eastern and western fronts, the great bulk of the ill-treatment occurred in the working camps, and by a curious paradox, it is in them that the best treatment is to be found. The ill-treatment was due to two main causes: first, to the fact that, except in very large working camps, the person in charge was a non-commissioned officer, and, second, to the passive resistance and in some cases the active insubordination of the British prisoners.

The non-commissioned officers, trained in the school of the German army and unrestrained by the presence of a superior officer, treated the prisoners in the way in which the rank and file of the German army have so often been treated. Men who refused to work, or in the opinion of the guards did not work hard enough, were kicked, spat upon, beaten with sticks, whips, clubs, rubber tubing, mining hammers and the butts of rifles. Those who escaped and were recaptured not infrequently received severe beatings before they were reported as recaptured and were formally punished for their offence. And all this was done notwithstanding the regulations, which, after laying down rules in the main reasonable enough for the use of arms by the guard, continue as follows (the quotation is from the instructions in force in the II. Army Corps district):—"Blows with the hand or fist or with sticks or clubs and kicks are forbidden. Except in the most exceptional and unusual cases it is inexcusable to lay hands on a prisoner."

Even where the non-commissioned officer was lawfully inflicting punishment, he would often by his perverse ingenuity add to its severity. Men were made to stand at attention on hot asphalted roofs, or before coke ovens, where they were nearly roasted, or sometimes in exposed positions without an overcoat in the freezing atmosphere of a winter's night. At more than one mine, the dark cells, in which, according to the German law, prisoners of war under punishment were obliged to pass their periods of close arrest, were constructed in close proximity to the main steam pipe and became so hot that the men had to strip themselves almost to the skin.

For all this there is no excuse or palliation possible; happily, however, there is another side to record. At some large German works the employers seem to have taken a real interest in their

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prisoners, and to have done whatever in them lay to make their lot endurable and even comfortable.[1] On the farms and similar places, the relations between prisoners and their employers were frequently, as in Great Britain, even cordial, and more than one repatriated British prisoner has spoken warmly of the kindness and consideration with which he was treated, though such cases were, of course, not common.

The impression produced by the study of all the available material is that there was neither in the main nor the working camps in Germany any officially recognized ill-treatment of prisoners; that there was, nevertheless, in many cases much cruelty by individuals, and that when as occasionally, but far too infrequently, happened, a prisoner could bring home to the authorities that some individual had exceeded his powers and acted outside the regulations, the offender was punished, sometimes by being sent away to the front, sometimes by a sentence to a term of imprisonment. On the other hand, it is also clear that in some cases the prisoners were treated, not only with humanity, but with kindness.

The reason for these contrasts is to be found in two things. First, the personal character of the man in charge, and, second, the independence of the army corps commanders, and even to some extent of the camp commandants, who not only placed their own interpretation on the regulations, but sometimes acted in deliberate defiance of them.

Men in the Occupied Districts.—While the above represents the considered opinion which results from the study of the very voluminous material available with regard to the camps in the interior in Germany, the same conclusion cannot be reached when the evidence dealing with the camps in the occupied districts is examined.

The cruelties inflicted on the prisoners in these places had their origin, and from the German point of view, their justification, as reprisals for alleged ill-treatment of Germans in British hands. It is not proposed to give here an account of the reprisals enforced on one side or the other, more than to allude to the severe conditions under which the first captured German submarine officers were interned in Great Britain, which resulted in the German Government retaliating by selecting from among the officers in their hands who bore well-known names (including among them the son of the former British ambassador to Berlin) and imprisoning them under exceptionally rigorous conditions. Most of the reprisals, while unpleasant enough for the victims, were not such as to amount to real cruelty.

But it is not too much to say that the treatment of the prisoners of war on the eastern and western fronts must, so long as the terrible story is remembered, bring indelible disgrace on the German nation, and on those responsible for the appalling cruelty inflicted on defenceless men. It was quite deliberate, as the following facts will show.

Eastern Front.—In the spring of 1916, German prisoners of war were sent to work at Rouen and Havre, and in May the German Government informed the British Government that it had in consequence decided to send 2,000 British prisoners to the occupied Russian territory to work under similar conditions to those existing at Havre and Rouen. They were accordingly sent, divided into four companies of 500 each, to four main camps, from which they were sent in smaller parties to work on numerous farms and in road-making and tree-felling. There is no serious complaint to make of the central camps, but at the others the conditions were very hard, the accommodation bad, and the *unter-offiziers* rough.

On Feb. 7 1917, the British Government received a German *note verbale* in which complaint was made that a considerable number of Germans were detained behind the British front in France, where it was alleged the "prisoners suffered from inadequate food, defective accommodation . . . as well as being subjected to hard work and irregularities in the matter of mails," and that they were exposed to German gunfire which "has resulted in several of them being killed." The Germans required that their men should be removed to a distance of at least 30 km. behind the firing-lines and "provided there with accommodation in accordance with the season of the year and hygienic needs." In default of the British Government notifying their compliance with these demands by Feb. 1 (the *note verbale* was dated Jan. 24 and received on Feb. 7), "a number of British prisoners will be transferred from camps in Germany to the area of operations in the western theatre of war where, in respect of employment, accommodation, food, and the question of mails, they will be treated in a manner corresponding to the practice of the British military authorities"—which means, of course, the practice alleged by the Germans, *i.e.* insufficient food, defective accommodation (only tents), hard work and irregular mails.

The British Government, in a *note verbale* for transmission to the German Government, dated Feb. 8 1917, gave the explicit assurance that the prisoners received the same food as the British troops, that 75% were in huts, the remainder being like many British troops in specially warmed tents with floor boards, that strict orders had been given against their being employed within the range of German gunfire though it was regretted that one man had been wounded by a shell which must have been fired at exceptionally long range, this being the only casualty which had occurred.

Within ten days of the date of the British reply, 500 men were sent, not to the western but to the eastern front, and they were "officially informed" that they would be sent to the trenches between Riga and Mitau and remain within the artillery zone by way of reprisal. On Feb. 25 these 500 men were forced to march 35 km. up the frozen river Aa, often through snow-drifts knee deep. Sledges followed to pick up the men who broke down from exhaustion, while the escort of Uhlans drove the stragglers on with lances and whips. Those who fell were robbed of their kit and property. Of the 500 who started, between 120 and 130 are said to have collapsed on the march. "They were brought in by transport later, but through their lying in the snow they were frost-bitten in the hands and feet."

Arrived at their destination, the men were kept waiting outside a "cavalry tent built on the ice of (marsh by) the river. It had wire beds on three racks, the bottom one being about one foot from the ground, so that the weight of a man's body weighed it down till he was lying on the snow or the ice."

The next morning they were paraded, and a notice was read out giving the reasons why they were there. The substance of this notice is given by one of the British prisoners who heard it, as follows:—

"You are here on a reprisal because the English have German prisoners working in the firing-line in France. They have bad accommodation, bad food, bad treatment; they are under fire and 36 men have lost their lives. In return, you are to work here in the firing-line and will get bad treatment, bad food, bad accommodation, and 36 of you have got to die."

The way in which it corresponds with the substance of the *note verbale* of Jan. 24, already quoted, which the soldier who gave the evidence could not possibly have heard of, cannot escape notice, any more than the fact that the accommodation provided corresponds with the complaint that some of the Germans at Havre and Rouen were lodged in tents.[2]

The threats contained in the notice were carried out to the letter. The accommodation was bad, the treatment was bad, the food was bad, and numbers of men died, while more lost toes, fingers or hand through frost-bite.

The tent was a large cavalry tent pitched on the frozen marsh, with a foot or more of snow and ice inside and frequently under shell-fire. There were some small stoves, but no fuel or entirely inadequate fuel was provided. The "revier Stube" was a wretched peasant's cottage (in which the guard also was quartered) in charge of a brutal Sanitäter. Men in the last stages of illness were sent by sledge to Mitau. When the thaw

[1] In some places the prisoners were even taken periodically to the local cinema, not always at their own expense.

[2] When the men had been in this place for a week the "German Government informed the Netherlands minister at Berlin, in a *note verbale* dated March 5, that British prisoners of war had not yet been sent quite close to the German firing-line on the Russian front."

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came the tent was moved to Pinne, on the other side of the river, where deep mud took the place of snow and ice inside the tent.

There was no water supply; such water as there was, was obtained by melting ice from the river or by digging down into the marsh, where filthy polluted water was obtained. Most of the men had no wash during the whole time they were there. The treatment was bad. Were it not established beyond the possibility of doubt, the story would be unbelievable. Men were driven out to work—breaking ice on the river, felling trees, making and repairing trenches under fire—when they could hardly stand, and had to be supported by their comrades to and from their work. One man died while being carried home; another, who had fallen exhausted on his way back to camp, was shot at point-blank range by the sentry; while a third man, who did not turn out quick enough one morning, was first abused and then attacked with a bayonet by the Sanitäter; further investigation disclosed the fact that he had been dead some hours, frozen in his bunk. The only punishment was tying to the post outside the tent for two hours after the men returned from work, under conditions hardly differing from crucifixion. A sergeant-major, having been urged by the interpreter to write home how they were being treated, eventually did so: "next day," he proceeds, "I got the letter back marked 'five days strong arrest.' After being hard at work from 6 A.M. to 6 P.M., I was tied to the pole from 7 P.M., during 36 degrees of frost." This is corroborated by several witnesses.

That this treatment was deliberate and inspired by higher authority is evident from the fact that the sergeant-major says he obtained a copy of the orders from the guard, which stated "that no mercy was to be shown to us; we were men who had, every one of us, assisted in stopping the Kaiser's army from going to Paris; and they were to think of their comrades who were being brutally treated in France. Any soldier failing to carry out these orders was to be severely punished."

The guards were given three-quarters of a loaf each day, the prisoners, doing hard work, received one-sixth of a loaf. The guards were given good, thick soup; the prisoners, soup "that you could drink straight off." To such straits were the men reduced that it is recorded by more than one witness that the men became so ravenous that they would eat anything. "There were," says one, "many unburied Russian bodies lying round the camp. Some men were so reduced that when they saw any bones they would rush at them and eat them like a dog. It was pitiful to see men reduced to such an animal stage." No parcels were allowed before April, and no letters. When the remnants of this unhappy company returned to Mitau, 20,000 parcels were found stored. Had they been forwarded much suffering might have been avoided and lives saved.

The result of this inhuman treatment was what might have been expected. At the end of April 1917, there were 77 men left in the camp out of the 500 driven there in February. Of these, no fewer than 47 were certified by the German doctor as unfit to leave their beds. No less than 23 had died from exposure and starvation—some 16 in the camp, the rest in hospital at Mitau, besides those killed by the sentries or permanently injured by shell-fire or frost-bite.

There can be no doubt whatever that the sufferings endured by this unfortunate 500 were directly due to someone in authority in Berlin. The terms of the notice read out to the prisoners and of the orders given to the guard are in exact accordance with the terms of the *note verbale* of Jan. 24 1917.

Western Front.—The story of the treatment of the prisoners on the western front is not less terrible, indeed in some respects it is worse in that their sufferings were more prolonged, though they were not exposed to the same climatic conditions as their comrades in Russia. There is overwhelming evidence in this case also of the deliberation with which the suffering was inflicted.

In April 1917 it was agreed, after the communications of January and February mentioned above, that neither belligerent would employ prisoners within 30 km. of the firing-line, and on April 28 a telegram was sent by the British authorities informing the German Government that orders had been issued that all German prisoners were to be removed. On May 30 a further telegram was sent stating that they had all been withdrawn to a distance of 30 km. from the firing-line, and requesting immediate information that the British prisoners had been so withdrawn on the eastern and western fronts. No reply was received till July 4, when the British minister at The Hague transmitted a communication from the German Government stating that "there can be no question in any case of intentional retention or concealment of British prisoners," and on July 9 a further communication was received, dated Berlin June 15, saying "that the withdrawal of British prisoners of war in the German fighting zone to a distance of 30 km. behind the firing-line has been completed everywhere."

On July 2 the British and German representatives at The Hague had made the following important agreement:—

"Reprisals against combatant and civilian prisoners of war may only be carried out after at least four weeks' notice of intention so to do has been given"; and second, "all captures are to be notified by the captor State to the other State with the least possible delay: every prisoner captured is to be allowed to communicate at once with his family and is to be provided with the means of doing so and the dispatch of his communication is to be facilitated: as soon as practicable after capture every prisoner is to be enabled to inform his family of an address at which they can communicate with him."

The statements with regard to the removal of the prisoners were not true. From early in 1917 up to the Armistice prisoners were kept by Germans within 30 km. of the front line and were there subjected to the most cruel treatment. After the above-mentioned agreement, and up to the date of the German offensive of March 1918, their number was probably not large, but after that date thousands were so detained under very bad conditions. No notice of the fact that they were to be so detained as a reprisal was ever given to the British Government.

In April 1917 a notice entitled "Conditions of respite to German prisoners" was handed at Lille to a British noncommissioned officer to be read out to his fellow-prisoners. It runs as follows:—

"Upon the German request to withdraw the German prisoners of war to a distance of not less than 30 km. from the front line, the British Government has not replied; therefore it has been decided that all prisoners of war who are captured in future will be kept as prisoners of respite (sic). Very short food, bad lighting, bad lodgings, no beds, and hard work beside the German guns under heavy shell-fire. No pay, no soap for washing or shaving, no towels or boots, etc."

The notice proceeds to the effect that prisoners are to write home of their sufferings and that "no alteration in the ill-treatment will occur till the English Government has consented to the German request" and then the prisoners would be removed "to camps in Germany, where they will be properly treated, with good food, good clothing." Stationery would be supplied and "all this correspondence in which you will explain your hardships will be sent as express mail to England." Similar notices were read out at several other places. The threats were carried out to the letter. The accommodation was everywhere and always as bad as it could be. In the spring of 1917 prisoners were confined at Lille in conditions comparable only to those of the "black hole" of Calcutta, the crowding was terrible, there were no washing arrangements, and the only sanitary accommodation took the form of tubs in the rooms. The same conditions were renewed or continued in 1918; in the spring of that year the men were told that they were being badly treated as a reprisal. Prisoners were sent to places behind the lines, where they had to work for eight or nine hours on end and even longer on entirely insufficient food. The evidence of over 2,300 men has been obtained with regard to 78 of these places, at 20 of which they were exposed to Allied shell-fire which caused many casualties, while at 38 they were engaged in work directly connected with the operations of war, being required in some cases actually to take up ammunition to the German guns. They were forced to do this by brutal ill-treatment, and were worked till they could do nothing more and either died or were sent back to Germany mere wrecks of their former selves. Men died in the train, their bodies being taken out at stations on the way; many more died within 24 hours of their arrival at the

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hospital to which they were sent, and often a large percentage (up to 30 % it is said in some cases) within the next three or four weeks. Their physical condition is vouched for by 33 medical officers who were prisoners: 10 of them immediately behind the lines who saw what was going on, and the remainder detained in the interior of Germany who saw and tended the prisoners on their arrival there.

The under-feeding of the prisoners on this front was aggravated by three things: First, the Germans did not notify the capture of large numbers of them in obedience to the Hague agreement of 1917; second, the prisoners were forced to give as their address some camp in the interior of Germany to which parcels were sent for them and, except in a few cases, not forwarded; third, steps were taken to prevent the French and Belgians giving the prisoners any food.

The *Kommandantur* at Mons on April 4 1918 issued a notice in French of which the following is a translation:—

"Conversation with prisoners is absolutely forbidden, as is giving them letters, food, or anything else. Breaches of this regulation will be punished by imprisonment for a maximum of three years or a maximum fine of 10,000 marks."[1]

This was repeated on July 28 and on Sept. 9 1918 the *Kommandantur* again called attention to the matter, the notice of the latter date containing a passage of which the following is a translation:—

"Notwithstanding this warning, frequent breaches of the regulation have been reported. The Kommandantur, being responsible for strictly maintaining order, has instructed guards to use their firearms when it becomes necessary so to do."[2]

This was no mere threat. Many civilians, women among them, were shot for attempting to help the starving prisoners, and many prisoners were shot on the spot even for attempting to pick up the remains of food which they saw in the road as they marched along.

This treatment was continued right up to the Armistice, when prisoners in the last stages of exhaustion and starvation stumbled into the British lines hardly recognizable as British soldiers. The High Command had faithfully kept their promise of "very short food, bad lighting, bad lodgings, no beds and hard work beside the German guns under heavy shell-fire."

PRISONERS OUTSIDE EUROPE.—Something must be added with regard to the treatment of prisoners elsewhere than in Europe, if only because serious complaints were made on both sides as to their treatment with regard to accommodation and food, especially in East Africa. There can be no doubt that much suffering was endured by prisoners of both nationalities in this part of the world; but it was mainly due to the conditions of the campaign and to the climate, while on the British side there appears to have been much justification for the complaints which were made against individual Germans for their want of consideration for the devoted men and women missionaries whom the fortunes of war had brought into their hands.

Turkey.—Little can be said with regard to the application of the Hague Convention by Turkey, because the Government of that country made practically no attempt to conform to the regulations contained in it. Their treatment of prisoners varied from an almost theatrical politeness to the great, to complete indifference to suffering—almost to barbarism—in the case of men of little esteem.

These oriental characteristics may be best illustrated by the fate of the British prisoners captured on the fall of Kut el 'Amara at the end of April 1916, when, as Enver Pasha stated, they became "the honoured guests of the Turkish Government." The officers were sent by steamer to Bagdad and thereafter drafted to various camps in Anatolia. The men were marched 100 m. to Bagdad, in stifling heat, with no sort of organization for food transport or medical care of those worn out by the privations of the long-drawn-out siege. The Turkish commandant promised that the day's march should not exceed eight miles. He kept his promise for one day, and thereafter the men were forced to march from 12 to 18 m. a day, herded like sheep by mounted Arabs who flogged forward the stragglers. At night they lay out on the open ground without any shelter. Many fell out and died. At one point 350 men were left behind in a sort of cow-shed, so sick as to be unable to move, and were picked up by the already overcrowded boats, where there was room only for the most desperately ill to lie down. Arrived at Bagdad, all but 500, who were too ill even for the Turks to force them forward, were sent on a 500-m. march to places where they were to work.

Out of a total of 13,670 of all ranks believed to have been captured at Kut, in the course of two and a half years 1,425 escaped or were repatriated, 2,611 are known to have died, while 2,200 were missing, and there were left in the hands of the Turks only 7,414, or little more than half of those captured.

Up to Dec. 1917 the Ottoman Government steadily refused to permit neutrals to inspect the camps, and though this concession was then made, it was so worded as in effect to be useless.

Bulgaria.—If due allowance is made for the backward condition of the country, it must be admitted that the treatment by the Bulgarians was correct, though complaint was made that British soldiers were flogged for disciplinary offences. This is permitted by the military law of Bulgaria but after representations were made on the subject the practice was abandoned in the case of British soldiers.

The food given the prisoners was the same as that given to the Bulgarian soldiers, and the hospital treatment was not less good than that given to their own men. The accommodation was rough but in general no worse than that of the inhabitants of the country. Every effort appears to have been made to improve conditions where they were remediable, and the authorities seemed anxious to treat their British prisoners with consideration. An unusual amount of liberty was accorded to the prisoners, and there is no little evidence of the kindness and friendliness of the Bulgarian civilians to the British.

Austria.—The few British prisoners captured by Austria were treated with consideration and in accordance with the provisions of the Hague Convention.

NEGOTIATIONS DURING THE WAR.—During the World War a notable step was taken in arranging for meetings between representatives of the belligerents for the discussion of matters relating to prisoners of war. In the spring of 1917 meetings had taken place between French and German representatives with useful results, and, largely owing to the insistence of Lord Newton, who was then in charge of the Prisoners of War Department of the British Foreign Office, a meeting between German and British representatives was arranged and took place at The Hague in June. Great Britain was represented by Lord Newton, Lord Justice Younger and Gen. Belfield, and Germany by Gen. Friederich and two others, the meetings being presided over by M. van Vredenburg on behalf of M. Loudon, the Netherlands Minister of Foreign Affairs. At this meeting arrangements were made for the repatriation of disabled combatants, for the internment of invalid interned civilians, for the repatriation of medical personnel still retained by the belligerents, and for the mitigation of certain punishments inflicted on prisoners of war. It was agreed that reprisals should only be carried out after a month's notice of intention to do so had been given and it was also agreed that all captures were to be notified with the least possible delay.

This meeting was followed by one which lasted from June 8 to July 14 1918, at which the British representatives were Lord Cave, Lord Newton and Gen. Belfield, the first-named being obliged to return before the agreement was signed. It contained no fewer than 60 articles with six annexes thereto, and dealt with the following subjects: the repatriation of invalids;

[1] The original wording was:—
"Il est absolument interdit de parler aux prisonniers ou de leur passer des lettres, des vivres, ou d'autres objets quelconques. Les infractions à cette prescription seront punies d'un emprisonnement pouvant s'élever à 3 ans, ou d'une amende pouvant atteindre 10,000 mark."

[2] The original wording was:—
"Malgré cette défense, de nombreuses infractions ont été signalées. La Kommandantur ayant pour tâche de maintenir l'ordre le plus strict, les soldats de surveillance ont reçu l'instruction de *faire usage*, le cas échéant, *de leurs armes à feu.*"

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the internment in a neutral country of prisoners who had been a long time in captivity; the protection of prisoners after capture; prisoners retained in an area of operations; notification of capture; equipment and organization of camps; food; punishments; help committees; relations with protecting powers; parcels and postal services; and the publication of the agreements in the different camps. Much was done by these two meetings to translate into a concrete form the principles laid down in the Hague Conventions, and to mitigate the lot of the prisoners, though the full benefit of the second agreement was never realized as it was never formally ratified.

In Dec. 1917 Lord Newton and Gen. Belfield met Turkish representatives at Berne under the presidency of M. Ador, of the Swiss Political Department, and an agreement was drawn up on lines similar to those of the German agreements.

QUESTIONS FOR THE FUTURE.—The foregoing investigation of the operation of the Hague Convention during the World War leads one inevitably to ask whether it is desirable and practicable to make any substantial amendment to that Convention. It is a most difficult question to answer, for, although not generally recognized, the whole problem is military rather than humanitarian. While of course all active ill-treatment should be prohibited, the lot of a prisoner must not be made so attractive in comparison with that of soldiers in the firing-line as to afford a temptation to them to desert or to do anything incompatible with their military duty. Further, while it is possible for the voices of humanity and charity to make themselves effectively heard in times of profound peace, it is useless then to formulate regulations which public opinion, stirred to its depths by alleged misdeeds of the enemy, will not allow to be observed, and which the military authorities will disregard in time of war. All that can be usefully accomplished is to put into the form of rules those principles which the good sense of all civilized nations accepts as correct, and for this purpose to use the experience gained during the World War, of which not the least important part was the value of direct conference between representatives of the belligerents during active hostilities for the purpose of dealing with the detailed application of those principles.

But it does seem desirable that regulations should be made dealing with the case of civilians found in any enemy country at the outbreak of war, for it is improbable that in any future war of nations civilians will be allowed to return home or to remain at large in view of the means of communication which modern science has made possible.

The value of the inspection of prisoners-of-war camps by the accredited representatives of the protecting State has been made abundantly clear, and their right to visit the camps, which was the result of an agreement made early in 1915 between the British and German Governments should be made permanent. It will, however, be extremely difficult to reconcile the desires of the humanitarians and the military authorities with regard to camps within the area of hostilities, though it will probably be found possible to come to some agreement defining the nature of the work on which prisoners of war may not be employed, and an attempt should be made to make more clear than it is at present the obligation of the captors with regard to the feeding and clothing of the prisoners in their hands.

For military reasons there would be no chance of obtaining a general assent to the prohibition of reprisals, but provisions similar to those contained in the agreements with the German and Ottoman Governments requiring notice before reprisals are made might be accepted.

Finally, those agreements made during the war with regard to the repatriation of disabled prisoners, and the conditions on which a prisoner should be entitled to internment in a neutral country if accommodation could be found, might be made of universal application.

There remains the most difficult question of all: whether it is possible to provide penalties for the infraction of any regulation which may be made, and to establish a tribunal with authority to punish individuals and States. Articles 227–229 of the Peace Treaty with Germany, satisfactory from one point of view, savour too little of the calm administration of justice. They are not reciprocal, the vanquished are given no right to have judicially investigated any complaints they may have against the victors. It would be far more satisfactory to have an alleged "atrocity" investigated than that, for want of public investigation, an unfounded legend of brutality should grow up.

It is perhaps too much to expect that, at the conclusion of a war in which the victors have made great sacrifices and undergone great suffering, they should take steps to establish a court for the trial of charges against their own people, but if provision had been made in time of peace for the establishment of a court to investigate all charges of wrong treatment in time of war the victors would not depart from their agreement. The establishment of such a court may well occupy the attention of statesmen and international lawyers.

AUTHORITIES.—The following is a complete list of official publications:—Correspondence between H.M. Government and the U.S. ambassador respecting the treatment of prisoners of war and interned civilians in the United Kingdom and Germany: Misc. 7 (1915), cd. 7817; do. Misc. 5 (1915), cd. 7815. Reports by United States officials on treatment of British prisoners of war and interned civilians in Germany: Misc. 11 (1915), cd. 7861; Misc. 3 (1916), cd. 8161; Misc. 14 (1915), cd. 7959; Misc. 15 (1915), cd. 7961; Misc. 19 (1915), cd. 8108; Misc. 16 (1916), cd. 8235; Misc. 26 (1916), cd. 8297; Misc. 7 (1917), cd. 8477. Report on conditions existing at Ruhleben: Misc. 13 (1915), cd. 7863. Report by Dr. A. E. Taylor on the conditions of diet and nutrition at Ruhleben: Misc. 18 (1916), cd. 8259; Misc. 21 (1916), cd. 8262. The same, and on proposed release of civilians: Misc. 26 (1916), cd. 8296; Misc. 35 (1916), cd. 8352. Correspondence respecting the employment of British and German prisoners of war in Poland and France respectively: Misc. 19 (1916), cd. 8260. Correspondence with U.S. ambassador respecting transfer to Switzerland of British and German prisoners of war: Misc. 17 (1916), cd. 8236. Reports of visits of inspection made by officials of the United States embassy to various internment camps in the United Kingdom: Misc. 30 (1916), cd. 8324. Report on the treatment of prisoners of war in England and Germany during the first eight months of the war: Misc. 12 (1915), cd. 7862. Report on the transport of British prisoners of war to Germany Aug.–Dec. 1914: Misc. 3 (1918), cd. 8984. Report on treatment of British prisoners and natives in German East Africa: Misc. 13 (1917), cd. 8689; do. London 1918. Correspondence with German Government respecting the burning of G. P. Genower, A.B.: Misc. 6 (1918), cd. 8987. Correspondence respecting the use of police dogs: Misc. 9 (1917), cd. 8480. Correspondence with H.M.'s minister at Berne respecting reprisals: Misc. 29 (1916), cd. 8323. Report on Wittenburg typhus epidemic: Misc. 10 (1916), cd. 8224; do. Gardelegen, Misc. 34 (1916), cd. 8351. Report on the treatment of officers in camps under X. Army Corps: Misc. 28 (1918). Report on the treatment of British prisoners behind the lines in France and Belgium: Misc. 7 (1918), cd. 8788; do., Misc. 19 (1918), cd. 9106; do., Misc. 27 (1918). Report on the employment of British prisoners in coal and salt mines: Misc. 23 (1918), cd. 9150. Agreement between the British and German Governments concerning combatant and civilian prisoners of war: Misc. 12 (1917), cd. 8590; do., Misc. 20 (1918), cd. 9147. Report on the treatment of British prisoners of war in Turkey: Misc. 24 (1918), cd. 9208. Agreement between the British and Ottoman Governments respecting prisoners of war and civilians: Misc. 10 (1918), cd. 9024. Work of the Central Prisoners of War Committee 1916–1919: *Revue Internationale de la Croix Rouge* (No. 26, Feb. 1921). Report of the Joint Committee to enquire into the organization and methods of the Central Prisoners of War Committee, cd. 8615.

Up to Jan. 1922, neither the British Government Committee on the treatment by the enemy of British prisoners of war, nor the Committee on the Breaches of the Laws of War, had published any general report; nor had the Reports of the representatives of the Netherlands Government been published. (R. B. D. A.)

PROFITEERING.—The word "Profiteering" was introduced in 1919 into an Act of Parliament, and thus may be said to have obtained official recognition as part of the English language. It had become current colloquially quite early in the World War. The following implicit definition was given by Sir Auckland Geddes (as president of the Board of Trade) in Parliament on the second reading of the Profiteering bill (1919):—"To profiteer is to make an unreasonably large profit, all the circumstances of the case being considered, by the sale to one's fellow-citizens of an article which is one or one of a kind in common use by the public, or is material, machinery, or accessories used in the production thereof."[1] As an urgent social and economic prob-

[1] Hansard, vol. 119, No. 114, Col. 545, Aug. 11 1919.

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lem the conception of "profiteering" was a new one as well as the name attached to it, since the possibility of unreasonably high profits being reaped on a large scale to the public detriment from the sale of articles in common use was a direct outcome of the conditions of disorganized trade and world-shortage of commodities which resulted from the World War. It is clear that under normal economic conditions high profits do not necessarily involve high prices, but may even be obtained as a result of greater efficiency of organization or production. It is probably true to say that before the war, as a rule, a free market and plentiful supplies afforded, in the case of most commodities in general use, an effective safeguard against excessive profits based on excessive prices.

It was no doubt partly with this consideration in view that (to meet the demand for a clearer definition of the offence) a provision was inserted in the bill in Committee, laying down that a rate of profit not exceeding the pre-war rate should not be deemed "unreasonable." It is with profiteering in this technical sense that this article deals, and not with the wider economic problems affecting profits as such.

The Profiteering Act, 1919, was thus a temporary measure designed by the British Government to meet peculiar circumstances. It was a measure "to check profiteering," and accordingly was framed to avoid, so far as possible, any interference with legitimate commercial enterprise. The great difficulty presented by legislation of this kind is to design an instrument of such accuracy, and to use it with such precision, that it shall deal effectively with the evil against which it is directed, without hitting the sensitive organism of trade and industry, the recovery of which was in itself an essential factor in the removal of those conditions of shortage and high prices of which profiteering was to a large extent a symptom. How far the Profiteering Acts succeeded in solving this difficulty is a matter of opinion, but this was the problem they had to deal with.

The main powers conferred upon the Board of Trade by the Profiteering Act, 1919, may be summarized as follows:—(*a*) to investigate prices, costs and profits at all stages; (*b*) to receive and investigate complaints regarding the making of excessive profits on the sale of any article to which the Act was applied by the Board of Trade, and after giving the parties an opportunity of being heard either to dismiss the complaint or to declare the reasonable price for such articles, and to order the seller to refund to the buyer any amount paid in excess of such reasonable price. The Board also had power, where it appeared to them that the circumstances so required, to take proceedings against the seller in a Court of Summary Jurisdiction; (*c*) to obtain from all sources information as to the nature, extent and development of trusts, and similar combinations.[1]

The Act was applied by the Board of Trade by a series of orders to practically every article of ordinary everyday use, including all articles of wearing apparel, household utensils and requisites, articles for mending and knitting, furniture, building materials, drugs and medicinal preparations, medical and surgical appliances and dressings, mineral waters, all articles used for fuel and lighting, tools, weights, measures, weighing and measuring instruments, motor spirit, stationery, and, in agreement with the Ministry of Food, to practically all articles of food the price of which was not otherwise controlled, including milk, bread, fish, tea, coffee, cacao, margarine and meat. Further, in accordance with extended powers given by Section 2 (2) of the Profiteering (Amendment) Act, 1920, the following processes were by order brought within the operation of the Acts: the repairing, altering or washing of articles of wearing apparel and household linen, etc., the repairing, altering or cleaning of clocks and watches, and the repairing or altering of boots, shoes and umbrellas.

For administrative purposes the Act empowered the Board of Trade to establish or authorize local authorities to establish local or other committees to which the Board might delegate any or all of their powers under the Act (except the power to fix maximum prices). The work fell naturally into two broad sections, viz.: (1) the larger transactions of wholesalers or manufacturers which raise wide questions affecting whole trades or industries, and (2) retail trade, which is much more affected by local conditions. To deal with (1) the Board of Trade set up a Central Committee, with its headquarters in London; to deal with (2) the Board invited local authorities throughout the country to appoint local profiteering committees.

Local Committees and Appeal Tribunals.—Over 1,800 local committees were established in the United Kingdom, and the vast majority continued in existence until the expiration of the Profiteering Acts in May 1921. Their constitution, powers and procedure were defined by regulations made by the Board of Trade, who delegated to the local committees the bulk of their powers under the Act in relation to retail sales. The regulations provided among other things that labour, women, and the retail trade should be adequately represented on local committees; that complaints should, except in special cases, be heard in public; that any member who happened to be a trade competitor of the respondent or otherwise personally interested should be disqualified from adjudicating; that a complaint should be lodged in writing within four days of the sale, and a copy forwarded to the respondent within seven days of its receipt; that a preliminary investigation should first take place, after which if a *prima facie* cause of complaint had been disclosed at least three days' notice should be given to the parties of the date fixed for hearing the complaint; and that both complainant and respondent should always be given an opportunity of being heard. The object of the preliminary investigation was to weed out frivolous complaints. The rule was laid down that it should invariably be held *in camera* and that the names of the parties to any complaint should not be made public until such time as the complaint was heard in public. The Board of Trade also appointed 108 appeal tribunals, to which the seller had a right of appeal against the decision of a local committee. The total number of complaints investigated by local committees during the operation of the Acts (Aug. 1919 to May 1921) was over 4,700; of these some 73% were dismissed. Only 173 appeals were made, of which roughly two out of every five were dismissed. Only 202 prosecutions by local committees were reported to the Board of Trade; in these fines were imposed to the amount of some £1,786, and costs ordered against the seller to the amount of £455. Within the limits laid down by the regulations local committees had full freedom of action and were in no sense controlled by the Department. The Department, however, both by correspondence and through a small staff of six or seven travelling inspectors, kept in close touch with the committees' work, and helped them wherever possible with advice and information. Apart from the work arising out of actual complaints, the local committees had the power to hold general investigations into prices, costs and profit at the retail stage, but comparatively few committees undertook such investigations. The report of the county of London appeal tribunal, which dealt with a much larger number of cases than any other appeal tribunal, has been published as a Parliamentary paper.

Central Committee.—This body, about 150 in number, was widely representative, including among its members manufacturers, traders, consumers, trade-union representatives, economists, representatives of the coöperative movement, etc. Mr. McCurdy, its first chairman, was succeeded after about 10 months by Mr. John Murray, M.P. The Board of Trade made regulations laying down the constitution, powers and procedure of the Central Committee, to which the Board delegated the power (*a*) to investigate prices, costs and profit at all stages; (*b*) to investigate, consider and determine complaints regarding unreasonable charges arising out of the wholesale sale of any articles to which the Act was applied; and (*c*) to obtain information regarding trusts and trade combinations.

The Central Committee rarely met as a committee. Its functions were rather those of a panel, and the work was performed by three standing committees: the Investigation of Prices Committee, the Complaints Committee, and the Standing Committee on Trusts. Every member of the Central Committee was appointed on one at least of these standing committees, which in turn appointed from time to time small sub-committees. These sub-committees, through which the bulk of the work was done, were composed of members of the Central Committee with the addition often of outside persons appointed (in practice at the suggestion of the sub-committee or standing committee concerned) by the Board of Trade.

The Investigation of Prices Committee undertook the investigations into the cost of production of various articles in all stages of their manufacture where they considered it desirable to obtain such information for the benefit of the public or of the Board of Trade. The reports on these investigations were published from time to time as Parliamentary papers: they cover the following subjects: agricultural implements and machinery, aspirin, biscuits, boot and shoe repairs, brushes and brooms, clogs, costings in Government department, furniture, gas apparatus, matches, metal bedsteads,

[1] Powers were also conferred on the Board of Trade by the Principal Act to fix maximum prices, and to authorize local authorities under suitable conditions to buy and sell any article or class of articles to which the Act was applied. These powers were only intended to be held in reserve for use in an emergency. Neither power was ever exercised, with the single exception of the temporary fixing of the price of motor spirit during the railway strike in the autumn of 1919. Further provisions were embodied in the Act (or added by the Amendment Act of 1920) giving the Board compulsory power of obtaining information, providing proper safeguards for confidential information and for secret processes, providing against victimization of complainants by sellers refusing to sell, excluding from the scope of the Acts sales for export or sales by public auction or competitive tender, and laying down maximum penalties by way of fine or imprisonment for persons offending against the Acts.

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motor fuel, pottery, standard boot and shoe scheme, tweed cloth, wool and worsted yarns, wool, and the wool-top-making trade.

The Complaints Committee undertook the investigation of specific complaints arising out of transactions or sales other than retail sales. In practice the Complaints Committee became, like the Central Committee itself, a panel, working almost exclusively through sub-committees or tribunals. The procedure was analogous to that of local committees, the complaint being first considered *in camera* by a sub-committee called the Preliminary Investigation Committee, who, if they were of opinion that the complaint did not give sufficient particulars or did not disclose *prima facie* grounds for hearing the complaint, had power (after giving the complainant an opportunity of being heard) either to dismiss the complaint forthwith or to require the production of further or better particulars or grounds of complaint within a stated period, failing which the complaint was dismissed. If the Preliminary Investigation Committee were satisfied that a *prima facie* cause of complaint was disclosed, a tribunal was appointed [1] to hear the case, seven days' notice being given to the parties of the time and place fixed for the hearing. The tribunal had power either to dismiss the case, or (if they were satisfied that an unreasonable profit had been made) to order the seller to repay to the complainant any amount paid by him in excess of the price declared by the tribunal to be reasonable; further, the tribunal might take proceedings against the seller before a court of Summary Jurisdiction. The hearing of all complaints before the tribunal was normally in public, subject to the discretion of the tribunal in particular cases, and the parties could conduct their own cases or be represented by counsel or otherwise. As in the case of local committees, trade competitors or persons otherwise personally interested were disqualified from adjudicating on the tribunal.

The Complaints Committee also investigated specific transactions brought to their notice, even where there was no formal complaint; *e.g.* cases referred to the Board of Trade by local committees where a complaint against a retailer had been dismissed, but it appeared probable that profiteering had taken place at some earlier stage of distribution or manufacture. The following figures show the number of matters referred to the Complaints Committee and the manner in which they were dealt with:—Complaints lodged or specific transactions referred to the committee, 607; profiteering found to exist, 73; number of prosecutions undertaken, 24; number of convictions obtained before the magistrates, 17; fines imposed, £815; costs ordered, £205.

The Committee on Trusts was charged with the duty of obtaining such information as is specified in Section 3 of the Profiteering Act, 1919, which required the Board of Trade to "obtain from all available sources information as to the nature, extent, and development of trusts, companies, firms, combinations, agreements and arrangements connected with mining, manufactures, trade, commerce, finance, or transport, having for their purpose or effect the regulation of the prices or output of commodities or services produced or rendered in the United Kingdom or imported into the United Kingdom, or the delimitation of markets in respect thereof, or the regulation of transport rates and services, in so far as they tend to the creation of monopolies or to the restraint of trade."

This section embodied a recommendation of the departmental committee appointed by the Minister of Reconstruction "in view of the probable extension of trade organizations and combinations, to consider and report what action, if any, may be necessary to safeguard the public interest," which reported in 1919. It is to be noted that the Act gave no power under which any coercion could be exercised on a trade combination except in so far as it brought itself within the penal clauses of the Act by charging unreasonably high prices. Parliament appears to have taken the view that powers of this kind ought to be the subject of further permanent legislation, and that the temporary powers of enquiry and publication given by the Profiteering Act should make it possible by preliminary investigation to get together a body of facts which would be of great value when permanent legislation on the question of trade monopolies was introduced. The numerous reports by sub-committees of the Committee on Trusts constitute in fact such a body of information. They show, on the one hand, that many of the big combinations now existing have been of public benefit; that by economies in working and efficient organization of manufacture, buying, and selling, they have been able to keep prices at a lower level than they must otherwise have attained. On the other hand, instances of abuse of monopoly power have been brought to light, and, in general, many of the reports are in favour of the provision of some kind of statutory power, under which action could be taken if a strong and close organization controlling the whole or nearly the whole of an essential trade or industry adopted a policy contrary to the public interest.

The following is a list of the investigations on which reports by the Committee on Trusts have been published as Parliamentary papers:—dyes and dyestuffs, dyeing, finishing, bleaching and printing, electric cables, electric lamps, explosives, farriery, fish, fixed retail prices, fruit, glassware, iron and steel products, laundry prices, meat, milk, oil and fats, pipes and castings, road transport rates, salt, sewing cotton, soap, tobacco, uniform clothing, vinegar and yeast. Reports on the following subjects by sub-committees jointly appointed by the standing committees on Prices and Trusts have also been published:—bricks, cement and mortar, dyeing and cleaning, light castings, stone and clayware, slates and roofing materials, and timber.

The Profiteering Act was to remain in force for six months only. It was, however, continued for a further three months by the Profiteering (Continuance) Act, 1919, and again for a further twelve months (until May 19 1921) by the Profiteering (Amendment) Act, 1920. The Amendment Act was largely concerned with improvements of machinery in points of detail where experience of actual working had disclosed defects. It contained, however, in Section 1 an important new provision, the object of which was to encourage the various trades and industries to take into their own hands the business of checking profiteering.

Section 1 reads as follows:—

(1). Where any persons or associations of persons appearing to the Board of Trade to represent a substantial proportion of the persons engaged in the production or distribution of any article or class of articles to which the Profiteering Act, 1919 (hereinafter referred to as 'the principal Act'), is applied, submit to the Board of Trade a scheme limiting the profit to be allowed on the manufacture or distribution of the article or class of articles at all or any stages of manufacture or distribution, the Board of Trade may, if they think it expedient, approve the scheme, and, where any such scheme is so approved, any profit sought or obtained in connexion with the sale of any article to which the scheme relates, which does not exceed such profit as is allowed by or under the scheme, shall not be deemed unreasonable for the purposes of section one of the principal Act.

(2). If the Board of Trade are satisfied that any scheme so approved secures an adequate supply to the home market of any articles or classes of articles to which the principal Act is applied, the Board of Trade may by order exempt producers who comply with the scheme from any general investigation under section one, subsection (1) (*a*) of the principal Act in respect of those articles or classes of articles and any articles of a similar description.

The preliminary work of investigation and negotiation in connexion with schemes submitted under this section was undertaken by the Central Committee, the final approval or disapproval resting, of course, with the Board of Trade. Owing to the unexpectedly rapid fall of markets and alteration in the general trade outlook in the latter part of the year 1920, conditions were not very favourable for profit-limiting schemes. Very few were put forward; of these some were withdrawn or not proceeded with, and only two [2] (relating to men's ready-made and made-to-measure clothing and to the retail sale of coal in the London area) were actually approved by the Board of Trade.

The foregoing is a brief review of the principles on which the Profiteering Acts were based, the machinery by which they were worked, and the nature of the work. The Acts were denounced as harassing the small retail trader while enabling the profiteer on a large scale to escape; but complaints against the harassing nature of the Acts came from all quarters, wholesaler, retailer, and manufacturer alike. Although it is possible that investigations may in rare cases have caused hardship to particular interests, this can hardly be held to outweigh the valuable results in helping to dispel misconceptions and suspicions by publishing facts. The figures already quoted with regard to complaints would indeed seem a sufficient answer to the charge that trade was unduly harassed. On the other hand the deterrent effect of the Acts must not be overlooked. From the point of view of checking profiteering, the mere existence of the penal clauses of the Acts and of the machinery for their enforcement was undoubtedly of great value. As regards the absence of any definite standard of a reasonable rate of profit, the original Profiteering bill was criticized in Parliament on the ground that it gave no clear definition of the offence. This criticism was met to some extent by the proviso that a rate of profit not exceeding the pre-war rate should not be deemed unreasonable; and in the Amendment Act the position was further defined by making it clear that the standard of comparison to be aimed at was the percentage rate of net profit, not gross profit, thus

[1] Originally by the Complaints Committee, but under the amended regulations of Aug. 7 1920 by the Chairman of Central Committee.

[2] Reports on these by joint sub-committees of the Standing Committees on Prices and Trusts, and also on the working of the standard boot and shoe scheme (which was not technically a scheme under Section 1), have been published as Parliamentary papers.

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ensuring that the seller should not benefit unduly by the fact that his oncost or establishment charges showed a smaller increase than did cost of wages and raw materials.

A word may be added with regard to anti-profiteering legislation outside the United Kingdom. The majority of European countries, including Belgium, France, Germany, Italy, Norway, Poland, Portugal, Rumania and Sweden, passed some form of legislation with a view to checking profiteering or speculation in the necessities of life. Legislation with this object was also passed in Australia, Canada, New Zealand, the Union of South Africa, and a number of the smaller British possessions. A number of foreign countries or British possessions studied through their representatives the working of the Profiteering Acts, 1919 and 1920, and several (as for example Italy, South Africa, Gibraltar and Sierra Leone) availed themselves largely of English experience in framing their anti-profiteering legislation.

(E. R. E.)

United States

"Profiteering," as the term has been used in the United States, may be roughly defined as consciously taking and retaining profits considerably in excess of the return necessary to equilibrate demand and supply, especially when such profits are the result of prices enhanced by the activity or policy of the recipient. Its meaning has therefore a direct relation to the current conception of a legitimate business "profit"—a point on which public opinion during the World War became peculiarly sensitive. Probably, conscious direct control of industrial processes never reached such development in the United States as during the World War. Prices were fixed and both supply and demand controlled. Income taxes were highly developed. An unusual mass of information concerning cost, production, consumption and stocks was obtained. As a result much became known of the profits made in different industries, and much information concerning them was given out—sometimes with the purpose of exercising a check. In the United States the chief sources of information are the cost reports of the Federal Trade Commission and data compiled from the income-tax returns. If it be remembered that not all that seems excessive is profiteering, it will be of value to recapitulate some of these data.

According to income-tax returns from some 7,000 corporations their net earnings of the pre-war years 1911–3 averaged 11% on invested capital. This corresponds well with the common judgment at that time that from 10% to 12% (depending on the risk) was a fair profit in most industries. Unfortunately, returns are not available in published material for these same corporations in 1917, but for 1918—a year of lower profits—they averaged 15%. The year 1917 was the time of maximum profits. We know that in that year the total net income of 31,500 corporations was well in excess of the total for all corporations in the country in 1913. These corporations made an average net return on investment of approximately 22%, and more than one-half of their net income was reported by those earning 30% or more. (It is to be noted that these figures do not include corporations earning under 15%. Nevertheless, it is probable that all corporations averaged approximately 18%.)

These income-tax returns are not conclusive. The padding of investment account and of costs was all too common, and the statistical treatment of the returns is not satisfactory. They do indicate, however, that average profits increased considerably between the pre-war period and 1918. More accurate and illuminating figures concerning particular industries were obtained by the Federal Trade Commission, and a few representative cases will give the best understanding of the situation. A study of the costs of 37 wheat-flour companies showed that the average earned on investment was 12·6% in the fiscal year 1913–4, 17% in 1914–5, 38·4% in 1916–7, and 34% in 1917–8. That this increase in profits was not due solely to increase in business is evident from the fact that the percentage earned on sales also increased, the rate being 3·4% in 1913–4 and 6·5% in 1916–7. In 1917 there was apparently no limit to the price purchasers were willing to pay, the condition being one of panic. The large profits of the year were partly due to the enhanced value of unsold stocks and to speculative profits derived from feed. In the next year profits were somewhat abated by Government regulation. The Federal Trade Commission, after noting that the margin of 25 cents per bar. allowed by the Food Administration was larger than the normal profit, said: "The Commission's investigations of costs and profits for recent months indicate that 25 cents a barrel is being taken by many millers as a guaranteed net profit after paying all income and excess profit taxes. . . ." In other words (1) taxes payable on net income were being wrongfully treated as expense, and (2) a maximum margin was being made the minimum. This course involved some fraud and showed concerted action. Depreciation and salary accounts were padded and capital charges were treated as operating expenses.

Twenty-two manufacturers of farm implements made at this time about 85% of the product in the United States. Their profits increased from about 9% on investment in the years just prior to the war to 16·6% in 1917 and 19·9% in 1918; and the rate of profit on sales increased several fold. There was no general shortage of farm implements and no unusual demand, for exports were cut off. The Commission says: "The large increase in the prices and profits of manufacturers in 1917 and 1918 was due in part to price understanding or agreements . . . and, to a more limited extent, the profits of dealers seem to have been due to similar activities."

From Senate Document No.248 (65 Cong. 2nd Session) further evidence of profiteering may be gained. It appears that oil companies circulated reports that the supply of gasoline was dangerously short, for the purpose of maintaining prices of that commodity while making "enormous" profits on fuel oil. Concerns bottling or canning vegetables, which had made future contracts, sometimes withheld portions of their output from delivery on such contracts and sold in the higher "spot" markets. In frequent cases licences were revoked by the Food Administration. The practice of such concerns in maintaining re-sale prices for jobbers contributed toward maintaining the general high level of prices and increased profits in some instances. According to the same document the steel companies in 1917, prior to Government price-fixing, made abnormal profits, and a number continued to make unusually heavy profits thereafter. The United States Steel Corp., which made 5% before the war, received 25% on investment in 1917; and 10 smaller concerns, such as begin their operations with the employment of steel furnaces, made from 30% to 319% on their investments. Certain sulphur companies took advantage of the war demand for sulphur to raise their prices to such an extent as to reap net profits of approximately $15 a ton, which meant over 200% on investment in one case. It further appears that "unnecessarily" large profits were made by the producers of yellow pine lumber in the South. A good margin per 1,000 bd. ft. had been considered to be $3, but in 1917 the average margin was over $4.80; and while the average profit on investment in 1916 was 5·2%, the figure was increased to 17% in 1917. The profits of tanners increased from two to five times, as they took advantage of the enormous demand for leather and exacted very high prices. The price of hides was rapidly advanced, notwithstanding that at the same time "great supplies were withheld from the public." Upon learning of approaching price control, one of the large packers took steps "quietly and promptly" to increase the appraised value of his tanneries.

Other figures indicating the general trend may be given as follows:—

	Percentage of net earnings to Investment		
	1914	1916	1917
Meat packers (large)	8·3	18·5	26·5
Tanners	12·9	33·8	25·7
Shoe manufacturers	15·1	26·1	24·7
Bituminous coal (Pa.)	—	6·0*	32·0*
Vegetable canners	—	9·0	32·0
Salmon canners	—	22·0	52·7
Petroleum refiners	15·0	—	21·0
Copper producers	11·7	—	24·4

*Percentage of net sales.

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According to the annual report of the Attorney-General for 1920, since Oct. 1919 sentences had been imposed on 49 sugar dealers and 20 clothing dealers. This was under the anti-profiteering law, referred to below. In addition, six sugar dealers and one flour dealer had been convicted of hoarding, and two coal dealers had been sentenced under the provision as to fixing reasonable prices. In all there had been over 2,000 indictments, arrests and sentences, involving chiefly the commodities just mentioned, together with meats, potatoes, and meals at restaurants. The great majority could not be sustained under the law.

Without further evidence it may be concluded that profits in many industries increased in the earlier part of the war more than 100% above the pre-war level, and that this increase was in not a few cases due in part to profiteering as above defined. High prices do not necessarily indicate excessive profits, but there is reason to believe that profiteering was common in cement, petroleum, lumber (notably ship timber), wool, clothing, sulphur, naval stores, rice, sugar, sand and gravel, raisins and other products, in addition to those already mentioned. In most of these cases the Government reduced prices and profits through some form of control. Anyone who had experience at Washington during the war knows that many persons went there for the purpose of furthering profiteering schemes. In some cases the method was to secure contracts at excessive prices, perhaps by bribery, certainly by misrepresentation. Many such cases later came to light, some concerning articles of clothing for the army and involving collusion with army officers. In other cases the method was to induce the Government to abstain from fixing a reasonable price or to induce it to fix a high price. Thus, in the United States, oil companies succeeded in virtually preventing any price-fixing on the ground that the exorbitant prices that prevailed were necessary to stimulate production; while lumber, copper and cement associations by concerted and persistent activity obtained prices that were unnecessarily high. In still other cases every effort had been made to defraud the Government in respect of excess profits taxes, to enable a business to "retain" profits larger than lawful. Equally reprehensible was the action of hosts of retail dealers, such as those selling shoes and men's clothing, who maintained the same percentages of profits on sales although the great increase in prices meant greatly increased absolute margins and percentages on investments.

The U.S. Government attempted to deal with profiteering in three ways: (1) taxation; (2) price-fixing; (3) direct action under the Food Control Act. The first and the last methods proved largely ineffective.

By special taxes levied on profits, many thought that the spoils of the profiteers could be regained by the public. In 1916 a tax of 12½% was levied on the profits of munitions manufacturers; and a general "war profits tax" and an "excess profits tax" were imposed in 1917. In 1918 these taxes were combined. Under this measure profits of corporations organized for profits were liable either to (1) a progressive tax on profits in excess of 8% on capital; or to (2) a flat tax of 80% of net income over the average profits for the three pre-war years 1911, 1912 and 1913. Not a few legislators and economists hoped that these taxes would make regulation of prices or profits unnecessary. Let any concern make what it can, they said, we will take it as fast as they make it. But, unfortunately, it proved so easy for most corporations to increase their investment accounts, and to pad their expenses, that the worst profiteers often showed small excess profits. Moreover, a considerable part of the tax was shifted to consumers in the shape of higher prices, as was possible during the inflation period.

Government price-fixing, while it did not prevent profiteering, did moderate the evil, notably through such substantial reductions as were made in the prices of wool, coal, sugar, flour and sulphuric acid. Unfortunately, this means was not used as vigorously and thoroughly as it would have been had there not been an ill-founded reliance upon profits taxes.

On Aug. 10 1917 the Food Control Act became law. Section 4 of this Act made it unlawful for any person to hoard or to make any unjust or unreasonable charge in transactions relating to "necessaries" (foods, feeds, fuel, fertilizers, farm implements and machinery), but imposed no penalty. Sections 6 and 7, however, provided for penalties and seizure, in case of hoarding. Section 5 authorized the licensing of dealers in necessaries and the fixing of fair storage charges, commissions, profits, or practices. The fixing of prices for coal and coke was authorized in section 25. It was under this Act that the Food Administration operated, and, as already indicated, its control over prices was partly effective. On June 30 1919, however, the activities of the Food Administration were suspended; and as the agitation concerning the "high cost of living" grew in volume, the Department of Justice assumed the task of enforcing the law, which remained in force while a state of war was only technically in existence. Between Aug. and Nov. 1919, the Department made some 92 seizures of such food products as eggs, butter, sugar, flour and pork, under section 7, and secured several indictments under section 6, one indicted party pleading guilty. The chief agencies depended upon were the local "fair price committees" such as had been established under the Food Administration. Indeed, the wartime organization of local food administrators was partly revived, and an extensive publicity campaign was initiated. But the Attorney-General found his efforts limited by the absence of a penalty clause in section 4 and the restricted definition of "necessaries," and, at the President's request, Congress reënacted the law in Oct. 1919, with amendments to cover these defects. Encouraged by this action, and animated, it is charged by his critics, largely by political ambition, the Attorney-General proceeded vigorously under the Act, and in his annual report for 1920 stated that there had been 1,049 prosecutions under section 4 and 99 convictions.

Meanwhile, a growing hostility to the Act was apparent, and the courts in several jurisdictions declared it unconstitutional. This was true in five of the ten chief bituminous coal-producing states. Action concerning anthracite coal profiteering was also blocked by a decision of the Federal District Court in Pennsylvania. The upshot of the matter was a decision of the Supreme Court in Feb. 1921, which finally declared the Act unconstitutional. The case was that of *U.S. v. L. Cohen Grocery Co.*, and involved profiteering in sugar. The reasoning of the Court was that Congress alone had power to define crimes against the United States; and, therefore, because the Act was vague and indefinite, and fixed no precise standard of guilt, and because it did not inform the defendant of the nature and cause of the accusation against him, it was unconstitutional. Thus ended the anti-profiteering crusade of the Attorney-General. Meanwhile, from April 1920 prices began to decline, and with that decline came a loss of interest in profiteering.

In a sense the U.S. Government was to blame for much wartime profiteering. In the first place it was lax in letting contracts and making purchases, either directly, or indirectly, by placing authority in the hands of interested persons. The "cost-plus system" invited profiteering as well as inefficiency. In the second place its combination of excess profits taxes and price regulation was unfortunate. At the same time that it fixed prices on a cost basis it spread the idea that it made little difference if excess profits were earned, as such profits would be reached by taxation. Taxation, however, proved at best to be an inadequate means of reaching profits, and early laxity in defining cost and investment made this means nugatory. The system as it worked in the United States tended toward laxity both in fixing prices and in collecting taxes on income. (L. H. H.)

PROFIT-SHARING AND CO-PARTNERSHIP (*see* 22.423).—Profit-sharing was defined by the International Conference on Profit-Sharing held in Paris in 1889 in the following formula: "The International Congress is of opinion that the agreement, freely entered into, by which the employee receives a share, *fixed in advance*, of the profits, is in harmony with equity and with the essential principles underlying all legislation." This definition, which is accepted by nearly all writers on profit-sharing, excludes on the one hand distributions made by a firm to its employees, say at Christmas, the amount of which is not fixed in advance, and to which the employees have no definite right.

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Such distributions are to industry what the Squire's coal and blankets are to village life, but they are not profit-sharing. It also excludes forms of "output bonus," etc., under which the individual employee (or the squad or gang) gets, or is supposed to get, a share of the money which he individually saves to the firm by working faster or better; this was formerly classed with it under the general term *gain-sharing*, and *profit-sharing* is still sometimes incorrectly used to cover such forms of bonus. Under true profit-sharing the share of the employees varies with the prosperity of the firm, and depends therefore not on their exertions solely but on the competence of managers and directors, the state of the market, and other considerations.

The Labour Co-Partnership Association in 1911 expressed its view that the co-partnership of labour with capital involved: (1) "That the worker should receive, in addition to the standard wages of the trade, some share in the final profits of the business, or the economy of production. (2) That the worker should accumulate his share of the profits, or part thereof in the capital of the business employing him, thus gaining the ordinary rights and responsibilities of a shareholder." To this in 1919 the Association added a further clause: (3) "That the worker shall acquire some share in the control of the business in the two following ways:—(*a*) By acquiring share capital, and thus gaining the ordinary rights and responsibilities of a shareholder. (*b*) By the formation of a co-partnership committee of workers having a voice in the internal management." The addition of the last clause is due to the belief, now rapidly gaining credence, that the smaller shareholders in the ordinary firm have in reality little or no voice in its management, and that other means are necessary to provide the employee co-partners with their share in control. It has not, however, been adopted by all, or nearly all, of the firms which have co-partnership schemes.

Profit-sharing and co-partnership are thus seen to differ in theory by the fact that the profit-sharer has a share only in the cash profits of his employer over a given period, and may take his share away in his pocket entire, whereas the co-partner must take some of his profit in the form of investment in the business, and receives also some share in the management. In some cases the co-partner does not actually have to invest, but is offered shares at par or at reduced rates, or even free, these shares generally carrying with them all shareholders' rights. In practice, however, there are so many possible variations that no general distinction is possible, and the terms are frequently interchanged. It will also be observed that both forms assume the existence in industry of two parties, the "firm" and its "employees." They are therefore not connected with the various coöperative experiments which have been made from time to time by groups of workers, forming themselves into a firm and dividing amongst themselves the profits or losses, with the coöperative colonies of Robert Owen in England, or the *ateliers* or self-governing workshops of Louis Blanc in France. Co-partnership, as now understood, is distinctly a "paternal" movement, the dominant "partner" in industry being moved to confer a favour on its junior; and though the ideals of Owen, Fourier and the Christian Socialists may have had some influence on the minds of the earliest co-partners, a truer descendant than the co-partnership of to-day is the working-class Coöperative Movement, which aims at the supersession of capitalism.

The earliest example of co-partnership comes from France. In 1843 a master painter of Paris, Edmé-Jean Leclaire, divided among his permanent hands (43 out of about 300 employed) the sum of 12,266 francs. The scheme met with approval and up till 1870 this "kernel," as he called it, of permanent workmen, who were members of the firm's mutual provident society, continued to take their share of the increasing profits. At no time did the members of the mutual provident society amount to more than a third of those employed. In 1870 the profit-sharing was extended to all the men employed, for however short a time, and upon this basis it has continued as "Brugniot, Cros et Cie. (ancienne maison Leclaire)." The arrangement for division of profits is as follows:—5% is first paid on the capital; of the remainder 15% goes to the managing partners (who according to French law have unlimited liability), 50% as a dividend to all workers in proportion to their time wages, and 35% to the mutual provident society—the "kernel"—which is now a partner in the business. The managing partners also receive a salary. This experiment, as it was the first, is also peculiar in the amount of control entrusted to the permanent workmen, the "kernel," who are very carefully chosen. Among their other privileges it falls to them to elect new managing directors among the employees, a privilege not, as far as the writer is aware, granted under any English scheme of co-partnership. The whole business, however, employs only between one and two thousand workers; its interest is, therefore, chiefly as an experiment. (For fuller accounts of this and other French schemes, including the *Familistère* of Guise, consult the publications mentioned at the end of this article.)

France, as it was the original home of co-partnership, has also been the country in which it has excited the most interest, and the comparative lack of trustification in French industry has made it easier for schemes established by individual firms to be accepted. The numerical weakness of French trade unionism has also made it easier to gain the adherence of French workers, for an established trade-union movement is generally hostile to co-partnership and profit-sharing.

United Kingdom.—In the British Isles, if we except a scheme inaugurated in 1829 by Lord Wallscourt for the farmers on his Galway estates and abandoned shortly afterwards, the movement begins in 1865 with the adoption of six schemes, of which five have since been abandoned, although one (adopted by Messrs. Jolly & Son, silk mercers, of Bath) survived until 1906. One of the five was the famous Briggs scheme, of the Whitwood and Methley Collieries, to which reference is made below. The movement then progressed very slowly for some years. Between 1865 and 1888 only 66 schemes in all were launched, of which all but fourteen had disappeared by 1920.

The International Congress on Profit-Sharing which drew up the definition quoted at the head of this article was held in 1889. In that year also the South Metropolitan Gas Co. adopted profit-sharing, and thus initiated it in the only British industry in which it has obtained any considerable hold. These two facts combined to stimulate an interest in profit-sharing, and during the four years 1889–92, 83 schemes were adopted, of which only 12 survive. A long decline in profit-sharing, owing partly no doubt to the trade depression which began in 1892, led up to rather less vigorous revivals during 1908–10 and 1912–4. The World War then practically put an end to the development of the system, until the phenomenal profits of the early months of the peace and the willingness of many firms to share some of them with their employees, led to an outburst of 42 schemes in 1919. The boom continued during the early months of 1920 (19 during the first six months); but during the subsequent industrial depression there was a marked slackening of interest in this direction.

Up to the end of 1919 the British Isles had given birth to 417 schemes, of which 198, or slightly less than half, have been abandoned for one cause or another. Of the remainder, 36 were run by gas companies (*see* below). These figures alone, however, would give a misleading impression of the size of the movement. Of the 144 schemes started up to 1918, only 15 are returned as affecting more than a thousand employees, while no fewer than 54 affect less than a hundred. Out of the 15 again, four are run by gas companies (the South Metropolitan, the South Suburban, the Gas Light and Coke Co., and the Liverpool Gas Co.), and of the remaining 11, four of the largest affect only a portion of the workpeople in the firm's employ. These are:—Messrs. Armstrong Whitworth & Co., (12,215 out of 69,000 employed); Messrs. Pease and Partners, of Darlington (2,243 out of 11,000); Messrs. Lever Bros. (3,542 out of 8,833); and the Bradford Dyers' Assn. (3,600 out of 9,800). The only really large concern whose profit-sharing affects nearly the whole of its workpeople is the Prudential Assurance Co., 18,500 of whose 20,000 employees participate in its scheme. Details of the number participating are not available for schemes

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started since 1918, but as out of the 42 firms only eight have a pay-roll of over 1,000, while ten employ less than 100, it would seem that the proportions would not be materially altered if they were all included. Neither do all the smaller firms include by any means all their employees in their profit-sharing schemes. The proportion varies from case to case, falling as low, in the case of one firm of manufacturers, whose scheme dates from 1889, as 50 out of 1,500, or 3⅓ per cent. It is clear that in this and similar cases the co-partnership is really a tiny experiment carried on with a few picked employees and is of infinitesimal significance in the industrial life of the country. Nor is it only the successful experiments that are of this type; the abandoned schemes tell the same tale, except that the number of participants is lower.

Apart from the gas companies, then, co-partnership in British industry has been confined, with one or two exceptions, to small firms, and these for the most part in minor industries. The food trades, such as cocoa, confectionery, jam, chocolate, etc., and the distributive houses provide a large number of experiments; tailoring, dress-making, boot and shoe manufacture, and printing and stationery are also considerable groups. In the great basic industries of the country, (mining, cotton, engineering and shipbuilding) and in transport, co-partnership has made practically no progress, nor does it seem to be making any.

What is the reason of this? An analysis of the reasons given for the abandonment of dead schemes may provide part of the answer. Forty-nine schemes were abandoned "for financial reasons," *i.e.* because there had ceased to be any profit to be shared. In 16 cases no cause can be assigned; and in about 40 the abandonment was due to changes connected with administration. There remain 91 schemes which were abandoned owing to the dissatisfaction of owners or men with their results. The men's dissatisfaction can generally be traced to a simple cause—the smallness of the dividend distributed. The average rate of bonus paid to workmen under all schemes varies within narrow limits and is generally about 5% per annum on the total of their wages. Translated into cash, this meant in 1918 that 105 firms paid to their workmen an average of £3 13s. 3d. per head, or, if the firms which paid nothing at all be excluded, of £5 15s. 2d. In 1919, the average bonus paid per head was £4 18s. 10d. It will readily be understood that so exiguous a cash benefit causes considerable disappointment to the worker who has been led to expect material advantages from being provided with an interest in the business; and this fact may also go some way towards explaining the failure of schemes which employers gave up owing to the "apathy" of their workmen. £3 13s. 3d. per annum, especially when paid in a lump at the end of twelve months, during which the workers have been working at ordinary rates, is hardly likely to provide a very strong incentive to better work.

This may account for the high mortality among profit-sharing schemes which have actually come into existence. More reasons, however, are needed to explain the smallness of their numbers and their comparative insignificance. This is undoubtedly due in part to the hostility of the consuming public, which tends to regard profit-sharing schemes as designed to keep within the industry money which should be used to reduce the price to itself. Thus the distributive Coöperative Movement, which is an association of consumers, has done very little in the way of profit-sharing or co-partnership, and that little is steadily growing less, and the English and Scottish Coöperative Wholesale Societies have both abandoned their schemes of profit-sharing, the former in 1886, and the latter in 1915.

The gas companies, to which reference has already been made, are not open to this criticism owing to their peculiar statutory position. All gas companies are regulated by Act of Parliament, and in most cases they are not allowed to increase their dividends unless the price of gas is correspondingly reduced. (In the other cases the dividend is limited to a fixed maximum percentage.) Thus the gas companies have never been able to make enormous profits at the expense of their customers, and moreover, since their accounts of capital and dividend must be regularly rendered to the Government, there is little or no cause for the suspicions which occasionally develop in co-partnership concerns, of "watered" capital and the like. Further, there was frequently before the war a considerable surplus which the companies did not wish to use in reduction of price, which, therefore, not being available for shareholders' dividend, could be distributed among the employees. This, by keeping up the workers' dividend, served to render the profit-sharing scheme popular. Since the war, surpluses have largely disappeared.

But the greatest bar to the success of the co-partnership movement has undoubtedly been the hostility of the organized labour movement. The trade unions are almost uniformly opposed to it as a policy, and in some cases even expel any member joining a co-partnership or profit-sharing scheme. This was the case in 1920 with the Amalgamated Society of Woodworkers, whose right to expel members joining Lord Leverhulme's scheme at Port Sunlight was contested in the courts, though the decision finally went against them. The earliest firms to adopt profit-sharing did little to allay the suspicions of the unions. They were generally as unfavourable to the unions as the unions were to them. The well-known experiment of Messrs. Henry Briggs & Co., which was launched in 1865, was avowedly intended to draw the men away from their union, and came to an end ten years later, after a somewhat stormy career, because the employees chose rather to uphold their union in resisting an attempt by the employers to reduce wages than to remain in the firm's employ and get what they could. The scheme of the South Metropolitan Gas Co., which nearly came to grief in its first year owing to the company's insistence that every workman should sign a yearly contract, dating from different days in each case (which would have rendered any concerted strike punishable at law), also required, until 1902, every workman to sign a declaration that he was not a member of the Gasworkers' union. Recently this attitude has been modified, and the most distinguished advocates of co-partnership, such as Mr. Aneurin Williams, now insist on the recognition of trade unions: but the unions nevertheless hold that it gives the workers in a single firm a sectional interest and so tends to divide them from their fellows in the same trade, and, further, that there is always a danger that workers in a profit-sharing firm may, in return for the profit-sharing, be induced to accept less than the rates of wages which it is the unions' business to maintain. As far as one can see, this attitude is not likely to be easily changed in the near future, and the co-partnership movement, therefore, is unlikely to spread beyond the small firms and the minor industries in which trade unionism is weak.

BIBLIOGRAPHY.—The Ministry of Labour's *Report on Profit-Sharing and Labour Co-Partnership in the United Kingdom* (Cmd. 544. 1920.) is indispensable. It contains nearly all the available information, and has an exhaustive bibliography. The best book giving the case for co-partnership is Charles Carpenter's *Industrial Co-partnership*. A useful book is *Co-partnership and Profit-Sharings*, by Aneurin Williams (Williams and Norgate, 1913); a good analysis is to be found in *Methods of Industrial Remuneration*, by D. F. Schloss (Williams and Norgate, 1907). Later Edition. The Labour Co-Partnership Association, 6, Bloomsbury Square, London, W.C.1., published a number of brochures dealing with particular aspects and particular experiments.

For the Labour point of view the best works are two pamphlets by Edward R. Pease: *Profit-Sharing and Co-Partnership; A Fraud and a Failure?* (Fabian Soc., 1913) and *Co-Partnership and Profit-Sharing* (Labour Party. 1921). See also chapters in *The World of Labour*, by G. D. H. Cole. (M. I. C.)

United States.—Profit-sharing, strictly defined, is a plan for increasing the ordinary remuneration of labour by amounts varying with the profits of the business. Popularly, the term is loosely used to describe a great variety of methods of wage payment. In this article it is used to describe an arrangement by which employees, other than managerial employees, receive, in addition to wages or salaries, a share of the net profits of the business, such share being distributed at the time of the declaration of dividends to stockholders. The arrangement may be expressed either by a formal agreement or an oral promise. Although the profits are contingent, the percentage of profits to be distributed is fixed and known in advance, and, like dividends,

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is paid sometimes in whole or in part in stock instead of cash. This definition excludes many forms of wage payment commonly associated and confused with profit-sharing, such as the bonuses sometimes measured by individual or collective output, length of service, attendance at work or employee savings, and sometimes given as Christmas gratuities, and such as sundry stock-purchasing schemes, none of which fluctuate directly with the net profits.

The term "co-partnership" is not generally used in the United States in this connexion, since the implied constituents, profit-sharing, stock-ownership and participation in management, are not often found in the same establishment. Many profit-sharing plans arrange for distribution of stock as a part of, or as an addition to, profit-sharing. There are also more than 60 known stock-purchasing schemes, besides many arrangements for "managerial" or "limited" profit-sharing, affecting less than one-third of the total employees. Probably fewer than ten of these varied plans provide for workers' committees as an integral part of the arrangement.

Related to the idea of co-partnership, but quite apart from profit-sharing, are a considerable number of schemes for labour's participation in management which have sprung up during and since the World War. These schemes vary all the way from representation on boards of directors, in a very few cases, to joint management through industrial and works councils, shop committees, grievance and welfare committees, shop chairmen and voluntary arbitration boards. The distinguishing characteristic of these management-sharing plans is that under them the management does not depend upon organized labour, but deals with its own employees collectively. They are distinct from profit-sharing, in that the employer retains all of the profits he makes, though the workers are given collectively a voice in determining the wages, hours and working conditions which to some extent affect the profits account. Without doubt labour's participation in management in such a sense is more usual than profit-sharing and co-partnership.

The pioneers of true profit-sharing in the United States, dating from 1886, are the Ballard and Ballard Co. of Louisville, Ky., engaged in flour-milling, and the N. O. Nelson Manufacturing Co. of St. Louis, Mo., manufacturers of plumbers' and steam-fitters' supplies. The years of greatest installation of new projects were 1901, 1906, 1909–11, 1914–6, and 1919. Fully 70% of all the known plans were started after 1910. These variations in the progress of profit-sharing in the United States correspond with those in England, where profit-sharing plans found favour during periods of ample employment and labour unrest. It is only natural, however, that periods of low profits should check the spread of profit-sharing and cause the abandonment of many plans, the average life of abandoned plans being two to three years. For this reason, and since no comprehensive study had been made in the five years preceding 1921, it is difficult to state with confidence the exact number of profit-sharing arrangements existing in that year, one of general business depression. On the basis of the Government report in 1916 and subsequent semi-official studies it is estimated that 86 true profit-sharing plans were in operation at the end of 1920. Of these plans more than one-half (53%) were in manufacturing establishments, 16% in mercantile concerns, 11% in banking institutions, 9% in public utilities and the remainder scattered. Approximately two-thirds of these concerns employed less than 300 people, and only one-seventh employed more than 1,000, so that the total number of employees was less than 50,000. The number of arrangements solely for stock purchasing is not accurately known but the inclusion of several large corporations, as the United States Steel Corp. and the International Harvester Co., raises the number of participating employees to a million or more.

In the determination of the divisible fund of profits, two general methods, subject to individual variations, are followed: (1) Setting aside a specific percentage of profits after all ordinary expenses of the business, such as depreciation reserves and interest on invested capital, are taken care of; (2) fixing a rate of dividend on employees' earnings coördinate with the rate of dividend on capital. Assume a corporation capitalized at $1,000,000 with an annual payroll of $100,000 and net profits of $220,000 a year. In most plans using the first method, the preferred and common stockholders first receive dividends (not to exceed a certain per cent, say 10%, or $100,000). The remainder of the profits fund ($120,000) is divisible and is shared with labour according to a fixed percentage, perhaps 50% to labour and 50% to capital, or 40% to labour and 60% to capital. Four of the more recent plans allow employee beneficiaries to send an accountant on their behalf to verify the company's computations. Under the second method, the divisible fund depends on dividends declared. Thus if a 10% dividend is declared, a fund equal to 5% or 7½% of the total payroll ($5,000 or $7,500) is distributed among workers. The advantage to the management of this method is that it may be found desirable to pass all dividends and use this amount for strengthening the business.

When the amount of divisible profits has been determined, there remains the apportionment of the respective shares to capital and labour. In most instances the employer determines this apportionment at the outset, announcing that perhaps 50% or 40% or 33⅓% of the divisible profits will be distributed among employees according to their earnings. Often, however, divisible profits are distributed according to the ratio of (1) total invested capital to total payroll or (2) interest on invested capital to total payroll. Assuming, in the example given above, that $120,000 remains to be divided, the ratio in the first instance is $1,000,000 (capital) to $100,000 (payroll) or ten to one, which allots $10,909 to labour and $109,091 to capital. In the second case, assuming 6% as a fair return on the investment, the ratio is $60,000 (interest) to $100,000 (payroll) or six-tenths to one, in which event labour's share is $75,000 and capital's share is $45,000. This latter method of division in 1921 was known to obtain in only one establishment.

An almost universal rule is that length of service shall be a condition of the eligibility of participants. In one or two cases the employee benefits as soon as hired. But most schemes require from three months to three years of continuous employment as qualification for a share in profits. Concessions from the specification of "continuous" employment are sometimes made to provide for such contingencies as sickness, unavoidable lay-off and accidents. Discharge for cause or quitting employment entails an automatic forfeiture of all claims to accumulated or accruing shares in profits; in one plan discharge for cause is the only occasion for forfeiture. The obvious intent of such regulations is to reduce labour turnover by rewarding the faithful. In this respect profit-sharing indirectly acts as a length-of-service bonus. A further rule as to eligibility in some plans is to require a written application from the employee who wishes to participate. In one such case employees are obligated to share in possible losses, not to exceed 10% of their earnings, 10% of their pay being held back by the employer each week to provide for this contingency. Loss-sharing in addition to profit-sharing is incorporated in four schemes. Still another restriction is as to the class of work performed, as shown by the amount of salary or wages or by classification of employment. Firms using this restriction evidently feel that the type of their workingmen is such that only a sharing limited to some of their employees would produce the desired results. Yet there is also the wish to experiment fully and the desire to extend the benefits of the plan, should limited participation be successful.

The form and time of payment of shares to employees are also important variants. Over three-fourths of the firms studied in 1916 paid their shares fully in cash, annually, semi-annually or quarterly. The others paid part in cash, part in company stock, or paid part into a common welfare fund or savings account. The stock-sharing or co-partnership plans provided many restrictions designed to encourage thrift, and to discourage speculation and absentee ownership. These restrictions take the form of prohibitions of sale of stock, sometimes only with the consent of an official of the company, or holding the stock in trust for the employee and paying him only the dividends, or of forfeiture of participating rights if such stock be sold.

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Four plans provide for workers' co-partnership committees, though there are several strictly stock-purchasing plans which allow shareholding employees to acquire a voice in management through the exercise of the ordinary voting rights of shareholders. The extent of the co-partnership in these forms is negligible.

All these varying details (and the variations are by no means exhausted in this recapitulation) reveal in large measure the spirit and purpose of profit-sharing. As a rule the employer announces his plan without previously consulting his employees. There is virtually unanimous agreement among successful profit-sharing employers that the coöperation, loyalty and stability of working forces—the chief avowed purposes of profit-sharing—are obtained by all the plans which have been in operation for any considerable period. There are, however, varying opinions as to how far these plans attain the more specific objects of (1) economy of time and material, (2) improvements in quality and quantity of output, (3) inducement to thrift, (4) avoidance of industrial disputes, (5) attainment of social justice. On the whole there is a considerable body of employers' opinion supporting the value and practicability of profit-sharing in improving industrial relations.

On the other hand union leaders universally condemn profit-sharing for three general reasons: (1) Where profit-sharing exists, wages less than the market rates are paid; (2) workers prefer a fair, fixed wage scale rather than a part of their wages undetermined and subject wholly to the employer's decision; (3) labour organization is undermined, as obligations to the firm are made a first lien on the workers' loyalty. That these criticisms have some foundation in fact is proved by the high percentage of abandoned plans and the reasons for their failure. Most of the failures were due to apathy or open hostility on the part of the workers, expressed in strikes, to diminished profits, or to changes in ownership of the business.

The success or failure of profit-sharing plans depends on circumstances not touched by the profit-sharing principle. Where favourable results have been obtained, they were due, not to profit-sharing as a mechanical device, but to the confidence which the employees had in the management.

Bibliography.—A comprehensive bibliography will be found in Boris Emmet's report "Profit-Sharing in the United States"—United States Bureau of Labor Statistics, Bulletin No. 208, 1917. Other references are: C. D. Wright, *Profit-Sharing* (1886); N. P. Gilman, *Profit-Sharing between Employer and Employee* (London and New York, 1892); idem, *A Dividend to Labour* (London and Boston, 1900); A. F. Burritt, *Profit-Sharing: its Principles and Practice* (New York and London, 1918); National Industrial Conference Board, Research Report No. 29, "Practical Experience with Profit-Sharing in Industrial Establishments" (Boston, 1920); National Civic Federation, Profit-Sharing Department, *Profit-Sharing by American Employers* (New York, 1920). (J. R. Co.)

PROHIBITION.—In the earlier article (*see* 26.578) under TEMPERANCE, reference has already been made to the various methods devised for securing total abstinence from the consumption of intoxicating liquor, and in particular to the progress of the movement for legislative Prohibition in the United States up to the year 1910. This latter movement eventually culminated in the establishment of nation-wide Prohibition by the Eighteenth Amendment to the Constitution of the United States, as proposed by Congress, Dec. 3 1917, ratified by the necessary three-fourths of all the states, and officially proclaimed, Jan. 29 1919, as part of the Constitution, becoming effective, in accordance with its terms, one year from the date of ratification by 36 states, namely Jan. 16 1920.

In the separate article under LIQUOR LAWS the measures adopted in Great Britain for further regulating the liquor traffic during 1910 to 1921 are dealt with; and here it is only necessary to deal with the advent of complete national Prohibition in the United States, where its adoption forms one of the most interesting chapters in the social history of modern times. The movement for Prohibition was affected by new scientific knowledge, new views of industrial economics, and educational forces of great variety, considerably intensified, but not substantially changed in character, by the experience of the World War. The conviction had grown steadily in the United States that social and industrial efficiency, and national unity of purpose, could not be had at any cheaper price than the cost or sacrifices involved (whatever they might be) in national prohibition; and this belief had almost reached the point where it could be translated into effective governmental action even before the war necessitated a supreme effort for such efficiency. Surprising evidence of this was seen in the passage, by a majority vote (193 to 189) in the House of Representatives, of the Hobson amendment for national prohibition, Dec. 22 1914, two years and four months before the United States entered the war. Save for the war, the country would probably not have had constitutional (which means virtually permanent) national prohibition as early as 1920. Forces were, however, at work which would have probably brought it within another decade, and with it the "bone dry" enforcement contemplated in the National Prohibition Act (popularly called the Volstead Act), the significant title of which is "an Act to prohibit intoxicating beverages, and to regulate the manufacture, production, use, and sale of high-proof spirits for other than beverage purposes, and to ensure an ample supply of alcohol and promote its use in scientific research and in the development of fuel, dye, and other lawful industries."

Up to the wartime legislation of 1917 and 1918 and the Volstead Act of Oct. 28 1919 for the enforcement of the Eighteenth Amendment, there had been but little change since 1910 in Federal policy. Federal taxation of liquor was greatly increased for revenue purposes in 1917 and 1918. The increasing sentiment in favour of prohibition throughout the country was reflected, however, in other Federal measures. In 1913 the Webb-Kenyon Act was passed, over President Taft's veto. It was based on the constitutional grounds that the Act delegated power over interstate commerce, exclusively vested in Congress, to a state, by making illegal the shipment of liquor from a "wet" state to a "dry" state contrary to the laws of the latter. Some such measure seemed necessary in order that local prohibition might be enforced in "dry" territory. Another indication of national sentiment in favour of restriction is found in the same year in the passage of the Jones-Works Excise Bill for the District of Columbia, which reduced the number of licensed saloons by Nov. 1 1914 to not more than 300, about half as many as before. The Isthmian Canal Commission on July 1 1913, by an administrative order previously adopted, abolished 35 saloons in the Canal Zone by declining to issue any further licences for the sale of liquor. In 1915 absolute prohibition for the District of Columbia was proposed in a rider to an appropriation bill, and defeated in the Senate by a small majority, and in the same year a bill for that purpose was favourably reported in the Senate by the Committee on the District of Columbia. In 1916 the Judiciary Committee of the Senate reported, 13 to 3, a resolution proposing the National Prohibition Amendment to the Constitution. A similar resolution received a majority vote in the House of Representatives in Dec. 1914, though it failed to secure the two-thirds necessary for passage. During the years 1915 and 1916 many of the states had enacted statewide prohibition laws, and there was a considerable extension of dry territory under local option in wet states.

Early in 1917 Congress enacted the Federal Anti-Liquor Advertising Bill with the so-called Reed Bone-Dry Amendment, as an amendment to the Post-Office appropriation bill. This was a drastic prohibition of the use of the mails for advertising, or soliciting orders for, liquor in "dry" territory, and was an extension of the principle of the Webb-Kenyon Act. Congress also adopted prohibition for the District of Columbia, over which it has exclusive legislative power. It provided for prohibition in Alaska to be effective Jan. 1 1918, and in the Porto Rican Citizenship and Civil Government Act it made provision for a referendum in Porto Rico on prohibition. This was held in July 1917, and resulted in a vote of 99,775 for prohibition to 62,195 against. All this action by Congress took place before the declaration of war in April, 1917. Following that declaration came the enactment of wartime prohibition in the Food Control Act of Aug. 10 1917, the liquor restrictions of the draft law of

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May 18, and the extension of their application in the Act to promote the efficiency of the navy, approved Oct. 6 1917. These measures are discussed later in the section on wartime legislation.

Quite apart, however, from war legislation, on Aug. 1 1917 the Senate adopted the resolution proposing to the states the National Prohibition Amendment by a vote of 65 to 20—more than two-thirds of the members present, and this resolution was adopted by the House with some amendments Dec. 17 by a vote of 282 to 128. On Dec. 18 1917 the Senate concurred in the amendments made by the House, and the resolution was thereupon submitted to the Legislatures of the several states for ratification. Ratified by the last of the necessary 36 states (Jan. 16 1919), and proclaimed by the Secretary of State (Jan. 29 1919), it became the Eighteenth Amendment to the Constitution, to go into effect one year from the date of its ratification, namely on Jan. 16 1920. The wording of the Amendment is as follows:—

1. After one year from the ratification of this article the manufacture, sale or transportation of intoxicating liquors within, the importation thereof into, or the exportation thereof from the United States and all territory subject to the jurisdiction thereof for beverage purposes is hereby prohibited.

2. The Congress and the several states shall have concurrent power to enforce this article by appropriate legislation.

3. This article shall be inoperative unless it shall have been ratified as an amendment to the Constitution by the legislatures of the several states, as provided by the Constitution, within seven years from the date of the submission hereof to the states by the Congress.

After Jan. 16 1919 the Amendment was ratified by all but three of the remaining states.

Whatever allowance may be made for the effect produced by the political activities of the Anti-Saloon League, an analysis of the vote in Congress for the submission of the Amendment showed a fair proportionate representation of the people residing in "dry" territory, and also the proportion of "dry" to "wet" territory in the United States. The subsequent votes in the State Legislatures on ratification of the Amendment corroborate this view. The accompanying table shows the order and dates of ratification by the several states, and the vote in each House of the State Legislatures by which ratification was enacted. The total number of votes in the state Senates or upper Houses, for ratification, was 1,297 in favour and 236 against, or 84% for national prohibition to 14% against; in the lower or more popular branch of the state Legislatures, the total vote for prohibition was 3,742, or 78%, to 1,001 or 22% against. It will be noted that in South Dakota, Idaho, Washington, Kansas, Utah and Wyoming no votes were cast against ratification.

The three states which had not ratified the Eighteenth Amendment to Sept. 1921 were Connecticut, Rhode Island and New Jersey. That the ratification of the proposed amendment failed in all three states by a very narrow margin is seen from the following facts. Rhode Island's State Senate by a vote of 20 to 18 on March 2 1918 postponed indefinitely the consideration of the ratification resolution; the resolution was presented again at the 1919 session, when the Senate voted 25 to 12 to postpone indefinitely its consideration. In Connecticut the Senate voted 14 for ratification and 20 against, and the House 153 for and 96 against. In New Jersey the House passed the ratification resolution, Jan. 24 1921, by a vote of 52 to 4, but the vote in the Senate on April 7 1921 was 10 in favour to 8 against, and the resolution failed because the state Constitution required at least 11 affirmative votes in the Senate as then organized.

Following the adoption of the Amendment came the Volstead Act, which was passed over President Wilson's veto on Oct. 28 1919. Before that, however, in addition to further war legisla-

Votes in Legislatures on Ratification of Eighteenth Amendment.

	Ratified by Upper House.		Ratified by Lower House.	
(1) Mississippi	Jan. 8 1918,	28 to 5	Jan. 8 1918,	93 to 3
(2) Virginia	Jan. 10 1918,	30 to 8	Jan. 11 1918,	84 to 13
(3) Kentucky	Jan. 14 1918,	28 to 6	Jan. 14 1918,	66 to 10
(4) South Carolina	Jan. 18 1918,	28 to 6	Jan. 28 1918,	66 to 29
(5) North Dakota	Jan. 25 1918,	43 to 2	Jan. 25 1918,	96 to 10
(6) Maryland	Feb. 13 1918,	18 to 7	Feb. 8 1918,	58 to 38
(7) Montana	Feb. 19 1918,	35 to 2	Feb. 18 1918,	77 to 6
(8) Texas	Feb. 28 1918,	15 to 7	March 4 1918,	72 to 36
(9) Delaware	March 18 1918,	13 to 3	March 14 1918,	27 to 0
(10) South Dakota	March 19 1918,	43 to 0	March 20 1918,	86 to 0
(11) Massachusetts	April 2 1918,	27 to 12	March 26 1918,	145 to 91
(12) Arizona	May 23 1918,	17 to 0	May 24 1918,	29 to 3
(13) Georgia	June 26 1918,	34 to 2	June 25 1918,	129 to 24
(14) Louisiana	Aug. 6 1918,	21 to 20	Aug. 28 1918,	69 to 41
(15) Florida	Nov. 27 1918,	25 to 2	Nov. 27 1918,	61 to 3
(16) Michigan	Jan. 2 1919,	30 to 0	Jan. 2 1919,	88 to 3*
(17) Ohio	Jan. 7 1919,	20 to 12	Jan. 7 1919,	85 to 30
(18) Oklahoma	Jan. 7 1919,	43 to 0	Jan. 7 1919,	90 to 8
(19) Maine	Jan. 8 1919,	29 to 0	Jan. 8 1919,	122 to 20
(20) Idaho	Jan. 7 1919,	38 to 0	Jan. 7 1919,	62 to 0
(21) West Virginia	Jan. 9 1919,	27 to 0	Jan. 9 1919,	78 to 3
(22) Washington	Jan. 13 1919,	42 to 0	Jan. 13 1919,	93 to 0
(23) Tennessee	Jan. 9 1919,	28 to 2	Jan. 13 1919,	82 to 2
(24) California	Jan. 10 1919,	24 to 15	Jan. 13 1919,	48 to 28
(25) Indiana	Jan. 13 1919,	41 to 6	Jan. 14 1919,	87 to 11
(26) Illinois	Jan. 8 1919,	30 to 15	Jan. 14 1919,	84 to 66
(27) Arkansas	Jan. 14 1919,	34 to 0	Jan. 13 1919,	93 to 2
(28) North Carolina	Jan. 10 1919,	49 to 0	Jan. 14 1919,	93 to 10
(29) Alabama	Jan. 14 1919,	23 to 11	Jan. 14 1919,	64 to 34
(30) Kansas	Jan. 14 1919,	39 to 0	Jan. 14 1919,	121 to 0
(31) Oregon	Jan. 15 1919,	30 to 0	Jan. 14 1919,	53 to 3
(32) Iowa	Jan. 15 1919,	42 to 7	Jan. 15 1919,	86 to 13
(33) Utah	Jan. 15 1919,	16 to 0	Jan. 14 1919,	43 to 0
(34) Colorado	Jan. 15 1919,	34 to 1	Jan. 15 1919,	63 to 2
(35) New Hampshire	Jan. 15 1919,	19 to 4	Jan. 15 1919,	221 to 131
(36) Nebraska	Jan. 13 1919,	31 to 1	Jan. 16 1919,	98 to 0
(37) Missouri	Jan. 16 1919,	22 to 10	Jan. 16 1919,	104 to 36
(38) Wyoming	Jan. 16 1919,	26 to 0	Jan. 16 1919,	52 to 0
(39) Wisconsin	Jan. 16 1919,	19 to 11	Jan. 17 1919,	58 to 33
(40) Minnesota	Jan. 16 1919,	48 to 11	Jan. 17 1919,	92 to 36
(41) New Mexico	Jan. 20 1919,	12 to 4	Jan. 16 1919,	45 to 1
(42) Nevada	Jan. 21 1919,	14 to 1	Jan. 20 1919,	33 to 3
(43) Vermont	Jan. 16 1919,	26 to 3	Jan. 29 1919,	155 to 58
(44) New York	Jan. 29 1919,	27 to 24	Jan. 23 1919,	81 to 66
(45) Pennsylvania	Feb. 25 1919,	29 to 16	Feb. 4 1919,	110 to 93

*Repassed in Lower House to correct error Jan. 23.

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tion affecting the liquor traffic, Congress enacted in 1918 prohibition for Hawaii and in 1919 a bone-dry law for the District of Columbia.

National prohibition was proclaimed Jan. 29 1919, and the year of grace allowed by the Eighteenth Amendment for it to go into effect was intended to give liquor manufacturers and dealers time in which to liquidate their business and dispose of their stocks. The so-called wartime Prohibition Act, however, which was enacted 10 days after active warfare had ceased (Nov. 21 1918), became effective on July 1 1919. The production of beer, except "near-beer," had been stopped at the beginning of the year as a food conservation measure, but even after wartime prohibition became effective, 2·75% beer was manufactured in some states on the assumption that it was a non-intoxicating liquor, and because Congress had not yet defined the quantity of alcohol a beverage might contain without coming within the meaning of the word "intoxicating," as used in the various laws, regulations and administrative orders. Rhode Island for example, enacted a state law declaring all liquors of less than 4% alcohol to be non-intoxicating.

The questions thus raised, together with the definitions of the Volstead Act declaring all liquors containing one-half of 1% of alcohol or more to be intoxicating and hence prohibited, were taken to the Supreme Court, which finally sustained both the Eighteenth Amendment and the Volstead Act's definition of intoxicating liquor, in two cases (*Hawke* v. *Smith* and *Rhode Island* v. *Palmer*, 253 U.S.) in which decision was rendered June 12 1920. The Court had previously sustained the War Prohibition Act and the one-half of 1% limit which it specified; but the liquor interests and the liquor-consuming public hoped that greater latitude would be given them by a narrower construction of the first section of the Eighteenth Amendment, which prohibited only intoxicating liquors, and therefore, it was argued, did not warrant legislation forbidding the sale and manufacture of any liquor which was, in fact, non-intoxicating, whether it contained more or less than one-half of 1% of alcohol. The Court, however, without stating or discussing this contention, cited the war prohibition cases in support of the conclusion that while "recognizing that there are limits beyond which Congress cannot go in treating beverages as within its power of enforcement, we think those limits are not transcended by the provision of the Volstead Act."

The Volstead Act provided for drastic enforcement, and arms the Government, through the Commissioner of Internal Revenue, with ample powers to punish and suppress any evasion. The regulations under this Act governing physicians' prescriptions and the procuring of wine for sacramental purposes are also drastic.

The Act supplementary to the National Prohibition Act approved Nov. 23 1921 contains still more strict enforcement provisions. It forbids physicians to prescribe for medicinal purposes other than spirituous and vinous liquor, and no physician may prescribe or any person sell or furnish on prescription any vinous liquor that contains more than 24% of alcohol by volume and not more than a quarter gallon or any quantity of such liquor containing more than one pint of alcohol for the use of any person within a period of ten days. This may seem to be an unnecessary and unwarranted interference with medical science, but it indicates that no power was likely to be refused that the administration authorities might find necessary to make enforcement effective. Other provisions giving the enforcing authorities control over importations for non-beverage purposes make it clear that both this Act and the National Prohibition Act apply to all territory subject to the jurisdiction of the United States and specifically continue in force all laws in regard to the manufacture and taxation of and traffic in intoxicating liquor and their several penalties as in force when the National Prohibition Act was enacted. Although the effectiveness and justice of these provisions cannot be accurately judged at present, they at least assisted materially towards enforcing national prohibition.

The question of the meaning of "concurrent power" to enforce the Eighteenth Amendment was also settled by the Supreme Court in *Hawke* v. *Smith*, in which the Supreme Court held that the provision of the Amendment in this connexion was within the amending power, was a part of the Constitution and "must be respected and given effect the same as other provisions of that instrument," was "operative throughout the entire territorial limits of the United States" and "of its own force invalidates every legislative act, whether by Congress, by a State Legislature, or by a Territorial Assembly, which authorizes or sanctions what the section forbids." The second section of the Amendment declared that "the Congress and the several states shall have concurrent power to enforce this article by appropriate legislation." The Supreme Court said that this "does not enable Congress or the several states to defeat or thwart the prohibition, but only to enforce it by appropriate legislation. The words 'concurrent power,' in that section, do not mean joint power, or require that legislation thereunder by Congress to be effective shall be approved or sanctioned by the several states or any of them; nor do they mean that the power to enforce is divided between Congress and the several states along the lines which separate or distinguish foreign and interstate commerce from intrastate affairs. The power confided to Congress by that section, while not exclusive, is territorially coextensive with the prohibition of the first section, embraces manufacture and other intrastate transactions as well as importation, exportation and interstate traffic, and is in no wise dependent on or affected by any action or inaction on the part of the several states or any of them." The prohibitionists could scarcely have hoped for a more sweeping endorsement, and the decision may be fairly considered further evidence of the widespread popular desire for effective national prohibition.

State Action.—Statewide prohibition had existed in 1910 in only nine states—one of them in New England (Maine); three in the middle-west (North Dakota, Kansas and Oklahoma); and five in the south (North Carolina, Georgia, Alabama, Mississippi and Tennessee). Not till 1914 did any greater tendency to statewide prohibition show itself, with the exception of an amendment of the state Constitution of West Virginia in 1912. But during the five years 1914–9 half the states adopted statewide prohibition, and these represented every section of the country, although they did not include some of the most populous states with large urban centres. In 1914 statewide prohibition was adopted by Colorado, Oregon, Virginia, Washington; in 1915 by Alabama, Arizona, South Carolina; in 1916 by Arkansas, Idaho, Iowa, Michigan, Montana, Nebraska, South Dakota; in 1917 by the District of Columbia, Indiana, New Hampshire, New Mexico; in 1918 by Florida, Nevada, Ohio, Utah; in 1919 by Kentucky and Texas.

From 1910 to 1914, and in lesser degree until 1920, there was meanwhile a continued struggle as to local option in states where statewide prohibition was not adopted with considerable fluctuation in the proportion of dry and wet areas or counties or towns, as the case might be, within the several states, and sometimes with the further fluctuation that the same area became dry at one election and wet at the next. Local option seems to have had its first trial in the United States in Indiana as early as 1832; when in 1881 Massachusetts adopted local option after extensive experiment with prohibition and ordinary forms of licence, that state became a model for other states in its local option law; local option in 1910 prevailed in 33 states. In Pennsylvania, where the licences were granted by the courts of quarter sessions and the judges elected by the people, local option virtually obtained, because elections of judges often turned on the question of whether or not licences should be granted in a given community; and in New Jersey some communities, by reason of the provisions of special municipal charters, enjoyed the privilege of local option. It was estimated in 1910 that the extent of the dry areas of the United States was to that of the wet areas approximately as seven is to five. The total pop., however, living in dry areas was approximately 41,500,000 to 46,000,000 in the wet areas.

Outside prohibition areas and local option areas there remained little territory in 1910 under other forms of licence or regulation,

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the most notable exception being the dispensary system in South Carolina, which was still in operation, however, in only six counties out of 22 that previously had state dispensaries; besides these there were 32 counties dry under local option.

Experiments with local option provided valuable tests of the spread of prohibition sentiment. A writer in the *National Municipal Review* for Oct. 1916, dealing with local option in the United States, stated that at that time 80% of the land area of the United States was under prohibition, affecting 54% of the pop. of the country; in other words that more than one-half of the pop. of the United States, spread over four-fifths of its area, was without licensed supply of intoxicants. In the 26 local option states the percentage of area made dry in that year by local legislation ranged from 18% in Rhode Island to 98·3% in Wyoming, with a median percentage of 78·5. Only three of those states had less than half their area under no licence; seven between one-third and three-fourths, and 16 more than three-fourths. Therefore, said this writer, "with 19 states wholly dry, 16 states more than three-fourths dry and 7 states more than half dry, it would appear from the map that national prohibition requiring the consent of 36 states is not far off."

Liquor Consumption.—Too much importance is often attached to actual statistics of the consumption of liquor as an evidence of the success or failure of local option, and of restriction or prohibition of manufacture and sale. They are by no means conclusive, and especially have slight bearing on the important question, involved in most local option and prohibition enactments, concerning the nature, character and number of saloons and places where intoxicating beverages are sold and consumed. The annexed official figures from the *United States Statistical Abstract* for 1920 give statistics for the consumption *per capita* of distilled spirits, wines and malt liquors for beverage purposes, from 1850 to 1920.

United States Annual Consumption per capita *of Distilled Spirits, Wines, and Malt Liquors, 1850 to 1920; in gallons.*

Year ended June 30	Distilled Spirits	Wines	Malt Liquors	All Liquors and Wines
1850	2·24	·27	1·58	4·08
1860	2·86	·34	3·22	6·43
1870	2·07	·32	5·31	7·70
1871–80*	1·39	·47	6·93	8·79
1881–90*	1·34	·48	11·37	13·20
1891–5 *	1·37	·39	15·20	16·96
1896–1900*	1·12	·36	15·53	17·01
1901–5 *	1·39	·47	17·34	19·20
1906–10*	1·43	·62	19·81	21·86
1911	1·46	·67	20·69	22·81
1912	1·45	·58	20·02	22·05
1913	1·51	·56	20·72	22·80
1914	1·44	·53	20·69	22·66
1915	1·26	·33	18·40	19·99
1916	1·37	·47	17·78	19·61
1917	1·62	·41	18·17	20·20
1918	·89	·49	14·80	16·18
1919	·80	·51	8·03	9·34
1920	·26	·12	2·63	3·01

*Average for the period.

Influences Behind Prohibition.—The facts and figures already set forth should help to indicate what were the influences which brought together the local, state and national forces, and led to the adoption of national prohibition in 1920, as well as to its virtual enforcement as a war measure July 1 1919, throughout the area of the United States and the territory subject to its jurisdiction. The movement was not to be ascribed, as some publicists have seemed inclined to believe, to a state of exaltation induced by the war. Neither was it due to the absence of many male voters engaged in military service and perhaps not able to make their opinions effective in the matter. Prohibition had its roots and causes outside of and far antedating these sentiments and experiences. The continuously rising standard of living of the masses in both urban and rural communities from 1910 to 1918 had much influence. The industrial demands for efficiency, and the growth of scientific knowledge about its requirements, had an important and increasing effect. Americans of all classes in increasing numbers perceived that, quite irrespective of their personal habits or desires with respect to the consumption of alcohol, they could not secure the advantages of abstinence, or of moderate and perhaps harmless consumption, on the part of the weaker and more numerous members of any community, unless they themselves were willing to forgo the liberty of personal consumption, even though they belonged to the minority whose efficiency might not in any case be seriously impaired. Enlightened opinion was also shown in the increasing regard for public health, and the measures which the nation as a whole, and the public authorities in most of its component divisions, were taking to promote it. The physiological effect of small doses of alcohol on physical strength and on mental processes had been studied by scientists for many years; and the activities of the leading life-insurance companies, during the decade here under review, in the dissemination of information with respect to personal and public hygiene, had also exerted a considerable influence upon the movement. The published statements of the life-insurance companies, analysing their mortality experience, have generally been regarded as unbiassed, but have not been unchallenged or free from conflicting interpretation. Their conclusions, however, steadily served to support the total abstinence arguments as to industrial efficiency and public health, and they were widely circulated by many of the companies in such a way as to exert an effective educational influence. Mr. Arthur Hunter, actuary of the New York Life Insurance Co., in a paper read before the National Conference of Charities and Correction in Indianapolis in 1916, presented a survey of this material in which he claimed that the American statistics, many of which were then only recently available in published form, corroborated the English data in indicating that total abstinence decidedly increased longevity. He said, "the experience of the seven American life insurance companies (and one Canadian company whose records had been studied) has proved that abstainers have from 10% to 30% lower mortality than non-abstainers, and there is no good reason for believing that if the other companies compiled their statistics there would be any different result, providing the companies exercised the same care in accepting abstainers and non-abstainers."

Lastly, and of as much weight, it would seem, as all the other reasons combined, there was among all classes a growing hostility to the liquor saloon, as a mischievous agency, largely controlled and dominated by anti-social influences, and by persons and corporations actuated by a strong motive of private profit. Furthermore, the liquor saloon was gaining a power in politics, and a control of matters affecting the social life and general welfare of the people, which made its growth disproportionate to that of any other social institution in the country. The public perceived the increasing political influence of the saloon, and the failure everywhere of the various experiments to develop a substitute for it, or, indeed, to organize any other successful centre of recreation, social intercourse and community life, in competition with saloons supported and controlled by the profits of the liquor industry. A formidable body of public opinion united many persons who were neither total abstainers nor wholly convinced by the economic efficiency and health arguments against alcohol. Nevertheless they were sure that drastic measures were necessary, even if they involved heavy personal sacrifice on the part of many persons, to rid the communities in which they resided, as well as those in which they did business, of the baneful results and by-products of the saloon. Thus many who never would have voted for state prohibition, and who were even disappointed with the general outcome of local option, were prepared, when the issue was presented, to support and defend national prohibition.

Results.—Various efforts were made between Jan. 1920 and the autumn of 1921 to appraise the economic results and the effectiveness of the enforcement of national prohibition. But there had not yet been time to get accurate and convincing statistics or to know how to make allowance for purely accidental factors. Adjustment to the new conditions was still going on, and the existence of old stocks of liquor and wine introduced

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an inevitable complication. In the case of war prohibition there was a tolerated delay of 7½ months, which the Supreme Court, in its decision upholding the war prohibition enactment, practically stated was a reasonable period, in lieu of compensation, to enable liquor dealers to dispose of liquors on hand. It was still necessary in the autumn of 1921 to depend largely upon the judgment of trained observers, who could be trusted to interpret partial but significant statistics. Of local and partial data there was no lack. *The Survey* for Jan. 17 1920, speaking of six months of the enforcement of war prohibition, said: "Thus the fact of national prohibition comes to pass without any of the dire disasters predicted—great bodies of men are not jobless; the breweries are not idle, but have turned to the making of soft drinks and ice cream; labor has not refused to work without beer. . . ; real-estate values have not slumped; in fact, the rentals charged to cigar stores, soda fountains, lunch counters, groceries and such like which are moving into the vacant saloons with all possible speed, are higher than they were; there has not been a reign of terror by outraged men demanding the return of their personal liberty." Another study made by *The Survey* and published Nov. 6 1920, of the city of Grand Rapids, Mich. (located in a state under constitutional prohibition since 1916), says that Grand Rapids in 1920 was practically free from drunkenness if not from drink; prohibition had all but emptied the county gaol; the county farm had run down for lack of prison labour; the police force had been greatly reduced; the withdrawal of liquor from dance and social halls had closed prolific sources of immorality and crime; and the number of arrests in two years had been cut in half.

A study under the direction of the Federal Council of Churches was made by the head of a social settlement in Buffalo, who visited eight cities, including three of the largest—New York, Philadelphia and Chicago—and the smaller cities of Washington, Harrisburg, Columbus, Detroit and Buffalo, examining the police returns, hospital returns, reports of lodging houses, charitable and community organizations, during the month of April 1920. Most of his material is from official sources and shows a decrease in the number of arrests in cities far apart, which cannot be explained by the operation of the usual causes of fluctuation. Apparently prohibition was the only factor common to all of these returns and operating upon them alike. Other reports, from many sources, of similar character show that throughout 1920 arrests for drunkenness and for all crimes in the principal cities diminished. In Philadelphia the total for the dry six months of 1919 compared with the wet six months of that year showed a decrease of 40% (47,000 to 28,530), and the chief resident physician of the Philadelphia General Hospital stated that there had been no increase in the use of drugs since prohibition.

Fifty-nine cities of the United States having a pop. of 30,000 or over and a combined pop. of over 20,000,000 (including New York, Chicago and Philadelphia) give the following official figures for arrests for drunkenness in the four successive years 1917–20: 316,842, 260,169, 172,659 and 109,768. Indiana shows 70% fewer arrests in 1920 for drunkenness than in 1917, the last year when the state was wet, for 39 cities with a combined pop. of nearly one million. Boston reports 5,000 fewer arrests in 1920 for all causes than for drunkenness alone in 1919; the state of Massachusetts reports 32,580 arrests for drunkenness in 1920 compared with 77,925 in 1919; Connecticut had 943 arrests for drunkenness in 1920 against 3,777 in 1919; New York City a decrease from 14,182 in 1917 to 5,813 in 1920; St. Louis a decrease from 2,605 in 1919 to 691 in 1920. A similar tendency in many cities is apparent in the returns for 1920.

Since prohibition, high wages and continuous employment came together during the year July 1 1919 to June 30 1920, it is difficult to state with certainty which of the three was the cause, or the major cause, of the increase in savings bank accounts, or of the decrease in industrial accidents reported during that period. An official statement of the Comptroller of the Currency given out in Washington Jan. 22 1920 stated that in national banks alone 880,949 new accounts were opened in the first 4½ months of the fiscal year beginning July 1 1919, and that the increase in the number of depositors in state and private banks, though not available, was known to be far greater than the increase of depositors in national banks. The Comptroller's official report (*48th Annual Report*) for the year ended Oct. 31 1920 states: "In the number of depositors or deposit accounts in national banks all previous records were exceeded, official reports showing that on June 30 1920 there were 20,520,177 deposit accounts in all national banks. This was an increase of 2,279,877 (12½%) over June 30 1919. There is now approximately one depositor in the national banks for every five of our population."

The most disinterested and intelligent observers, accustomed to judging public conditions and social facts, differed widely in their verdicts on prohibition, its economic results and general benefits or disadvantages to the public welfare in the first year of national prohibition. That is likely to be true for several years to come. The more authoritative opinion, however, seemed to be that the first effects had been generally beneficial; that the popular sentiment in support of effective prohibition was gaining in strength, and that the experiment would be continued and developed. The fears of lurking danger to social institutions or to the moral integrity of the people (which some critics believed to be inherent in prohibition), seemed likely to be outweighed by the economic and political advantages of freedom from the saloon, and the semblance, at least, of more orderly communities, less petty crime and less abject poverty. The majority of moderate drinkers seemed to be willing to sacrifice their personal liberty for these desirable results. The intemperate constitute a minority as compared with the total abstainers plus a majority of those who had been moderate users of intoxicating beverages, and their number may be expected to diminish from year to year. The business interests which were thought to be menaced by prohibition found, at the time when national and wartime prohibition went into effect, means of readjustment without great loss and without inflicting on the nation the burden of any scheme of compensation. The outlook for the future was in 1921 one of hope that new forces and new funds had now been released, which might be directed to providing normal recreation and facilities for social and community life which the saloon did not provide, but for which its very existence had precluded other provision being made.

U.S. War-emergency Measures.—After the entry of the United States into the World War, Federal legislation began with the Draft law of May 18 1917, Section 12 of which authorized the President to make regulations for the prohibition of the sale of alcoholic liquors in or near military camps and to officers and enlisted men of the army. An Act to promote the efficiency of the U.S. navy, approved Oct. 6 1917, extended these provisions to include the navy and all places for training and mobilization connected with the naval service. This section made it unlawful to sell or supply intoxicating liquors to any military or naval station, cantonment, camp, fort, or officers' or enlisted men's club, or to sell intoxicating liquor, including beer, ale or wine, to any officer or member of the military force while in uniform. The Food Control Act of Aug. 10 1917 prohibited the use of foods, fruits or food materials in the production of distilled spirits for beverage purposes, but authorized the President to prescribe rules for their use in the production of distilled spirits for other purposes. It provided also that distilled spirits should not be imported into the United States, and that whenever the President should find that limitation, regulation or prohibition of the use of foods, fruits or food materials in making malt or vinous liquors for beverage purposes, or that the reduction of the alcoholic content of such liquors is essential for food conservation, he should be authorized to prescribe and give public notice of such limitation, prohibition or reduction as might be necessary. This Act also authorized the President to commandeer and pay for distilled spirits needed for the manufacture of munitions or military supplies.

The so-called War Prohibition Act, enacted Nov. 21 1918, 10 days after the signing of the Armistice, was an amendment to the Agricultural Appropriation Bill, and provided that from June 30 1919 until the conclusion of the war and of demobilization, the date to be determined and proclaimed by the President, it should be unlawful to sell for beverage purpose any distilled spirits or to withdraw distilled spirits from bond except for export. It also provided that after May 1 1919 no grains, cereals, fruit or other food products should be used in the manufacture or production of beer, wine or other intoxicating malt or vinous liquor for beverage purposes, and after June 30 1919 no beer, wine or other intoxicating malt or vinous

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liquor should be sold for beverage purposes except for export, until the conclusion of the war and of demobilization, the date to be determined by the President. This Act also prohibited the importation, from the date of its approval until the period of its termination, of distilled malt, vinous or other intoxicating liquors. The President was further authorized by the Act to establish zones about coal mines, munition factories, shipbuilding plants or wherever necessary to facilitate war work, in which strict prohibition should be made effective under heavy penalties. This Act continued in force until national prohibition came into force by reason of the refusal of the President to declare demobilization to have been completed before that date, and the section of the Act authorizing the President to establish special zones as above described was incorporated from a joint resolution of Congress, having the force of law from the earlier date of Sept. 12 1918.

The Prohibition Enforcement Law or Volstead Act, enacted Oct. 28 1919, three months before national prohibition came into effect, provided for the enforcement of both the War Prohibition Act and the Eighteenth Amendment. The President exercised the powers conferred on him under the Food Control Act of Aug. 10 1917, and under it the manufacture of distilled spirits in the United States was prohibited on and after Sept. 8 1917. Through the Food Administration the President also stopped the use of food materials in the manufacture of beer on Dec. 1 1918. All these measures were strictly enforced and achieved their major purposes by securing conservation and the maintenance of discipline and sobriety in all places where men in uniform were stationed. They did not affect the civilian population because of the short period of prohibition of manufacture, and because of the existing stocks in territory where local or state legislation permitted its sale. No state legislation was necessary to carry out the purposes of the special war period restrictions. (S. McC. L.)

PROPAGANDA, the term applied to a concerted scheme for the promotion of a doctrine or practice; more generally, the effort to influence opinion; by a false analogy from such plural words as "memoranda," frequently applied to the means by which a propaganda is conducted. The objective of a propaganda is to promote the interests of those who contrive it, rather than to benefit those to whom it is addressed; in advertisement to sell an article; in publicity to state a case; in politics to forward a policy; in war to bring victory. This differentiates it from the diffusion of useful knowledge; the evangel of a mission; publication of the cure for a disease. In such objectives there may be a secondary advantage to the contriver, but to benefit the subjects of the effort is the leading motive. Similarly those engaged in a propaganda may genuinely believe that success will be an advantage to those whom they address, but the stimulus to their action is their own cause. The differentia of a propaganda is that it is self-seeking, whether the object be worthy or unworthy, intrinsically, or in the minds of its promoters.

Statements or arguments known to be self-interested tend to raise suspicion. A wide examination of propagandas supplies an empirical argument in justification of such an attitude. Indeed, casuistically considered, indifference to truth is a characteristic of propaganda. Truth is valuable only so far as it is effective. The whole truth would generally be superfluous and almost always misleading; the selections made range from a high percentage to a minus quantity. The time factor is vital. If a quick sale or a decisive victory is possible, opportunism may be more useful than exactitude. If a permanent market is to be opened or a protracted campaign is expected, caution is required in suppression or in misstatement. Although truth may thus be irrelevant to the success of a propaganda, it does not follow that those engaged in it are consciously unethical. Doubtless, in every effort to control opinion, there are persons either indifferent to justification, or who justify the means by the end. But the more the emotions are excited, whether by patriotism or by cupidity, by pride or by pity, the more the critical faculties are inhibited. It is a quality of propaganda, as of counter-propaganda, that high-minded persons on both sides commend their cause by identical arguments, and that high-strung persons soon come to believe what they wish to be true. Their character and their enthusiasm lend weight to many partial statements, or even make false coin ring true.

The suspicions aroused by an admitted propaganda lessen its effectiveness, from which it follows that much of the work has to be furtive. Part of the task, and that the more easy, is to whip up existing inclinations, but the more arduous and the more frequent duty is to reverse or to create opinion. Efforts are therefore made to present "tendencious" matter as impartial. The simplest case is seen in the familiar methods of newspaper advertisement. The crudest form is a direct printed recommendation of an object, obviously paid for. More subtle, but still plainly a paid advertisement, is a general paragraph in the "News" columns, with the letters *Adv.* at the foot. Best of all is commendation in the editorial columns or description disguised as news, these methods being seldom adopted in the responsible Press of the better kind, but familiar in organs subsidized to support an interest, possibly with a free hand on everything except that interest.

The methods of a propaganda are limited only by the resources and the ingenuity of its promoters. They may be studied in their most intensive form in the propagandist efforts during a war; the magnitude of the object secures the necessary funds, and at the same time attracts the services of persons of more intellect and character than would usually devote themselves to such a pursuit; in the atmosphere of war, moreover, truth, like many other fine qualities of humanity, is judged by expediency, with varying answers.

The use of propaganda in war dates from remote antiquity. It is plain that Herodotus, with his alert and modern mind, suspected the possibility of "working" the oracles whose pronouncements had so great an influence. But in Urania VIII., 22, he describes a propagandist effort made in the Persian War by Themistocles, son of Neocles, which in intention and method might have occurred in the recent World War:—

"Themistocles, having selected the best sailing ships of the Athenians, went to the places where there was water fit for drinking, and engraved upon the stones inscriptions, which the Ionians, upon arriving next day at Artemisium, read. The inscriptions were to this effect: 'Men of Ionia, you do wrong in fighting against your fathers, and helping to enslave Greece: rather, therefore, come over to us; or, if you cannot do that, withdraw your forces from the contest, and entreat the Carians to do the same. But if neither of these things is possible, and you are bound by too strong a necessity to revolt, yet in action, when we are engaged, behave ill on purpose, remembering that you are descended from us, and that the enmity of the barbarian against us originally sprung from you.' Themistocles, in my opinion, wrote this with two objects in view; that either, if the inscriptions escaped the notice of the king, he might induce the Ionians to change sides and come over to them; or, if they were reported to him, and made a subject of accusation before Xerxes, they might make the Ionians suspected, and cause them to be excluded from the sea-fights." (Herodotus VIII., Urania 22.)

Propaganda on similar lines has been conducted in almost every war in history, but until the World War (1914–18) chiefly as a subsidiary part of the actual military or naval operations. Clausewitz, the Polish-Prussian officer (1780–1831) whose works on the conduct of war were translated into most modern languages and formed the basis of most military theory, laid it down partly as a prediction and partly as a precept that war must be waged with the whole force of a nation. Military propaganda may therefore be defined as the attempt to add the psychological factor to the other resources of warfare. It may be considered formally under four heads:—(1) Control of Home Opinion; (2) Control of Neutral Opinion; (3) Control of Allied Opinion; (4) Control of Enemy Opinion. Counter-propaganda is the effort to counter the operations of the Enemy.

(1). *Control of Home Opinion.*—In modern times even the most autocratic ruler or state cannot hope to conduct a protracted war, or a war that brings a great burden on a nation, or a war that sways with doubtful success, unless public opinion is favourable. A large part of propaganda must therefore be for home consumption. It will proclaim the certainty of victory, describe actual and prospective military and naval triumphs, obliterate or explain reverses. It will vaunt economic strength, financial resources, power of organization; it will explain difficulties in the supply of food and raw materials, give the reasons for vexatious regulations and interferences with the ordinary routine of trade. When the war appears to be going unfavourably, it will urge the need of endurance. But it will not neglect the moral appeal. It will insist that the war is one of defence, or at least for an unselfish purpose; that victory will be for the good

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of the world, will be a permanent triumph of right over wrong. At the same time, according to the mentality of the nation, it will insist on historical military glory, on the pursuit of the national aspirations such as recovery of ancient rights, redress of old wrongs, material benefits to be derived from victory, appalling consequences of defeat. The outrageous conduct of the enemy, his unnecessary cruelty, his breach of international law are all important.

(2). *Control of Neutral Opinion.*—The propaganda addressed to Neutrals covers much of the same ground, with the least possible stress on the interested motives, much stress on the defensive and inevitable sides of the war, the certainty of victory and its benefit to all humanity. Very careful attention is devoted to explaining as necessities all the steps that have interfered with the rights of Neutrals or have been positively harmful to them. Much care is given to exposition of the thesis that victory would also be to the benefit of the Neutrals.

(3). *Control of Allied Opinion.*—This is of great difficulty and of increasing importance with the prolongation of a war. It is necessary to anticipate points of friction, gloss over points of diverging interest, pay very careful deference to the Allied contribution to the common cause and to the absolute identity of interest. In the World War many mistakes were made in this aspect of propaganda, but by none more conspicuously than by the Germans, whose treatment of their Allies was marked by compulsion rather than by persuasion.

(4). *Control of Enemy Opinion.*—The efforts in this direction fall under three main heads:—Insistence that victory is certain and that prolongation of the war is only increasing the inevitable disaster to the Enemy. Attempts to stir up disaffection amongst the Enemy's Allies; attempts to stir up internal trouble in the Enemy's country.

The four sub-divisions enumerated above cover the main purposes of both propaganda and counter-propaganda, but they are only formal, and it is of vital importance to remember that under modern conditions a propaganda cannot be limited to the group for which it was intended. The most rigid censorship and scrutiny at the frontiers did not retain within Allied Countries or in Germany what was prepared for home consumption, with the result that the propaganda of one camp was often used almost without alteration as counter-propaganda in another. Neutral countries were the battle-ground in which contending propagandas met, and where statements of alleged facts and arguments came in contact.

THE BRITISH EFFORT IN THE WORLD WAR.—In the usual British fashion propaganda in the World War came into existence by the extension of the normal duties of several different bodies, with the result that there was much overlapping, as well as many gaps and considerable diversity of aim and method. From time to time new bodies were created, partly absorbing, partly replacing and partly combining the agencies in operation. Even when the Armistice came, no complete organization had been achieved, and the very great success actually obtained may be ascribed to the flexibility of the methods, the devotion of those who conducted them, and a very remarkable unity of purpose which overbore such personal rivalries as are inevitable in human affairs. A logical and consecutive account of the British propaganda is impossible. No complete organization ever existed, and as much of the most successful work was necessarily conducted secretly, and much was done by private enterprise, for instance by the spontaneous patriotism of universities, publishers, newspapers and private persons, an exhaustive description is impossible. The official side of it was conducted at first chiefly by the Foreign Office, the War Office and the Admiralty, as extensions or side issues of their normal duties. Many special missions were inaugurated by these bodies, or directly by the Cabinet.

In the beginning of 1918 a special body, the Ministry of Information, under a Cabinet Minister, Lord Beaverbrook, was created to combine and extend British propaganda with special reference to the control of Home and Neutral opinion, and another special body, the Department of Enemy Propaganda (afterwards the British War Mission), under Lord Northcliffe, for the same purpose, with special reference to control of opinion in enemy countries. Under the energetic direction of these two great publicists and the brilliant staffs they assembled, British propaganda enlarged its sphere, increased its potential and began to approach coherence. The steps of most vital consequence, however, must be attributed to Lord Northcliffe and his staff. They were early impressed with the conception that propaganda must be closely linked with policy. With the willing coöperation of the Ministry of Information, they first secured a general unity of method and purpose in purely British work, and, next, by propaganda conferences in London, extended a similar unity to British, French, Italian and American propaganda. Still later, as the war appeared to be nearing its end, they formed a general committee containing representatives of all the great Departments of State and worked out a Peace Propaganda Policy, to which the assent of the British Cabinet was obtained and which was at once made the basis of all British propaganda. Arrangements had been made for another conference of Allies in which the British Peace Propaganda Policy was to be coördinated with the policy of our Allies, when the signing of the Armistice made further effort of this kind unnecessary. Later in this article the steps which led to this ultimate coördination will be described more fully, or will become more apparent as the scattered agencies which led to it have been explained. But it is pertinent here to observe that the final stage, reached by slow experience, should have been the initial stage. In any national propaganda, the national policy, if such indeed exist, should be within the cognizance of those who have to create and direct the machinery for endeavouring to control opinion.

From the outbreak of the war in 1914 to the end of 1915, the official organization of British propaganda was highly tentative. The task of creating and directing public opinion during war had never before been a function of British Governments and did not consort well with the national traditions. In the first months of the war, during Mr. Asquith's Ministry, a War Propaganda Bureau was set up in the National Assurance Offices at Wellington House; a Neutral Press Committee, with special reference to Cabling was established under the Home Office, and a News Department, to deal with the Press, was formed by the Foreign Office. Gradually these three departments came more under the authority of the Secretary of State for Foreign Affairs; but they operated to a large extent as independent agencies without central control.

The Admiralty and the War Office had to exercise strict control over the publication of news relating to actual or proposed operations and other matters relating to the navy and army. The censorship which they had to exercise strictly for military reasons, gradually acquired a wider purpose and passed into a dissemination of news essentially propagandist. The direct effect of this bias given to news was upon home opinion, but naturally passed from home countries to neutrals, and from neutrals to enemies. It had therefore the legitimate objects not only of concealing what it was useful to conceal, but of making suggestions which might deceive. From indirect or accidental propaganda, it passed over to deliberate propaganda. Similarly the official representatives of the Foreign Office in Allied and neutral countries quickly found that their routine duties of explaining the intentions of the British Government, and of assisting public and private British interests, necessarily acquired a propagandist bias. As there were obvious inconveniences in this course, the propagandist activities in foreign countries gradually became detached from the official diplomatic activities, and acquired direct relationship with special departments at home. A similar series of events took place in the case of the representatives of the British army and navy in foreign countries, especially those attached to the Secret Services. As their efforts became more propagandist, it was convenient to separate them. Thus in various ways a propagandist service crystallized out of normal services.

During this period, and, indeed, until the end of the war, the voluntary work of the great newspapers and publishing houses made an important contribution to British propaganda. It is perhaps necessary to insist on the voluntary side of this work. It has never been the tradition of the British Government to

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subsidize or to control the British Press, and although some efforts were made in that direction, they were signal failures. The great newspapers and the great publishing houses jealously maintained their independence and their right of criticism; they were willing to accept censorship so far as it was supposed to prevent the leaking of information that might be of service to the enemy. But they fought bitterly, and successfully, any attempts of the Censorship to overstep the bounds of military needs. (*See* CENSORSHIP.) The independence of their attitude and the strength of their patriotism combined to make their voluntary propagandist effort of the utmost importance.

Ministry of Information.—It will be convenient to deal first with the grouping of propagandist agencies under the Department, later the Ministry, of Information, as this body was the first to combine a number of scattered bodies under one direction, although, as will be shown later, the War Office, under the Directorate of Military Information, created earlier an extensive propagandist headquarters.

The Department of Information was formed by a resolution of the War Cabinet on Feb. 20 1917. According to that resolution its object was to take over and unify the various foreign propaganda activities, and to act as a general publicity bureau under the War Cabinet. Col. John Buchan was brought back from France and appointed Director of Information. Propaganda thus acquired its own specific organization separate from other Government Offices and directly under the Prime Minister. There was necessarily much overlapping with the War Office, but on the whole the Department of Information worked toward the control of civilian opinion, the War Office to that of military opinion; the former concentrated attention on political and general subjects, the latter on military subjects.

The Department of Information, during the time of its existence, covered the work of British propaganda in Allied, neutral and enemy countries. It was arranged in four sections:—

(*a*) An administrative section, divided into branches, corresponding to the different countries, each branch being under the charge of an official who was a specialist in that geographical area.
(*b*) A producing section which dealt with literature and art and was virtually a large publishing establishment.
(*c*) A producing section concerned with cables and wireless and the distribution of cinema films and press articles.
(*d*) A political intelligence section, which provided reports upon political and civil matters in foreign countries.

Foreign propaganda was conducted (*a*) among foreigners on a visit to Britain or resident there as correspondents, and (*b*) in the foreign countries themselves. (*a*) The first task involved hospitality to foreign visitors, the securing of facilities for Allied and neutral correspondents, and the arranging of visits to the British front, the British fleet and other centres of interest for writers and public men from Allied and neutral countries. Three châteaux on the western front were used for guests by the Department of Information—one for American visitors, one for the Allied and neutral press, and one for visitors in general. A large number of distinguished foreigners were invited to Britain, since it was held, with reason, that the best propaganda in any country was that done by the citizens of the country themselves. (*b*) Propaganda in foreign countries was conducted by the issue of a very large number of publications in different languages, including pictorial journals, pamphlets and books. The *War Pictorial* was issued monthly in eight editions with a circulation of over 700,000. Six oriental papers were published fortnightly in different languages, and the Department published fortnightly journals in Spanish, Greek, and Portuguese. Exhibitions of photographs and war films were arranged throughout the world. Over a million words of propaganda material a month were cabled by Reuter, and there were also daily cable and wireless messages sent from the Department. An average of 400 articles per week was sent out to the foreign press. Bureaux of Information were established in the different Allied and neutral countries, which assisted to distribute the material prepared by the Department, and also acted as intelligence centres. A special section dealt with propaganda in enemy countries by means of articles and cables printed in the newspapers of adjacent neutral States, and by aeroplane and balloon distribution on the different fronts.

The organization of the Department of Information obviously left much to be desired. In the first place it was not a ministry and had no ministerial head. This led to two disadvantages: the War Cabinet had little time to spare for the supervision and direction of its policy, and in dealing with other ministries it lacked the prestige necessary to safeguard its interests and enforce its requirements. Again, it had no single domicile, being housed in four different parts of London, and this led not only to a great deal of delay in its work, but prevented it being organized according to the normal plan of a Government office.

The Ministry of Information was constituted on March 4 1918, with Lord Beaverbrook as minister. It took over the whole organization of the old Department of Information, with the exception of the Political Intelligence branch, which was transferred to the Foreign Office, and the section dealing with enemy propaganda (excluding Turkey and the Middle East), which was transferred to Lord Northcliffe. The new Ministry was organized on the normal lines of a Government department, and was able to draw for its increased staff upon a large number of distinguished volunteer workers. The new Ministry had four main departments:—

(1). The Intelligence Department received and digested all information necessary to the efficient work of propaganda in the different countries, translating policy into terms of propaganda. The special cable and wireless messages which were issued daily were prepared under the direct supervision of this Department.
(2). The Propaganda Department was in charge of the actual administration of propaganda in foreign countries. Under its director there was a section for each important country, or group of countries. Each section was in charge of a "National" at the headquarters of the Ministry, and in each foreign area there was a corresponding organization which carried on the work in that area. Over each of the main sections there was a special officer called the controller, whose business it was to supervise the work of the "Nationals," more especially with a view to the expenditure of public money.
(3). The material for propaganda—apart from the cables and wireless, which were directly under the Intelligence Department—consisted of press articles prepared or arranged for at the Ministry's headquarters; literature in the shape of journals and pamphlets; and war photographs, films, pictures. The preparation of pictures, photographs and films, as well as their distribution, was directly controlled by the minister, and was no longer in the hands of War Office Committees, as had been the case with the old Department of Information.
(4). The Ministry gave special attention to what might be called "personal" propaganda, securing facilities for foreign correspondents to visit British centres of interest and to meet representative British public men, and, generally speaking, the widening of sympathy for Britain's cause by the personal and social contact of Britons with the citizens of other lands. In this direction the work was large and ramified. A Facilities branch arranged for visits and entertainments; an Overseas Press Centre acted as a clearing house between all branches of the Ministry and the correspondents of the Overseas Press in this country; a special organization dealt with the entertainment of American troops in Britain. Besides the work of personal propaganda done in Britain itself, much was done by representatives of the Ministry abroad, who acted as popular and democratic ambassadors, keeping in touch, not with official, but with unofficial powers.

The nature of its duties made it impossible for the Ministry of Information to be a rigid organization like an ordinary Government office. Propaganda is not a static thing and can never be standardized, and the constitution of a propaganda department had to be adapted to so fluctuating a subject matter. Constant revision was necessary, both in material and method. Moreover, the larger part of the work of the Ministry had to be done quietly and unofficially, and without advertisement, since popular opinion in every country is so delicate an instrument that attempts to play upon it in the name of a foreign government, even an Allied Government, would without doubt have been resented. The anomalous character of its duties was reflected in the curious variety of its staff. It is probable that never before in any Government department had there been so many distinguished men of a type so remote from that of the normal official. All varieties of talent were needed—the skilled journalist and the expert in publicity for the actual business of

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propaganda, the experienced business man for the control and expenditure of machinery, and the student of public affairs for Intelligence and Policy.

Directorate of Military Intelligence.—Until the end of 1915, the Intelligence Section of G.H.Q. (France), and the Director of Special Intelligence at the War Office, made somewhat casual efforts in the direction of propaganda at home, abroad and amongst the enemy forces, and did more in the direction of acquiring information about the propagandist activities of the enemy. The supreme military authorities, however, either attached little value to propaganda, or were more absorbed by their directly combatant functions, and gave no encouragement to the development of propaganda. In the beginning of 1916 Gen. Sir George Macdonough returned from France to become Director of Intelligence on the Imperial General Staff. Thenceforward until the end of the war, a branch of his directorate was devoted to propaganda with continually increasing intensity. Under his stimulation and with the encouragement and the active assistance of Brig.-Gen. Cockerill, his second-in-command, a small group of men, half of them regular officers and half distinguished civilians with temporary commissions, a very large and successful organization was built up. It worked in close coöperation with General Headquarters at the various fronts and with the propagandist agencies in England. Its command of material drawn from all the branches, open and secret, of the Directorate of Military Intelligence, and its close connexion with the fighting services, gave it very large opportunities, of which it took full advantage; on the other hand, the fact that it was a branch of the War Office, run on strict military lines, prevented the full extent of its activities being known, and the credit of much that it accomplished was assigned to organizations more accustomed to work before the footlights.

Reports, captured documents, photographs and any other matter with a possible propagandist use, were collected from all the fronts. Samples of all propaganda prepared by the enemy were obtained from neutral countries, through the postal censorship, by direct capture, from the navy and from all other available sources. Details of the actual fighting operations, stories from the fronts, and all matter tending to show the conditions of fighting on both sides were assembled. Letters written by prisoners of war were read in the special censorship and copies of any judged to be of utility were preserved for reproduction in *facsimile*. Illustrated booklets describing the happy conditions of enemy prisoners in British camps were prepared. The foreign press, especially that from enemy countries, was regularly read, and extracts taken. From these and similar materials propaganda was prepared for distribution, partly by the regular staff of the section, partly by distinguished civilians who gave their services, and largely by wounded or otherwise disabled officers of literary capacity seconded for the purpose. The propagandist material prepared in this way was first carefully censored from the military point of view, in case inadvertently it might contain information which it was desired to keep secret. It was next submitted, especially where it contained matter with any political significance, to the Foreign Office. It was then ready for use. A staff of linguists was maintained to examine and translate material from foreign sources which covered almost every known language. The prepared propaganda, if useful for other than English readers, was translated into foreign languages ranging from Urdu to Spanish, from Russian to Arabic.

A few examples may serve to illustrate the range covered by the War Office propaganda. A German Army Order captured in E. Africa showed contempt or ignorance of Mahommedan religious customs. It was reproduced in *facsimile*, with a translation into every known tongue spoken by Mahommedans. A pamphlet written by Dr. Liebknecht, the German socialist leader, suppressed in Germany, was reproduced in German. Photographs of German prisoners showing their miserable condition on capture, their reception in the British lines with food, chocolate and cigarettes, and their happiness in their ultimate quarters in British prisoner of war camps, were reproduced as a small album. Letters written home by German prisoners of war, describing the comfortable conditions under which they lived, were reproduced in *facsimile*. An erroneous account of the battle of the Marne, written in Spanish for circulation as German propaganda in S. America, was followed by a correct account with exact maps, written by a British general who had been actually engaged in the battle. Every effort of German propaganda was followed and promptly countered in the same language as that in which it had been written. Perhaps the quickest exchange and counter-exchange took place through a cable and wireless service. All the messages issued by the enemy by cables or wireless telegraphy were intercepted and transmitted at once to the War Office. They were followed by a special staff, and the replies to them often reached their destinations a few hours after the originals, more often than not in time for the same editions of foreign newspapers.

Increasing attention was paid to the unification of the propaganda issued by the Allies, and to the pooling of information useful for propaganda. Regular conferences took place at British and French military headquarters in France for the purpose of coördinating propaganda. With the same object constant touch was maintained between the military propagandist staffs in London and Paris. A weekly journal, *Le Courrier de l'Air*, was prepared and issued at the War Office for circulation in the part of Belgium under German occupation. It contained information as to the progress of the war, general news, political intelligence, and much ordinary magazine reading.

Articles suited for British newspapers were offered to editors, and were freely used. These for the most part consisted of descriptions of scenes in the war on various fronts, written by officers who had been engaged in them. Similar matter, and articles covering a wider field, were distributed to English newspapers in every part of the world. A special staff watched the newspapers to observe the kind of articles that were most freely taken by each, so as to suit the supply to the demand. In the same way articles on almost every subject connected with the war were translated into foreign languages and distributed to newspapers in foreign countries. Large quantities of matter were sent to the Department of Information for distribution by their agencies, especially in neutral and Allied countries. There were several military distributing agencies in the Near East, and farther away, of which the largest was an "Arab Bureau" in Egypt. Some of these had local presses at which copy sent from London was set up, but a very large bulk of matter, especially illustrated matter, was prepared and printed in London, and sent out in bulk. According to its objective, it was distributed through vernacular newspapers, or by special agents, who smuggled it into enemy countries.

As regards distribution to enemies, a certain amount of this important side of the propagandist effort was done through the Department of Information, but the War Office itself directed the greater part of the work, especially where it was desired to reach enemy soldiers directly, or the enemy civilian population through them. From the examination of prisoners of war and by the direct admission of the German authorities it became clear that this service was highly effective. Early in 1917 the decision was made to extend considerably the work of preparing and distributing propaganda for the enemy troops on the western front. A special sub-section was created under the charge of an officer who had just completed an analysis of over 2,000 books and pamphlets of enemy origin. At that time there was no objection to the use of aeroplanes for the distribution of literature over the enemy's lines. The sub-section prepared and had translated into German a large quantity of suitable literature, much of it written by the officer in charge of the section (the writer of this article), other matter selected from the work of the Department of Information or from other sections of the War Office. Some of these early efforts were too successful; in particular the Germans objected to a cartoon with the legend "A German Family that has had no losses in the War," depicting the Kaiser and his sons in uniform, on the ground that its distribution was an offence against military discipline

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Captured flying officers accused of distributing propaganda were tried in Germany by court martial and received severe sentences. Although in fact the sentences were not carried out, after negotiations had taken place through a neutral Power between the British and German Governments, the Germans let it be known that any future cases would be treated with the utmost severity. The French continued the use of aeroplanes in spite of this threat. But the British Air Ministry opposed the use of aeroplanes, partly on the ground of the "bad psychological effect of working under such threats, on young pilots and aviators," and partly on the more valid ground that the supply of trained men and of machines was no more than sufficient for the direct purposes of this branch of the forces. After an attempt, obviously impractical, to distinguish between propaganda that could not be regarded as "inflammatory" and that therefore could be distributed by aeroplanes, and propaganda that could not escape this charge, British G.H.Q. accepted the position and decided against the use of aeroplanes for the distribution of literature. The stock of literature prepared for the western front, except such small parts of it as could be used by other army devices, was transferred to the Ministry of Information and to the French army.

The War Office Enemy Propaganda Section then turned to the devising of other possible methods for the distribution of literature by mechanical means. Information was collected from all possible sources, the methods of the enemy being carefully watched. With the assistance of the Aerial Inventions Board and the Munitions Inventions Department, many devices were tried, and as soon as any had reached a promising stage, the officer in charge took it out to France, to discuss its possibilities, and, with the assistance of the intelligence officers of the army, to test it under field conditions.

A section of G.H.Q. Intelligence had obtained great success in dropping homing pigeons and other means of carrying messages on known areas where they could be found by British agents behind the enemy lines. In this work fabric balloons with timing devices for dropping loads at the required localities were employed, but the apparatus on the one hand was unnecessarily exact, and, on the other, much too costly for the distribution of literature. The Germans were found to be using very large balloons of scarlet Japanese paper which carried bundles of newspapers and other matter long distances, sometimes releasing them by slow-burning tinder fuzes. It was clear, however, that this method was haphazard, as balloons and loads destined for the neighbourhood of Verdun not infrequently dropped in Kent. Experiments were undertaken to study the lifting capacity of light balloons, the load and degree of filling that would enable them to rise to an approximately known height, and the arrangement of time fuzes so that they would liberate weights at known distances varying with the strength of the wind. At the same time experiments were made as to the shape, economical mode of manufacture and dimensions of paper balloons, and on the treatment of the paper to lower the rate of diffusion of coal-gas or hydrogen.

A large number of devices such as rockets, grenades and shells were enquired into, but were not adopted because of various objections raised against their use by the military authorities. A device consisting of a fire-balloon, the fabric of which consisted of propaganda sheets joined by strips of touch paper, seemed promising, but did not reach success.

Extensive experiments were carried out with the object of adapting an apparatus invented to distribute light bombs to the distribution of literature. It consisted of a box-kite with an automatic conveyer which carried five-pound loads of propaganda up the cable, liberated them at the required height, and automatically returned for another load, the sheets when liberated being carried to their destination by the wind. The method was extremely good; it was cheap, easy to work, and had a range of upwards of ten miles according to the strength of the wind. But objection to its use at the front was taken by the Air Force on the ground that the cable of the kite would be a danger to aeroplanes.

In connexion with the last-mentioned apparatus, extensive observations were carried out on the wind-driftage of sheets of paper of different shapes and weights, and of the methods of releasing them at height. Experiments were made from aeroplanes and from captive balloons, and the range and conditions of falling were ascertained. It was found, for example, that in a wind of approximately ten miles an hour, a bundle of 150 sheets liberated at a height of 2,500 ft., came to the ground two miles away, scattered over an area 500 yd. square. In higher winds and from greater heights much more distant ranges could be attained. The War Office Propaganda Section accordingly suggested that aeroplanes might be safely used, flying at heights proportioned to the strength of the wind, and the distance of the enemy lines, by flights well within the British lines. But this proposal also was "turned down."

By the end of 1917 it became clear that the use of paper balloons was the only method which would encounter no opposition, and attention was therefore concentrated on producing them on a large scale and on applying the experience gained in other directions to them. By far the largest bulk of propaganda distributed by the Allies on the western front was released from balloons, and it may therefore be of historical interest to describe their final form. The propaganda balloons were made of paper cut in longitudinal panels, with a neck of oiled silk about 18 in. long. Their circumference was approximately 20 ft. and their height when inflated 8 feet. They were liberated inflated nearly to their full capacity—from 90 to 95 cub. ft. of hydrogen. The weight of the balloon was under one pound, the load of propaganda four pounds. The leaflets were attached to a fuze of treated cotton, similar to the tinder of flint pipe-lighters, and burning at the rate of an inch in five minutes. The string of propaganda was tied to the neck of the balloon, and just before liberation a slit was cut in the neck to permit the escape of gas, and the end of the fuze was lighted. The weight and lift were adjusted so that the balloon could rise several thousand feet into the air before the loss of gas due to expansion would have caused a state of equilibrium. At this point the first bundle of leaflets was set free, and the process was continued until, at the end of the run, the last bundle was released. The total time length of the fuze and the attachment of the bundles to it were calculated according to the area which it was desired to reach and the strength of the wind. Experimental improvement of the "dope," by which the rate of diffusion of the gas was lowered, and the manufacture of balloons of double the standard capacity, had made runs of upwards of 150 m. practical, before the Armistice suspended operations. But the bulk of the propaganda was actually scattered over an area of from 10 to 50 m. behind the enemy lines, rest camps and villages occupied by the troops being made the chief targets. Each distribution unit at the front consisted of two motor lorries which carried the balloons, hydrogen cylinders, and personnel to convenient positions, generally from 3 to 4 m. behind the front line.

Early in March 1918, the method of balloon distribution was in full working order, and the War Office Propaganda Section resumed the active preparation of material. The reproduction of selected letters written by prisoners of war was resumed, and *Le Courrier de l'Air* was enlarged and improved by the introduction of direct propaganda. A series of leaflets, known as the A.P. (Aerial Propaganda) was begun. The first of these, sent to France in March, was a complete German edition of the British Prime Minister's speech on British War Aims. This had been incompletely reported in the German newspapers, and in the new edition attention was directed to the portions which had been taken out by the German censorship; copy for other leaflets was selected from German and Austrian newspapers, was contributed by G.H.Q. (France), by the War Aims Committee, by the Ministry of Information, and by the new Directorate of Propaganda in Enemy Countries which had been established under Lord Northcliffe. But the whole series was selected, revised, edited, and produced by the War Office, and a very large proportion of the actual leaflets were prepared by the officer-in-charge. The first of the series was sent to France on

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March 16, the last, number 95, on Sept. 4; of the whole series over 12 million leaflets were sent to France.

Later, in 1918, when, under the energetic direction of Lord Northcliffe, the machinery for propaganda in enemy countries was greatly increased, there was a further extension of distribution by balloons. The military successes of the Allies were being concealed from their troops by the Germans, and it was thought that quick and accurate information would further demoralize the Germans. In conference with the War Office, Lord Northcliffe's department arranged that the leaflets should be divided into two categories, "stock leaflets," the contents of which would not deteriorate by a little delay, and "priority leaflets" containing matter of urgent importance. The latter were printed three times a week and sent in editions of 100,000 direct to Messrs. Gamage, who were manufacturing the balloons and the "releases." They were at once prepared for distribution, handed over to the Military Transport Department and sent via Boulogne direct to the distributing stations. In favourable weather they were thus actually in the hands of the Germans 60 hours after being written.

But even with the best arrangements, distribution by balloon is subject to many delays from weather and other conditions. Lord Northcliffe continued to urge on the Cabinet the need of distribution by aeroplane, and was at last successful in breaking down the resistance. The writer of this article, then liaison officer between Lord Northcliffe's department, the Directorate of Military Intelligence and the Air Force, in the second half of 1918 carried through the final stages of the negotiations. The last obstacle was the fear of the Air Ministry that bundles of leaflets suddenly scattered in the air might foul the steering guys of the aeroplanes; he devised a simple mode of packing the leaflets so that they would fall as a solid bundle for 20 ft. before dispersing. On the morning of the Armistice, the first packets of propaganda made up on this system were delivered to the Air Force in France.

The methods of distributing propaganda by the Allies were ascertained in a conference held in August 1918 at Crewe House under the chairmanship of Lord Northcliffe. Aeroplanes were used by the British forces in the Near East, and by the Italians, French and Belgians on the western front. But it was clear that either lack of aeroplanes or of personnel limited their use even by those who had no objection to it. The Italians used special devices such as rockets and shells, the French were experimenting with shells and trench-mortars and were trying to manufacture balloons on the British model, and both the French and Belgians sent large quantities of newspapers and of other matter to be distributed by the British balloons. The Americans had hardly reached the actual stage of distribution before the end of the war, but they had developed a small rubber balloon with a very ingenious timing device for releasing the load. It is a reasonable assumption, however, that all these methods would be replaced by aeroplanes in any later war.

Lord Northcliffe's Directorate.—In Feb. 1918 the Prime Minister appointed Lord Northcliffe to be Director of Propaganda in Enemy Countries. Lord Northcliffe brought to the task a limitless faith in the possibility of controlling public opinion, a unique experience in the methods of publicity, and direct access to the Prime Minister and the War Cabinet. He selected a council of advisors and an executive staff of remarkable authority and talent, and Crewe House, in Mayfair, London, the headquarters of the new Department, quickly became the centre of far-reaching activity. A mere catalogue of the operations undertaken, and of the men who carried them out would occupy many pages.[1] But two names must be mentioned, as without them Crewe House would have been little more than a powerful addition to the existing propagandist agencies. Sir Campbell Stuart, a young Canadian who had been of great assistance to Lord Northcliffe on his mission to the United States of America, was selected as deputy-director of the department and deputy-chairman of the committee. Lord Northcliffe's choice was fully justified by the remarkable powers of tact and conciliation shown by Stuart, who rapidly disarmed all suspicion on the part of existing organizations, found out how to get the best work out of all of them and how to combine their efforts towards a single resolute purpose. Lord Northcliffe selected Mr. H. Wickham Steed as his chief political adviser. Steed at the time was foreign editor of *The Times*, and for many years had been the representative of that journal in Rome and Vienna. He had an exceptional knowledge of the political personalities of modern Europe, the open policies and the secret aspirations of all the nationalities great or small. He was an idealist, believing that truth and justice could bring ordered peace to chaotic Europe; a realist, conscious of the stubborn obstinacy that would yield only to force and of the ignorance that misled the accepted leaders of men. Steed provided the knowledge and lofty enthusiasm which shaped the policy of Crewe House, Stuart the conciliatory tact which made concerted action possible, Lord Northcliffe the swift judgment between contending views, the experienced instinct for what was practical, and the driving force to make the practical actual. The present writer assisted at many intimate deliberations at Crewe House; he desires to add his own observations to the varying estimates that have been made of Lord Northcliffe. The Director of Propaganda in Enemy Countries was patient in listening to the facts and arguments put before him, decisive in coming to a judgment on them, swift and powerful when action began. Steed's knowledge, Stuart's organizing tact, and Lord Northcliffe's driving force and far-reaching influence, made Crewe House different in quality and energy from any preëxisting agency.

The inspiring principle of the new organization was that propaganda should depend upon policy. It may be argued, although not convincingly, that a definite constructive Allied policy could not have existed in the earlier stages of the war, when fortunes were changing and the nature of the ultimate decision was uncertain. In any case, if a concerted policy did exist, it was unknown to those who were conducting propaganda. The wiser propagandists in most countries therefore endeavoured to limit themselves to a restricted field from which declared "war aims" and ultimate terms of peace were excluded. Rasher agents plunged, with results that were often ludicrous and sometimes disastrous. Dr. Lamprecht, the German historian, for example, confessed that the consequences of the German propaganda were often gruesome. Probably, he wrote, more harm came to the German cause from the efforts of the German professors than from all the efforts of the enemy. "None the less it was done with the best intentions. The self-confidence was superb, but the knowledge was lacking. People thought that they could explain the German case without preparation. What was wanted was organization." A single example will illustrate the results of lack of organization amongst the Allies. The French military authorities complained to the War Office that German propaganda appeared to be entering France in large quantities through England. They sent examples, and asked that precautions should be taken. On enquiry it was found that the incriminated documents were the product of one of the British civilian propagandist agencies. Doubtless it was a matter of opinion whether the French or English judgment of the efficacy of the leaflets was the more correct, but the real fault was the absence of harmonious effort. In 1918, the fifth year of the war, it became of vital importance that the Allied peace aims should be explained with a clear and unanimous voice to the war-weary enemy. It was to this purpose that Lord Northcliffe addressed himself. He used his influence first to extract from the British Government the broad lines of a definite policy, in order that the propaganda of his Department might not be in conflict with the casual and sporadic utterances of ministers, next to secure unity of purpose among the British and Allied propagandist agencies.

The first campaign was against Austria-Hungary. The British Government, hampered by the secret Treaty of London, hesi-

[1] *Secrets of Crewe House*, by Sir Campbell Stuart (London, 1920), gives an account of Lord Northcliffe's undertaking.

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tated between the policy of working for a separate peace with the Habsburg dynasty, leaving its territory almost untouched, and the alternative of trying to support and encourage all the anti-German and pro-Ally elements in the Austria-Hungarian Empire. The objective selected by Crewe House was to support the national desires of the Czechs, Southern Slavs, Rumanes, Poles and Italians for independence, so as to form a strong non-German chain of Central European and Danubian States, and thus to encourage the disinclination of these peoples to fight for their German masters.

The chief obstacle to the policy of the British propaganda was the pledge given to Italy in 1915, to give her certain Austrian territories inhabited by Southern Slavs. In 1917, the Serbs, Croats and Slovenes had assembled in Corfu, and under the leadership of Dr. Trumbitch, president of the Southern Slav Committee, and M. Pashitch, prime minister of Serbia, had proclaimed the unity of the three Southern Slav peoples. Early in 1918, after recovery from the disaster of Caporetto had begun, the united Southern Slavs, on the initiation of Mr. Wickham Steed and Dr. Seton Watson, came into conference with leading Italians and agreed to settle amicably the territorial controversies in dispute. Lord Northcliffe took up the position at that point, and almost the first step of his campaign was to send Mr. Steed and Dr. Seton Watson to the Congress of Oppressed Habsburg Nationalities which took place at Rome with the consent of the Italian Government. Meantime he urged on the War Cabinet the need of coming to a decision between the alternative policies and of obtaining the agreement of the French, Italians and Americans to the choice. He got only a dubious and halting opinion from the British Foreign Secretary, who urged that the same propaganda could be adapted at least to the earlier stages of either policy. This indecision, maintained through the war and through the peace negotiations, led to the disastrous adventure of D'Annunzio, for the Italians, like other peoples, flushed with the unexpected joy of complete victory, forgot the wise concessions to which they had been willing when the issue was doubtful. But Lord Northcliffe's mission achieved a temporary and successful unity of purpose. A joint commission consisting of representatives of Italy, Great Britain and France, was established at the Italian general headquarters, with the special object of conducting propaganda directed to the oppressed nationalities in the Austrian armies. Representatives of committees of each of the oppressed nationalities were attached to the commission. A polyglot printing press was acquired, and large quantities of propaganda of all kinds were distributed by aeroplane, rockets, grenades and contact patrols. The latter consisted of deserters of Czecho-slovak, Southern Slav, Polish and Rumanian nationalities, who volunteered for this service against their former oppressors. The effect was soon apparent. Deserters belonging to the subject races came over to the Italian armies in large numbers, so that the attack planned by the Austrians had to be postponed. Unfortunately, the complete success of the effort, apparently assured early in May, was prevented by the reactionary tendencies within the Italian Government, supported by the uncertain attitude of the Governments of France, Great Britain and the United States. But even in the face of this difficulty, the success was so great that, after the battle of the Piave, members of the Inter-Allied Propaganda Commission were received and thanked by the Italian commander-in-chief.

While this great campaign was taking place on the Italian front, the propaganda addressed to Germany was being intensified. On assuming office, Lord Northcliffe found the War Office propaganda department, described above, in full operation. Except that he at once began to press the Government to renew the original permission for the use of aeroplanes, he suggested no change in the War Office work. His committee at Crewe House, however, first with the assistance of Mr. H. G. Wells and after a few weeks with that of Mr. H. Hamilton Fyfe, set to work to frame a general propaganda policy directed against Germany, and to produce leaflets and other matter. Some of this material was given to the War Office Department; much of it was distributed by special means chiefly through neutral countries. In July, when the work in Italy had been established on permanent lines, and Mr. Steed had returned to London, it was decided to concentrate all the production of propaganda at Crewe House, with the object of bringing it more into line with a concerted policy. Accordingly, the writer of this article was transferred from the War Office to Crewe House, but kept in touch with the War Office as liaison officer, the army remaining the agent for distribution.

The General Committee met daily at Crewe House, receiving the reports of the different branches, collecting information from all possible sources, and stimulating the propagandist work against Austria-Hungary, Bulgaria and Germany. It became more and more obvious during the summer of 1918 that the spirit of the enemy was breaking on every front, that they were alert to every suggestion as to the approach of peace, and that the supreme necessity was a clear statement of the intentions of the Allies. Lord Northcliffe, with varying success, continued to press the Government for such a definition of policy as would serve as a true basis for propaganda. The fundamental principle on which he wished to act was that when a line of policy had been sanctioned as a basis for propaganda, the Allied Governments should be asked for their assent to it, so that their propaganda departments might act in concert. Failing to obtain a clear lead from the British Government, who at that time appeared to have no definite policy with regard to any issue of the war, Lord Northcliffe convened an inter-Allied propaganda conference at Crewe House. It was attended by Lord Beaverbrook, Minister of Information, representatives of the British Foreign Office, War Office, Admiralty and Air Ministry, and by delegates from France, Italy and the United States, the U.S.A. delegation, however, being instructed to attend only as observers. The conference, after a plenary session, divided into committees to discuss details of policy, methods of publicity and methods of distribution. At a final plenary session the reports of the committees were adopted, and it was agreed that they should be submitted by the heads of the four missions to their respective Governments for approval. The conference then constituted a permanent Inter-Allied Body for the conduct of propaganda in enemy countries. Steps were at once taken to secure the permanency of contact between the propagandist agencies which had been established at the conference, and these became increasingly effective until, when the Armistice came, there was almost complete unity of action amongst the Allies.

As the possibility of peace drew nearer, it became still more urgent that propaganda should be kept free from any trace of confusion. To secure this, a Central Body, called the Policy Committee of the British War Mission, was formed at Crewe House; it consisted of representatives of Lord Northcliffe's department and of the War Cabinet, the Admiralty, War Office, Foreign Office, Treasury, Ministry of Information, Air Ministry, Colonial Office, India Office, War Aims Committee and Official Press Bureau. It decided to undertake the following activities:—Study of peace terms, study of utterances by important enemy representatives, their real significance and the nature of the response to be made to them. It had to take action almost at once, since the German Peace Note, with its reference to the publication of President Wilson's "fourteen points," required immediate attention from British propagandists. Lord Northcliffe's committee had been studying the fourteen points with a very close attention. It was plain that they could not be understood as a full recitation of the conditions of peace, and that it was therefore a matter of honesty and of prudence to define the interpretation put on them by Great Britain before accepting the surrender of Germany. This view was accepted by the Policy Committee, and, after detailed discussion, a statement drafted by the Crewe House Committee was adopted in principle. It was approved, by a representative of the Government designated for the purpose, for unofficial use as propaganda policy. Each department henceforward made it the text of its productions. As this document is of historical interest, it is here printed in full.

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Confidential.

PROPAGANDA PEACE POLICY

The following conditions are indisputable:—

In no sense shall restoration or reparation in the case of Belgium be taken into consideration when adjusting any other claims arising from the war.

1. The complete restoration, territorial, economic and political, of Belgium.
2. The freeing of French territory, reconstruction of the invaded Provinces, compensation for all civilian losses and injuries.
3. The restoration to France of Alsace-Lorraine, not as a territorial acquisition or part of a war indemnity, but as reparation for the wrong done in 1871, when the inhabitants of the two Provinces, whose ancestors voluntarily chose French allegiance, were incorporated in Germany against their will.
4. Readjustment of the frontiers of Italy as nearly as possible along the lines of nationality.
5. The assurance to all the peoples of Austria-Hungary of their place amongst the free nations of the world and of their right to enter into union with their kindred beyond the present boundaries of Austria-Hungary.
6. The evacuation of all territory formerly included in the boundaries of the Russian Empire, the annulment of all treaties, contracts or agreements made with subjects, agents or representatives of enemy Powers since the revolution and affecting territory or interests formerly Russian, and coöperation of the Associated Powers in securing conditions under which the various nationalities of the former Empire of Russia shall determine their own form of Government.
7. The formation of an independent Polish State with access to the sea, which State shall include the territories inhabited by predominantly Polish populations, and the indemnification of Poland by the Powers responsible for the havoc wrought.
8. The abrogation of the Treaty of Bucharest, the evacuation and restoration of Rumania, Serbia and Montenegro, the Associated Powers to aid the Balkan States in settling finally the Balkan question on an equitable basis.
9. The removal, so far as is practicable, of Turkish dominion over all non-Turkish peoples.
10. The people of Schleswig shall be free to determine their own allegiance.
11. As reparation for the illegal submarine warfare waged by Germany and Austria-Hungary, these Powers shall be held liable to replace the merchant tonnage belonging to the Associated and neutral nations illegally damaged or destroyed.
12. The appointment of a tribunal before which there shall be brought for impartial justice individuals of any of the belligerents accused of offences against the laws of war or of humanity.
13. The former Colonial possessions of Germany, lost by her in consequence of her illegal aggression against Belgium, shall in no case be returned to Germany.

The following conditions of Peace are negotiable:—

1. The adjustment of claims for damage necessarily arising from the operations of war, and not included amongst the indisputable conditions.
2. The establishment, constitution and conditions of membership of a League of Free Nations for the purpose of preventing future wars and improving international relations.
3. The League of Free Nations shall be inspired by the resolve of the Associated Powers to create a world in which, when the conditions of the Peace have been carried out, there shall be opportunity and security for the legitimate development of all peoples.

The action taken thereon by the Enemy Propaganda Committee at Crewe House was as follows: At their suggestion Lord Northcliffe made it the basis of an address to the United States officers in London on Oct. 22 1918. The Production Department of the Committee got to work on a series of pamphlets and leaflets dealing with the different points of the memorandum. The memorandum was sent to the French, Italian, and American members of the inter-Allied Body for Propaganda in enemy countries, with the request that they should take similar action on it to that taken by the British Policy Committee and bring it up for discussion at the next meeting of the inter-Allied body. Lastly they decided to prepare and give wide publicity to an article covering the whole ground of the memorandum, so that the policy could be presented in the same terms to the British people, to their Allies and to the enemy. The steps taken by Crewe House, and the corresponding action taken by other departments concerned, were reported and approved at a meeting of the Policy Committee at Crewe House on Oct. 28 1918, the last meeting actually held.

Events were moving swiftly, and Crewe House found that there was no time to carry out the original intention of circulating the general statement through one of the more important monthly periodicals. It was therefore decided to ask Lord Northcliffe to give the peace policy the wide and immediate publicity possible by the use of his name and by the sources of distribution at his command. He agreed at once, and so consummated the efforts of British propaganda. On Nov. 4 1918 an article under his name appeared in *The Times* and *The Daily Mail*, *The Paris Daily Mail*, and the leading papers in Canada, Australia, New Zealand, S. Africa, Newfoundland, India, the British Dependencies, the United States of America, S. America, France, Italy, Spain, Switzerland, Holland, Norway, Sweden, Denmark, Japan and elsewhere, and very soon afterwards in Germany. The arrangements for this wide publicity were made personally by Lord Northcliffe, and the cost of cabling was borne by him. The final form of the article was due to him, but its substance represented the unanimous views of his advisory committee, the members of which he had selected, and over whose deliberations he had presided.

ALLIED PROPAGANDA.—The principles and methods of propaganda have been so fully illustrated in the foregoing account of the British effort, that little would be gained by a detailed description of the operations of England's Allies. France went through a history much like that of Great Britain. In the earlier stages of the war, propaganda was conducted by a number of agencies, for the most part in extension of their normal functions. As the war proceeded, concentration and intensification were achieved, ending in the work being placed under the control of a single minister with a large staff. The control of home opinion was less difficult than in England, as it was already in the tradition of the Government to regulate the dissemination of information and of official views. As, however, a considerable part of the French population was in territory occupied by the Germans, there had to be an extensive distribution of propaganda through the army and by secret agents. An intensive campaign was conducted in Alsace and Lorraine, the services of distinguished Alsatians of French descent being employed with great success. Neutral opinion was influenced by special missions and by resident agents. Much care was given to French propaganda amongst the Allies. Distinguished civilians of British and American nationality were frequently invited to France, and given every opportunity of seeing the spirit in which France was making her prodigious effort and the enormous difficulties she had to face. French agents kept in close touch with British opinion of every class, and in every part of the Empire, not neglecting Ireland and Quebec. In one respect this branch of French propaganda was more far-seeing than most of the British work; it was not content with the actual problems of the war, but anticipated and prepared for many of the difficulties and possible causes of friction that might arise in the making even of a victorious peace. France early foresaw that, as German colonies were unlikely to be restored to Germany, it would be necessary for France and Britain to be in general agreement with regard to extra-European territories. The French effort to reach the enemy directly was on a smaller scale, but was similar to the work done by the British War Office. By exchange of views and materials a high degree of concord was reached.

Belgium was in the unfortunate position of being able to operate directly only in a very small part of her own territory. By direct effort, and with the willing coöperation of France and Britain, she was able to keep in close contact with her own people. The unmerited calamities which fell on Belgium secured her in advance the sympathy of neutral and Allied nations, so that special propaganda was unnecessary. Italy was rather a theatre for propaganda than a direct propagandist. She spoke with so many different voices that, except for a certain amount of direct propaganda addressed to the enemy, she was unable to explain her attitude very clearly either to neutrals or to Allies. On the other hand, she issued a series of magnificent photographic descriptions of her arduous campaigns, which explained well the immense difficulties of military operations on the Italian front, and the brilliant technical methods by which

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they were overcome. The Americans devoted the same energy to propaganda as to preparation for actual warfare. Representatives were at once sent to Europe to examine and report on the methods of propaganda employed by the Allies. By Sept. 1918, an American Propaganda Department had been established with branches in London, Paris and near Verdun. Much literature was produced, and its distribution by aeroplane and by balloon had been arranged when the Armistice came.

GERMANY.—It would be difficult to say how far the exaltation of the German spirit in 1914 was due to official inspiration, or how far the long campaign of German intellectuals and industrials, before 1914, for the aggrandizement of Germany, had inspired official opinion. In any event, the outbreak of the war let loose a flood of literature unanimous in sentiment and apparently spontaneous. Professors and pastors, politicians of every section, pan-Germans and socialists were united in proclaiming the necessity of the war and the certainty of victory. But even in these early days there were striking differences of opinion. One school urged that the war was defensive, forced on Germany by the "encircling policy" of her enemies. German militarism was a necessary consequence of a position surrounded by powerful enemies, of the Russian danger, and of English jealousy of her commercial success. As it was difficult to reconcile this theory with the actual German plan of campaign and with the fate of Belgium, much stress was laid on the theme that an offensive was only the best means of defence. When victory came, annexations were to be limited to what might be necessary for future security. Another school proclaimed the historic mission of Germany, her high culture and civilization, the advantage to the world of her victory. The great empires of the past had expanded and developed for selfish ends; Germany wished to free the seas for all the nations, and to open up the world so that all the peoples great or small could develop on their own lines. England, France and Russia had been the great oppressors of smaller nations and races; Germany would liberate them. The unification of Germany had been the first stage in a beneficent process which would lead, first, to a great federation of Middle Europe, and then to a federation of the whole world. A third school expounded a somewhat careful form of the Bernhardi and Treitschke doctrine. The great and expanding German people required land within the German Empire in which the surplus population might find room and yet remain German. Outlet must be found for German talent, organizing capacity, capital, manufactures, and the necessary supplies of raw material must be forthcoming. These objects Germany would have preferred to attain peacefully. But she was a late arrival on the world-scene, and her rapid development had aroused such envy, particularly from England, that her legitimate rights could be secured only by force. Yet a fourth school, relatively small in numbers but of great influence in the navy, army and among the big industrials, appealed directly to cupidity. The riches, natural resources and possibilities of all parts of the world in which German influence could be extended or which Germany could take from her enemies were described elaborately. The growth of the British Empire was displayed in almost affectionate caricature as an accomplishment of successful piracy; England, however, must now disgorge to the younger and stronger pirate. It was an odd but possibly significant circumstance that, in all these diverging views, little attention was paid to the events immediately preceding the various declarations of war.

So far we are dealing with the unofficial home propaganda of Germany. It consisted to a much larger extent than in Great Britain of books and pamphlets, some of which doubtless were subsidized, but most of which apparently were spontaneous. These served also for the German peoples in foreign lands, and were exported in very large quantities, often in their original form, often in translation so as to serve as propaganda for neutrals. It was a characteristic of German self-confidence that they appeared to think that explanations good enough for Germans were good enough for neutrals and even for enemies. But in addition to such private or at least apparently unofficial efforts, there was an official propaganda on a large and highly organized scale. The German Press was organized for war, with the object not only of influencing home opinion but neutral opinion, directly through the circulation of German papers in Switzerland, Holland, and Scandinavia, and by their effect on foreign editors. Dr. Theodor Wolff, the well-known editor of the *Berliner Tageblatt*, said that "German censorship passed news concerning facts, but forbade discussion of war events or internal politics and of many other subjects." The Government suppressed criticism or the giving of information with regard to the internal conditions of the country. Every two or three days the newspapers received printed orders indicating what they were forbidden to publish, the attitude they were to assume on particular topics, and the articles from other papers they were free to reproduce. Editors were usually allowed to produce their papers without a preliminary examination of the proofs, but transgression of the regulations was followed by prosecution or suspension. One form of punishment was to place a paper on "preventive censorship," under which all proofs had to be submitted, and any matter could be struck out, without, however, removing responsibility for what remained. The *Norddeutsche Allgemeine Zeitung* was a purely official organ, and several other papers, notably the *Kölnische Zeitung* and the *Berliner Lokal-Anzeiger*, were semi-official.

With regard to the Press generally, there were several agencies of direction and inspiration. The Press Department of the Foreign Office issued a regular news-sheet containing the statements and views the propagation of which was desired; it also acted directly on newspaper correspondents. The Admiralty had a very active publicity department, for some time under the direction of Mathias Erzberger and Paul Rohrbach. The Ministry of the Interior had a separate organization and also circulated "tendencious" sheets. The War Press Bureau, controlled by the Higher Command, was the most important propagandist organ. It issued commands to the censorship, laying down the prohibitions and the special attitudes which were circulated through the local authorities, and it had a special foreign section. Moreover, daily Press séances were held by three officials, representing respectively the Foreign Office, the War Office and the Admiralty, at which instructions and directions too delicate to be committed to paper were issued.

German propaganda in neutral countries was officially controlled by a branch of the Foreign Office, the *Zentralstelle für Auslandsdienst*. It issued material for propaganda and propaganda for distribution through the official representatives in foreign countries. Every Germany embassy or legation had at least one organ under its immediate control, sometimes published in German specially for German readers, more often in the language of the country in which it was issued. The material consisted of copies of a special newspaper, the *Nachrichten der Auslandspresse*, prepared by the War Press Bureau, a daily paper containing telegrams and notes on current events, and often selected news cuttings issued by the general staff. Another official agency, believed to be directed by the Admiralty, issued an attractive and well-illustrated periodical, the *Kriegs Kronik*, as well as the *Kriegs Nachrichten*, the latter consisting of prepared articles on war subjects and a "Berlin" letter, for the edification of the foreign Press.

In addition there were several highly important private organizations for foreign propaganda. The *Deutscher Ueberseedienst Transocean* was a syndicate established before the war by big German industrials to supplement and correct the service of the official Wolff Bureau. It issued the daily German wireless, had a special foreign news-service consisting chiefly of selected cuttings from German and foreign newspapers, and a very fine illustrated monthly periodical in five languages—*Der Grosse Krieg in Bildern*. It had an intelligence division which reported on the standing and personality of newspaper editors in every country, and suggested means of influencing them. The *Kriegsausschuss der deutschen Industrie*, formed originally to represent industrialists in their controversies with the Government, became an extensive propagandist chiefly on trade matters. A bureau at Frankfort-on-Main, partly official, dealt chiefly

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with Latin countries. The *Deutsch-Südamerikanisches Institut*, and the *Hamburgischer Ibero-Amerikanischer Verein* were occupied chiefly with Latin and Latin-American countries, and had agents and usually press organs in every country where Spanish or Portuguese is spoken. The Far East was served through the *Ostasiatische-Lloyd*, which supplied a distributing centre in Shanghai.

Until the United States of America came into the war, there was a very active German campaign to influence American opinion in favour of Germany. A great part of it was conducted from the German embassy in Washington, and through the German consuls throughout the United States. Much work was done by special missions such as that of Dr. Dernburg, a former Colonial Secretary, and every German bank or trading corporation was a centre of organized effort. A very large number of serious books by well-known German authors were translated into English for American readers. These followed certain main lines. They drew contrasts between the peaceful progress of Germany since her unification, as compared with the violence of other Powers. They represented Germany as being engaged purely in self-defence. They offered veiled threats or bribes to the United States with reference to Japan. They insisted on the moral basis of German culture and civilization. Closely similar lines were followed by many leading Americans of German descent. Perhaps the most effective of these American-Germans was Hugo Münsterberg, professor of psychology at Harvard, who advocated the cause of his natal country with eloquence and apparent moderation. His main point was that the war was really a struggle between Russian barbarism and the western culture of Germany, France taking sides because of Alsace-Lorraine, England because of her commercial rivalry and desire for German colonies. If Germany were beaten, it would be a triumph of Asiatic Russia and of Japan over the culture of Europe and America. It was suggested that the task of America was to give Europe an honourable peace, which she could do only by the strictest neutrality, with a leaning to Germany. Some true Americans also engaged in propaganda in favour of Germany. Some of these, doubtless, were mere hirelings; the better were chiefly persons of standing in the literary, scientific and musical world, who had been much in Germany. Some of the exchange professors were leaders in this work, and very naturally advocated with zeal and knowledge the best side of the German character and the great part Germany had played in the arts and sciences. Still more vocal were the Irish-Americans, who devoted themselves with a malignant bitterness to propaganda against England.

As regards direct German propaganda against the enemy, comparatively little was done, as compared with other combatants, in the distribution of propagandist literature from Germany amongst the actual troops opposed to her. The *Gazette des Ardennes* was the most successful effort. It was a regular newspaper, written in French and often with an illustrated supplement. It was sent into France by balloons, and occasionally by aeroplane, and sometimes gained entrance through a neutral country. It was eagerly sought, as it was baited with genuine information as to French prisoners. Otherwise it consisted of well-arranged propagandist matter of the usual type. The *Continental Times*, written in English, was founded before the war as a genuine newspaper for Americans travelling in Germany and Austria. During the war, probably with the aid of a German subsidy, it developed into a propagandist organ, chiefly anti-English, and almost ludicrous in its exaggerated malevolence. It was freely circulated among English prisoners in German camps, where, fortunately, it was the occasion of a good deal of amusement. The *Russkiya Iszvestia*, written in Russian, was distributed to Russian prisoners of war, and to a smaller extent in Russia. It was a competent piece of work, addressed to the task of persuading the Russian peasant that his two chief enemies were England and his own Government, and that the victory of Germany would mean liberation.

Germany's greatest propagandist effort against her enemies was carried out by indirect means. Wherever she thought that there was opportunity, she endeavoured to excite the discontented subjects of her enemies. She sought to get in touch with Irishmen, Indians, Arabs, Egyptians, Boers, Algerians and Georgians, and with various black races. A special organization or committee in Berlin attended to each of these peoples, and to many others. Where possible, representatives were lured to Berlin, and, if thought useful, were provided with funds. Missions, sometimes accompanied by Germans, were sent wherever they could be sent with safety. On the negative side the effort had some success, and existing discontent was sedulously fomented. But on the positive side there was little gain, for the Germans were seldom able to persuade the actual or tentative rebels that their future position would be any better under the domination of Germany. (P. C. M.)

PROPELLANTS (*see* 10.83).—A propellant explosive should burn comparatively slowly, and thus allow the use of a suitable charge for the required muzzle velocity without causing a high chamber pressure, and enable the maximum pressure to be kept low while better sustained; it should burn regularly—which depends upon the area of surface exposed to burning—and the rate should be easily capable of regulation; it should be smokeless, without bright flash; it should not give excessive heat during combustion, but be easy of ignition and not leave any solid residue; it should have both chemical and ballistic stability while in storage. The method of manufacture and the proportionate mixture of cordite, the British smokeless propellant (*see* 7.138), have been very largely controlled by the postulated requirements, particularly as regards keeping qualities.

With cordite manufactured by the methods in vogue before the World War the nitrocellulose used was highly nitrated, necessitating the use of acetone as a solvent. This involved a serious disadvantage in that the supply of the solvent materially governed the output of cordite. The enormous amounts of propellant required and the demand for rapid supply during the war made this disadvantage seriously felt, and thoughts were turned in the direction of discovering some expedients in which a state of lower nitration would render possible the use of some other solvent, which could be more easily obtained, as well as the devising of new methods by which the time expended in manufacture might be materially reduced. At the same time it was postulated that disturbance of the ballistic and heat value of cordite M.D. was not to be incurred.

Experiments resulted in the introduction of a class of cordite known as R.D.B. (Research Department, mixture B.), with which ether-alcohol is used as the solvent. It consists in a percentage composition of nitroglycerine (42%), nitro-cotton (52%), mineral jelly (6%). A larger percentage of nitroglycerine was included in this mixture in order to compensate for the lower nature of nitrocellulose, and a higher proportion of mineral jelly to reduce the higher temperature produced by the extra proportion of nitroglycerine. The appearance of this class of cordite, as compared with cordite M.D., is not so clear, generally warped, with a rougher surface. With this mixture, not only was there the advantage in employing a solvent, of which supply was assured, but also the time required for drying in manufacture was considerably reduced.

Originally, the tubular form was introduced for cordite in order to maintain an equal area of burning surface, and so permit a more equally sustained pressure during combustion. In the form of strips, cordite gives very similar action as in the form of tubes; this form in manufacture and otherwise has other advantages which favoured its use for cartridges. But since, when made up into charges, strip cordite is apt to become packed tight, and so practically form a solid bundle, the result on explosion may not be as desired.

The provision of cellulose for conversion into nitrocellulose depended during the war very largely on the obtainable supplies. In Germany different expedients were tried, amongst them an unsuccessful attempt to use an artificial silk made by dissolving wood-cellulose in suitable solvents. But practically all the nitrocellulose made in that country, during the war, was made from a certain kind of paper, probably from some form of wood-cellulose (*see* CELLULOSE).

The American service propellant N.C.T. (nitrocellulose tubular) is a soluble nitro-cotton powder gelatinized by ether-alcohol, and containing a small percentage of diphenylamine added to act as a stabilizer. The powder is practically a pure nitrocellulose powder, and consists of nitrocellulose (97%), stabilizer (0·5%), volatile matter (2·5%).

The nitration of the cellulose is similar to the process in the case of cordite, but the drying of the powder is not carried so far, a con-

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siderable proportion of the solvent being retained. The stabilizer, being a substance with an affinity for nitrogen dioxide (NO_2), is intended to prevent the free presence of nitrous acid should any decomposition occur. It is claimed for the stabilizer that it at the same time acts as a detector and shows when decomposition is occurring, by means of the resulting discoloration; but this claim does not appear to have been clearly established. The shape of the powder is different from that of cordite. The mixture is extruded through dies, for charges for smaller guns in a tubular form, and for larger guns as a stick with several longitudinal holes; as it is extruded, it is cut into short lengths, the lengths having a proportionate relation to the diameter of the hole in the stick. This shape enables greater ease in making up cartridges than with cordite, requiring merely the weighing of the charge on scales as against cutting lengths of cordite according to size and weight. Nitrocellulose tubular is not so powerful as cordite, and therefore larger charges are required; it is hygroscopic, and consequently, if cartridges become damp, considerable variations in ballistics may result; it is not so stable in storage as cordite. On the other hand, it is more uniform in burning (at a slower rate and with a lower temperature than cordite), and so causes much less erosion in a gun; and, further, the loading temperature has less effect on ballistics than with cordite, and the regularity in worn guns is better. The colour of the grains varies very much and may be buff, brown, dark blue or even nearly black, perhaps owing to slight changes in the stabilizer present; but practically no difference in stability has been detected, except when the colour becomes brick-red, or rusty, when it may be concluded that corrosion has set in.

A flameless powder has been made in America for which it is claimed that, with field guns firing this kind of powder, it is possible for the eyes of the gunner to see the muzzle of the gun at the moment of firing, and that the flash is imperceptible at a distance of a mile. The composition of the American powder is approximately 60% of nitro-cotton, stabilized only with potassium carbonate, 25–28% of nitroglycerine treated in the same way, 5–7% of diphenylphthalic diethylester of the phthalic acid obtained by esterifying phthalic anhydride with ethyl-alcohol in the presence of sodium bisulphate and 3–5% of neutral potassium tartrate; vaseline or mineral jelly up to 5% is used to balance the composition. The dimensions of the powder-sticks and the exact composition depend upon the form to be used and have to be calculated.

The German propellant used with the 77-mm. gun was in the form of tubular sticks, and was a ballistite containing a stabilizer of "centralite" type, the stabilizer being the thio-urea derivative corresponding to diphenyldimethyl-urea. This last substance has been found frequently in German powders; it is very resistant to the action of acids and alkalis and is oxidized by fuming nitric acid only after prolonged heating at a high temperature.

A ballistite containing 60% of nitrocellulose and 38% of nitroglycerine has been used by the Germans; and also a mixture of nitrocellulose (66·16%), nitroglycerine (25·97%), sym. diethyldiphenyl-urea (5·64%), volatile matter (0·91%), mineral matter (1·32%). With certain guns the Germans tried a mixture of ammonium nitrate (84·5%), carbon (15·0%), ammonium chloride (0·5%), in a compressed block, in the shape of an annulus, which was inserted in the cartridge-case above a charge of ordinary nitrocellulose powder. What was the exact result of this combination is not clear.

Among sporting powders which were tried during the war as propellants might be quoted as an example E.C.3—a powder made by a private company—which was used rather largely in trench warfare. This also is a nitrocellulose powder, which after forming to required shape is treated with acetone so that the outer surface is hardened. It is claimed for this process that the pressure during burning is more evenly distributed and more regularly maintained, since the hardened skin of the powder allows of slow burning to commence with and the porous interior allows more rapid action later on. (F. M. R.)

PROTHERO, SIR GEORGE WALTER (1848–), English man of letters, was born in Wilts. Oct. 14 1848. Educated at Eton, King's College, Cambridge, and the university of Bonn, he became fellow of King's College, Cambridge, and was history lecturer there from 1876 to 1894, when he became professor of history at the university of Edinburgh 1894–9. He was a member of the Royal Commission for Ecclesiastical Discipline 1904–6. In 1899 he succeeded his brother Rowland (afterwards Lord Ernle) as editor of the *Quarterly Review*. He was also editor of the Cambridge Historical Series and co-editor of the *Cambridge Modern History*. During the World War he was head of the historical section of the British Foreign Office, and in that capacity attended the Peace Conference in Paris (1919). He was created K.B.E. in 1920. Amongst his publications are *Life and Times of Simon de Montfort* (1877), *Memoir of Henry Bradshaw* (1889), and various volumes of historical papers, as well as the *British History Reader* (1898).

PROTOPOPOV, ALEXANDER DMITRIEVICH (1864–1918), Russian statesman, was born in 1864 and educated in a military school. He served for some time in the army, but he soon left the service and went into business. As a big landowner of the Simbirsk province he took an active part in the Zemstvo life and was elected member of the executive board of the Simbirsk Zemstvo and marshal of the nobility of the Simbirsk province. In 1907 he was elected member of the third and subsequently of the fourth State Duma, where he joined the left wing of the Octobrist (Moderate Liberal) party. Later he became vice-president of the State Duma. The first unfavourable rumours with reference to him arose in connexion with an interview with Herr Max Warburg, the German financier at Stockholm. In March 1916 he visited the capitals of western Europe as one of the leaders of the Russian parliamentary delegation. On his return journey he privately met at Stockholm Herr Warburg, the head of the Scandinavian section of the German Committee on Food Supplies. The importance of the conversation was, however, greatly exaggerated by the press, and also by Protopopov himself. At the beginning of Oct. 1916 Protopopov was appointed, through the influence of the Emperor, Minister of the Interior, in succession to Khvostov, and thus entered the Sturmer Cabinet. A former leader of Liberals, he proved to be now the strongest upholder of reaction. He enforced the censorship with unexampled rigour, and his interference with the food-supply work of the Zemstvos and Towns Union created a serious danger to the activities of these organizations. At a stormy meeting held at the Duma he was asked by his political friends to resign his post, and when he refused to do so they struck his name off the list of members of the party. Hated by the Liberal circles and the Duma, Protopopov not only supported the reactionary policy of Sturmer and Prince Galitzin with the utmost energy, but he is said also to have been one of the secret organizers of the disturbances of Feb. 1917, which he proposed to suppress by military force, and which, unexpectedly for him, resulted in the overthrow of the Empire and of himself. He was arrested by the Provisional Government and committed for trial. He remained for many months in the Peter and Paul fortress and was executed by order of the Extraordinary Commission in Sept. 1918.

PROTOZOOLOGY (*see* 22. 479) is that branch of zoology which is concerned with the group of animals known as the Protozoa. It is not, as its name might seem to imply, a primitive form of zoology. As a science it is comparatively young, but, owing chiefly to the practical importance of some of the animals with which it deals, it had in 1921 already become one of the largest and most cultivated fields in biology. The Protozoa are very interesting animals, from both the practical and the theoretical standpoint. Nevertheless, they are all small, and most of them of microscopic dimensions. To the general public they are therefore invisible, and consequently unknown, except by the conspicuous results—such as diseases—which they occasionally produce. In common speech they are still nameless, though they are popularly included among "animalcules" and "microbes." But these are unscientific and unnatural groups, which comprise all microscopic creatures, both animals and plants; and consequently the Protozoa are still confused, in the popular mind, with other "microbes," such as the Bacteria, with which they have no connexion.

It will be evident that protozoology, as an independent science, must necessarily have arisen as a comparatively late offshoot of zoology. Its history is bound up with that of the microscope, an instrument which bears much the same relation to protozoology that the telescope does to astronomy. Before microscopes were invented no Protozoa could have been clearly visible. With the first lenses, the largest and most conspicuous of them were discovered; and as microscopes were improved, more and more minute creatures gradually became known. Out of the confusion of forms which the microscope has continued to reveal, the Protozoa have ultimately emerged as a well-defined group of animals, and, as a result, those who study these animals have slowly built up a new section of zoological science.

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As an individual science protozoology only became self-conscious at a quite recent period. The name itself, though already in use between 1870 and 1880, only became current after the opening of the 20th century—that is to say, within the memory of many living zoologists. But the science was really born—though not baptized—when the first Protozoa were discovered. This far-reaching discovery was made in the latter half of the 17th century. It was made by a man who was neither zoologist nor physician, but who occupied the humble position of chamberlain to the sheriffs of the little town of Delft, in Holland—Antony van Leeuwenhoek (1632–1723), an amateur microscopist, who studied at no university, nor under any of the great professors of his day, but whose title to fame rests upon the simple and honest application of his own native genius. This remarkable man made his own microscopes, lenses and all, and turned them upon almost every object which suggested itself to his quick imagination. In the course of his work he examined the water from the leaden gutters of his house, from the well in his courtyard, and also fresh rain-water, snow-water and "the water wherein pepper had lain infused." He found that all these liquids, and many others, were not clear and empty when viewed by the microscope, but teeming with living creatures. The discovery was promptly communicated by letter to the Royal Society in London, who published a part of it in the year 1677. Some of the animals which Leeuwenhoek here described can now be identified as Protozoa, and his letter may therefore be regarded as the first page in the history of protozoology.

Leeuwenhoek, the father of protozoology, himself studied and described many Protozoa. His observations were soon repeated and confirmed by others, notably by some of the early Fellows of the Royal Society and his fellow-countryman Huygens, the great astronomer. But for many years protozoology made little progress, and remained essentially what it was originally, an amusement rather than a science. Although many good observations were made and recorded, they were always disjointed, and often distorted by fancy and speculation. Many good zoologists regarded with doubt and misgiving everything seen with the microscope, an attitude of mind which has not quite disappeared even in these days of perfect instruments. Even the great Linnaeus (1707–1778), who attempted to catalogue and classify all animals and plants, and thereby founded modern systematic biology, never really overcame his suspicions sufficiently to incorporate the Protozoa firmly in his system. His mental attitude is shown in the name "*Chaos infusorium*," with which, in 1767, he dubbed a mixed lot of questionable protozoal organisms—the term *Chaos* itself having been suggested, no doubt, by Ovid's "*rudis indigestaque moles*."

But already at this period many workers were convinced that the Protozoa—or "Infusoria," as they were then called, from their occurrence in infusions—have a real existence. The once notorious John Hill (1716–1775), in the course of his journalistic, theatrical, medical, and botanical adventures, turned his attention to microscopes; and in 1752 he described and, for the first time, scientifically named, a number of Protozoa which he had seen in infusions. Up to this time writers had been content to call them by diminutives of the names of larger and more familiar creatures, or occasionally by names suggested by comparison with some common object. We thus find the early protozoologists describing their observations upon "little insects," "worms," "fishes," and even "reptiles," and upon "the slipper," "the sun," "the trumpet," "the gimlet," or "the bell animalcule." It was not until 1773 that a serious attempt was made to reduce the chaos to order by careful observation and description and classification of the "Infusoria." This notable work was done by the Danish naturalist, O. F. Müller (1730–1784); and his last book, published posthumously in 1786, is the first systematic treatise on protozoology. It is a remarkable work, full of shrewd observations, and showing astonishing insight, but containing, of course, many mistakes which were inevitable at that period. Many of the Protozoa described and sketched by Müller—mostly from observations made, as were those of Leeuwenhoek, with the aid of only a simple lens—are easily recognizable now by a protozoologist.

The circumstance that Müller was able to attempt a comprehensive systematic treatise on the Protozoa implies that a very considerable advance had taken place in biological thought since microscopic organisms were discovered. Many of the earlier workers, like the uneducated at the present day, believed in spontaneous generation. They believed, with Aristotle, that many "imperfect" animals were bred in mud, water, or decomposing matter; and so long as this view was tenable there was no reason why these misbegotten offspring of the superabundant vitality of the earth should display any particular constancy in their appearance or any fixity of form. Consequently, to attempt to describe and classify the "Infusoria" must have seemed a futile task to many men of science two hundred years ago. Spontaneous generation, as a scientific doctrine, was not really demolished by the admirable experiments of Redi (1668), as is often supposed, for he disproved it for only the larger and more obvious animals, such as insects; and the later discovery of microscopic organisms raised the whole problem once more, but presented it in a much more difficult form. It was Redi's countryman, Spallanzani, who, a hundred years later, extended his observations to microscopic animals, and showed by means of ingenious and exact experiments that the "Infusoria" spring from living antecedents, and live, grow, and multiply like larger creatures. Spallanzani helped to lay the foundations on which Müller built, though his own work was not firmly consolidated until, a century later, the last rivets were driven in by Pasteur and Tyndall.

In the latter half of the 18th century many minor contributions were made to protozoology, and although these were continued during the early part of the next century, no considerable advance was made until about 1830, when the Berlin zoologist, C. G. Ehrenberg (1795–1876), began to publish his researches. With amazing perseverance he studied, described, and named all the "Infusoria" that he could find: and as he pursued his investigations not only at home, but also in Egypt, Arabia, Siberia, and elsewhere, the forms which he discovered were not a few. His chief contribution to protozoology was published in 1838—a monumental folio volume of more than 550 pages, accompanied by an atlas of 64 coloured plates. This is still one of the classics of the science. It contained much that was new and much that was true, everything of note that his industrious reading could find in the works of his predecessors, and withal a mass of mistakes, to which he clung tenaciously—in spite of violent contradiction and criticism—to the end of his days.

Ehrenberg's most dangerous opponent was a Frenchman, Félix Dujardin (1801–1860). In 1841, with an octavo volume of some 680 pages, but only 23 plates, he undermined the foundations of the big folio, and thus overthrew, for all time, many of the favourite theories of his German antagonist. Dujardin's work is also a protozoological classic. Together with Ehrenberg's volume it marks the end of the old protozoology of the micrographers and the beginning of the new science as a special branch of zoology. Rarely does the modern worker, unless he be a historian, require to consult any earlier treatises than these.

Since the time of Dujardin only one really exhaustive work on the Protozoa as a whole has been written. This is the great monograph by O. Bütschli, of Heidelberg, published in 1880–9. It is significant of the vast modern development of protozoology that up to 1921 no work on a like scale, by a single individual, had been produced. It is now, indeed, impossible for any one man even to read all that has been written on the Protozoa, and the more recent workers have had perforce to devote their attention to some particular group of these organisms, or to some special branch of protozoology. To master a detail of the science is now the work of a lifetime. No one man could in 1921 claim to be an expert in all protozoology any more than in all mathematics or all chemistry. The territory already surveyed was so vast that the most he could hope to do was to cultivate his own small holding properly.

The Modern Science.—Since the middle of the 19th century biological theory and practice have undergone profound changes; and in more recent years protozoology, with the rest of zoology, has largely changed its character. This period has seen—to note but a few of its more striking developments—the establishment of the Theory of Organic Evolution, the rise of the Cell Theory, the foundation of Histology and Cytology, and the unfolding of Physiology and Embryology and Medicine as experimental sciences. Protozoology has been profoundly influenced by all these new growths, and has itself contributed not a little to them. An attempt has been made, and has already been partly successful, first, to discover all the Protozoa there are, both living and fossil; then to investigate their structure in the minutest detail, and to ascertain how they live and develop; and finally, to understand their relations to other organisms and their place in nature. Countless monographs have been written on individual species, on the larger and smaller groups into which these can be scientifically classified, on collections made all over the world, and upon the special physiological, medical, and other problems which the Protozoa, as a whole or in part, present. But we must content ourselves here with the merest sketch of the growth and status of modern protozoology.

Before proceeding, we must note some of the peculiar difficulties which differentiate protozoology from the rest of zoology. The animals with which it deals are, speaking generally, invisible to the naked eye. Consequently, they cannot be studied and anatomized by ordinary methods. The protozoologist has first to become a master in the use of the microscope, and to learn its limitations as an instrument of research. When he

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has become proficient he must learn or devise methods for catching, watching, breeding and preserving those Protozoa that he wishes to study, and must thus become familiar with a peculiar and varied technique adapted to the investigation of the lives and habits of animals invisible to the unaided eye. He must then acquire the power of correctly interpreting what he sees under these peculiar conditions. If he is an efficient microscopist and a good observer, endowed with abundant patience and ingenuity, and if, at the same time, he is a good zoologist and sound philosopher, then, with experience and diligence, he may hope some day to become a good protozoologist. From the very nature of the subject, therefore, it will be obvious that it is easier to make mistakes in protozoology than in most other branches of zoology; and there can be little doubt that the writings on the Protozoa, taken as a whole, contain a larger percentage of error than those on any other group of animals. Protozoology is, indeed, still in its infancy, and learning slowly and painfully by the method of making mistakes.

Protozoology, like most other sciences, is important from two different standpoints, which may be called the theoretical and the practical. On the theoretical side we have to consider its relations to the rest of zoology, and the value of its contributions to biological philosophy; on the other side, we must consider the utility of its practical applications, which are chiefly medical. In other words, we must look at protozoology as a pure science and as an applied science. It is necessary to distinguish these two aspects, although they are inextricably blended in reality. Protozoology was actually applied in medicine before it was ready; and this led not only to great confusion but almost to the severance of Medical Protozoology from the rest of the science. But progress on the medical side has now reacted beneficially upon the pure science, by bringing to light many new facts and setting many new problems.

The Pure Science.—The theoretical importance of protozoology is not what it appeared to be fifty years ago. It has not fulfilled some of the high hopes then entertained for its future. In the earlier period the writer of an article such as this would have begun, in all probability, by declaring that the study of the Protozoa would lead to the solution of most of the outstanding general problems of biology. He would have pointed out that these animals were of the greatest importance in connexion with the two chief biological generalizations of his time—the Cell Theory and the Evolution Theory—and he would probably have ended by saying that it was only lack of detailed knowledge which prevented protozoology from answering most of the fundamental questions of biology. Yet we have now an abundance of the sort of information then regarded as requisite, and the great problems are still, for the most part, where they were. It is both interesting and instructive to inquire how this has come about.

The cell theory was first definitely formulated, in Germany, by Schleiden (1838) and Schwann (1839), and was modelled into its modern form by Max Schultze (1861): that is to say, it took shape at the time of the reformation of protozoology by Ehrenberg and Dujardin, when the science was still feeling for a foothold. According to the cell doctrine, all organisms, both animals and plants, are built up of structural units, called "cells," in much the same way as a house is built of bricks. Schultze defined "a cell" as "a little lump of protoplasm with a nucleus inside it," and this definition was generally accepted. It should be noted that this proposition, so far as the larger animals and plants are concerned, is not a "theory" at all, but a statement of fact easily verifiable by means of the microscope. The body of a rabbit or a cabbage is, for the most part, actually composed of "cells" as conceived in the definition. The "theory" was introduced when the proposition was held to apply to all organisms at all stages in their development. Dujardin had shown that the Protozoa are soft-bodied animals composed of "sarcode"—the "protoplasm" of later workers—in which no constituent "cells" are discernible. Like "cells" Protozoa contain "nuclei," but, unlike the large animals, they show no internal differentiation into cellular units. It was thus necessary to introduce some new conception if the cell theory was to become universally applicable.

The extension of the theory, so as to enable it to include the Protozoa, was made by von Siebold. Each individual protozoon, he said, is itself a "cell." It is comparable with a single one of the innumerable units of which the bodies of large animals are built. The Protozoa are "unicellular" animals, all others "multicellular." According to this doctrine, therefore, a protozoon is not comparable, as an individual, with a whole multicellular animal, but with one of the cells in its body: or, the other way about, a multicellular animal is not an individual of the same sort as a protozoon, but a colony of such individuals.

This conception appeared so plausible—owing, it must be supposed, to the backward state of protozoology and cytology at that date—that it found ready acceptance; and, in spite of the cogent objections which have been raised against it by Huxley (1853), Whitman (1893), Sedgwick (1894), Dobell (1911), and others, it has prevailed down to the present day. The cell theory is still taught to almost every beginner in biology. He is still told that he is not an individual, but a community of individuals; and that the protozoon, which he can see with his own eyes leading an individual existence, is not an individual—such as he believed himself to be—but the equivalent of one little bit of his body.

When the cell theory was being founded, another great biological generalization was just emerging—the doctrine of Organic Evolution. Charles Darwin's great work, which appeared in 1859, created a revolution in biological thinking. Although Darwin's own work, and his statement of the theory, appear to be unexceptionable, the doctrine miscalled "Darwinism" developed along extravagant lines—chiefly, as is now evident, owing to the wild speculations and dominating influence of E. Haeckel and other German writers. The "cell theory" was immediately subpoenaed to give evidence for these "Darwinists." They wrongly believed that the evolution theory required the presence of some "most primitive" and "elementary" animals—from which all the "higher" forms had been derived—on the earth at the present day; and the shaky syllables let fall by the cell theory were eagerly seized upon, interpreted, and ultimately incorporated as incontrovertible facts in the case of the "Evolutionists." "Unicellular" organisms—such as the Protozoa—thus became the starting-point of evolutionary speculations. The Protozoa were obviously the "simplest" animals, since less was known about them than about the others; and they were clearly the "most elementary," each individual representing but one of the structural elements of which the others were composed. Their insignificant size made them the "lowest" forms on earth, and their position—according to the "theory"—at the bottom of the "*Scala Naturae*," made them the "most primitive." It thus became easy to show, by specious arguments and "question-begging epithets," that protozoology occupied a position of fundamental importance in biology. By studying the Protozoa the earliest stages in evolution would be revealed. The beginnings of life would be laid bare. Physiology and morphology would appear in their elemental forms, stripped of all confusing detail. And optimists were not wanting who divined that, by higher and still higher powers of the microscope, Nature's inmost secrets—such as the origin of life itself—would be divulged.

These fantastic dreams have been slowly dispelled by the "dry light" of reason. It has become clear that protozoology was placed in a false position by the devotees of the cell doctrine and the dogmatic evolutionists. Let us look at the fundamental conception of the "unicellularity" of the Protozoa from another angle, and see how it appears in the light of modern knowledge.

In the first place, it is clear that the Protozoa cannot properly be described as "unicellular." Every protozoal animal has an independent existence. It has its own peculiar structure, exercises its own proper functions, leads its own life—often, indeed, a very complex one. As an animal it is, from every standpoint, as much an "individual" as a man is. One protozoon is one whole animal, just as one man is one whole animal. From the

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standpoint of common sense, no less than from that of modern zoology, the whole organism is the unit of individuality. But when we examine a protozoon under the microscope we still see—as Dujardin saw—that its body is not differentiated internally into cells, as is that of a man. Its body is often surprisingly complex in structure, but it is never composed of cells. It is clear, therefore, that we can contrast the body of a man with that of a protozoon by saying that the one is cellular in structure, the other *non-cellular*. To call it "unicellular," and thus compare one whole animal with a minute differentiated fraction of another, is obviously absurd. It is as though a man who had only seen houses built of bricks were suddenly to encounter one constructed, all of a piece, of concrete; and then, being unable to find the familiar individual bricks in its fabric, were to declare that the concrete house is not a house—in the sense that the brick house is—but one large and peculiarly modified brick.

When once it is realized that the Protozoa are not, in any sense, "elementary" or "unicellular" animals, but a group of peculiarly constructed creatures, adapted in a special way to particular conditions of life, then it will also be realized that we have no reasons—apart from preconceived ideas derived from unsound generalizations—for believing that they represent "primitive" or "first" forms of life. That they are not "simple" we now know. It is true that they display, on the whole, less visible structural differentiation than most of the larger animals; but physiologically they are very complex. That they are able to perform all the chief functions of "higher" animals, but with fewer instruments, does not make their mechanism easier to understand; and it is thus hardly conceivable that the Protozoa can ever offer us the easiest way of approach to physiological problems. They offer us, indeed, the most difficult field in animal physiology, owing to their microscopic size and *apparent* simplicity of structure. As a great physiologist has well said: "Experience and reflection have shown me that, after all, the physiological world is wise in spending its strength on the study of the higher animals. And for the simple reason that in these, everything being so much more highly differentiated, the clews of the tangles come, so to speak, much more often to the surface, and may be picked up much more readily" (Michael Foster). Attempts to found a "general physiology" on the Protozoa as "cells" and "elements" are doomed to failure, for they are based upon an unsound philosophy; and the speculative and deductive efforts in this direction—such as that of Verworn in Germany—have slowly given way before the experimental and inductive methods of Jennings and others in America and elsewhere.

As a point of historic interest, it may be noted that the father of protozoology and his immediate followers had none of the extravagant later notions regarding the "unicellular" and "elementary" nature of the Protozoa. For Leeuwenhoek the Protozoa were animals like any other animals, but delightfully and marvellously little; and he thus saw more clearly and naturally than many of his later successors.

There are probably few biologists who now cherish any hopes of seeing the fundamental problems of biology solved by the study of the Protozoa, though the majority still speak and write in the optimistic language of last century. For these mental survivals there is a psychological basis, which seems worth noting before we go on to consider the true status and value of protozoology. There is a curious disposition, apparently inherent in the human mind, to suppose that by studying the most minute creatures we can come nearer to first principles. And it is the same with the study of the larger organisms. As the cytologist probes into the structure of an animal with higher and still higher powers of the microscope, he feels that he is gradually "getting to the bottom" of his problems. He feels that when his microscope has resolved the larger animals into their smallest component parts, and has revealed every detail of the smallest living thing, he will be face to face with fundamentals. It does not require much thought to realize that this is a fallacy. The deeper we delve, the more detail we discover. But it is all of the same sort: we add to the quantity and not to the quality of our knowledge. With the highest possible magnification we shall obtain no information which is qualitatively or fundamentally different from that to be derived from the study of large organisms, and their gross anatomy, with the naked eye.

The mental bias just mentioned seems to be responsible for many popular—and not a few "scientific"—notions about the Protozoa. It appears, for example, to be at the back of the unreasonable but common belief that the Protozoa are "elementary" and "primitive" animals. Although few biologists now believe in spontaneous generation, yet many are able to believe that living things must have been spontaneously generated from lifeless matter in the past; and to those who hold this belief it still appears self-evident that the organisms so generated were microscopic. Consequently, these biologists feel that the Protozoa must, in some way, be nearer than other animals to "the beginnings of life," and they find no difficulty in conceiving that the first animals were "Protozoa." In the same way, when these same biologists come to consider evolution, and the relations of living animals to one another, they find in the Protozoa the easiest starting-point for their speculations. The Protozoa are "the simplest" animals, and the human mind works most readily from simple to complex conceptions. Consequently, evolution is pictured as necessarily moving in the same direction—the simply constructed creatures coming first, and the complex developing from them. But it is surely a poor philosophy which would constrain Nature to order her infinite events in that particular sequence in which thoughts happen to follow one another most easily in the mind of man.

What, then, it may be asked, is the theoretical interest or value of protozoology? Clearly it is this. Biological theory is sound in proportion to the truth of its generalizations. When all the facts are known about all animals and plants, we shall be able to make true general propositions about them. Before we know the facts our generalizations can be but partial and premature—more or less lucky guesses, based upon incomplete knowledge. All biological theory is at present in this condition and therefore the careful study of any animal or group of animals—such as the Protozoa—will, if it yields new facts for generalization, be valuable ultimately as a contribution to biology. At present we cannot hope to do much more than collect facts, by means of accurate observation and apposite experiment. When we have collected and critically analyzed them, we can sometimes make tentative generalizations of a lesser order. But the larger and truer generalizations will come later.

It may be said that if this is all that can be expected from protozoology, then it is no more important than any other branch of zoology: there is no reason why we should study the Protozoa rather than any other group of animals. All this is quite true and reasonable; but there is also a reason why protozoology is likely to yield results of particular interest. The Protozoa are a group of animals organized on a different principle from the rest. They are, as we have just seen, non-cellular animals with peculiar lives and habits. Structurally and functionally they differ, in many ways, from all other animals. Now all the chief biological generalizations—almost all general propositions relating to such phenomena as birth, growth, development, sex, reproduction, heredity, variation, and death—have been derived from observations made upon the larger multicellular animals. When general ideas were formulated on such subjects the Protozoa were practically left out of account. When the more important facts about the Protozoa are firmly established, we shall be able to recast many of our biological theorems in a more satisfactory form. The Protozoa offer us, in other words, a new world of animals for generalization, and a new standpoint from which to survey our old-world zoological knowledge. The discovery of the Protozoa was to zoology what the discovery of America was to geography. But we are still, in protozoology, in the 16th century. For our knowledge of the new world we must still depend upon travellers' tales, upon reports of things ill-observed and misunderstood, marvels and myths and mysteries. But some day we shall have accurate and faithful records, and then protozoology will come

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into its own. As yet we are hardly on the threshold of the new biology, but for those who delight in the destruction of error and the advancement of true learning, the protozoological prospect is already full of hope.

The Applied Science.—The chief practical applications of protozoology are to medicine. Certain of the Protozoa live as parasites in the bodies of men and animals, and thereby cause diseases. Some of these are so important that they are widely known—for example, malaria and sleeping sickness—and the elucidation of such diseases is one of the most interesting and recent chapters in biology. Protozoology also has certain applications to agricultural science, because many Protozoa inhabit the soil, but their value is still doubtful.

The founder of protozoology was the first to find Protozoa inhabiting the living bodies of other and larger animals. In 1681 he described one such "animalcule" which was living in his own intestine. In 1683 he described and depicted others from the intestine of the frog. All these are recognizable, with fair certainty, at the present day. Leeuwenhoek did not suggest that these "parasites" were in any way concerned in the causation of disease, and it is probable, indeed, that the forms which he observed are not. But already at that date the "microbe" theory of disease-production was in existence, for it was guessed at long before any "microbes" were discovered; and consequently we find that, even in Leeuwenhoek's lifetime, the suggestion was put forward that his "little animals" might be the "causes" of certain disorders. We find, for example, an early fellow of the Royal Society remarking, in 1683, of a "murren" which had raged among the cattle in central Europe, and of which the cause was undiscovered: "I wish Mr. *Leewenkoeck* had been present at some of the *dissections* of these infected *Animals*, I am perswaded He would have discovered some strange *Insect* or other in them." Mr. Leeuwenhoek's successors have, on many a like occasion, fulfilled the expectations of "the ingenious Fred. Slare, M.D., and F.R.S.," but his "strange insects" they now call "Protozoa" or "Bacteria."

From the time of Leeuwenhoek to the present day the parasitic Protozoa have been studied with increasing attention. Their relation to diseases has been gradually elucidated, though we are still very far from finality in our knowledge of this absorbingly interesting subject. The history of our knowledge is long, and the discoveries have followed devious ways—too devious and intricate to be more than touched upon here.

Our knowledge of protozoal diseases—diseases colloquially said to be "caused" by protozoal parasites—really begins as recently as the middle of the 19th century, when Louis Pasteur (1822–1895) began his researches on a disease of silkworms called *pébrine*. Applying to the investigation of this disease the genius which stamps his work on "microbes" generally, Pasteur first discovered its causes, and then deduced methods for its prevention. The "cause" he found to be a microscopic parasite, now called *Nosema bombycis* and classified among the Protozoa. Although Pasteur did not know that the parasite was a protozoon, his work on *pébrine* and other microbic diseases was of fundamental importance for protozoology, because it demonstrated the *methods* by which such diseases can be studied and elucidated. Pasteur's scientific principles were impeccable, and equalled only by his own practical applications of them. It is common knowledge that he founded modern bacteriology; but in so doing he also laid the foundations of medical protozoology. To the casual reader it may seem strange that the study of silkworms can have any bearing upon medicine, or could in any way contribute towards the alleviation of human suffering. But there was another practical result of Pasteur's work which everyone will immediately appreciate, since it can be expressed in pounds, shillings and pence. Before *pébrine* attacked the silkworms of France the silk industry yielded an annual revenue of 130,000,000 francs to the State. After the disease had raged for a dozen years the revenue had fallen to 8,000,000, and the industry was on the brink of ruin. To have discovered the causes of the disease, and to have devised, as a direct consequence, means for its control, and, as a further consequence of this, to have rehabilitated the whole silk industry—these are practical results which everyone can understand. And one has but to remember that protozoal diseases may affect man himself and his larger domesticated animals—not merely silkworms—to realize the practical possibilities of protozoology.

Towards the close of the 19th century medical protozoology became linked up with another branch of zoology—entomology, the science which deals with insects. This connexion has nothing to do with the silkworms just mentioned, but arose through the discovery of the part played by certain other insects in the causation of protozoal diseases. The discoveries in this field began, once more, with the investigation of a disease of domesticated animals; but the pioneer was not, in this case, the Frenchman Pasteur, but the Scotsman David Bruce. His work is of such importance that we must notice it at this point.

The Work of Bruce.—Some parts of Africa are the home of certain large blood-sucking flies called "tsetse." The "Fly Country" is uninhabitable except for wild animals; and long before its full significance was understood, the fly itself was recognized as a serious obstacle to the opening-up of Central Africa. Livingstone, the greatest of all African explorers, was so impressed with the fly's importance in this connexion that he put a vignette of a tsetse on the title-page of his *Missionary Travels* (1st ed., 1857). Live stock taken into the "Fly Country" rapidly succumbs to a disease which is called "nagana" in Zululand, where Bruce's original investigations were made. The disease was also called "tsetse-fly disease," since it was believed by the European settlers to be caused by the bite of the fly. The natives believed, however, that it was "caused by the presence of large game, the wild animals in some way contaminating the grass or drinking-water."

Bruce began his work in Zululand—after an abortive attempt in 1894—in Sept. 1895 (the month of Pasteur's death). His full report on his researches is dated May 1896. In this almost incredibly short space of time he demonstrated that nagana is caused by a protozoal blood-parasite—since named *Trypanosoma brucei*, after its discoverer; that the parasite lives normally in the blood of big game, without harming them; and that it is conveyed from animal to animal by the tsetse. When the fly sucks the blood of an infected animal it becomes itself infected with the trypanosomes, which are subsequently re-inoculated into other animals by the fly when it sucks their blood. If these other animals are domestic stock, such as oxen or horses, they become infected with trypanosomes, contract nagana, and die. If they are wild game, such as antelopes, they also become infected, but develop no disease. In nature the trypanosome lives in the game and the flies alternately, the fly acting as an intermediary in the spread of infection from antelope to antelope. The big game—indigenous in the country—are habituated to and proof against the infection; domestic animals—foreigners, introduced by man—are not, and when infected usually die.

Bruce thus succeeded in extracting elements of truth from both the European and the native beliefs, and was able to combine them into a true theory of the causation of nagana. At the same time he threw a flood of light on many other protozoal diseases, and suggested all sorts of possibilities concerning their causation and prevention. He forged new links between protozoology and medicine and between entomology and protozoology. It is true there were other lights and other links before. Trypanosomes were known, and known to cause diseases, before Bruce went to Zululand. Timothy Lewis and Griffith Evans had observed similar parasites in India more than a decade earlier; and Theobald Smith and Kilborne, in America, had demonstrated in 1893 that the disease of cattle known as "Texas fever"—a disease also caused by a blood-inhabiting protozoal parasite—is transmitted from beast to beast by the agency of ticks. But Bruce's work was solid, complete, and demonstrative. By clean experiments and right reasoning he contributed more to science in a few months than hundreds who have followed up his work have since been able to contribute in many years. In work of this sort it is the quality, not the quantity, that counts. Later researches have but served to enhance the

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magnitude and difficulty of the problem which confronted Bruce in 1895; and to find a just parallel to the masterly manner in which he solved it, we must go back to Pasteur. There is, indeed, the same simplicity, the same directness, the same insight in the work of both these men. Their works are enduring demonstrations of the method of science: they are a delight to read, and illustrate on every page the favourite maxim of Boerhaave: *Simplex sigillum veri.*

The following-up of Bruce's discoveries and the working-out of details and consequences have led to the accumulation of an immense amount of new knowledge—protozoological, entomological, and medical. We can do no more than mention it here. We must, however, notice one of the first-fruits of his labours—the application of his results to the study of human diseases. This application was made mainly by Bruce himself. A few years after he had done his great work on nagana he attacked the problem of sleeping sickness, a human disease which has depopulated large areas of Central Africa. Bruce and his collaborators were able to show that this disease is similar to nagana. It is likewise caused by a trypanosome, which is conveyed to man by the bite of a tsetse-fly, and which is capable of living in other animals. In this case the parasite had been previously seen by Forde and Dutton, and by Castellani. But its relation to human disease and the part played by the tsetse in its transmission were first clearly demonstrated through the work of Bruce.

Malaria and Other Diseases.—We must now notice another disease, which is known by name to all—malaria, " the scourge of the tropics." This disease, as we now know, is also carried from man to man by the agency of a blood-sucking fly—in this case a mosquito, and it is also caused by a blood-inhabiting protozoal parasite, though it is one very different from that which causes nagana. Moreover, this parasite lives in men and mosquitoes only. After undergoing a peculiar development in the blood of a human being, it is sucked up with his blood by a mosquito when it feeds upon him. Provided that the mosquito is of the right sort, the parasites in the blood—if they are in the proper stage of development—undergo further remarkable changes in the mosquito's body. Thereafter the mosquito is able to infect other men with the parasites, which it injects into their blood in the process of sucking. And so the life of the parasite continues.

The foregoing is the briefest synopsis of a very complicated story, in which almost every event has been worked out in great detail. Hundreds have contributed to this work, though some of them can hardly be said to have coöperated in it. Indeed, such bitter fights have taken place among them that it has now become almost impossible to mention the names of some workers without offending others. The history of these discoveries would give an unpleasant shock to anybody simple enough to believe that men of science always labour for truth and the advancement of knowledge rather than for fame and personal gain. Fortunately the names of the leading discoverers are now known to almost everybody, and their individual achievements are no longer in dispute. Even the " general reader " is familiar with the name of Laveran, the great Frenchman who, in 1880, discovered the malarial parasites in human blood; of Patrick Manson, the founder of modern tropical medicine, who divined, in 1894, the part played by the mosquito; of Ronald Ross, who, inspired by Manson, first worked out in 1898 the complete development of the malarial parasite of birds, and thus solved the general problem; and of Grassi and his fellow-workers in Italy, who immediately confirmed Ross's work and extended and successfully applied his results to the study of malaria in man. When the 19th century ended the story was almost complete.

It will be evident that malaria, nagana, and similar diseases are not purely protozoological problems. It will also be obvious that such diseases might be stamped out and prevented by attacking either the protozoal parasites which " cause " them, or the insects which transmit them, though there could have been but little hope of success in coping with such diseases before the life-histories of the parasites were discovered. When protozoology, entomology and medicine have solved their respective parts of such problems, then many tropical regions which are now forbidden ground will become habitable for man and beast. The practical importance of protozoology in cases such as these is self-evident. The facts speak for themselves.

Malaria is a far commoner disease than nagana, and the discoveries relating to it have therefore made a far wider appeal to the public. It intrigues the public to hear that there would still be no Panama Canal but for the great discoveries in connexion with malaria. It would excite them but little to hear that some obscure tribe of Zulus could now keep cattle in places where it was previously impossible. But the advancement of science is not measured in such terms, and science values most highly those who discover and enunciate new principles. Already we can observe that the problems presented by nagana and malaria are similar, and that most of the generalizations which their solution can give us are, indeed, the same. We can see, too, that history, in the end, is generally just. Consequently, we may hazard a guess that in years to come the historian of science, in his impartial search for beginnings and great names, will not fail to note the sequence of the discoveries which we have just considered, and will apportion his praise accordingly.

The World War Period.—Medical protozoology, like many another branch of science, received a powerful stimulus from the World War of 1914–8. Not only was much of the previously acquired knowledge put into practice, but this practical application in turn revealed or emphasized the gaps, defects, and errors in many current conceptions, and so led ultimately to the prosecution of new researches and the acquisition of much new knowledge. Surveyed from the most general standpoint, the war appears to have taught us little that was new regarding malaria and the other protozoal diseases already mentioned. Its chief protozoological contribution has been to our knowledge of those Protozoa which live in the human intestine, and more especially to the elucidation of the disease called amoebic dysentery. We may therefore say a few words on this subject at this point.

The Protozoa known as " amoebae " form a large and interesting group. Most of the species live independently in such places as ponds, ditches, or the soil; but some of them live in the bodies of other animals, and one of them—called *Entamoeba histolytica*—was already known before the war to live in the human bowel and " cause " amoebic dysentery. The parasite was discovered by Lösch in Russia as long ago as 1875. Its real relation to dysentery, however, was not made clear, though much debated, until just before the war, when the admirable researches of two American workers in the Philippine Islands—E. L. Walker and A. W. Sellards—were published. During the war their results have been confirmed and greatly extended, chiefly by the investigations of British workers. As a consequence, we now know as much about amoebic dysentery as we do about malaria or the diseases due to trypanosomes. There are several points here which are worthy of mention.

We now know that no less than five different species of amoebae may live in the intestine of man, though only one of these—the " dysentery amoeba " already mentioned—ever does him any harm. Moreover, we now know also that amoebic dysentery is a comparatively rare disease. There are many different kinds of dysentery, and the kind due to amoebae is far from being the commonest. Before the war amoebic dysentery was generally recognized as a disease more or less restricted to the tropics, though certain other kinds of dysentery occur all over the world. The curious fact brought into prominence by the war is that the dysentery amoeba itself is very common almost everywhere. This parasite, which can cause, by its presence in the bowel, a violent and sometimes fatal form of dysentery, usually does no such thing. Very many people, in all parts of the world, are infected with it, but very few ever suffer any appreciable harm from its presence. The parasite and the person who harbours it are usually suited to one another in such a way that they can live together comfortably, oblivious of the existence of one another. There are, for instance, in the British Isles at this moment many thousands of people who are

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heavily infected with these disease-producing parasites, and yet enjoying perfect health.

Another curious feature of amoebic dysentery is the circumstance that it cannot be contracted from a person suffering from the disease. The people responsible for the spread of infection are those who harbour the parasite but themselves suffer no ill consequences from its presence. The explanation of these seemingly contradictory facts is really quite simple, now that we know the life-history of the amoeba and its relation to disease. It is a popular fallacy to suppose that any parasite is the sole "cause" of any disease. A disease is a joint result of many antecedent factors, and in the present case it would probably be nearer the truth to say that the person who harbours the amoeba, rather than the amoeba itself, is the "cause" of amoebic dysentery. For dysentery results only when the infected person happens to be abnormally sensitive to infection with the amoeba, and the condition is as harmful to the parasite as it is to the patient. Normally man and amoeba fit one another, and there is no trouble. Abnormally there is a misfit, and amoebic dysentery is the consequence. The disease is really an unimportant side-show in the life-history of the parasite, the result of its being planted in unsuitable soil.

The foregoing considerations will serve to show once more the value of protozoology in the study of human diseases. What hope could there ever be of eradicating a disease such as amoebic dysentery if we remained in ignorance of the life-history of the parasites connected with it? We might cure every case of the disease—we might conceivably prevent the death of every patient who contracted it; but even if we did, it is now clear that this would have no effect whatever upon the continuance and prevalence of the disease itself. Such procedure could not possibly stamp out amoebic dysentery, or even reduce by one the annual number of cases of this disorder. This is not to say that protozoology has yet enabled us to do either of these things; but it has enabled us to formulate the problem correctly, and has shown the uselessness of expending our energies in wrong directions. Greater results will follow when our knowledge is greater and more properly and consistently applied.

It has been supposed for so long that the parasites which produce protozoal diseases are peculiar to tropical or subtropical countries that the discovery of the dysentery amoeba in Britain may seem surprising. It is really not so surprising as the circumstance that nobody, until quite recently, had thought of looking for it here. And there are many equally remarkable parallels. To mention only those diseases and parasites which we have already noted, we can now say that malaria occurs indigenously in Britain—though this was hardly suspected until recently; and that parasites closely similar to those which cause nagana and Texas fever have now been discovered in the sheep and cattle of the United Kingdom. How far these observations are of practical importance the future will show, but already they clearly indicate that protozoology may be studied with profit at home no less than abroad.

Organization and Training of Workers.—In conclusion, we shall now note very briefly what has already been done for the promotion of protozoology as a branch of science.

As a profession it still hardly exists. Most of those who have enlarged the science have been zoologists or medical men engaged in teaching other subjects and in practising their professions. Many great discoveries have been made by men who cannot be described as protozoologists. But the science has now become so vast, from the amassing of myriads of complicated details, that it can no longer be regarded as an occupation for anyone but a highly trained specialist. The amateur toying with his microscope, the ordinary zoologist or physician working in occasional vacations or leisure hours snatched from practice, can no longer expect to make any solid contributions to protozoology. In future all great advances in knowledge must come from those who are bred up as protozoologists—who not only have the necessary physical and mental gifts for this most difficult study, but who also are prepared to devote their lives and energies to it, and to it alone.

Modern science has already developed to such unwieldy proportions that it has ceased to be coherent and has burst asunder into separate segments. The day of the "scientist," with all science for his province, is gone for ever. If men of science are to escape the fate of the builders of the Tower of Babel, it can only be by conscious coöperation. Each worker must do his own special work, but must do it with due regard for his fellow-labourers in adjoining sections, and with the plan of the whole building constantly before his eyes. Protozoology must, accordingly, develop along its own lines and by the labour of protozoologists, but it must remain in touch with the rest of zoology and with medicine and with all other sciences whose collaboration is likely to be mutually beneficial. We can already observe the bad effects of non-collaboration in the modern school of protozoology which originated with Fritz Schaudinn in Berlin. Over-specialization has there led—after beginning on an admirable foundation of fact—to fantastic speculation and the promulgation of doctrines which are biologically unsound.

One of the good results of the World War was to encourage the collaboration of workers in different branches of science, and in Britain the bonds which previously existed between protozoology and medicine have been greatly strengthened. One of the most obvious conditions necessary for the continuance of this alliance is the growth of protozoology itself. Unless the protozoologists can build solidly, and not too slowly, they will lose their advantages. Unfortunately, no adequate provision has yet been made for the training of workers in protozoology. At present there are in Britain and elsewhere few first-rate professional protozoologists and few competent teachers, but a large number of day labourers and dabblers from other sciences. Protozoologists are still mainly recruited from other professions. The remedy for this state of affairs will be found only when protozoology is recognized as a separate science—an occupation for specialists and not for smatterers; and when encouragement is given to its development by the founding of professorships in the subject—or similar appointments—in the larger universities. These professorships must be primarily for research, and secondarily for teaching purposes. The professor must have ample time and funds for teaching himself, and for carrying out his own researches. If he is sufficiently gifted to do both these things, he will be able at the same time to teach his science to others who would follow in his footsteps. But the time has now gone when the junior demonstrator in zoology or the lecturer on general parasitology in the medical schools can expect to "take up" protozoology for a term or two and thereby profit science or himself. Unfortunately, too little had been done up to 1921 to create the necessary facilities.

A professorship in the subject, founded on the right lines, was indeed instituted in London University some years ago, but it had remained unoccupied up to 1921 since the death of its first holder in 1915. At Cambridge the Quick professorship of biology, founded later, at one time appeared likely to develop into a chair of protozoology, but these hopes were not fulfilled. An assistant professorship, chiefly devoted to protozoology, recently existed in the Imperial College of Science in London; but no further appointment was made to this post after it was vacated by its first occupant. The medical schools of Great Britain have, in some instances, lecturers in protozoology, but these are mostly medical men with other work to perform and no special knowledge of the science as a whole. The schools of tropical medicine in London and Liverpool have been more fortunate, and have been able to appoint to their staffs protozoologists who can devote their undivided attention to the subject. But here again it is chiefly the practical side of the science, as applied to medicine, that is being fostered. Rothamsted Experimental Station has a protozoologist to study the subject in its agricultural aspects, and several universities and other institutions of minor importance have members who have specialized in protozoology. Veterinary medicine in Great Britain has, however, still done little for research or instruction in protozoology.

In the British colonies and dependencies things are no better. A chair of protozoology has recently been created in India;

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but as a general rule protozoological research and teaching are still being carried out under unfavourable conditions by hard-worked professors of other subjects. The valuable work already done by many of these men is surely a sufficient pledge of the profits that will accrue when more adequate provisions are made.

If we turn to the United States we find that Columbia University has a professor of protozoology and Johns Hopkins an assistant professor. There is also an American professor of protozoology in the Philippines. But with these exceptions, and a few of lesser importance, protozoology is advancing in America and elsewhere by the labours of zoologists and medical men whose appointments were not primarily established for the furtherance of the science.

RECENT LITERATURE.—The most trustworthy of recent books dealing with the Protozoa as a whole are those of E. A. Minchin, *An Introduction to the Study of the Protozoa* (1912), and F. Doflein, *Lehrbuch der Protozoenkunde* (4th ed., Jena, 1916). See also D. Bruce and others (1903–1919), *Reports of the Sleeping Sickness Commission*, i.–xvii. (Royal Society, London); C. Dobell (1911), "The Principles of Protistology" (*Arch. f. Protistenkunde*, vol. xxiii., p. 269); C. Dobell and others (1921), *A Report on the Occurrence of Intestinal Protozoa in the Inhabitants of Britain* (Medical Research Council, Special Report Series, No. 59, London); C. Dobell and F. W. O'Connor (1921), *The Intestinal Protozoa of Man* (London); S. P. James (1920), *Malaria at Home and Abroad* (London); H. S. Jennings (1906), *Behavior of the Lower Organisms* (New York); A. Laveran and F. Mesnil (1912), *Trypanosomes et Trypanosomiases* (2 ed. Paris); E. L. Walker and A. W. Sellards (1913), "Experimental Entamoebic Dysentery," *Philippine Journ. Sci.* (B. Trop. Med., vol. viii., p. 253). (C. Do.)

PRYOR, ROGER ATKINSON (1828–1919), American jurist and politician (*see* 22.533*), died in New York City March 14 1919. In 1912 he published a volume of *Essays and Addresses*.

PRZEMYSL, SIEGES OF, 1914–5.—The Galician town of Przemysl (*see* 22.534) was first fortified in 1854, when Austria mobilized against Russia. The completely exposed position of the N.E. frontier made it imperative to lay out fortifications. The Archduke Charles had already, in 1824, called attention to this weak point. In case of an invasion of East Galicia by the Russians, the first natural obstacle capable of bringing them to a halt would be the river beds of the lower San and the Dniester, and the obvious thing to do was to strengthen this line by constructing a series of fortifications. On the San it was originally intended to build out Jaroslau as a fortress, but the decision in 1854 fell on Przemysl. In later years a row of smaller bridge-heads and *points d'appui* arose along the Dniester, which greatly increased its value as an obstacle. In the course of one year a fortified ring of no less than 65 forts had been erected round the town of Przemysl. The year 1870 saw the building of a permanent ring of forts finished, but the works were not a match for a bombardment by modern siege guns, owing to the very niggardly expenditure sanctioned. Although after 1888, and in the last years before the World War, the modernization of the fortress from a technical standpoint was begun and some modern self-contained forts were constructed, it was in 1914 still in a very unsatisfactory condition. The short time available for equipment between the first days of mobilization and the first siege by the Russians was indeed spent in feverish activity, but only a very small part of the neglect of the past 10 years could now be made good. The works on the ring of forts, which was 48 km. in circumference, were more or less out of date. Only 12 of them could be considered "bombproof," while all the rest were only "shellproof," and even so only against 24-cm. bombs and 15-cm. shells of old-fashioned construction. The *points d'appui* for the infantry and the battery emplacements lying between the forts were almost without exception only splinterproof shelters, and some were mere field fortifications constructed of wood and earth. The infantry line running through these was protected by wire obstacles, generally only three rows deep. In front of the line of the ring of forts one enormous task had to be undertaken in preparing for the defence—the clearing of the foreground. No less than 18 villages and from 7 to 8 km. of forest were levelled to the ground. Numerous barracks, ammunition magazines, communications, bridges and other buildings, had still to be erected within the ring. The armament of the fortress was also on a very low footing, consisting of about 1,000 guns in all, of which more than half were short-range weapons for ditch defence, and in *traditores*. These were 12- and 15-cm. cannon dating from 1861, 15-cm. mortars dating from the 'eighties, and 8-cm. cupola, disappearing cupola, and minimum port guns of old construction. About 450 of the guns were distant defence guns, being for the most part old 9-cm. field guns (M 75/96) with a range of only 6 km. Of modern guns the fortress at the beginning of the war had altogether only four 30.5-cm. mortars, with a range of 9·5 km., and 24 8-cm. field guns dating from 1905, effective up to 7·5 kilometres. The distant defence guns also included some 12-cm., 15-cm. and 18-cm. siege cannon, dating from 1880, 10 10-cm. and 15-cm. cupola howitzers made in 1899, 15-cm. mobile howitzers of the same year, and 24-cm. mortars made in 1898. As regards munitions the average provision was 500 rounds per gun, and not even that in the case of the modern mortars. For all the four 30·5-cm. mortars taken together there were 300 rounds in the fortress. Of machine-guns there were altogether 114, one-third of which were built into the forts, leaving two-thirds for mobile use.

For the purpose of provisioning the fortress an estimate of 85,000 men and 3,710 horses had been established. In peace time one month's supplies were stored in the fortress, with the understanding that an increase to three months' should be made during the arming period. The Austro-Hungarian Higher Command did its utmost at this time to increase the store of supplies, and, by making full use of the available railways and motor columns, succeeded in provisioning the fortress for four months and a-half. These precautions were all the more justified as, at the last moment, the garrison was augmented by the addition of the 23rd Honved Inf. Div., two field tramway sections and other minor formations, which brought up its strength to 130,000 men and 21,000 horses. At this strength the fortress was provisioned, not for four and a-half, but for three months.

The actual garrison of the fortress at the beginning of mobilization consisted of the Austrian 111th and the Hungarian 97th Landsturm Inf. Bdes., one reserve squadron, one reserve battery, 40 companies of garrison artillery, 44 Landsturm artillery brigades, 7 companies of sappers, and the essential sanitary and labour detachments. When the Austro-Hungarian armies retreated behind the San, after the breaking-off of the battle of Lemberg–Nawa Ruska, there were added to the fortress command (under Field-Marshal-Lt. Kusmanek von Burgneustädten) the Austro-Hungarian 93rd and 108th Landsturm Inf. Bdes. and the 23rd Honved Inf. Division. Earlier additions had been: two Hungarian march regiments, of which, however, one was handed over to Jaroslau and Radymno, one Hungarian Landsturm hussar unit, and lastly a group consisting of four battalions formed out of various Landsturm formations, auxiliary police and others, cut off from the main body. All in all, the fortress establishment, when the last man of the mobile armies had left the zone, consisted of: 61½ infantry battalions (of which 40½ were Landsturm), 7 squadrons, 4 field-gun batteries, 43 fortress-artillery companies, 48 Landsturm artillery brigades, and 8 sapper companies; also sanitary corps, military and Landsturm labour detachments, fortress and tramway formations, balloon detachments, telegraph, telephone and radio formations, and so forth. The value of the troops shut up in the fortress may best be judged by the facts that two-thirds of them were Landsturm, including therefore older and less trained men, and that the formations which had been fighting on the open field were reduced to nearly half their strength. There had been, since the beginning of the World War, only two brigades to take duty in the fortress, and one of these even was sent temporarily to the IV. Army Command. The rest of the troops in the fortress were therefore not over-familiar with the duty of the fortress.

The Russian siege army, commanded by Gen. Radko Dimitriev, consisted originally of the whole of the III. Army, with the IX., X., XI. and XXI. Corps and parts of the IV. and VIII. Armies. When the Austro-Hungarian forces resumed the offensive in the beginning of Oct. 1914, the Grand Duke Nicholas withdrew three divisions of the III. Army from the circle of

** These figures indicate the volume and page number of the previous article.*

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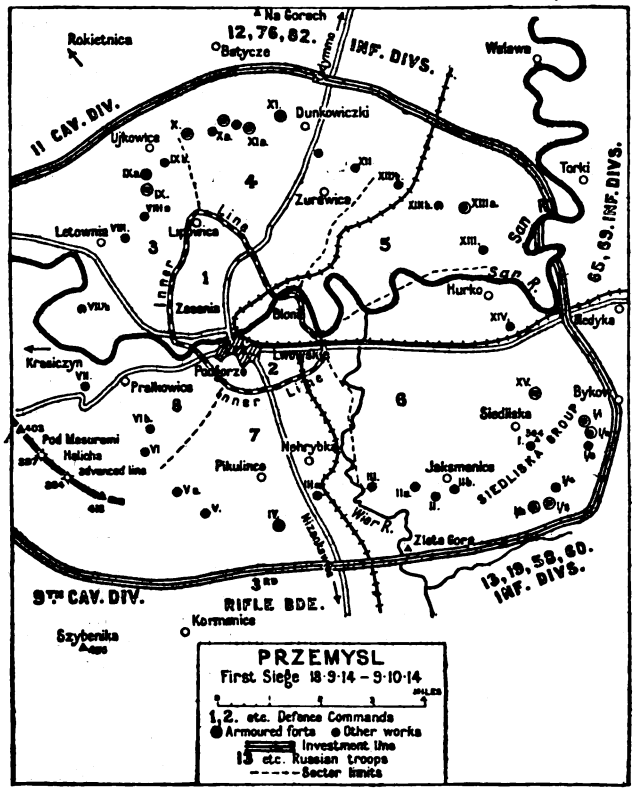
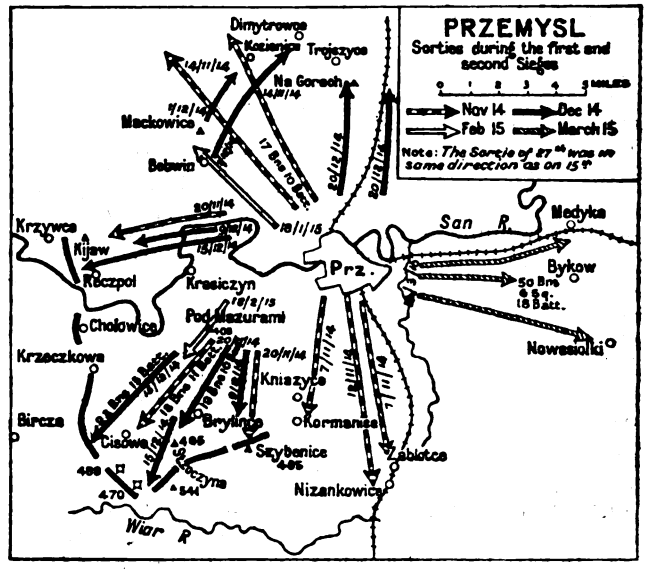
bombardment and sent them to the lower Vistula, with the object of enveloping the enemy. There were now nine and a-half infantry and two cavalry divisions left behind for the blockade of the fortress. Three of these divisions were posted on the N. front, half a division on the S., while the main force of six divisions encircled the E. and S.E. front, which was the point of attack actually fixed upon by Radko Dimitriev, and the two cavalry divisions were encamped on the W. and S.W. front. Counting the Russian infantry division at 16 battalions and the cavalry division at 24 squadrons, the Russians employed no fewer than 150 battalions and 48 squadrons, 800 guns of the field army and the heavy guns of the siege-artillery parts in the siege of Przemysl.



The First Siege, Sept. 18–Oct. 9 1914.—On Sept. 18 1914, when the Austro-Hungarian armies had marched off westwards from the San and the area of the Przemysl fortress, the fortress was left to itself, with orders—issued to Kusmanek on the 16th—to resist "to the uttermost." The building of the ring of forts and the distribution of the fortress garrison in the defence zone had now been completed. Only one correction had to be made in the line of defence—on the S.W. front, where it lay too near to the town itself, thus exposing the town and the San bridges to the danger of a direct bombardment. Kusmanek therefore selected a position in the foreground, 2 to 3 km. in front of the ring of forts, running from Krasiczyn over the height of Pod Mazurami to that of Helicha, and had this rapidly fortified and occupied by four battalions. This measure obliged the Russians to fix their line of investment at a corresponding distance from the town at this point also.

The Grand Duke allowed only a very cautious pursuit of the retreating Austro-Hungarians by the Russian armies. The IV. and V. Armies advanced toward the N. of the fortress and across the San; the VIII. Army was ordered to push forward through the Chyrów and Sambor area, and S. of the fortress to the ridge of the Carpathians; the III. Army was to take up a position immediately in front of the E. front of the fortress. On Sept. 20 the first Russian detachments crossed the San at Walawa, to be followed at once by other troops coming from Radymno and Jaroslau, where the bridgeheads had been surrendered to the Russians. These troops surrounded the N. front of the fortress. Portions of the III. and VIII. Armies now advanced towards the S. and S.W. fronts, while on the W. front two cavalry divisions by Sept. 24 completed the hemming-in of the fortress. By means of numerous very vigorous sorties and by violent artillery fire, Kusmanek succeeded in his task, which was to draw as many Russian forces on to himself as possible. He turned the Russian investiture into an exceedingly difficult undertaking.



The first great sortie was executed by Maj.-Gen. Weher, Commandant of the VI. defence zone, with five battalions and two batteries, on the Grodek road and S. of it, to force back the Russian line of investment between Medyka and Byków. Taken entirely by surprise, the Russians fell back from the first position, and two infantry divisions brought up to their support suffered heavy losses from the artillery fire which now began.

Kusmanek's next opportunity was when he learned that considerable forces were concentrated in the Nizankowice-Kurmanowice-Fredropol area, with the intention of passing along the S. side of the fortress to push forward towards the west. On Sept. 29 he sent Field-Marshal-Lt. von Tamássy with the 23rd Honved Inf. Div. to attack them by way of Halicha in the direction of the Szybenica height. Here the result was the forced deployment of considerable Russian forces against the 23rd Honved Inf. Div., and consequently the delaying of the Russian westward advance.

Minor sorties on other fronts were also successful, and everywhere a lively artillery battle was kept up in order to rivet the enemy's attention on the fortress. The Russians, for their part, maintained a violent bombardment of the forts in the ring. On Oct. 2 an interruption occurred in the Russian gunfire on the E. front. A *parlementaire* distinguished by a white flag brought a message from Radko Dimitriev demanding the surrender of the fortress. He was sent back as quickly as he had come bearing Kusmanek's written answer to Radko Dimitriev: "Herr Kommandant, I consider it beneath my dignity to give your insulting demand the reply that it deserves." Thereupon the hail of steel on the forts began afresh.

Kusmanek's refusal had hit Radko Dimitriev hard. It was scarcely possible to fulfil the Tsar's wish and bring about the speedy fall of Przemysl. A *coup de main* was impracticable, because the siege artillery material was still too far away and could not be fetched up quickly enough on account of the bottomless roads. In the first days of Oct., too, the Austro-Hungarian offensive was launched, and this might within a very short time bring Przemysl the looked-for relief. Radko Dimitriev therefore found himself obliged to revert to a curtailed form of attack, and now tried to make up for the defectiveness of his artillery and technical preparations by reckless onslaughts. As the Austro-German general offensive had necessitated the removal of some of his N. front divisions to the mobile armies, he made up for

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lost numbers by making excessive demands on his remaining brave divisions which he sacrificed literally to the last man.

Kusmanek had tried to prevent the withdrawal of the Russian divisions by a sortie of the 23rd Honved Inf. Div. with 12 battalions and 7 batteries in the direction of Rokietnica. Radko Dimitriev's plan was, while keeping up the bombardment against the whole ring of forts, to make a demonstration on the N. front and direct the main attack on the S. front against the Siedliska group. The Russian infantry had gradually worked its way up to the ring of forts. The number of siege batteries had been successively augmented—mainly long-distance 10-cm. field-gun batteries, but also some 15-cm. and 21-cm. batteries.

When the Austro-Hungarian offensive had begun on Oct. 4 there was no more time to be lost. The bombardment was doubled in intensity, and on Oct. 5 a *coup de main* was attempted by a Russian division against the Siedliska group. But the attack was broken by the fire of the defenders, and the division streamed back to its positions, losing heavily. On the 6th three other divisions met the same fate, when, after a bombardment of the N. and S. fronts had increased to the utmost violence, they attempted to take the Siedliska group by storm. Kusmanek, not to be misled by the Russian demonstrations, had recognized in time the direction in which the main attack would be delivered and had raised the strength of the most exposed section of the defence (Section VI.) from 11 to 25 battalions and increased its artillery to some 350 guns.

The crisis came on Oct. 7. The 76th Inf. Regt. of the Russian 19th Inf. Div. had on the previous night crept up unnoticed to Fort I. and the infantry lines adjoining it. At dawn one battalion of the regiment succeeded in entering the fort. After a furious battle, heroically led by the commandant, Lt.-Col. Svrljuga, the 149 survivors of the Russians who had forced an entry laid down their arms. The courageous garrison had withdrawn to the interior of the fort, defending it section by section, and all attempts to smoke them out and kill them failed. The neighbouring flanking batteries at Hurko were able to prevent Russian reinforcements from coming in. While this attack was in progress the 69th Reserve Div. on the Grodek Road, the 60th and 13th in front of Jaksmanici, and the 3rd Rifle Bde. on the S. front had lost heavily by unsuccessful assaults.

In the night of the 7th to the 8th the Russians renewed their furious attacks but without penetrating at any point. A general attack, which was to have followed on the next day, did not take place; and only the Siedliska group was again the object of assaults by Radko Dimitriev's decimated divisions, both morning and evening. This last desperate effort also failed completely, and bled the Russians so severely as to put a complete stop to their attacks from that time onward. After more than 72 hours of embittered fighting a gradual *détente* set in, none too soon for the overstrained nerves and spirits of the defenders.

On the 9th the first effects of the approaching relief were felt. In the course of the night the Russian cavalry divisions on the W. front had withdrawn, and during the day the investing ring began to be opened by the troops on the N. and S. fronts, while those on the S.E. and E. fronts gradually retired to their positions in the line of investment. With the entry into the fortress of the first Austro-Hungarian cavalry patrol on the evening of the 9th and of infantry detachments on the 11th, the relief of Przemysl was accomplished.

Of the Austro-Hungarian armies the III., under Boroević, advanced direct on Przemysl. Three corps of this army forced a battle upon portions of the siege army N. of Przemysl, and, on the 11th, beat them back across the river, now greatly swollen by a downpour of many days, with enormous losses. The Russians thereupon entrenched themselves on the E. bank of the river. The Russian VIII. Army now established itself on the heights S.E. of Przemysl up to the Chyrów-Sanok area. The III. Army, at a good distance, faced the E. front of Przemysl.

Radko Dimitriev had imagined that he could subdue Przemysl in a very short time. But all these enormous sacrifices proved vain. During a siege of barely three weeks he had lost nearly 70,000 dead and wounded without having any results to show, for the works of the fortress had suffered very little, and the Austro-Hungarian losses were quite small. On the other side the brave conduct of the Austro-Hungarian defenders had saved a powerful fortress which, in the forthcoming battles on the San, afforded a good basis as a *point d'appui* for the field armies and was able to come to their aid when their supplies failed.

Period Between the First and Second Sieges.—When the Austro-Hungarian armies on the San and S. of the fortress as far as Chyrów advanced to attack along the whole front, the hope of an interval for reconstruction, which the fortress so urgently needed, was by no means realized. On the contrary, lying as it did in the centre of the battle front, it was obliged to take a most active part in the battle now developing, lending garrison troops to the field armies on the one hand and helping generously with the provisioning and supplies on the other.

Very soon after the relief the 23rd Honved Inf. Div. was withdrawn to reinforce the III. Army. It played a successful part in the hardest battles, especially distinguishing itself in the storming of the strong Magiera height.

Altogether there were taken from the garrison, which also made repeated sorties onto the foreground of the E. front, 22 battalions and 27 batteries. Further assistance was given by the artillery support from the ring of forts.

Even greater tean the active part taken in the battle, and far more lowering in its effect on the garrison, was the support in material given by the fortress to the field armies. During the long rainy period before the relief the lines of communication for the fresh drafts of the armies had become an absolute bog. In addition to this, the Russians in their retreat had systematically destroyed roads, bridges and railways (the railway termini were Rzeszow and Zagorz), to the great detriment of the system supplying the armies. It was only natural that every deficiency that arose in the armies, in so far as it could not be made good by transport from the rear, should be supplied by the fortress, which, in spite of all, possessed considerable reserves of material. The fighting armies, from whose attack far-reaching results were expected at the time, had at all costs to be maintained in good fighting condition until the railways were reconstructed.

As it was confidently expected that the borrowed stores—about 21 days' rations had been supplied by the fortress—and the munitions and other material could be replaced almost immediately, the fortress came in the end to be considered as, to all intents and purposes, the base of supplies for the armies. Presently the Army Higher Command realized the mistake that had been made in this matter, and not only forbade all further withdrawal of supplies from the fortress but, in the days immediately preceding the retreat, ordered the armies in their turn to provide it with supplies. On Oct. 28, too, railway communication was restored by way of Chyrów, after the repair of the bridge at Nizankowice, and masses of supplies began to be hastily poured into the fortress.

Yet another burden was imposed upon the fortress by the bringing into it of the wounded and of prisoners, in addition to the very large number of civilian inhabitants. The wounded, it is true, were evacuated almost at once into the interior, before the second siege, but during the second siege 2,000 prisoners were brought into the fortress, and 18,000 civilians had remained within it. So that, taking the average establishment at 128,000 men and 14,500 horses, there were, at the time of the second siege, 148,000 men and 14,500 horses to provide for. By eking out supplies to the utmost, and in the end slaughtering horses, the provisioning of the fortress would last until the second half of March. If the working of the railway coming up through Chyrów had started one week earlier, no supplies need have left the fortress, and its stores would undoubtedly have been replenished on such a scale that it could have held out until the spring offensive had come into effect. The starving-out of the fortress, which forced on its commander the heart-breaking decision to capitulate, and the setting free of the Russian armies investing it would then have been avoided.

Second Siege, Nov. 6 1914–March 2 1915.—On Nov. 5 the fortress was isolated for the second time, after the field armies

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had broken off the battle of Przemysl and the San in the night. Once more Kusmanek was confronted with the same tasks as in September. Shortly before the retreat of the field armies the fortress had been reinforced by the 85th Landwehr Bde. and a company of airmen. The strength of the garrison was approximately the same as at the beginning of the first investment. In order to extend the fortress's sphere of action, and to force the Russians to keep their line of investment at a greater distance from the actual ring of forts, at the same time obliging them to use more forces for the occupation of the longer line, Kusmanek had new foreground positions laid out. These formed a curve beginning at the Na Gorach height, and, passing 2–3 km. in front of the western ring of forts, came out S.E. of Krasiczyn at the old foreground position. From Helicha this position was extended to the S. of the fortress through Zlota Gora up to the Siedliska group. This measure secured a double advantage: it placed another obstacle in the way of the attacker, who would have to surmount it before he could assault the ring of forts; and the works would suffer far less from the bombardment, as the siege artillery would be forced to remain farther away from the fortress. On the 9th the investment of the fortress was completed for the second time. The Grand Duke Nicholas had selected the Russian XI. Army under Gen. Selivanov for the siege. This army, consisting of about four infantry and one to two cavalry divisions, had barely half the forces used in the first siege under Radko Dimitriev. This circumstance, and the comparatively small activity shown by the Russians at the beginning of the second siege, pointed to the conclusion that Selivanov was less concerned with a rapid seizure of Przemysl than with the idea of a regular siege, in which he would effect a saving of men on his own side while exploiting the scarcity of food supplies in the fortress, leaving the garrison to grow weak from starvation before he advanced to a serious attack. Kusmanek, on the other hand, displayed all the more activity. The months of Nov. and Dec. he employed in aggressive defence, and only desisted when the decimation of his forces by disease forced him to do so. In nine sorties he seized every possible opportunity of damaging the enemy, of preventing any withdrawals from his forces to the field armies; of destroying his supply trains and lines of communication, and finally of bringing into the fortress any food-stuffs—such as fruit and vegetables—which could be collected. In Dec., when the Austro-Hungarian armies took the offensive again, these sorties gained in importance, for each important action undertaken by the fortress with the object of containing Russian forces was necessarily a great disadvantage to the Russians defeated in the battle of Limanowa–Lapanow. Above all, in the case of a successful advance by the right wing of the III. Army, the possibility of coöperation between that wing and the sortie troops was not excluded.

On Nov. 7 and 12 further sorties were undertaken in the direction of Nizankowice and Kormanice. On the 14th, following on a report by the airmen of movements of Russian forces through Pruchnik to the W. and S.W., an assault was delivered on Rokietnica by 17 battalions and 10 batteries. For the same reason an equally powerful sortie was made from the S.W. front on the 20th, the main force moving on Cisowa, and the side columns towards Krzywcza and the Szybenica height.

In Dec. the Russians also became more active. Having let Nov. go by without doing more than prepare a more or less systematic siege, they now began their attacks and turned Dec. into a month of many battles. Quite at the beginning the 82nd Inf. Div. advanced against the N. front. Kusmanek delivered a vigorous counter-blow from the area of Mackowice against the enemy's right flank and repulsed the attack. On Dec. 9 this action was followed by yet another sortie by 19 battalions and 10 batteries from the S.W. front, with the object of preventing the departure of the Russian 81st Inf. Div.

In the middle of Dec., when the battle of Limanowa–Lapanow had reached its height, Kusmanek received an order from the Army Higher Command to deliver a fresh assault. In the hope of being able to join hands with Krautwald's group, advancing on the right wing of Boroević's army, Kusmanek prepared for a great undertaking. With 23 battalions and 15 batteries, commanded by Field-Marshal-Lt. von Tamássy, he pushed forward on the 15th in the direction of Bircza and Krzywcza. After four days of victorious fighting, the heights halfway between Cisowa and Bircza were captured, the enemy driven back along the whole of the S.W. front, and the road to Bircza laid open. But as Krautwald meanwhile had been forced back by the Russians, and as the hope of effecting a junction with him had become a forlorn hope on account of the great distance intervening, and as, further, a fresh violent attack had been launched against the northern foreground position, Na Gorach, Kusmanek found himself obliged to turn his attention to this latter, and to recall Tamássy on the 19th to the fortress.

Once more it was the Russian 82nd Inf. Div. which advanced on Na Gorach. Portions had already penetrated the advanced positions when Kusmanek's counter-attack set in on the 20th, and on the 21st threw them back to the line of investment.

At the end of Dec. yet another order from the Army Higher Command led to a fresh sortie. After the battle of Limanowa–Lapanow the Russians, taking advantage of their interior lines, had opened a counter-offensive against the troops of the III. and IV. Armies which had pushed forward into West Galicia. The proposal was for a sortie to be made in a south-westerly direction, falling in with the left flank of the Russian attack on the one hand, and on the other making a second attempt to effect a junction with the III. Army's right wing, which was pushing forward towards Lisko, Sanok and Rymanow. But with the suspension of the offensive on the 28th the sortie troops were brought back.

This sortie brought the offensive activity of the garrison to a close for the time being, in consideration of their ever-increasing losses through fighting and sickness. All forces were now to be reserved for the effort on a large scale to relieve the fortress, which was planned for the middle of February.

The month of Jan. saw the beginning of a period of great self-denial and sacrifice for the garrison, in consequence of the increasing scarcity of food. The commandant and his staff had in addition the difficult task of maintaining the striking power of the garrison with insufficient means, which involved exacting the maximum of service from each individual soldier in spite of his lack of nourishment. On Dec. 1 1914 Kusmanek, counting upon a delay in the relief operations, had ordered the first general reduction of rations for men and horses. At the end of the month the first horses were killed for the purpose of providing meat and saving fodder. Had the fortress been consuming its full rations it could not have held out beyond the end of Jan., but by the reduction of the ration and further slaughter of horses (up to 7,450), supplies were eked out until the end of March. The extension of the life of the fortress was in proportion to the establishment of horses it was necessary to keep up. For the projected break-through sortie and for the absolutely essential fortress duties a minimum establishment of 4,500 had to be allowed for. By means of further reducing the ration, resorting to incredible makeshifts, and sacrificing 3,500 more horses, the provisioning was made to last until March 24, but there was a rapid mounting-up of the sick list. By the beginning of March one-fifth of the fortress establishment had fallen. To the scarcity of food was added in the winter months that of clothing, footwear and all the other necessaries of life. The garrison had been equipped, for the most part, with summer clothing, and even this had been badly damaged in the fighting. In respect of technical and artillery supplies also, the fortress gradually lost its power of resistance. The barrels of the guns had been gradually burnt out by the excessive demands made on them, and the range of the guns declined accordingly. The stores of ammunition were also rapidly coming to an end, despite the utmost economy.

While the striking power of the fortress was suffering sensibly from all the unspeakable privations imposed by hunger, cold and want, the besiegers were gradually becoming more active. At first the Russians confined themselves to increasing the airmen's activity. Almost every day their airmen circled round the fortress, with very little hindrance from its quite inadequate means of defence, dropping bombs on the forts and the town. In

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the beginning of Feb. the systematic bombardment of the fortress set in. In the middle of the month the besiegers brought up the line of investment nearer to the N.W., W. and S.W. fronts. On the night of the 18th three regiments attacked the foreground position at Pod Mazurami, but were beaten back with heavy losses. It seemed to the Russians that the garrison's striking power was still too strong; and they let three weeks pass before equipping themselves for an important attack. On March 13 a powerful Russian force advanced against the N. foreground position Na Gorach–Batycze. Against so strong an attack, delivered by at least two regiments, the 35th Light Inf. Regt. could make no stand. As other powerful Russian forces were advancing against the N. front from Radymno, and as Kusmanek considered his own garrison too weak for a counter-blow and also wished to save his forces for the great final break-through, he gave up the foreground position and refrained from counter-attacking. At the same moment the Austro-Hungarian Higher Command had reached the conclusion that the II. Army's offensive would not be able to bring about the desired relief of the fortress, which was therefore inevitably doomed, since the food supplies would be exhausted by March 24.

A break-through from the fortress might conceivably save a portion of the garrison for the Austro-Hungarian army forces, and it had therefore to be attempted. In consideration of the state of supplies, March 19 was fixed as the latest time limit for its execution. Kusmanek had already made all the necessary preparations. He was free to choose the direction in which the sortie was to be made. His decision fell on the E., as it appeared to him impossible for his exhausted men to effect a junction with the II. Army through the mountainous area. On the E. the ground was practicable, and he might hope to have an opportunity there of destroying Russian railway lines and communications, and also possibly to have the good fortune to capture a Russian supply store. In case the break-through failed, he would then be able to take back provisions into the fortress and so prolong its life by a few days.

With two infantry divisions and three independent infantry brigades (50 battalions, 6 squadrons and 18 battalions) the break-through was begun on the morning of the 19th. After some opening success the troops, in a heroic seven-hour battle, fought their way up to the Medyka heights, coming to a stand here at 10 A.M. A flanking counter-attack by the Russian 58th Reserve Div., which had been brought up from the Carpathians, then forced them to return to the fortress, their losses being heavy on account of their exhaustion. The fate of the fortress and the garrison was now finally sealed. The Russians realized the aim of this last sortie, and they had captured on prisoners the order regarding it; they therefore knew that the fortress was almost at the end of its power of resistance. Kusmanek now awaited their attacks. All the sortie troops had returned to their old positions on the 19th. The same night the Russian masses made a violent assault on the E. front. Until the morning of the 22nd Selivanov exerted himself to the utmost to take the fortress by storm. An endless bombardment by the heaviest-calibre guns set in, and was followed by assaults on the N.W., N. and N.E. fronts, as well as on the E. front and the foreground position, Pod Mazurami. But the brave defenders held their ground and repulsed one attack after another. At last Kusmanek, armed with authority from the Army Higher Command, decided to destroy the fortress, since it was now quite impossible to save it. On March 22 between 5 and 6:30 A.M., just as renewed Russian attacks had begun, the works were blown up as far as possible; all guns, the small remaining store of ammunition and the technical arrangements were demolished, all arms broken, motors and other vehicles burnt, and the remaining horses shot. Kusmanek then sent a *parlementaire* to the Russian siege army. When the conditions for the surrender had been fixed the Russians entered the town to take over the administration.

Kusmanek betook himself at once with his staff to Selivanov's headquarters. The garrison,[1] which was allowed all military honours and looked upon even by the enemy as a model of military bravery, remained about another week in Przemysl, and was then removed in large detachments by way of Lemberg. On the 24th the Russian General Artamanov took command.

After four and a half months of heroic defence the fortress of Przemysl had fallen, through hunger and sickness. To the brave garrison, and in the first place to the determined commandant, Gen. von Kusmanek, and to Gen. von Tamássy, leader of most of the sorties, the highest admiration was due, and the victorious enemy, whose own courage was proved by the enormous tribute of lives sacrificed before the forts and ramparts of the fortress, recognized this in full measure.

Recapture of the Fortress, May 30–June 3 1915.—Soon after the fall of the fortress of Przemysl the Russians had taken in hand the reorganization of its works. Particularly after the visit of the Tsar, who inspected the destroyed works in the second half of April, the reconstruction was taken in hand with feverish haste. Numerous heavy guns, including French ones, were brought into the fortress, and a strong garrison was maintained. By the middle of May Böhm's and Puhallo's armies had advanced in a concentric attack on the positions S. of the fortress, as well as on the S., S.W. and W. fronts, while Mackensen's army pushed forward in the area N. of the fortress and over the San. While the Allied armies were thus advancing on Przemysl the Russians were undecided whether to hold the fortress or not. By the middle of May they had begun the work of evacuation and the withdrawal of troops. But in the second half of the month the idea of holding the fortress gained ground, and the Grand Duke finally ordered it to be held "to the last extremity." When Mackensen's army began its offensive on May 24 on both sides of the Szklo in a south-easterly direction, the fortress became more and more closely surrounded to the N. also by the ring of investment. By the 30th the necessary heavy artillery had also been brought up, in spite of the delay caused by the ruined roads and bridges, and the bombardment of the S.W. and northern fronts immediately began. These were the two fronts against which the attack was to be directed. While the X. Corps of Puhallo's army stormed the S.W. front, the Bavarians of the XI. Army, in conjunction with one Prussian infantry regiment, one Guard battalion, and the dismounted troops of the 11th Honved Cav. Div., executed the main attack on the N. front.

Misled by the violence of the attack of the Austro-Hungarian infantry regiments (the 9th and 45th of the X. Corps), who, on the 30th, stormed the Pralkowce fort, on the S.W. front, Work VII., the Russians awaited the main attack there and brought their whole strength into play against the X. Corps. But although they were able to force the Austrians to evacuate the fort, they could not themselves reoccupy it. Meanwhile the Germans had done good work on the N. front. Their bombardment was mainly directed against the forts, X., Xa., XIa. and XI., lying between Ujkowice and Dunkowiczki, and for this guns of all calibres, including the 42-cm. mortars, were used. On the 31st, after heavy fighting, ending in a *mêlée*, Forts Xa. and XIa. were taken, as well as the adjacent infantry positions, and Fort XI. capitulated. On June 1 the Russians brought up strong reserves, but not in time to avert the fate of the fortress. On the morning of the 2nd Fort X. fell into the hands of the attacking forces after its obstinate resistance had been overcome by a liberal bombardment. By the evening Fort XII. had also been captured, and Forts IXa. and IXb. surrendered to Maj.-Gen. Berndt's cavalry. The break-through of the ring of forts had succeeded. North of Zurawica the Russians made one more stand; but this line had also been forced by the evening of the 2nd, and the Russians betook themselves to their last line of resistance immediately in front of the nucleus. But the attack did not get as far as this, for the Russians abandoned the fortress on the night of the 2nd, influenced probably by the successes attained by the XI. and II. Armies. Their rearguards took up new positions on the E. front of the fortress on the line Medyka–Siedliska.

At 3 A.M. the Bavarians of Lt.-Gen. Kneusel's division entered the fortress from the north. Maj.-Gen. Berndt followed from the N.W. with the Austro-Hungarian 4th Cav. Division. By 6

[1] In round figures 107,000 men, among whom were 28,000 invalids both fit and unfit for transport.

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A.M. the Austro-Hungarian X. Corps had also come in. But the attacking forces did not remain long in the evacuated town. In a hurried pursuit they overran the Siedliska position and pushed forward to the E. of the town.

The fall of Przemysl fortress, which had been subdued in barely four days, meant for the Russians the loss of the most powerful pivot of their San front. Not without reason had the Grand Duke—who had tried to gain a success over the IV. Army by a violent assault at Rudnik during the hard struggle for Przemysl—ordered the fortress to be held "to the last extremity." By its fall the forces of the Austro-Hungarian III. Army and the German XI. Army were set free, and could go to the aid of the dangerously situated IV. Army. On the 4th the Russians abandoned the San front. Thus the recapture of Przemysl, apart from the great moral impression it made, was decisive also in a strategical sense. (E. J.)

PSYCHICAL RESEARCH (or SPIRITUALISM) (*see* 22.544).—The matters referred to under the general name "Psychical Research" are distinguished from ordinary subjects of scientific interest by two characteristics. They appeal to the sense of wonder and the love of the marvellous and are concerned with "superstitions," that is, with beliefs which, after being ingrained in the human soul by an immemorial past, are now disavowed by science, but still affect human action. Secondly, they seem to involve abnormal extensions of human faculty, and are readily taken to indicate a survival of human personality after death, and a possibility of obtaining authentic communications from the departed. They consequently arouse strong emotional reactions, provoke strong dislikes and are peculiarly susceptible of vitiation by self-deception, bias and fraud. Hence they are usually treated in a partisan spirit on both sides, like matters of politics, and not with scientific impartiality, and the good faith as well as the competence of the witnesses have always to be tested and every allegation has to be verified. In all these respects the subjects of psychical research are intimately bound up with the religions; but it would be a mistake, nevertheless, to relegate them to the "supernatural," and hastily to declare them unfit for scientific investigation. Their investigation is difficult, but not impossible, provided that in a given society it is favoured or permitted. Of course, if it is proscribed as "sorcery" and made a capital offence, as was the case all the world over until recently, investigation will languish, and it may well be that the practice of burning psychics as "witches," persisted in for many centuries, has effectively eliminated most of the possessors of unusual faculties. However, to begin with, the term "supernatural" should be discarded. It merely assumes what is the cardinal point at issue, viz. that the realm of nature has been completely explored; and only omniscience could assert this. The allegations to be inquired into by psychical research, therefore, should be described, neutrally, as "supernormal."

Nevertheless, the peculiarities of the subjects of psychical research condition further differences which should be noted in any account of their history. They render the influence of public opinion far more important than it is in the ordinary subjects of scientific inquiry. It is true, doubtless, that everywhere the progress of any subject of human interest depends on two factors, on the quantity and quality of human intelligence devoted to its elucidation, and on the social atmosphere, *i.e.* the attitude towards it taken up by public opinion. Of these the former is ordinarily more conspicuous and important, for it directly affects the progress made. The latter acts indirectly, by affecting the amount and sort of the attention paid to a subject, and its effects do not all lie on the surface. But if there is in a society a real desire for more knowledge on a subject, research into it will be organized; inquiries will be set in motion, adequately equipped and endowed, and the conduct of such inquiries will become a career. If, on the other hand, there is little interest, nothing will be done; as also if knowledge is supposed to be absolute or adequate, or if its absence is held to be inevitable and is acquiesced in. If, lastly, the knowledge sought is feared or disapproved of for any reason, various measures will be taken for effectively repressing interest in it; nor must it be supposed that such social taboos cease to operate merely because witch-burning has ceased to be a popular entertainment. In general, moreover, subjects which are inchoate and contentious are far more sensitive to changes in the social atmosphere than those which are recognized, established and endowed. For toward the latter the social attitude is fairly stable and changes only slowly, and they possess, moreover, a permanent organization, which provides for their cultivation (or is supposed to do so), and on which their progress mainly depends. In the case of the former, progress may depend chiefly on the social attitude, and indeed may even consist chiefly in a *change* of social attitude. It is unreasonable, for example, to expect progress in psychical research so long as the energies of researchers have to be devoted primarily to eluding the police or the officers of the Holy Inquisition.

The history of psychical research during the decade 1910–20 provides excellent illustrations of all these reflections. It is composed of a short pre-war period of obscure labour in the cold shade of social neglect, a short eclipse due to the complete immersion of all scientific workers in the pursuits and passions of the World War, accompanied by a grotesque ebullition of superstitions long supposed to have become extinct, and followed shortly afterwards by an astonishing revolution in social sentiment, which rendered psychical research popular and reputable as it had never been before, but is now slowly yielding and relapsing into the pre-war tone of feeling. Before the World War the great bulk of public opinion was either hostile to the subjects of psychical research, or at any rate indifferent to their scientific investigation. That, at least, seemed to be the obvious construction to be put upon the general indifference towards scientific psychical research, and was borne out by the results of a *questionnaire* intended to test the extent and depth of the desire to have knowledge of the most exciting of these subjects, viz. the individual's survival after death. The answers, as analyzed by the writer in the *Proceedings* of the Society for Psychical Research (pt. 49, 1904), seemed to indicate that such a desire was actively functional only in comparatively few minds at any one time, and that these were nearly always excited by the stimulus of a recent bereavement. This explanation seemed, moreover, to account sufficiently for the ordinary social attitude towards the subject. For it would follow that under normal circumstances the great majority, who were *not* animated by the bereavement-sentiment, would effectively repress the few who were, and would mould public opinion and social institutions accordingly—as had manifestly happened—both to scientific and to religious "orthodoxy." But it would also follow that if for any reason the bereavement-sentiment should become widespread, powerful and dominant, it might be predicted that there would ensue a great outburst of interest in psychical research, and a passionate demand for any method that held out to the bereaved human heart the immediate consolation of a direct communication with the departed.

Accordingly this is what happened in consequence of the World War. If we put aside, as mere "propaganda" for the benefit of the superstitious, the crop of bogus prophecies that accompanied the outbreak of war, and such successful appeals to primitive credulity as the legends of the "Russians from Archangel," and of the "Angels of Mons" (the latter, though published as *fiction*, was actually taken as *fact*), we find that at first the normal peace-sentiment persisted. It remained engrossed in mundane affairs and showed itself by a complete and exclusive absorption in the war. Nothing else seemed to matter, and scientific inquiries that did not minister to the war were simply dropped in an ecstasy of patriotic fervour. It seemed, therefore, the sheer waste of a guinea to continue to subscribe to an inquiry whether the human lives that were sacrificed so prodigally on the battle-fields were really dead and done with. No wonder the membership of the Society for Psychical Research in England went down from 1,205 in 1913 to 1,055 in 1916.

Meantime, beneath the surface of social convention, the bereavement-sentiment was growing to proportions unparalleled in civilized history. It was merely awaiting a signal to reveal itself. The signal was presently given, in a high academic

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quarter, by the courageous act of a bereaved father, who did not shrink either from exposing himself to academic ridicule or from divulging the private evidence which he had obtained of his son's survival and declaring that it had satisfied him. That a distinguished physicist at the head of the university of Birmingham should openly endorse spiritism was a remarkable event: yet Sir Oliver Lodge's *Raymond* (1916) was not in itself a remarkable book. Evidentially it did not show that Mrs. Leonard produced anything markedly more conclusive and better in quality than the evidence obtained long before through Mrs. Piper and other "psychics"; nor was there anything remarkable about the quantity of its evidential communications. Hardened sceptics should have had no difficulty in explaining away the "hits" it narrated, as they had dealt with its many predecessors. Nor did its version of the after-life differ markedly from the descriptions of the "summerland" that had been the staple of spiritist literature for the past 50 years, while its apparent crudities, *e.g.* of ghosts smoking "cigars" and drinking "whiskies-and-soda," were no less susceptible of a "symbolical" explanation.

Sir Oliver Lodge's "Raymond."

But what turned out to be remarkably different was the reception of the book. It was found that patriotism paralyzed the voice of criticism. The scoffing reviewer, who had been accustomed to say that interest in psychical research was "morbid" and a sure passport to the lunatic asylum, or that the mystery of the grave was insoluble and that anyhow no sensible man had the slightest desire to solve it, was no longer regarded as the sort of person to express what the public wanted to hear about a book of that kind. So he was not allowed to touch it, or perhaps himself experienced a change of heart. Able editors perceived that, in war-time, consolations that appealed to millions of bereaved hearts must be treated tenderly, if only to keep the home front unbroken. So *Raymond* was reviewed respectfully and copiously, and enabled to break down the barrier of peace-time convention. A flood of lesser books followed, ascribed to the living or returning dead, and mostly composed of communications received by relatives of fallen soldiers, through automatic writing—not without an admixture of pious fraud. Unfortunately they were mostly written by people who paid little or no attention to the difficulty of getting evidential communications and of making their value apparent to their readers, and who considered the mere form of the communication as a sufficient authentication, being wholly ignorant of psychology and of the tricks they were, unconsciously, capable of playing on themselves. Nor did amateur automatism alone profit by this innovation. Professional "psychics" obtained an enormous vogue. The resignations from the Society for Psychical Research ceased, and accessions took their place. The membership went up from 1,055 in 1916 to 1,305 in 1919; and the new members were not only willing to pay the two-guinea subscription of a "member" instead of the guinea of the "associate," but insisted on a more active and enterprising policy, and came within measurable distance of "hustling" this eminently respectable society into an endorsement of spiritism.

Of course a change in the social attitude produced in this way cannot be permanent. The old influences persist, and will inevitably reassert themselves and produce a relapse into the former apathy, unless the exceptional opportunites are exploited, and the abnormal will to believe is fortified by positive achievements. In the long run, therefore, the status of psychical research will depend, not on the mere intensity of the desire to know and the amount of social approval it can secure, but on the amount of solid scientific work that will have been accomplished under the stimulus of the abnormal social conditions. It is necessary, therefore, to turn to the scientific side of psychical research, though the developments here will be found to have been relatively small and by no means commensurate with the volume of popular interest excited by the war.

Nevertheless a certain amount of scientific progress has been made, enuring both to the benefit and to the detriment of psychical research. It may be classified under the following heads: (*a*) Psychology, (*b*) Multiple Personality, (*c*) Telepathy, (*d*) Trance, (*e*) Automatic Writing, (*f*) Physical Phenomena, (*g*) Dowsing, (*h*) Thinking Animals.

Psychology during the war made considerable progress because numbers of academic psychologists were compelled to practise, and to apply their theoretical conceptions to clinical problems, while numbers of medical men, finding themselves unable to cope with the profound disturbances of mental equilibrium, inaccurately, but conveniently, designated as "shell-shock," were compelled to reckon with the psychical side of medicine. Thus were large bodies of intelligent men forced not only to apply their theories to concrete cases, and to correct them by their working, but also to recognize the power of the disordered mind to simulate the most various lesions and diseases of the body. As might have been anticipated, the older systems of academic psychology, being compiled out of aesthetic preferences, metaphysical prejudices, methodological assumptions, introspective observations of conscious states, and highly artificial and limited laboratory experiments, did not stand the test of application to the battle-field at all well.

The "psychoanalytic" method, however, devised long before by Dr. Sigmund Freud of Vienna, for tapping the unconscious depths of the mind and bringing their contents to the surface was found to be capable both of explaining the symptoms and in many cases of suggesting a cure. Hence though the psychological theory on which Freud worked had seemed (and been) improbable, extreme and crude, and had (justly) encountered the strongest emotional repugnance, there was no gainsaying the practical validity of his method, and the reality and importance of the mind's unconscious structure. The mind had to be conceived, like the spectrum, as having invisible (unconscious) extensions, as truly characteristic, as susceptible of investigation, and in some respects as important, as its visible (conscious) regions. It had in consequence to be admitted that psychic contents could be "repressed" into this unconscious region without thereby losing their identity and reality, and could thence continue to produce effects in consciousness, even by those who refused to follow Freud in assigning none but an erotic motive to this repression. These psychological discoveries had a considerable bearing on several branches of psychical research. They seemed to throw a flood of light on the mechanism of multiple personality. A "repressed complex" could explain the growth of a "secondary self." They also modified the notion of "fraud."

Not only was it clear, as had indeed already long been recognized by investigators, that a secondary or trance-personality might perpetrate a fraud of which the primary or normal self might be innocent, incapable and unaware, but a personality of either kind might *become* unaware of the fraud it had committed by "repressing" its knowledge thereof. Thus the problem of the fraudulent medium was enormously complicated, and it could be suggested, as by Dr. Culpin (*Spiritualism and the New Psychology*, London, 1920), that even the most honest mediums were frauds, who had cleared their consciences by "repressing" the knowledge of their delinquencies. Furthermore, this same process might be used to explain many errors and gaps in the narratives of observers of supernormal occurrences. Having "repressed," as unwelcome, the real facts, they might honestly deny that they had ever possessed or divulged the knowledge they were bent on regarding as supernormal: it would thereupon appear to be so. Hence repression of the truth would have to be added as a third to mal-observation and forgetfulness, as a very subtle source of error in testimony to the occurrence of the supernormal, and would further complicate the problem of what the evidence really proved. On the other side it is fair to remember that whatever goes to show how little we really know as yet about the functions of the mind should act as an encouragement to psychical research, and renders more credible *pro tanto* claims to unsuspected powers.

In the field of multiple personality Dr. Morton Prince has extended and confirmed his brilliant researches, attending particularly to the proof of the reality of "coconscious" secondary selves (*cf.* his *Unconscious*, 1914). It will doubt-

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less have gratified the readers of his *Dissociation of a Personality* (1906) to learn that "Miss Beauchamp" was afterwards happily and healthily married though her husband did not know what a heroine of psychological romance he had espoused. The most striking and substantial contribution to the subject is, however, contained in the admirably recorded and narrated story of the strange case of "Doris Fischer," for which science is indebted to the Rev. Dr. Walter F. Prince, who in consequence became interested in psychical research, and subsequently (1920) succeeded the late Prof. J. H. Hyslop as secretary of the American S.P.R. The record extends over three large volumes (1915, 1916, 1917) of the *Proceedings* of the American S.P.R., contains almost 2,500 pages of print, and is fully worthy of such elaborate treatment. It narrates how, as a little girl of three, "Doris Fischer" was thrown down violently by her drunken father, and so sustained a psychic fracture, which "dissociated" her into "Margaret" and "Real Doris," the former being a personage very similar to "Sally" in the "Beauchamp" case. But for 19 years no one discovered the dissociation, and even her mother only thought Doris a little odd and forgetful, when as "Real Doris" she displayed ignorance of what "Margaret" had just said or done. At the age of 16 another painful scene, at her mother's death-bed, led to a further dissociation and the mergence of a new personality. "Sick Doris" was born mature, grave, hardworking and conscientious, but totally ignorant of everything that had happened before her birth. Again the dissociation escaped detection, because "Margaret," whose "mental age" never rose above 10, undertook to instruct her uneducated partner, and succeeded, at the cost of all-night sittings and violent quarrels. Between these two the "Real Doris" was for six years almost completely crowded out. How she was restored by the skill and tact of Dr. Prince, after he had taken charge of the girl and discovered her condition and how first "Sick Doris" and then "Margaret" were weakened by being put to sleep whenever they cropped up, and grew younger and younger under this treatment, and in the case of "Sick Doris" actually infantile, until they finally evaporated, may be read in Dr. Prince's fascinating record.

Multiple Personality.

Theoretically the case (which was fully reviewed by the present writer in *Proceedings* S.P.R., pt. 74: *cf.* also the article by Dr. T. W. Mitchell in pt. 79) is important also for two reasons. In the first place it brings out that the dissociations were plainly *protective*, and relieved the strain of an otherwise intolerable life. Secondly, they were attended by a considerable number of supernormal incidents which, though not unprecedented in other cases of dissociation (*e.g.* the "Watseka Wonder"), had not formerly been recorded properly. Indeed, if one can accept the record in vol. iii. of the sittings "Doris Fischer" had with Dr. Hyslop's medium "Mrs. Chenoweth," these incidents were the clew to the whole affair, and the dissociations were caused by, or complicated with, spirit-possession. But this interpretation is not apparently accepted by Dr. Prince, and is something of an excrescence on the main story.

Telepathy.—Little progress has been made in establishing telepathy as a process in nature. It remains a sort of half-way house for those who do not feel able to deny the supernormal altogether and yet shrink from the spiritist interpretation. It fulfils this function best if its nature and operation are left vague, so that anything and everything may be set down to telepathy of some sort. Hence believers in "telepathy" have not any strong motive for coming to close quarters with their theory, while the more intelligent spiritists dislike it as rendering any conclusive proof of spirit-identity practically impossible. The opponents of the supernormal first use it freely to disparage the evidences of spiritism, and thereupon frequently proceed, somewhat illogically, to cast doubts upon its own reality. Telepathy, however, has one great advantage, that of being susceptible of experiment. Unfortunately such experiments as are undertaken not only do not succeed in increasing our knowledge of its conditions, but hardly even confirm the earlier experiments on which the existence of telepathy is based. The most noteworthy of the experiments that have yielded positive results were those undertaken by Miss Miles and Miss Ramsden, published in the S.P.R. *Proceedings*, pt. 69 (1914). On the principle that anything supernormal may be attributed to some sort of "telepathy," one might perhaps chronicle here the very anomalous *Adventure*, experienced by two well-known academic ladies of Oxford in the gardens of Versailles, but not published until six years after the event, in 1911 (*cf.* the review in S.P.R. *Proceedings*, pt. 64).

On the other hand, elaborate attempts made by two psychologists in America to verify the existence of telepathy have led to results which at first sight appear to be wholly negative. Dr. J. E. Coover, of Leland Stanford Junior University, was specially endowed as a psychical researcher by the brother of its founder, and in due course produced in 1917 a book of 640 pages. Among its rather miscellaneous contents (it contains *inter alia* a pleasing account of the outwitting of a fraudulent "trumpet-medium" by hidden machinery) he describes 100 series of 100 experiments with cards (court cards omitted) made by 100 pairs of Californian students, for the purpose of testing the existence of telepathy as a faculty widely diffused in some slight degree among human minds. The "agent" was instructed to draw a card and to determine by casting dice whether to look at it or not, and in the former case to try to impress his knowledge (without contact) on the percipient; while the latter had to answer in both cases, but for about half the time would thus be really guessing at random. The results, when tabulated and added up, yielded in the first series of 5,135 genuine "experiments" 153 complete successes (most probable number, 128), in the second series of 4,865 control experiments or "guesses" 141 complete successes (most probable number, 122).

There was therefore a slight excess of successes, but Dr. Coover rightly argues that it was too small to be significant of anything beyond chance. He claims therefore to have disposed of the idea that telepathy may exist in minimal intensity in *all* minds, and evidently thinks that this disposed of the whole case. This, however, would seem to be going too far, on his own showing. For his figures do *not* dispose of the possibility that telepathy may exist in a faint degree in *some* minds. Indeed they rather suggest this possibility. For if we examine them with a view to testing this hypothesis, we may select, as *possibly slightly telepathic*, the series in which the "percipients" got 3 or more complete successes in their "experiments." There were 14 of these, in which 54 complete successes were scored in 711 experiments. The most probable number being 18, the excess is now large enough to be significant of something beyond "chance." But not, apparently, of telepathy, so much as of a sort of "lucidity" or "clairvoyance." For if we treat the (supposedly fortuitous) series of "guesses" similarly, we get still more remarkable results. The series with 3 or more complete successes once more turns out to be 14, and yields 49 complete successes out of 690 experiments (most probable number, 17). But curiously enough 5 of the 14 best "guesses" are identical with 5 of the 14 best "experiments." As the most probable number for such a coincidence is only 2, it can hardly be fortuitous. Moreover, if we add together the "experiments" and "guesses" of these 5 series, we get 41 complete successes out of 500 experiments, as against a most probable number of 12. Again something beyond "chance" is indicated. As, however, this something operates about equally well whether the percipient is trying to determine a card which was actually being thought of is only guessing, it can not be set down to conscious telepathy. This again accords with the other evidence that goes to show that telepathy, if it exists, is not greatly dependent on the conscious efforts of the mind; or otherwise, that if minds communicate telepathically, it is by way of the subliminal. For the rest, of course, the moral is that further experiments should have been conducted with the 5 successful pairs, in order to determine whether they would continue to produce a surplus of successes; but unfortunately this idea did not occur to Dr. Coover.

Dr. L. T. Troland also experimented in telepathy, with very elaborate apparatus, in the Psychological Laboratories of Harvard University (1917), in order to utilize an endowment given in memory of Richard Hodgson (*cf.* Review in S.P.R. *Proceedings*,

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pt. 80). He, too, got negative results, and did not go on long enough. In fact, he failed so completely that he failed even to prove that telepathy did not exist, or that at any rate he and his colleague were completely devoid of telepathic ability. Only 605 experiments were made, and only 284 complete successes were obtained. Now this is very sensibly *below* the most probable number (302); but, as Dr. Troland observes, an abnormal deficiency is quite as significant of something other than chance as an abnormal excess. It may mean the presence of some factor that *inhibits* success, and if this can be established, it is just as supernormal as one that *produces* success. However, Dr. Troland does not hold that in his experiments the deficiency is sufficiently great. He has not observed how it arose. His total figures were arrived at by lumping together two sets of experiments. In one of these the stimulus shown to the "agent," to which the "percipient" was to react by pushing an instrument either to the right or to the left, was exposed for 30 seconds; in the other, for 15 seconds. Now in the former series there was *no* deficiency of right reactions; 129 successes out of 249 experiments are slightly *above* the probable number, 124. The whole of the deficiency was incurred in the 15-second series, which yielded only 155 successes out of 354 experiments, instead of a most probable 177. As the only difference between the two series was in the duration of the exposure, the idea easily suggests itself that the 15-second exposure was too short to enable the percipient to react rightly. And not only that; it seems to have positively inhibited the right reaction, presumably by inducing an "anxiety-neurosis." In other words, if the "agent," or more probably the "percipient," got "flustered" by the shortness of the exposure, his very knowledge of the right reaction would lead him to make the wrong one. Thus a marked deficiency in correct responses over a long series might imply as much supernormal knowledge, and yield as good evidence of telepathy, as a marked excess; much as it is implied in the "negative hallucination" of a hypnotic subject that he both sees and does not see, the object of the hallucination, and indeed that he *must* see it (subconsciously) in order to avoid it. Again, however, the series of experiments was not long enough to make the appeal to the calculus of probabilities decisive. For the present, therefore, it is best to conclude that the reality of telepathy is not yet either proved or disproved: the evidence is just about enough to keep it alive as a hypothesis.

Trance.—The phenomena of trance continue to be studied, and although Mrs. Piper, the most famous "medium" of this type, was pensioned by the S.P.R. and retired so long ago as 1910, she has no lack of successors. Indeed, the great majority of the customers of "psychics" frequent trance-mediums. Their manifestations continue to be much the same; entranced psychics become obsessed by one or other of their regular "controls"—usually grotesque personages that cannot be identified, and may fairly be suspected of being creations, at least to a large extent, of the medium's subliminal imagination. There are poured forth (in the "good" sittings one hears about) masses of details about the sitters and their concerns, often hesitant, inconclusive, vague, sometimes wrong, often non-significant, but sometimes so startlingly apposite as to shake all but the sturdiest scepticism. The evidence presented in Sir Oliver Lodge's *Raymond* was obtained in this way; Miss Radclyffe-Hall and Lady Troubridge have recorded similar evidential sittings with Sir Oliver's chief medium, Mrs. Leonard, in S.P.R. *Proceedings*, pt. 78. Mrs. Sidgwick produced a final and monumental review of the Piper case in S.P.R. *Proceedings*, pt. 71 (1915).

As regards the theoretic interpretation of these trance-communications, the tendency, even among those most inclined to believe that they convey authentic messages from the departed, is to complicate the process of communication. It is recognized more and more that there have to be reckoned with, not only the medium, with his natural limitations of faculty and training, but the medium's "subliminal" or subconscious, the medium's "controls," who are supposed to transmit the messages from the communicator proper, and possibly the effects of abnormal conditions, not only in the medium (trance-personality) but also in the "control" and "communicator," owing to the effort to communicate. It is evident that these complications may account for many errors and obstructions; but they detract *pro tanto* from the authenticity of the actual communications.

Automatic Writing.—Automatic writing continues to flourish and to furnish psychical researchers with large masses of raw material. But its quality is not equal to its quantity, and its interest is for the most part psychological rather than evidential. Nevertheless a few cases of automatism laying claim to scientific importance may be noted. Undismayed by the failure of Mrs. Verrall to get, through automatic writing, at the contents of a sealed letter left, before his death, by Frederic Myers with Sir Oliver Lodge (*cf.* S.P.R. *Journal*, Jan. 1905), many of the leaders of the S.P.R. continued to work at cross-correspondences, and the results of their labours bulk large in the *Proceedings* of the society 1911–9. They discovered some curious cases among the writings of their automatists, the most remarkable perhaps being that entitled *The Ear of Dionysius* (1917), which was worked out by Mr. Gerald Balfour, and held to indicate the *post-mortem* agency of Prof. Verrall. But unfortunately the value of the coincidences on which the method relies is not capable of exact determination, and the whole method of proving spirit-identity by cross-correspondences is too literary and recondite to be appreciated without an intellectual effort, and so fails to impress the ordinary man. The automatic writing of a Dublin lady, Mrs. Travers Smith, excited some interest, both on account of the enormous speeds attained in its method of production (a planchette travelling over an alphabet under glass), and because of the claim that communications had been received from Sir Hugh Lane, before it was known that the *Lusitania* had been sunk, and that he had been one of the victims of this outrage. The case is narrated in *Voices from the Void* (1919).

Great interest was excited when Mr. Bligh Bond, in his *Gate of Remembrance* (Oxford, 1918), announced that he had been guided in his excavation of Glastonbury Abbey by the automatic writings of a friend who produced copious communications, largely in very debased Latin, from a number of the monks who had inhabited the Abbey from the 11th to the 16th century, and had revealed the correct location and dimensions of the Edgar Chapel, though all the extant antiquarian evidence had made these statements seem quite improbable. Mr. Bligh Bond also had the courage to print in the first edition of his book similar predictions about the Loretto Chapel, of which the remains had not then been found: when, after the war, excavation was resumed, these also were found to be correct substantially—*i.e.* allowing for the facts that the original script was in some points capable of more than one interpretation and that the excavators did not always hit upon the right one. Cases of practically valuable information received in a supernormal manner are extremely rare, and Mr. Bligh Bond's is one of the best of them.

Physical Phenomena.—To pass from automatic writing to physical phenomena is to pass from the least to the most contentious of the subjects that concern the psychical researcher, from a region where the facts are admitted and the interpretation alone is in dispute, to one where fraud has to be guarded against at every step and where *all* the facts are suspected by some to be due to it. Not that fraud is excluded in the former case: automatic writing can be simulated (like anything else) and with a little luck and ingenuity organized deception can be effectively practised with great success, as is amusingly shown in E. H. Jones's *The Road to Endor* (1920), describing how two British officers beguiled the tedium of their captivity and fooled both their comrades and the Turkish officials in charge of their prison camp. In fact, fraud is so easy that nothing depends on it; it is recognized by all competent inquirers that the whole value of automatic writing depends not on the mode of production but on the evidential character of the contents. In dealing with physical phenomena, on the other hand, the elimination or discounting of fraud is the primary consideration; the more so that fraud is certainly abundant, and that the conditions seem designed to facilitate it. This should be recognized by both sides, and should be no reason for refusing absolutely to investi-

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gate cases in which *prima facie* the evidence is good, and fraud is absent or, apparently, impossible. As for the conditions, it may conceivably be that just as photographs must be taken in the light and developed in the dark, so the curious growths to be described presently can only be developed in more or less complete darkness. But the inadequacy of the lighting, even in cases where red light is allowed sufficient to distinguish the hands and faces of the sitters, is a valid reason for demanding that the deeds done in the darkness of the séance-room shall be mechanically controlled by adequate substitutes for the sitters' senses of sight and touch, which the darkness puts out of action or renders untrustworthy. To secure this control, it would probably be necessary to construct a special laboratory in which extensive machinery (incapable of forgetting or being hallucinated) would record all the physical changes going on during the sitting. It reveals a curious lack of seriousness in the human attitude towards psychical research that no such laboratory had yet been provided anywhere.

In spite of these drawbacks, however, physical phenomena will not down. There have been plenty of frauds, and plenty of exposures, including that of an Italian medium of international fame, Eusapia Palladino, who began the decade well with a favourable Report by Mr. Everard Feilding and Mr. Baggally on a series of sittings she had given them in Naples (S.P.R. *Proceedings*, pt. 62, 1911). These investigators, though they reported many movements of objects they could not account for, nevertheless emphasized that Eusapia needed continuous watching because she always cheated when she was given the chance. The chance was given her when she went to America in 1909, and the result was a very handsome and complete exposure, which eclipsed her reputation, even though many of her patrons continued to hold that nothing new had been proved against or about her mediumship, and that it was not wholly fraudulent. Still she died obscure (1918) and fashion took to other mediums.

At present a somewhat different type of physical phenomena is in vogue, in which puzzling movements occurring within the radius of the medium's arm or foot are no longer the staple of the performance, and which it is more difficult to set down to fraud, because the evidence is largely recorded in flashlight photographs, which seem on the face of it to involve the supernormal. In particular two or three cases of "materializations" seem to be deserving of further study. The first of these is connected with a French lady known as "Eva C.," whose mediumistic career goes back to 1906 and the "Villa Carmen" sittings at Algiers, which ended in the customary charges, and denials, of fraud. Some years later she turned up in Paris, living in the house of Mme. Alexandre Bisson, and her materialization phenomena speedily attracted attention. Early in 1914 the chief German psychical researcher, a medical man, Dr. von Schrenck-Notzing, published a lavishly illustrated book, *Materialisations-Phaenomene*, on the materializations of Eva and the similar performances of a Polish girl, Stanislava P.; owing to the war it was not translated into English until 1920. It describes the elaborate precautions taken against fraud and to secure the genuineness of the "materializations"; but the extraordinary flashlight photographs of the plastic substance out of which they were built up are even more convincing than the physiological reports on its character. It is shown exuding from various parts of the medium's body, chiefly the mouth (whether or not the head and the hands were enclosed in muslin bags), hanging about the body in festoons, and forming itself into fingers, hands and faces, which are often incomplete and usually flat and picture-like. This of course gives a measure of support to the only explanation which the sceptics have so far been able to excogitate, viz. that the pictures are first swallowed by the medium and then "regurgitated." This theory, however, hardly explains how they manage to reappear so unruffled, or how the "plasma" is got through the muslin bag when the medium's head is sewn up, and back again. Nor does the medical and microscopic examination of small samples of the plasma which Dr. von Schrenck-Notzing was allowed to take confirm a stomachic origin: its character appears to be epithelial. The reports of Mme. Bisson and Dr. von Schrenck-Notzing were subsequently confirmed by a French medical man, Dr. Gustave Geley, in a lecture given to the Psychological Institute at the Collège de France in Jan. 1918, on "Supernormal Physiology and the Phenomena of Ideoplasty," and in the summer of 1920 "Eva C." was very searchingly examined by a committee of the S.P.R. in a series of sittings held in London: phenomena were not as copious as in Paris, nor on so large a scale; but their general character was confirmed, and no trace of fraud was detected (*cf.* S.P.R. *Proceedings*, pt. 81).

The "materializations" of "Eva C." seemed at first to receive independent support from the mediumship of Miss Kathleen Goligher of Belfast. This medium, and the family circle in which she sat, were exhaustively studied by Dr. W. J. Crawford, a lecturer in mechanical engineering in the local university, who described his conclusions in a series of books; *The Reality of Psychic Phenomena* appeared in 1916, *Experiments in Psychical Science* in 1919, while the third, *The Psychic Structures at the Goligher Circle*, delayed by the author's sudden death, appeared in Feb. 1921. They formed a graduated series, growing more and more sensational in their results, and in the end actually represented as visible facts what had originally been suggested as hypothetical inferences. In his first book Dr. Crawford, while candidly admitting that he believed the directing intelligences concerned to be departed human spirits, set himself to study the mechanics of the phenomena observed, raps, levitations of the table, and other movements of objects, after establishing their supernormal character. For this purpose he used phonographs, manometers, spring balances and a variety of weighing machines, in a red light "nearly always" sufficient to show plainly the hands of the sitters, and proceeded to determine *exactly* the amount and incidence of the forces employed in producing the movements. As a result of his experiments, he came to the conclusion that the mechanical effects observed could only be explained by postulating hypothetical structures, with a definite shape, connecting the bodies moved with the body of the medium at her ankles. These structures, which he called "psychic cantilevers" and "psychic rods," though invisible and intangible, had a size, shape and position which could be mapped by observing at what points the phenomena could be stopped by interposing between the medium and the objects moved.

In his second book Dr. Crawford extended these results, and showed that ordinarily the weight the bodies levitated was added to that of the medium (as if she held them), while when this psychic substance was weighed in a weighing pan at a distance from the medium, her weight would simultaneously be reduced; he claimed to have observed a temporary loss in this way of as much as 54 lb., nearly half her normal weight. He also stated that he obtained impressions on clay of the ends of such a "cantilever column." Finally these structures became visible, and his last book is adorned with flashlight photographs appearing to verify the correctness of his deductions about their origin and application. Moreover, in appearance they curiously resembled the "plasma" issuing from "Eva C." By ingeniously applying moist dyestuffs to various points in the stockings and underclothing of the medium, Crawford claimed to have determined the course taken by this "plasma" in issuing from, and returning into, the body of the medium, declaring also that he had felt the collapse and recuperation of her muscles which accompanied these processes. As his narrative stood, the Goligher case appeared to provide the most impressive evidence ever obtained for the reality of "materializations." Dr. Crawford's premature death in 1920 made it temporarily difficult to pursue independent inquiry into the matter; but at the end of 1921 further investigation by Dr. Fournier D'Albe proved that the manifestations were fraudulent.

Observations of so-called "telekinetic" phenomena, *i.e.* movements of small objects such as celluloid or pith balls, matchboxes, teaspoons, balances, etc., without contact, in the presence of a Polish lady, Stanislava Tomczyk (now Mrs. Everard Feilding), who had been "dissociated" in consequence of experiences during the Warsaw riots of 1906, were reported by Prof. I. Ochorowicz of Warsaw in the *Annales des Sciences*

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Psychiques (1909–12), and confirmed by Dr. von Schrenck-Notzing in 1913–4. Some of the photographs appeared to give a clew to the mechanics of these phenomena by showing very fine threads connecting the hands of the medium and passing beneath the object levitated. It is argued however, partly on the strength of the negative results of investigating the medium before and after the phenomena, partly on the ground of differences in the appearance of these threads and of cotton, silk and hair (illustrated), that the threads were of a psychic and supernormal character, and in fact plastic emanations similar to those of "Eva C." In the summer of 1914 the medium came to London to be examined by the S.P.R., but the outbreak of war prevented the continuation of the investigation.

Another branch of physical phenomena is represented by what is called "spirit-photography." In this, as in the (now extinct) method of "slate-writing," everything depends on the prevention of fraudulent substitutions in the plates (or slates). If this is neglected, the production of "spirit-photographs" becomes easy enough. One of the earliest practitioners of this art, William Keeler, has recently suffered annihilating exposure of his "Lee-Bocock" frauds at the hands of Dr. W. F. Prince (Am. S.P.R. *Proceedings*, vol. xiii. 2, March 1920), after having had his case stated in *Proceedings*, vol. viii. (1913), of the same society. Other cases of "spirit-photography" may be said to be still under investigation, and, though none had in 1921 been proved genuine, their detection is usually a highly technical matter. Dr. Prince has also convincingly shown by a critical study of the evidence that an old "poltergeist" case, "the Great Amherst Mystery" (1879), was in all probability due to the (unconscious) fraud of the medium, who had been "dissociated" by a shocking event in her personal history, which she had, apparently, "repressed" (Am. S.P.R. *Proceedings*, vol. xiii. 1, 1919).

"*Dowsing*," as a method of finding water in dry places, continues to be used with considerable success, and it is certainly impressive to find that certain firms of well-sinkers regularly employ dowsers, and are so confident about their skill that they are willing to make contracts on "no find, no pay" terms. It is said, however, that they then (not unreasonably) protect themselves by charging higher rates. The subject was somewhat actively debated in Germany shortly before the World War, because the German governor of South-West Africa had a cousin who was a water-finder, and employed him with great success (*cf. Des Landrat von Uslars Arbeiten mit der Wünschelrute in Südwest Afrika*, Stuttgart, 1912). A pamphlet by A. J. Ellis, issued by the U.S. Geological Survey (*The Divining Rod*, Washington, 1917), though it dismisses the matter dogmatically as a mere superstition, has a useful bibliography.

Thinking Animals.—Before the World War Germany was also the chief home of a vigorous dispute about "thinking animals," which must be noticed in this connexion, not only because allegations of supernormal faculty were made, but because the logical problems involved, the difficulties in ascertaining the facts and in guarding against deception, and the partisanship of the disputants, were identical. For though at first the issue appeared to be simply a question of zoölogical fact, to be decided experimentally by biological and psychological experts, it soon appeared that not only was there the usual divergence between conservatives and progressives, but that the experts were divided by the conflict between the tendencies to emphasize the unity of life and to affirm the supremacy of the human mind; moreover, when, as was soon the case, a considerable amount of *odium theologicum* was imported into the discussion, a similar division was observable among theologians. The result was a complete replica of a controversy in psychical research. The trouble began so long ago as 1904, when Herr von Osten produced a horse, his "Clever Hans," which he had taught to do simple sums by tapping with his hoofs. He had proceeded on the logically false assumption that mathematical thought is peculiarly arduous, and on the biologically false assumption that to discover unsuspected extensions of animal intelligence would be particularly cogent in directions remote from the natural interests of the beast. However, "Hans" indisputably tapped out the right responses in the presence of his master, and even (though rarely) in his absence, and the scientific scandal became so great that an inquiry had to be made (by order of the Ministry of Education); as a result the explanation was adopted, with the approval of the Berlin psychologist, Prof. Stumpf, that the observant animal reacted to slight, unconscious indications given by the experimenter. Thus there was neither thought nor fraud, but only visual hyperaesthesia (*cf.* Pfungst, *Clever Hans*, English translation, New York, 1911).

Officially this report was supposed to settle the matter. But an Elberfeld gentleman named Krall was not satisfied. He bought "Clever Hans" after von Osten's death, and examined his visual acuity, finding it to be 2½ times that of a man. He also trained up a whole stud of equine mathematicians, that became famous as "the Elberfeld horses." Among them one turned out to be a genius, "Muhamed," while another, "Berto," was blind, and so incapable of visual hyperaesthesia. Elberfeld became a place of pilgrimage; a multitude of books, pamphlets and articles appeared (*cf.* Krall, *Denkende Tiere*, Leipzig, 1912); a review was founded for the recording of the prodigies of animal thought (*Tierseele*, 1913). Presently, at Mannheim, an invalid lady took to exhibiting a thinking dog, "Rolf," who, though not so mathematically minded, appeared to be gifted with a rare sense both of philosophy and humour. True, the animal refused to "work" unless held by a chain, and this procedure naturally fostered suspicions that the natural brilliance of his mind might have been improved by a little judicious wire-pulling; but there arose plenty of reputable observers to testify that the chain was kept slack, and even some to declare that "Rolf" had been known to answer correctly in the absence of his owner and had furnished answers not known to any human mind: the opposition, therefore, could only attack the competence of the observers, and sometimes succeeded in showing that they had been laxer than they had imagined. Yet, despite the indignant protests of those who claimed to have vestiges of common sense or knowledge *a priori* of where the limits of the possible were laid down, the open-minded (like Darwin), not afraid of "fool" experiments, went to see, and were duly puzzled: even eminent psychologists, like Prof. Claparède of Geneva, reported favourably, more or less. A poet, Maeterlinck, came away from the horses with the conviction that the phenomena were supernormal; and was satisfied that horses, dogs and cats were by nature "psychics," while elephants, monkeys and asses were not and, unlike the former, could not tap the cosmic reservoir of potential knowledge. The said "reservoir" was hypothetical, but seemed to be needed to provide for the correctness of answers not known to any human mind, and so transcending "telepathy" (which had also been suggested) (*cf. The Unknown Guest*, Eng. trans., 1914, p. 267).

Clearly, this question of "thinking animals" exhibits the tantalizing perversity of other problems in psychical research. The truth about it is not a problem in pure science, and is not susceptible of settlement by its methods. For these demand that the good faith of the observers can be presupposed and that undistorted observation of the facts is possible, both conditions often far less completely fulfilled, even in the established sciences, than is usually assumed. In the unreclaimed borderland between superstition and science neither condition can be satisfied; every "fact" may prove to be real only as a hallucination is real, or to be distorted into a monstrous *mirage* by prejudice and bias, while the will to believe (and equally the will to disbelieve) is so free to select, to emphasize, to interpret, that it can create practically any "fact" it chooses. In short, truth in this region is unmistakably emotional; men's attitude towards it essentially resembles their attitude in religion or in politics; the abstraction from human feeling (or rather from every feeling but the desire for knowledge), which is postulated in the ideal of pure reason, is simply impracticable here. So long as every "fact" adduced on either side has to be treated as suspect, and every step is contentious, scientific progress, if it is possible at all, cannot be otherwise than slow. There is only one way for believers in the supernormal to shortcircuit this procedure: if they can apply

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their beliefs to the ordinary course of reality and show that they develop so much practical value that they must be reckoned with, they cannot in practice be treated as false. If, for example, secrets were regularly discovered, and information transmitted, by "telepathy," if fortune-tellers frequently told their clients how to make fortunes, and business "clairvoyants" were employed by financial houses, this pragmatic proof would be irresistible, and would suffice to convince the world. Actually, however, the pragmatic test rather tells *against* belief in the supernormal: for the supernormal knowledge believed in is not taken to be trustworthy normally; nor do believers in it act on it, thus betraying the fact, which they may not realize themselves, that they do not take their beliefs quite seriously. In this respect they are like very many other people. For, as Prof. Carveth Read (*The Origin of Man*, ch. viii., London, 1920) has shown, even among the most benighted savages believers in "magic" have always to behave sensibly, for all the extravagance of their beliefs. They pray, *but* they *also* keep their powder dry, and thus their action reveals which of their beliefs are only half-beliefs or make-believe.

In ultimate analysis the question becomes one of the place, function and significance of beliefs which are not quite matter-of-fact about what are not quite matters of fact. To appreciate these, we have to discard the illusion, traditionally fostered by logic, that there is no alternative to firm belief but whole-hearted disbelief. Actually the gradations and fluctuations of beliefs are infinite, and in many departments of life such unstable beliefs are normal and dominant. They can easily coexist with others, abstractly inconsistent with them, in a mind unwilling to abandon either, or perhaps unaware that it is entertaining them. Thus even Herbert Spencer showed that he had *some* belief in ghosts by his comical indignation when his hostess told him she hoped that so stalwart a disbeliever would not mind sleeping in the haunted room of a country house (*Autobiography*, i., p. 480). The only way of redeeming from this region of incomplete beliefs that are below proof a subject of general human interest—and no others ever fall into it—is to make it part of the ordinary routine of life, which every one accepts in practice (whatever the theoretic reason he may give to himself and others), simply because no one can ignore it and live. But if ever the objects of psychical research should be effectively subjected to such a transfer, this would clearly mean a spiritual revolution of the most far-reaching kind.

LITERATURE.—This is still largely contained in periodicals. In England those of the Society for Psychical Research must be mentioned in the first place. Both the *Proceedings* and the *Journal* maintain a high scientific and literary level, and contribute, record or review all the important developments of the subject. The addresses which are delivered by presidents of the society on coming into office form an interesting record of the attitude taken up towards the subject by a number of eminent thinkers (*e.g.* Henri Bergson, 1913; Gilbert Murray, 1916; L. P. Jacks, 1917; Lord Rayleigh, 1919; W. McDougall, 1920). But the society's publications do not notice all the tittle-tattle of the movement, for which it is necessary to consult the weekly *Light* and the monthly *Occult Review*. The former is the official organ of British spiritualism, and the latter is not sufficiently critical of the material it publishes, which, though entertaining enough, appears to be often (almost avowed) fiction. In July 1920 *The Psychic Research Quarterly* began to appear, which promises to be a high-class periodical, and in its Oct. number published the first photographs of Miss Goligher's "materializations." In America the *Proceedings* and *Journal* of the American S.P.R. have the same standards as the English society. But they were long edited by the late Prof. J. H. Hyslop (d. 1920), who soon became a convinced (though critical) spiritist, and reflect his work and his views in a very voluminous and somewhat one-sided way. They are now edited by his successor, Dr. W. F. Prince, the brilliant investigator of the Doris Fischer case, and the acute critic of sundry cases of fraud. In France the *Annales des Sciences Psychiques* have published some good material and continue to give a good idea of the movement in the Latin countries. The *Bulletin* of the Institut Général Psychologique used not infrequently to contain articles on psychical research, but now that an *Institut Métapsychique* has been founded in Paris, with an ambitious programme, it is probable that in future these will appear in its *Bulletin* (no. 1, Oct. 1920). In Germany *Psychische Studien* continue. In Switzerland the *Archives de Psychologie* used often to publish valuable studies bearing on psychical research, while it was edited by the late Prof. Theodore Flournoy (d. 1920), the author of the famous study on the automatisms of "Hélène Schmidt," *Des Indes à la planète Mars* (1900), *Esprits et Médiums* (1911), and of the very remarkable study of a modern mystic "Cécile Vé" (in no. 57, 1915).

As regards books, many have been referred to above. The outstanding importance of Sir Oliver Lodge's *Raymond* and of W. J. Crawford's works on the Goligher case has been already explained under "Trance" and "Physical Phenomena." William James's "Final Impressions of a Psychical Researcher" was reprinted from the *American Magazine* in *Memories and Studies* (1911) and should be consulted for the conclusions left in the great psychologist's mind by his prolonged interest in psychical research. As books of a general character taking a favourable view of the phenomena, there may be mentioned Sir W. Barrett's *On the Threshold of the Unseen* (1917); J. A. Hill's *Spiritualism, its History, Phenomena and Doctrine* (London, 1918); J. H. Hyslop's *Psychical Research and Survival* (1913), *Life after Death* (1919), *Contact with the Other World* (1919); H. Carrington's *Problems of Psychical Research* (London, 1914), *Modern Psychical Phenomena* (1919), *Psychical Phenomena and the War* (1919). Among hostile accounts the best are I. L. Tuckett's *The Evidence for the Supernatural* (1912); E. Clodd's *The Question, If a Man Die shall he Live Again?* (London, 1917) and J. McCabe's *Is Spiritualism based on Fraud?* and *Spiritualism: a Popular History* (both London, 1920). Prof. M. Dessoir's *Vom Jenseits der Seele* (1917, 4th ed. 1920) is also unfavourable in the main, though appreciative of the attitude and work of the S.P.R., and interesting as coming from an academic psychologist who has not disdained to investigate the phenomena alleged. Dr. A. von Schrenck-Notzing's works are important (*Materialisations-phaenomene*, Munich, 1914, 2nd. ed. announced for 1921, Eng. translation by Dr. Fournier d'Albe, London, 1920; *Der Kampf um die Materialisations-Phaenomene*, 1914; *Physikalische Phaenomene des Mediumismus*, 1920). Dr. G. Geley's *De l'Inconscient au Conscient* (Paris, 1919) is an attempt to form a theory of the supernormal physiology of "Eva C." A translation by S. de Brath came out in 1920 (London). Lastly A. J. Philpott's *Quest for Dean Bridgman Conner* (London, 1915) may be instanced as an instructive investigation of an automatic romance (communicated through Mrs. Piper), which, though plausible and partially correct, turned out to be essentially false, and to illustrate how untrustworthy information obtained through supernormal channels at present is. As medical works dealing with psychotherapy and dissociations of personality, those of Dr. Boris Sidis, who made his mark by narrating the strange case of the Rev. Mr. Hanna (*cf.* Sidis and Goodhart, *Multiple Personality*, New York, 1905), *The Foundations of Normal and Abnormal Psychology* (London, 1914), *Symptomatology, Psychognosis and Diagnosis of Psychopathic Diseases* (Boston, 1914) and *The Causation and Treatment of Psychopathic Diseases* (Boston, 1916), may be mentioned; also W. H. R. Rivers' *Instinct and the Unconscious* (London, 1920) and W. Brown's *Psychology and Psychotherapy* (London, 1920).

(F. C. S. S.)

PSYCHOTHERAPY.—The modern branch of medicine to which has been given the name of "psychotherapy" may be regarded as covering all attempts made to mitigate or remove such symptoms as may be attributed to the operations of an unhealthy mind. These symptoms may be mental, for instance confusion of mind, or delusions, or obsessions, and may not be associated with any bodily symptoms or only with such as are trifling. On the other hand the symptoms may be bodily, for instance paralysis, or some form of loss of sensation, or indigestion, and may not be associated with any but trifling mental symptoms. The treatment of symptoms due to mental ill-health by physical agents such as rest, exercise, change of climate, baths, electricity or drugs is not psychotherapy.

Psychotherapy has been practised in all ages, sometimes upon those patently suffering from mental or moral disorders, but perhaps even more often upon those whose symptoms in fact depended upon mental or moral weakness or disorder but in whom the affection appeared, from the superficial character of the medical knowledge of the moment, to be due to organic disease of the body. In such cases psychotherapy has enjoyed considerable success, whether practised in connexion with religion and philosophy or with superstition and charlatanism (*see* FAITH HEALING, 10.135). Under circumstances such as these there has always been, and indeed still is, a formidable admixture of the miraculous, and it is not intended here to examine systems like that of Christian Science or the miracles of Lourdes. The term "psychotherapy" is of comparatively recent origin and has received wide acceptance in that it usefully stands for treatment based upon scientific psychology, normal and morbid. Three methods of psychotherapy will here be considered, from the purely medical point of view: those of Moral Suasion, Suggestion and Psycho-analysis.

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Moral Suasion is historically the oldest method, and was advanced to a high level of excellence by the Stoic Philosophers. Illness, whether mental or physical, involves, to an extent depending upon the circumstances of the case and the character of the patient, pain and discomfort, disability with the fear of its consequences upon economic and social position and the fear of death. It is principally in the relief of discomfort and pain that persuasion has its success. Many patients are seriously alarmed at any abnormal feeling in any of their organs, are apt to call such feelings painful and to colour their descriptions with such adjectives as "awful" and "terrible." Others will ascribe symptoms of a commonplace character to serious disease of some important organ,—for example, when flatulence is mistaken for heart disease or turbid urine or pain in the back is regarded as indicative of kidney disease. Merely to induce such patients to be more precise in language and then in simple terms to offer some proximate explanation of their symptoms will often, without the association of any remedial agent, place their ideas in better proportion and mitigate or abolish their pains. Therapeutics have, very naturally, up till quite recent times been dominated by the endeavour to treat the symptom of which the patient complains rather than to attack the disease which is producing the symptom. For the most part treatment has been either by frankly miraculous methods or by those which have been in part empirical and in part miraculous, that is, by those in which some wonderful and unknown factor has seemed to coöperate with the supposed remedy. It has more recently become increasingly apparent that remedial agents not uncommonly owe their seeming success firstly to the fact that most disorders pass away whether treated or not, and secondly to the fact that the mental attitude of the patient can in itself assist at his cure and that this attitude may in many persons be modified for good or ill by the physician or other attendants of the sick man. Galen long since pointed out that "when the imagination of a sick man has been struck by the idea of a remedy, which of itself is without efficacy, it becomes endowed with beneficent power." The method of persuasion seeks to use this recuperative power which lies in the patient's mental field and to set it to work either without or with the assistance of physical agents. It seeks by reasonable explanation to impress upon the patient that his symptoms are transient and that his malady is curable, that it is important for him to aid in his own cure by taking a balanced view of the ills which afflict him and to face them with hope and courage. There is not, as in treatment by suggestion, an endeavour to impose an authoritative assertion to be blindly accepted as a matter of faith, but an endeavour to secure the penetration of an idea by the power of reason, to discuss the situation with the patient and to obtain his acceptance of the case as put forward by the physician. The fear of the disabling effect of illness may also be dealt with by the physician, who may point out, where he is so justified, that on recovery the disability will pass away or that if any be left it will be of an entirely trifling character. In serious disablement and in cases of which the end is likely to be death, it becomes the duty of the philosopher and the priest to fortify the courage and resignation of the patient. Not infrequently, however, the physician, willing or not, has himself to assume their functions and to adapt his exhortations to the needs of men of various creeds and levels of culture.

That persuasion on these lines is of value as a therapeutic agent there can be but little doubt, but its chief disadvantage lies in its limited scope, in that its appeal is to highly developed and organized faculties, just those faculties with which the neuropathic are not for the most part particularly gifted and which are the first to be weakened in disease. In practice, persuasion is apt to degenerate into partial explanations authoritatively enunciated, in which the physician has to make the best he can of the ignorance of the patient and of his own necessarily meagre scientific acquisitions, and in which pure ratiocination plays a small part. In short, persuasion merges into suggestion.

Suggestion, as a formal method of therapeutics, is but of recent origin (*see* 26.48). In large measure it has been, from the earliest times, ancillary to miraculous, magical and professional modes of healing. Under other names it has often been the only curative agent and has been used uncombined with physical agents or ritual performances, but for the most part it has been practised in combination with these. Professional or scientific medicine, though seeing no way of escape, has often sought and still seeks to have as little to do as possible with so indeterminate and varying a mode of cure. It struggles after more exact and precise results, in the fond hope that at some distant date each disorder, psychic or somatic, shall either be prevented from occurring at all or if it occurs shall be met forthwith by some one rapidly acting and efficacious medicament.

The first great impetus to the use of suggestion as a formal method of therapeutics came from Mesmer during the latter part of the eighteenth century, and for well nigh a century suggestion, employed as such, was associated with hypnotism (*see* 14.201). The artificial induction, but not by drugs, of a state in some ways resembling sleep was first called by this name rather before the middle of the nineteenth century, and it was found that the hypnotized person was, in a great majority of cases, in a condition in which suggestions made to him were acted upon with astonishing accuracy either at once or at some subsequent time as determined by the hypnotizer, in short that his suggestibility or capacity for receiving and acting upon suggestion had been much increased. The word "suggestion" used in association with mental therapy has lost some of its precision. Few are agreed as to its meaning: no one can do more than speculate as to the mode of action implied by it. It is common to hear detractors of some cure, whether it be miraculous, or of the character of those relied on by Christian Science, or emanating directly from orthodox medicine, explain it as being "merely" due to suggestion. What is really meant by such an explanation is not always apparent, and it is desirable to restrict the meaning of the term "suggestion" as applied to therapeutics to the process in which it is sought authoritatively to instil an idea into the patient's mind with a view to the relief of some morbid process. From the catalogues of cases set forth by some practitioners it would appear that almost any affection is capable of amelioration or cure by suggestion. A more modest and a more generally held estimate would limit the cases amenable to this treatment to those of functional disorder and of organic disease in which super-added functional symptoms are a prominent feature. The difference between persuasion and suggestion, as indicated above, is that in the former an appeal is made, at least in theory, to the highest levels of the patient's mind, whereas in suggestion (and particularly is this the case when it is combined with hypnosis) directions are delivered to levels of which the patient is only partially conscious, or which he is not aware of as being concerned in the production of his symptoms, or which he does not hold to be capable of activation in their amelioration, or of which, indeed, he is wholly unconscious. In the endeavour to make use of such levels it is plain that it may be necessary to endeavour to inhibit the operations of those that are higher, since these are occupied largely and sometimes almost wholly by the miseries of the patient.

Suggestion suffers from the essential vice of the older therapy in that it is directed rather to the treatment of the symptom than to the disorder of which the symptom is but part. Movement may, for example, be restored to a paralysed limb, but the mental processes of which the movement is the outcome may nevertheless remain unhealthy. A coördinated purposive action is not wholly explained in terms of the movement of a limb, but involves preliminary sensual, perceptual, rational and volitional activities, one or several or all of which may be affected. Criticism has largely been directed against the method of suggestion in that it would seem to convert the patient into an automatic machine which responds to activation without knowing what it does or why it does it: there is obedience without reflection or judgment. Whether this be always so or not, the physician in any case is in ignorance as to which part of the whole psychological system he is operating upon; indeed he is ignorant as to which part of it is in a morbid state. Hysteria is held by many

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psychologists to lie in mental dissociation, that is that the various mental processes do not coöperate harmoniously and that some are active while others are dormant. Suggestion in the hypnotic state seems artificially to procure this very state of dissociation, and in fact is widely held to induce a mental state analogous to, if not identical with, that of hysteria. To avoid so unhappy a result of a therapeutic measure as the establishment of a morbid state, endeavours have been made to practise suggestion when the patient is not under hypnosis, that is, when he is awake. It is nevertheless usual to direct the patient to allow his mind to adopt an attitude of passive receptivity, and when, if he can, he has done this to make suggestions to him. Only so far as the critical faculties are dormant are such suggestions likely to be efficacious, and if the critical faculties are dormant the method is open to such objection as may be made to hypnotism. This mode of suggestion is probably but little removed from the method of persuasion, the physician hoping that his case may be accepted under the guise of suggestion with a minimum of adverse criticism.

The term "auto-suggestion" has been used to denote a process in which the patient himself attempts to exercise a salutary influence upon his malady by concentrating his thought upon the idea of his cure or by, as it were, commanding his symptoms to disappear. The operation may be assisted by the withdrawal of the patient to a quiet place, by his placing himself in an attitude of repose and by his endeavour to empty his mind of all ideas save the one which is curative. Given sufficient intensity of purpose a man may by such treatment of himself rise superior to the ills that afflict him, think or act in spite of them, and, indeed, in certain cases annihilate them. It is not, however, given to many to reach success on these lines. Afflicted man seeks two things, one to know what really is the matter with him and the second to obtain succour from forces external to himself; he ardently desires a diagnosis and a healer. The desire for correct diagnosis is necessarily shared by him who aspires to be a scientific physician, prompts the constant search for the cause of symptoms and inspires the hope that, a cause being discovered, treatment will be more radical and effectual. Such ideas have led to the inquiries which of recent years have been instituted into the development of the human mind, both from the racial and from the individual aspects, and have resulted in new methods of mental analysis.

Psychological analysis (or "psycho-analysis") has been practised by the method of introspection for centuries. It involves the examination of his mind by the individual himself and the attempt to differentiate between such mental operations as those of feeling, knowing, reasoning, wishing and willing. Such inquiries eventuated in difference of opinion and ceaseless controversy as to the spheres of these faculties, as they were called; nor was the introspective method, owing to the difficulty of getting it efficiently practised by patients, of much value in morbid psychology. The newer methods of analytical psychology as applied to morbid mental manifestations, or to such bodily symptoms as might be supposed to be due to disordered mental processes, have addressed themselves to the discovery of a presumedly basic causative idea, its association with other ideas, and its genesis.

The earliest signs of mind in the individual have the character of reflexes, that is, that upon the reception of a certain stimulus by the organism a particular series of movements ensues. Some of these pass by the name of instincts, are of a complicated character, and appear to occur without previous experience and without education or direction from without. Very early, however, in the history of the child the play of instinct is controlled, repressed or supplanted by positive injunctions from others, by the inculcation of habits, by lines of thought and conduct suggested to him by his observations of those about him, by his desire to imitate their doings and to repeat their sayings, and by his personal experience. The purely natural development of the child is interfered with in order that he may be fitted for life in a civilized society. During this process certain actions initially pleasurable come to be regarded as unconventional, or reprehensible, or shameful, or immodest, or all of these together, and so gradually rules of thought and conduct come into being. Almost all, and perhaps all, thoughts and actions are associated with some emotional tone, that is, with feelings of pleasure or displeasure or pain. Such feelings are of varying intensity, being in some cases so weak that they can scarcely be discerned and in others so powerful as to occupy and command the entire personality. During the education of the child a separation may be brought about between an action and the associated emotional tone or affect, as it is termed. If a child has learnt to regard a pleasurable act as blameworthy and in fact acts no longer in this particular way, the affect which was associated with the act may become partially or wholly detached from it and may perhaps be replaced by its opposite. It is one of the hypotheses of psycho-analysis that a dissociated affect of this character may produce symptoms at once or in later life, either because the affect has not been passed on to some other important or more legitimate object of activity and remains as a quantum of unused psychic energy, or because it has become attached to a substitute for its original partner of unworthy or ridiculous character. The gradual passing on of affects from lower levels of activity to those that are higher has been called sublimation, and their progress from the satisfaction of very lowly bodily wants to the highest ethical and aesthetic acquirements of the mind has been elaborately examined. The failure in attachment of an affect to any sort of substitute for its original partner may result in those indefinite emotional states, sometimes of a distinctly morbid character, in which the individual may be happy or miserable or excited or apathetic for no reason which is obvious to himself or to anyone else; while the attachment of affects to somewhat trifling and comparatively valueless objects is seen in the inordinate interest taken by some in domestic pets, bric-a-brac, pastimes, or fantastic and inane social entertainments. Sometimes, however, the affect remains unconverted and still attached to the original act, so that a conflict arises between the primitive and personal desires on the one hand and desires of later acquisition weighted with civilized, ethical, legal and religious authority, on the other. Many such conflicts are plainly carried on in full consciousness, and are examples of the lust of the flesh against the spirit and of the spirit against the flesh and of the contrariness of the one to the other, but others are by no means so obvious, and their existence may only betray itself by trifling, though odd, deviations from ordinary conduct, by unexplained prejudices and habits, or by symptoms of functional nervous disorder or by the yet more pronounced symptoms of insanity. The conflicts which lie in the field of consciousness may largely be dealt with, in so far as they come under the notice of the physician, in that field. The mere disclosure to another of the existence of a conflict may suffice to produce a therapeutic effect, and this may be further enhanced by the discussion of the subject and its illumination by another mind, but there are conflicts in which the opposing elements and their origin and genesis are not apparent or recognized or indeed discoverable without much labour. Such conflicts are said to lie in the field of the unconscious and to be due to the persistence in that field of repressions made at that time of life when the instinctive desires of the individual, tutored by early environment and education, have undergone a process of restraint. By a wide, and as it seems to some, unnatural extension of the term "sexual" the interest of the infant in its excretory functions and its relations with its parents is ascribed to the sexual instinct, and is that which, owing to existing social conventions, is most subject to repression. It is held that the relations of the child to his mother have an element of sexuality hitherto not determined. Hence the frequent occurrence of such terms as the "Oedipus Complex" and "incest" as descriptive of certain infantile affects. It is further held that the earliest interest of a child in itself is of a sexual character, that it is "auto-erotic." Progress is made from this stage to another in which the child's sexual admiration for himself is termed "narcissism"; then to one in which the interest is extended to other members of his own sex, and finally to one in which sexuality

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becomes centred upon the normal object, that is upon the opposite sex. This development may be arrested at any point, and the arrest may later in life be displayed in various sexual perversions. If a person in whom such an arrest has occurred, say, at the stage of homosexuality, is living in a civilized society, difficult internal conflicts are likely in later life to ensue between the strength of his desires and his fear of outraging both social convention and legal enactment; or, owing to the fixation of his affect upon an object, not the normal end object of the sexual instinct, he may find himself impotent in his relations with one of the opposite sex. The efforts of psycho-analysis are directed towards the discovery of repression, arrest of development and the conflicts which are thus generated. If these can be brought to light there is hope that further development may occur, that unattached or badly attached affects may find appropriate and fitting objects, and that conflicts may be resolved by the co-ordinating action of the conscious.

Analysts are not, however, in complete agreement as to whether sexuality is the sole or essential cause of functional nervous symptoms. Some find in the desire of the individual to express his influence upon others, or his "will to power," an active determining cause of the internal conflict which arises when he finds himself in opposition to social conventions and to such activities of those about him as tend to impede his progress. Others again seek to find conflicts not so much in the past development of the individual as in the difficulties which arise when he endeavours to attain such ideal ends as he has proposed to himself. But whatever the value attached to the elements of causation of morbid states there is general agreement that it is not only the conscious field with its obvious conflicts which has to be explored but that the unconscious field should also be examined in as much detail as is possible.

The form of the content of the unconscious and of the conscious mind appears to be determined by analogous processes. Perceptions are apparently not invariably noted by the conscious. It is not an uncommon experience to discover perceptions which must have been made at a certain time and place which only well up into consciousness at some later date, while the details of a perception which were not clear or even considered at all at the time they were received, may be placed in their true position by analysis. In certain morbid states, for instance, delirium and mania, memories of events and even of languages which have been forgotten for many years, may be recovered. Such memories lie in depths of mind to which the term "unconscious" alone seems applicable. Constructive ideation and ratiocination appear also to proceed in the unconscious mind. Problems which have been propounded and set aside for a while receive, as it were suddenly and unexpectedly, a solution; indeed such solutions are recorded as having been reached during sleep. Similarly the execution of works of art, pictorial, musical or literary, is, especially in the case of genius, often effected without immediately preceding conscious mental effort, while the ideas of preachers, orators, wits and ordinary conversationalists often seem voiced automatically. Indeed the obtrusion of conscious effort not uncommonly mars rather than enhances the value of artistic expression. Conventionally the term "subconscious" has become restricted to those states of mind which, though not at the focus of conscious thought, can be brought to that focus at the will of the individual, but the differentiation between such states and those which are brought to consciousness only at exceptional times or by analytic methods seems to be of a very indeterminate nature. A much more particular meaning is assigned to the unconscious by some who make of it a rather sharply defined collection of primitive and instinctive infantile affects. Whatever may be the view adopted on this point, there is but little division of opinion as to the view that the affects which impel conduct, whether primitive or elaborated and sublimated, lie to a great extent in the unconscious, and the search for and examination of these affects when brought into consciousness constitute the great merit of knowledge of self. Not only does the unconscious seem to contain the powers already alluded to, but it has been sought to establish that there is in it a something which has been termed the "censor" which seeks to prevent the emergence of unacceptable affect unconscious into the sub-conscious and thence into the conscious. To this "censor" is also attributed powers of transmutation of ideas and symbolization which render the [illegible] and unpalatable operations of the unconscious less unacceptable to the conscious. The examination of dreams by the analytic method is held to have demonstrated the existence of such operations. The ideas of a given dream are one by one examined, with a view to the discovery of their associations, that is of their immediate relation with other ideas, and it is found that the manifest content of the dream is but a condensation of a much wider range of ideas and only indirectly and allegorically expressive of them. The dream is found to be the expression of an affect whose existence may perhaps not hitherto have been recognized and whose passage into the conscious has been prevented. On these points also there is not a complete consensus of opinion, and by some the analysis of dreams is held to disclose not only or so much the expression of the most primitive affects but also the ends which the individual in fact desires but of which he is but unconfessedly and dimly, if at all, aware. Indeed the interpretation of dreams seems not infrequently to depend not so much upon a thoroughgoing analysis as upon the psychological views and imagination of the interpreter.

Another method of exploration is that by free association. The patient is placed in a comfortable position and is directed to close his eyes and then to say whatever idea comes into his head, no matter how absurd or rude or otherwise offensive it may be. Ordinary volitional precautionary control being in this way relaxed, vent is given to the repressed content or at least various groupings of ideas are disclosed. Analogous results are obtained when, owing to intoxication or disease, patients reveal trains of thought remote from those to which in healthy states they give utterance, the very existence of which has been unknown to them and which when known is repulsive.

A third method of analysis is that by the "time-association" test. In this again the patient places himself in a comfortable position and relaxes his attention to what is going on or to any particular line of thought so far as is possible. He is directed to listen to certain words pronounced by the analyst, and on hearing one forthwith to say the word which first arises in his mind. The time between the signal word and the reply is noted. Normally the length of time is two to three seconds, and if it is prolonged or if after some 45 seconds no reply has been given the reaction is considered to be worthy of further examination and to indicate the existence of a group of ideas associated with a definite and perhaps marked emotional tone, that is, with a "complex," as such a group has come to be technically called. But the time element is in fact not the only one of importance in this test, since the character itself of the reply word is put to valuation. Test words may elicit replies of a rhyming character, or altogether commonplace, but on the other hand they may be so inconsequential and unexpected that a surmise at once arises that they imply the existence of a complex.

Such then are the methods adopted in analysis, and it must be plain that if carried out in detail they must necessarily occupy a considerable amount of time. Unhappily in practice analysis is apt, owing to the limitation of available time, to be slip-shod, while deductions are hastily drawn from hastily gathered data; this is by so much the greater a misfortune in that the outstanding merit of analysis lies in its claim to be something of an exact method of examination and thus to supply in psychotherapy a way of discovering, and so of treating, the basis of the symptoms complained of. Though an analysis may not be thorough or the results of a thorough analysis may be incorrect, yet some amelioration of symptoms may occur, and in such an event it is possible that the process of cure is somewhat similar to that obtaining in treatment by suggestion. Though in an impartial analysis the physician should be little more than a recording machine, it is extremely difficult for him to avoid making, or at least being the occasion of, suggestions. The patient seeks a cure at the hands of one whom he regards as

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having special knowledge; he is hopeful of a good result and is prepared to act upon the advice proffered. In a multitude of cases such factors seem to constitute the essentials of the cure, while the subsequent particularity of method is but of secondary importance; and however much analysis may scorn suggestion, and it does so quite ostensibly, it, like other methods, can hardly hope to escape such vitiations of its pure practice. In analysis the patient must necessarily feel a more than ordinary degree of confidence in one to whom, through a species of psychic vivisection undergone by himself, he is prepared to reveal such facts about himself as the penitent reveals only under the safeguards of the seal of confession, and indeed possibly to go further and reveal much more that is revolting and that is not present in consciousness. Such confidence in itself implies a faith which would move mountains and a mental state singularly receptive of suggestion. From deductions based upon their experience some analysts regard an examination as incomplete until and unless a sexual complex has been discovered. This probably accounts, at least in part, for the fact that the time occupied runs sometimes into years, and that even then the results are not wholly illuminating and satisfactory: while it almost certainly does account for an unfortunate persistence of thought along sexual lines which sometimes develops in patients treated by this method. It is, however, in the detailed elaboration of investigation and in the consequent establishment of unsuspected relationships between ideas and trends of thought and action that the undisputed merit of later psychological methods is to be found. Hitherto psychological examination of the normal mind has for the most part been by the subject of the subject, that is, the subject has been artificially objectified by itself; while examination of the abnormal mind has mostly been confined to the conscious superficies. Analysis has made examination both of the normal and of the abnormal a definite study of objective mental phenomena.

Many diseases in general and many functional nervous disorders and mental affections in particular get better or well by a natural process of cure, and it is difficult to distinguish among the antecedents of the process of betterment those which especially have a causal relationship with it. Some such are artificial and have been devised on various grounds,—religious, magical, philosophical and scientific,—for therapeutic purposes; but the essential difficulties in therapeutics are to determine the efficacy of such artificially introduced antecedents and whether the desired result might have been attained without them. Hence the remarkable discrepancies of opinion as to the value of modes of treatment, even when they have been originated and practised by those trained in scientific method and of ample knowledge. The frequent apparent absence of adequate physical factors in the causation of many functional nervous and mental diseases, the dualism which distinguishes between the spheres of action of mind and body, and the apparent potency of the psychic activities of one person directed upon the mental state of another, combine to justify the practice of psychotherapeutics. Nevertheless, even with a proper respect for most recent developments, it is still difficult to be sure as to which is the most successful method, or whether a combination of physico- and psychotherapeutics may not be better than either alone. It is strange to note how exceedingly exclusive the methods of therapy are apt to be. Those who perform miracles or heal by processes such as those of Christian Science claim no technical skill in medical diagnosis or any regard for it, but variation in treatment according to variation in diagnosis or at least according to the various aetiological factors discovered might be expected from the scientifically trained. Nevertheless too frequently the persuasionist, the hypnotist or the analyst apply their methods, much in the way that their precursors of long ago applied their nostra, with entire lack of discrimination. Perhaps lying behind their particular methods there is a common factor, one of personal influence, in which certain outstanding practitioners excel and which the remainder conspicuously lack. That there is such a factor is apparent when an ignorant practitioner is seen to be highly successful and one who is learned to be unsuccessful. In truth, however, the nature of this influence, like so many of the antecedents of improvement in cases of functional nervous and mental disorders, is at present unknown. There must be a very considerable advance before we obtain accurate knowledge of the relative value of the many therapeutic factors that are perhaps concerned. At present treatment is largely haphazard, and improvement is ascribed to the treatment, if any, immediately preceding it; treatment which, maybe, has nothing whatever to do with the improvement that occurs.

LITERATURE.—The most important works on psycho-analysis are four by S. Freud, the most prominent investigator of the subject, translated for English readers by Brill: *Collected Papers on Hysteria* (1912), *The Interpretation of Dreams* (1913), *The Psychopathology of Everyday Life* (1914) and *Three Contributions to the Theory of Sex* (1918). Brill has given a good account of these in his *Psycho-analysis*. Jung's deviation from Freud's position is set forth in *Collected Papers on Analytical Psychology*, edited by Constance E. Long (1917). *Dream Psychology* by M. Nicoll (1920) expounds an interpretation of dreams of a less sexual character than that given by Freud. P. Janet criticised the methods and findings of psycho-analysis in his report to the 17th International Congress of Medicine (*Proceedings* of the Congress, Sect. 12, pt. 1, p. 13). This criticism is somewhat elaborated in Janet's *Les Médications Psychologiques* (1919). On hypnotism the following works are good and ample: J. M. Bramwell, *Hypnotism* (1913); A. Forel, *Hypnotisme* (tr. by H. W. Armit 1906); C. Lloyd Tuckey, *Treatment by Hypnotism and Suggestion* (7th ed. 1921). On persuasion the following may be commended: Paul Dubois, *De l'Influence de l'Esprit sur le Corps* (Engl. tr. 1910) and *L'Education de Soi-même* (Eng. tr. 1911); J. Camus and P. Pagniez, *Isolement et Psychothérapie* (1904); J. Déjerine and E. Gauckler, *Psychonévroses* (1911). A book from a distinctively Christian point of view is the *Spiritual Director and Physician* by Rev. V. Raymond, tr. by Dom Aloysius Smith (1914). (E. D. M.)

PUBLIC ASSISTANCE.—A marked feature in the social-economic history of the 20th century, and one which became even more marked in its second decade, has been the growth in public expenditure in relief of private wants. "Public Assistance" is of two kinds, direct and indirect. Direct public assistance is the receipt of any benefit in money or in kind at the expense of the rates or taxes which is wholly or partly unpaid for by the recipient. Direct public assistance includes objects like old-age pensions, unemployed benefit, children's meals and medical assistance. Indirect public assistance includes cheap baths and wash-houses, main drainage, cheap railway tickets, sanitary inspection and regulation generally, the control and maintenance of water supply and roads. It is with direct public assistance only that this article deals.

In the form of general doles, public assistance has always exercised a most disastrous influence on the countries where it prevailed. In the ancient world the State was founded on slavery and the citizens were a minority. In Athens the payment of citizens for attendance at the public assemblies and religious ceremonies known as the theoric fund, exercised a corrupting influence on the democracy from the time of Pericles, and Aristotle lays down the general proposition: "Demagogues distribute surplus revenue to the poor. These receive them and are again in want. For such help to the poor is like 'the cask with holes in it.'" The free distribution of corn at Rome had the same results. At first it was sold cheap to the poor in 121 B.C.; then in 58 B.C. it was made free. At first only one-eighth of the citizens took part in the distribution, but within little more than a decade the proportion had increased six-fold, and the number reached 320,000. Cæsar reduced the number to 150,000, but in Augustus' time it rose again, and the rise continued till as Gibbon relates "in the age which preceded the fall of the Republic only 2,000 citizens were possessed of an independent substance." When the imperial granaries, namely Sicily and Carthage, were lost, the wretched people, by this time quite destitute of self-help and self-reliance, were thrown back upon voluntary charity and the Church.

GREAT BRITAIN.—In modern times England has been the "classic land" for State-regulated public assistance. The system dates from 1601, the 43rd year of the reign of Elizabeth. During the Middle Ages the poorer classes depended on the feudal chiefs and the Church. As the feudal system decayed the poor fell back on the ecclesiastical foundations, and in the oft-quoted

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words of Fuller, the abbeys "dispensed mistaken charity, promiscuously entertaining some who did and many who did not desire it: yea! these abbeys did but support the poor whom they themselves had made." With the dissolution of these abbeys these poor people were thrown back on the State, and under the Statute of Elizabeth, which lasted unimpaired till 1834 and in 1921 was still the basis of the Poor Law, a compulsory assessment was made "for the relief of the impotent and the setting of the able-bodied to work." (*See* under CHARITY and CHARITIES, 5.880 *seq.*)

The administration of the Poor Law proceeded for 230 years with variations of leniency and severity till 1785, when a period of excessive expenditure set in, which in some cases swallowed up the whole of the annual rateable value of the land and reduced the nation to the verge of bankruptcy, leaving the population in a state of complete demoralization. In 20 years from 1783 the Poor Law expenditure had more than doubled itself, and in 1817 it had reached the enormous total of £7,871,811 for a population of about 11,000,000. In 1832 a Royal Commission was appointed which conducted a thorough inquiry and collected striking evidence on the moral deterioration. It appeared from the evidence that the change made in the character and habits of the poor by once receiving public relief is quite remarkable. They are demoralized ever afterwards. "The disease is hereditary," it was contended, "and when once a family has applied for relief they are pressed down for ever." The receipt of relief by a man has been compared in its results to the loss of virtue in a woman. They are never the same again. The commissioners state that pauperism seems to be an engine for the purpose of disconnecting each member of the family from all others: of reducing all to the state of domesticated animals fed, lodged and provided for by the parish without mutual dependence or mutual interest.

The Commissioners showed that the bulk of the abuses and evils disclosed were the direct result of indiscriminate outdoor relief. They laid down the principles: (1) that the pauper's condition shall be less eligible than that of the independent labourer of the lowest class who has to bear the charge; (2) that the function of the State should be limited to the relief of destitution, such destitution to be tested by the willingness to enter a workhouse or institution; (3) that remedial relief as opposed to the relief of destitution should be left to voluntary charity. The main truth is that in all public relief there must be an element of deterrence and some check or test to prevent general pauperism.

On these principles the new Poor Law, the administration of which was handed over to the Commissioners, was based, and it was exercised with such efficiency that in 1871 with a population of 22,500,000 the cost was almost exactly the same as in 1817 with a population of 11,000,000; in other words the cost of pauperism per head of the population had sunk from 14s. to 7s. Between 1873 and 1883 the percentage of those in receipt of direct public assistance was slightly over 3% of the population, the lowest point reached being 2·9 in 1878 and 1879. In the meanwhile the working-classes had not only recovered their self-respect and self-reliance but had through their own organization, the trade unions, the friendly societies, the coöperative societies and the building societies, provided a complete answer to all the difficulties of the Labour problem. In these trade unions and friendly societies they themselves without help from the State had elaborated methods by which provision was made for sickness, accident and old age. Their coöperative societies provided them with the necessaries of life of excellent quality at little over cost price; their building societies provided them with the means to acquire their own houses. At the beginning of the 'nineties a complete survey of the whole problem was taken by the Royal Commission on Labour, and it appeared that the income of 542 trade unions was £1,790,000 and the membership 1,080,000. There were 29,742 friendly societies with a membership of 8,320,262 and funds of more than £26,000,000; also 1,624 coöperative societies with 1,119,000 members and £17,000,000 capital; the sale of foods amounted to £48,500,000 and the profits to £4,774,000; while the assets of the building societies (£50,700,000) brought the total capital funds traceable to the working-classes up to between £90,000,000 and £100,000,000, quite apart from their deposits in savings banks, etc., which a competent authority estimated at another £160,000,000 at the very least. So different was the position that Mr. Ludlow (the chief registrar of the friendly societies) could say in his evidence before the Commission: "Now the black spots in the country may I think almost be counted on the fingers. In former days it was very nearly black, with but few white spots." This wonderful development of self-help embraced all skilled labour and was gradually taking hold of the unskilled, giving the English workingman a knowledge of business and a training in self-government such as the working-man in no other non-English speaking country possessed in anything like the same degree, if at all.

The serpent however was in the grass. The politicians saw capital in the working-man as a voter. In 1886 the first breach was made in the Poor Law system by the institution of municipal distress committees which withdrew the unemployed to a certain extent from the workhouse test. In 1890 the fees for elementary education were remitted, that the poor might have more wherewith to pay for the food and clothing of their children, but it was not till the beginning of the 20th century that, to use Aristotle's expression, more holes were made in the cask. In 1905 the Unemployed Workmen's Act was passed. In 1906 the Children's Meals Provision Act was passed, in 1907 the Administrative Provisions Act, in 1908 Old Age Pensions were adopted and in 1911 the system of National Health Insurance was introduced with its famous bribe of "9d. for 4d." By 1913 it was no longer possible to form any idea of what proportion of the population was living on its exertions and what was depending on public subsidy, or what was the administrative cost. In January of that year therefore, the writer, with the support of friends on both sides of politics, began to ask for a return which would give the facts and figures. In 1919 the fourth edition of that return was published, and later information enables the following picture to be given in 1921.

In 1890 the expenditure on public assistance from rates and taxes was £25,000,000, in 1901 £40,000,000, in 1911 £68,800,000, in 1919 £172,800,000 according to a return which includes figures as old as 1916 (No. 160, 1920), and for the year ending March 31 1921 no less than £332,000,000 (including war pensions) as far as can be gathered from statements in Parliament. The beneficiaries from the last-mentioned return appear to number not fewer than 28,000,000 out of a population which cannot be put higher than 48,000,000. In other words 58% of the population in 1921 were receiving help from public funds, at a rate of about £6 11s. per head, as compared with 4·6% at a rate of 7s. per head in 1871.

With regard to the total of 28,000,000, on the one hand there is, as will be seen, a great deal of fraud and overlapping which may tend to reduce the number, but on the other hand there are a great many gaps in the figures of the return, the figures relating to the National Insurance Unemployment Act being given at 58,000—much too few for the year ending March 31 1921.

We must now say a few words as to some of the holes in the cask, and on the means, if any, of regulating the money poured in or stopping the leaks.

The principal British Acts concerned are (1) the Education Act with the Provision of Meals Acts, etc.; (2) the Old Age Pension Acts; (3) the National Health Insurance Acts; (4) the Public Health Act, (*a*) as to hospitals and treatment of disease, (*b*) as to maternity and child welfare; (5) War Pensions and Ministry of Pensions Acts; (6) Housing of the Working Class Acts; (7) Acts relating to the relief of the poor; (8) Unemployed Workmen's Act; (9) Unemployed Insurance Act. No account is here taken of the bread, coal and railway subsidies, which amounted in 1920–1 to about £87,000,000; they are omitted because they affected the whole population and were temporary.

The Education Act would not at first sight seem to fall under the heading of public assistance, but educationists take an entirely new view of their work to that of other days. "Formerly," says an education report of the London County Council in 1910,

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"education was in the main confined (1) to the growth of character, (2) to the growth of the mind. Now it looks increasingly at the social problems which present themselves for solution in the case of the individual child, the problem of physical deterioration, of under-feeding, of impoverished homes and unsuitable employment." In regard to necessitous children, the same authority remarks: "Necessitous children are not necessarily ill-nourished at the time of application, though they would become so if relief were withheld." Not a word is said about the duties of the parent. The same is true of the Public Health Acts, the administrators of which do not consider the character of the individual, but solely the health point of view.

With regard to the vast expenditure under the Education Acts, the select committee on national expenditure reported in Dec. 1918 that they had been impressed by the atmosphere of financial laxity in which questions involving education are apt to be considered, and state that under the Act of 1918 neither Parliament nor the Board of Education nor the local authorities can control education.

With regard to the Old Age Pensions Acts which were to diminish Poor Law expenditure and empty the workhouses, the minister who introduced the proposal in 1908 stated that no Chancellor of the Exchequer in his senses would think of adding £3,000,000 to the sum of £6,000,000 which he proposed. In 1921 the amount voted was £28,000,000, and a proposal to add £15,000,000 thereto was only defeated by a majority of 12, the proposer stating that this was but an instalment and that he was in favour of raising the amount of the pension from 10s. to 20s. and reducing the pensionable age from 70 to 60. As to the administration of those Acts it is noteworthy that Ireland with a pop. of 4,390,000 drew £3,329,000 for 181,000 pensioners, while Scotland with a pop. of 4,760,900 drew £1,664,000 for 90,000 pensioners. This looks as if there was a leak somewhere.

Old-age pensioners have from the first received medical relief from the Poor Law, and now, if necessitous, are entitled to receive other relief as well. The separation of the local administration from that of the Poor Law for political reasons has had unsatisfactory results, apart from the extra expense.

With regard to the administration of the National Health Insurance Act, Sir Arthur Newsholme, a well-known authority, has stated that "the system is not actuarially, financially or medically sound, and has involved expenditures in administration entirely incommensurate with the benefit received."

The overlapping of the insurance system with the Poor Law has involved endless difficulties, and it appears from the Return No. 160 (1920) that the annual expenditure for the year given (1919 is the latest available) was £4,294,000 out of a total expenditure of £20,311,000. It was stated as long ago as 1912 that overcoats, underclothing and food were given under sanatorium benefit, thus relieving public health and Poor Law funds, and sanatorium benefit was only a rechristened form of outdoor relief. As to the Poor Law, it may be observed in passing that its expense increased between the years 1911 and 1919 from £15,000,000 to £18,000,000 for England and Wales alone, and as old-age pensioners left the workhouse their places were filled by those under 70 years of age.

With regard to the unemployed insurance it appears that the reserve of £20,000,000 which existed after the World War was exhausted by June 1921, and that the Treasury was drawn upon for another £10,000,000, while as to the unemployed dole the magistrate at the Thames police court on May 18 1921 said: "It has been said from this bench over and over again that such doles lend themselves to and almost induce fraud."

All that can be said with certainty as to the national housing scheme is that the losses to the central and local Government on each house annually will amount to an enormous sum. Originally 1,000,000 houses were to be built. In May 1921 the annual loss to the State on each house was placed officially at £60 apart from loss to the rates. This makes an annual loss of about £18,000,000, or a total eventual loss at the end of 60 years of £700,000,000. Thus a privileged class of house-holders will be created at an enormous loss.

The attitude of Parliament to such expenditure gives little hope of a check from that quarter. There is a constant complaint of the apathy and slight attendance at debates on economy, and the late Speaker of the House of Commons pointed out that since 1900 there has been a great change in the attitude of the House towards economy and that now the advocates of economy "do not get a look in." The Chancellor of the Exchequer frankly said in March 1920 that with such items as old-age pensions, a national unemployment scheme and a national housing scheme, it was impossible to offer a blunt uncompromising refusal to proposals for new expenditure.

With regard to the central authority, economy is unlikely from that direction, for enormous increases have been made either in the shape of additional salary or temporary bonus by Whitley Councils consisting of civil servants to the lower grades and by the Government to the higher grades (including the Treasury), which in both cases, without previous knowledge or sanction of Parliament, the central authority has by circular invited local authorities to follow, and the central authority has a means in the Exchequer grants (which it can give or withhold at will) for stirring up the local authority to spend money.

On the whole then, there seem few weapons in the hands of those who would stop the progress of a democratic nation on the road to ruin. But they comprise, first, a complete statement of accounts showing how the money is raised, how it is spent, what is the administrative cost and who are the beneficiaries, whether worthy or unworthy. Secondly, the institution of a strong but small central commission, as in 1832, to ration the administration of the whole of the new system of public assistance, taking care not only to punish fraud and put down overlapping but also to make the position of the beneficiaries (apart from war pensioners) less eligible than that of the lowest class of independent workmen, and introduce some stringent and deterrent test. Lastly, to make it clear that all this vast expenditure from the rates and taxes, however carefully disguised, falls in the long run most heavily on the working-classes, by wasting the fund from which come new enterprises and increased wages on myriads of officials who make the poor man's life a burden to him.

(G. Dr.)

United States.—Owing to the fact that the United States is still a new country with a comparatively small number of poor, the need in its communities for public assistance in the relief of poverty and attendant ills has been much less urgent than in European countries. One consequence is that the "right to relief" has been recognized in the laws of only a few of the states. That every man ought to support himself and his family is, or has been, the working social theory of Americans of all classes. They have looked with disfavour on continued subsidies and other payments which might seem to be part of a routine, preferring to provide temporary assistance when necessary, treating each case as an emergency, in the expectation that the beneficiary will soon be able to shift for himself. They have declined to recognize formally the existence of a necessitous class. Hence much of the relief work in the United States up to 1921 was still done by privately supported agencies.

In the decade 1910–20 it became obvious, however, that a change had begun. Americans seemed to be losing their aversion to paternalistic government, and the newer proposals for social betterment tended to call for some kind of legislation involving an extension of state or municipal activity and for an appropriation. Among the more progressive states and cities it became the rule to establish departments of public welfare, which, though their duties and perhaps their theories were somewhat vague, nevertheless made incessant demands for further appropriations and for fresh welfare legislation. It is characteristic of the American point of view, however, that this welfare movement concerned itself less with the lowest forms of poverty or with the most helpless layer of the dependent than with improving the conditions of life among wage-earners in general.

The tendency to extend the range of Government activity in welfare work did not escape serious criticism. This criticism was perhaps most emphatic with respect to the ever-widening

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scope of the work undertaken by public health departments. The point was made that in so far as these bodies exceeded the limit of indispensable activities they were "pauperizing" the public. The accepted view was that the duty of sanitary authorities was not to help any one family to be healthy, but to prevent any one family from disseminating disease. But it is almost impossible to draw a line between necessary functions and those which are largely philanthropic. Thus many cities maintained a large staff of physicians and nurses whose duty it was to visit schools and even households, giving advice and treatment free. From the private practitioner's point of view this work was an encroachment on his legitimate sources of income, but free medical treatment in the case of school-children, for example, is merely an incident of free education, for the ability to receive education is in large degree dependent on physical fitness. It should be said, moreover, that in most cities free treatment was not given unless the recipient was unable to pay, and that in any case the community was only protecting itself by promoting the health of its individual members. The same question was involved in the establishment of sanatoriums in many parts of the United States for the treatment of tuberculosis and other communicable diseases, both aiding the sufferer and safeguarding the public from him, as had been done in the case of the insane for many years. In some of such institutions a nominal charge was made, but by far the greater part of the expense was paid by taxation. Hospitalization came to be expected as a right, regardless of the ability of the patient to pay the cost of treatment. Thus the American public was being taught to feel that the state or county or city was bound to provide certain kinds of public assistance which had been regarded as outside the scope of state subsidies.

Of the newer proposals for public assistance none gained more rapid headway than that for mothers' allowances or pensions. The first such law was passed by Missouri in 1911, and granted allowances to widows with children and to deserted mothers; by 1920 there were similar provisions in 39 states. These allowances ranged from $2 a week for each child up to $25 a month for the first child and $15 a month for each additional child. The age limit, after which the allowance was to cease, was placed at 13 years in some states and as high as 18 in others. Up to 1920 the aggregate of these allowances had not become so large as to alarm taxpayers, and in so far as the system saved the children from being committed to public institutions—orphan asylums and the like—it was undoubtedly beneficial. Legislation for mothers' allowances, no doubt, tends to create a demand for old-age pensions, but up to 1921 no state had yet undertaken this form of subsidy. Taxes for mothers' allowances were mostly levied and administered by the county governments.

Another form of public assistance which grew rapidly in the decade 1910–20 was that connected with the health of children, particularly those attending school. As early as 1892 New York City provided for the inspection by health officers of school-children, and by 1920 practically every city had organized some form of health examination for all pupils attending public schools. In later years the scope of the work was considerably expanded; skilled medical examiners were employed to give especial attention to eyes, throats and teeth, and, where necessary, treatment was often given at public expense. Special open-air schools were opened in many places for tubercular children; and proper conditions maintained for giving the children adequate fresh air, rest and nourishment. In many poorer districts, where the educational progress of the children was found to be retarded by under-nourishment, it became customary for the school authorities to provide a daily luncheon, which was served either free or at a nominal price. In 1919 cities having each a pop. of more than 30,000 expended an aggregate of $1,849,624 on medical work for school-children, and an additional amount of $908,742 on other child conservation work, such as the employment of trained nurses to visit mothers in congested districts and the establishment of infant welfare stations where mothers could obtain medical advice and free treatment for their babies.

To determine the aggregate amount of public assistance in the United States it is necessary to state that such items as those for sanitation, prevention of epidemics, protection to life and property cannot properly be regarded as public assistance. The following tables, based on U.S. Census Bureau reports, show the increase in public expenditures in the period 1913–9 for health conservation and maintenance of charities, hospitals and correctional institutions:—

HEALTH CONSERVATION

Expended by	1919	1913
States	$12,249,333 (1918)	$ 6,388,114
Counties	5,000,000 (est.)	2,815,466
Cities	20,208,615	12,000,000 (est.)
Total	$37,457,948	$21,203,580

CHARITIES, HOSPITALS AND CORRECTIONS

States	$118,084,025 (1918)	$ 87,585,903
Counties	60,000,000 (est.)	37,815,508
Cities	55,086,145	32,896,351
Total	$233,170,170	$158,297,762
Grand total	$270,628,118	$179,501,342

Thus the increase in expenditures for the purposes noted was somewhat more than $90,000,000 in six years. These figures, however, include the cost of certain activities which cannot rightly be classed as public assistance, and which are approximately one-third of the total. With respect to the more recent compilations of the Census Bureau, it is possible, because of the greater fullness of data, to exclude those items. Thus a tabulation of the expenditures by the states for public assistance in 1918 would include the following:—

HEALTH CONSERVATION.	
Treatment of tuberculosis—	
In institutions	$5,105,556
Elsewhere	643,981
Treatment of other communicable diseases	1,488,186
Conservation of child life	285,674
Other health activities	764,497
CHARITIES AND HOSPITALS.	
Supervision	849,727
Outdoor relief	517,827
Care of poor—	
In state institutions	211,995
Elsewhere	121,101
Care of children—	
In state institutions	1,328,441
Elsewhere	2,023,205
Care of blind, deaf and mute—	
In state institutions	4,458,758
Elsewhere	1,713,274
Other charities—	
State institutions	8,924,208
All other	530,862
Hospitals—	
General	2,613,951
All other	3,149,100
Hospitals for the insane—	
State	47,860,528
All other	2,091,304
Total	$84,682,175

The expenditures of cities for similar purposes in 1919 were as follows:

Prevention and treatment of communicable diseases—	
Tuberculosis	$5,145,280
Other communicable diseases in hospitals	4,427,510
Other treatment	2,271,364
Conservation of child life—	
Medical work for school-children	1,849,624
Other child conservation work	908,742
Charities and hospitals—	
General supervision	854,466
Outdoor poor relief	4,631,697
Poor in institutions	7,715,940
Care of children	7,125,436
Other charities	3,570,051
General hospitals	16,735,615
Insane hospitals	3,871,082
Welfare commissions	47,307
Total	$59,154,114

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With respect to conservation of health, items representing general administrative expenses have not been included in the two preceding tables, although a certain percentage of these undoubtedly belongs under the heading "public assistance." Whatever their amount may be it is offset by the unavoidable inclusion of certain expenditures for preventive health measures, most of which are undertaken for the benefit of the community at large rather than with the definite purpose of aiding needy persons. Detailed figures showing the expenditure of counties were not available, and it is possible that if the aggregate expenditure for mothers' allowances were known, it would materially increase the totals given in this article.

The available data indicate that, exclusive of Federal provision for former soldiers and their families, and for other agencies for dependents which come under the jurisdiction of the Federal Government, the total expenditure for public assistance in the United States in 1920 was more than $200,000,000, the appropriations originating as follows: states, $90,000,000; counties, $45,000,000; and cities, $65,000,000. It seemed probable that these appropriations would rapidly increase as the more recent projects for public assistance became more fully developed and as the economic reaction following the World War spent itself.

(F. H. H.)

PUBLIC TRUSTEE (*see* 27.334).—The Office of the Public Trustee, created in Great Britain by the Public Trustee Act 1906, was opened at Clement's Inn, London, on Oct. 1 1907, under Sir Charles John Stewart, K.B.E. (1918), who organized and controlled the Department during a period of rapid growth until his retirement in 1919. He was succeeded in office by Mr. Oswald Richard Arthur Simpkin, to whom fell the equally difficult task of post-war reorganization. The other principal officers of the Department in 1921 were Mr. Ernest King Allen, Assistant Public Trustee (at Kingsway), and Mr. Thomas Moffat Young, Deputy Public Trustee, at Manchester. The staff in 1921 numbered 874 in London and 86 at Manchester.

The number of trusts and estates accepted for administration by the Public Trustee in the first year (1907–8) was 63, valued at £384,000. In 1913–4 the acceptances were 1,573 cases valued at £13,500,000, and at the end of that period the Office was administering 5,480 cases, representing a value of £43,500,000, and had distributed 450 cases and £5,834,691 of trust funds. Meanwhile the staff had grown in number from 19 to 370, the annual fee income from £502 to £55,283, and the expenses from £3,312 to £49,428. On April 1 1914 a Northern Branch of the Department was opened at Manchester (Northern Assurance Buildings, Albert Square) under a Deputy Public Trustee, and following on the Report of the Royal Commission on the Civil Service the Public Trustee's staff was made a part of the permanent Civil Service.

The outbreak of the World War found the Department manned almost entirely by officials of military age, and probably no Government Office suffered so much from the transfer of members of its staff to the fighting services. During the greater part of the war period most of its work had to be done by women clerks and by such temporary men as could be recruited under the existing conditions. In Sept. 1914 new and onerous duties were laid upon the Public Trustee by his appointment under the Trading with the Enemy Act and Proclamation as Custodian for England and Wales of enemy property. The Act provided that all sums payable to enemies by way of interest, dividends or share of profits should be paid over to the Custodian; that firms with enemy partners and companies with enemy shareholders should make returns to the Custodian disclosing such enemy interests, and that all persons holding or managing property on account of enemies should give particulars to the Custodian. Under the Patents and Designs Act 1907, the Public Trustee was also appointed to receive royalties in respect of patents avoided or suspended under the Patents, etc., Temporary Rules Act 1914. A separate "Trading with the Enemy" Branch was opened at 2, Clement's Inn on Nov. 30 1914. Further legislation in 1915, 1916 and 1917, and also the Peace Treaty, threw additional duties upon it, and in 1921 it employed a special staff of 327 persons at Kingsway and Cornwall House. The fees collected by the Public Trustee as Custodian from 1914 to 1921 amounted to £412,000.

In 1915 the Public Trustee Office was removed from Clement's Inn to new Government buildings in Kingsway, Sardinia Street, and Lincoln's Inn Fields, but the continued growth of the work and staff made it necessary to invade the adjoining buildings, Queen's House and Victory House.

The progress made during and after the war is indicated by the following table:—

Cases Accepted		Value	Fees	Expenses
1914–15	1,543	£11,624,000	£65,390	£61,632
1915–16	1,595	16,622,000	74,762	72,171
1916–17	1,811	16,544,000	95,238	98,330
1917–18	1,876	17,862,000	107,139	130,457
1918–19	1,767	17,192,000	119,619	175,581
1919–20	1,950	21,864,000	148,756	241,787
1920–21	1,559	15,682,402	283,499	398,389
Total since Oct. 1 1907	18,030	166,164,701	1,074,109	1,345,652

Two facts stand out conspicuously from this record. The first is the large business annually brought to the Department by a "voluntary" public and the very large number and value of the estates under the Public Trustee's care. The second is that whereas the Department was apparently self-supporting from 1907 to 1916, after 1916 the fees earned under the Public Trustee Act were insufficient by an increasing margin to cover the cost of the work done under that Act. The explanation in a nutshell is that the scale of fees which was in force until April 1920 was nicely calculated to cover (without a profit) the cost of staffing, housing and working the Department under the conditions which existed before the war, with a non-pensionable staff of young men who were content to look to the future of a rapidly growing office, rather than to the immediate present, for adequate pay. Such a scale of fees was bound to prove too low when the Department had to pay (in part) the salaries of an absent staff as well as those of their temporary substitutes, to make provision for pensions, to meet the charges for larger and more expensive buildings, completely to reorganize its *personnel* after the war on an entirely new basis of salary values, and finally to conform with the new and much more generous treatment of Civil Servants in the matter of base salaries and "cost-of-living" bonus which followed the institution of Whitley Councils in the public service.

On the retirement of Sir Charles Stewart the Lord Chancellor appointed in April 1919 a strong Committee, with Sir George Murray, G.C.B., as chairman, to review the whole position of the Department and to report upon questions of staffing, pay, policy, decentralization and fees, and it did so in Nov. 1919. With one dissentient the Committee approved the general lines on which the office had hitherto been conducted and recommended as a basic policy that "trust estates should, while retaining the service of outside agencies, secure the further advantages afforded by a Public Department having at its disposal within its own walls independent experts capable of criticizing and possibly correcting or supplementing the advice received through the ordinary channels available to the private trustee." The Committee recommended the modification and strengthening of the internal organization in certain respects, and in order to restore the financial equilibrium, upset by the war, suggested a new scale of fees calculated to increase the income of the Department by about £120,000 a year. With regard to branch offices, the Committee recognized the successful and economical management of the Manchester office and approved the principle of decentralization, but hesitated to recommend further experiments in this direction "until the possible deterrent effect of the increased fees on new business has been ascertained." Mr. S. Garrett in his Minority Report advocated a restricted service and somewhat lower charges, and doubted whether "business would be obtained in the provinces at the fees proposed by the Majority Report." The Majority Report was accepted by the Lord Chancellor, and the new scale of fees became operative on April 1 1920.

The increase of fees was still too recent in 1921 for its effects to be accurately measured, and the calculations upon which it was framed had already been to some extent upset by unforeseen circumstances. It remained to be seen whether Civil Service conditions strictly applied to a Department which, like the postal, telegraph and telephone services, was essentially a business undertaking, but unlike them was not a monopoly, were compatible with commercial success in a field open to competition. The competitors of the Public Trustee are (*a*) banks, insurance companies and other corporate trustees, and (*b*) solicitors, who are the active managers of thousands of trusts and estates nominally administered by others. If the Public Trustee's charges were to rise beyond a certain level his services would not be sought, and his competitors, who as employers are entirely untrammelled, would be greatly stimulated and assisted. In 1921 there was as yet no indication that this level had been reached, and those who resorted to the Department had at any rate the satisfaction of

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knowing that the Public Trustee's fees, if and when they showed a commercial profit, would be reduced.

On the administrative side the Public Trustee Office may be regarded as an established success and an institution of great public utility in protecting beneficiaries against the loss of trust funds through incompetence and dishonesty. Its work has been brought up to a high standard of efficiency, and the system of organization under which every trust is administered by an individual trust officer, who is personally responsible for its proper conduct, disarms the criticism that the functions of a private trustee cannot be performed by a department of the State. Another fear, viz. that the aggregation of a vast body of investments under the control of a single official might be a public danger, has found no justification in experience. Although the Public Trustee is responsible for investments of one kind and another (apart from "enemy" property) of a nominal value exceeding (in 1921) £143,000,000, they are in fact so multitudinous in character, represented by so many separate earmarked holdings, governed by so many different trust instruments, and in so many cases controlled jointly by co-trustees, that it would be impossible to deal with them *en masse*. As a further safeguard the Public Trustee, from 1914 onwards, has enjoyed the advantage of the counsel of an Investment Advisory Committee composed of representatives of finance in the City of London; in 1921 it consisted of the Rt. Hon. Frederick Huth Jackson, Mr. R. Martin-Holland, C.B., Sir R. M. Kindersley, G.B.E., and Mr. J. A. Mullens, Junr. This Committee meets monthly to review and discuss with the Public Trustee all investments and sales for reinvestment made by him.

Public Trustee in Other Countries.—The first country to possess a Public Trustee was New Zealand (1872), and the Public Trustee of New Zealand had in 1921 offices at Auckland, Christchurch, Dunedin and Wellington. In Australia there are Public Trustees at Sydney (N.S.W.), Adelaide (S.A.), and Hobart (Tasmania), and Public Curators (with similar functions) at Melbourne (Victoria), and Brisbane (Queensland). In Canada there is a Public Trustee at Toronto. In India and Burma there are Administrators-General and Official Trustees (offices at Allahabad, Bombay, Calcutta, Madras and Rangoon) who have some of the functions of the Public Trustee in England. Ireland has a Public Trustee (at Dublin), who receives only purchase moneys paid under the Irish Land Acts.

PUCCINI, GIACOMO (1858–), Italian composer (*see* 22.632). His recent works include *La Fanciulla del West* (*The Girl of the Golden West*, 1910); *Le Rondine* (1916); *Il Tabarro*, *Suor Angelica*, and *Gianni Schicchi* (1918).

PULITZER, JOSEPH (1847–1911), American editor and newspaper proprietor, was born in Budapest, Hungary, April 10 1847. He came to America in 1864, entered the Union Army, and served to the end of the Civil War. In 1868 he became a reporter on the *Westliche Post*, a German newspaper in St. Louis, and in 1871 managing editor and part owner. In 1869 he was elected to the Missouri House of Representatives; in 1872 was a delegate to the Liberal Republican National Convention which nominated Horace Greeley for president; and in 1874 was a member of the Missouri Constitutional Convention. In 1876–7, during the Hayes-Tilden controversy, he was in Washington, D.C., as correspondent for the New York *Sun*. In 1878 he purchased the St. Louis *Evening Dispatch* and *Evening Post*, combining them as *Post-Dispatch*. In 1880 he was a delegate to the National Democratic Convention. In 1883 he bought from Jay Gould the New York *World* (*see* 19.569), which fearlessly attacked political corruption. In 1884 he was elected Democratic member of Congress from the state of New York, but resigned after serving a few months. In 1896 he allied himself with the "Gold" Democrats and opposed the nomination of William Jennings Bryan. During his later years he was blind and spent much of his time cruising about the world in his yacht, but to the end continued to direct his New York paper. He died on board his yacht in Charleston harbour, S.C., Oct. 29 1911. Interested in improving the profession of journalism, he worked out a plan for establishing a school for training journalists. In 1903 he set aside $1,000,000 for establishing a school of journalism at Columbia University. His own idea as to the object of such a school is set forth in an article, "The College of Journalism," contributed to the *North American Review* for May 1904. In Sept. 1912 the School of Journalism of Columbia was opened. He left $500,000 each to the New York Philharmonic Society and the Metropolitan Museum of Art.

His son, RALPH PULITZER (b. 1879), succeeded him in control of his newspaper properties. He married (1905) Miss Frederica Vanderbilt Webb of New York City.

PUTNIK, RADOMIR (1847–1917), Serbian general, was born on Jan. 25 1847 at Kraguyevats. Like many other prominent figures in the life of his country, he came of a family which had emigrated to the Banat during the Turkish conquest and returned to Serbia after the expulsion of the Turks. Passing through the artillery school (which afterwards became the Serbian military academy), he obtained his commission in a line regiment. In 1876 he commanded a brigade in the war against Turkey, and when war was renewed in 1877 became chief-of-staff of the Shumaja Division. In the Serbo-Bulgarian War of 1885 he held a similar post in the Danubian Division, and in 1889 was made deputy-chief of the general staff, and taught as professor at the military academy in Belgrade. Like many other brilliant officers, he suffered from the favouritism which Kings Milan and Alexander had introduced into the Serbian army and from the consequent atmosphere of intrigue and personal rivalry. He was placed on the retired list, and it was only after the military revolution which destroyed the Obrenović dynasty in 1903 that he obtained his real opportunity of service. In that autumn he was appointed general and chief of the general staff. In 1906 he succeeded Gen. Gruić as Minister of War, and again held that office in 1912, during the decisive period when the military convention with Bulgaria was being negotiated. On the outbreak of war with Turkey he was made *voivode* or marshal (being the first holder of that title) and commander-in-chief, and was responsible for the rapid success of the Serbian arms at Kumanovo, Prilep and Monastir. It was largely owing to his vigilance and foresight that the treacherous night attack by which the Bulgarians opened the second Balkan War (June 29 1913) was so complete a failure. In the preceding months of suspense he and his staff had worked out a careful plan of action, and when Gen. Savov on July 1 gave his amazing order for the cessation of hostilities, Putnik was able to launch a counter-offensive, which resulted in the long-drawn-out battle of the Bregalnitsa and the final retreat of the Bulgarians. When the World War broke out he was undergoing a cure at an Austrian watering place—a very practical proof that the Serbian High Command was not preparing for an armed conflict. At first placed under arrest, he was released by special order of the Emperor Francis Joseph and conveyed to the Rumanian frontier. His impaired health did not prevent him from resuming the position of Serbian generalissimo and organizing the resistance of the country to invasion; and he inflicted upon the forces of Gen. Potiorek three successive defeats—the battles of the Yadar (Aug. 16–20), of the Drina (Sept. 8–19) and of Rudnik, which ended on Dec. 14 1914 with an Austrian rout and the complete evacuation of Serbia. On the latter occasion Putnik's success was rendered definitive by the genius of Gen. Mišić, the commander of the I. Army. Putnik retained the supreme command during the triple invasion of Serbia by the German, Austro-Hungarian and Bulgarian armies in Nov. 1915, and shared the retreat of the Serbs through Albania. When, however, the exiled Government established itself at Corfu, he and most of his staff were placed on the retired list. He himself withdrew to France. He died on May 17 1917 at Nice.

PUTUMAYO, or ICA (*see* 1.788), one of the larger tributaries of the Upper Amazon, rising in Ecuador in the Cordillera of the Andes, near Pasto, flowing in a S.E. direction and joining the Amazon at a point somewhat S. of lat. 4° S. The middle reaches of the river are also known as the Caquetá, the lower reaches being called the Caquetá or Yadurá. The Putumayo, which gives its name to the whole region through which it flows—a wilderness of tropical forest of which the sovereignty has been long in dispute between the republics of Peru, Ecuador and Colombia—obtained an evil notoriety in 1912 after the publication by the British Government of the Blue Book containing the evidence, collected by Mr. (afterwards Sir Roger) Casement, of the atrocious methods employed in this district by the agents of the Anglo-Peruvian Amazon Rubber Co. in order to force the natives to collect rubber. These crimes, which recalled those of the Congo and covered the whole gamut of hideous atrocity (there were some too horrible to publish

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even in the Blue Book), were first denounced in *La Felpa* and *La Sancion*, papers published at Iquitos, in 1907, shortly before the Peruvian firm of Arana Brothers—who had exploited this territory since 1896—was merged in the Anglo-Peruvian Co., with its headquarters in London. It was not, however, till 1909 that the attention of the British Government was directed to this matter by the revelations of Mr. Hardenburger, an American traveller, in the British periodical *Truth*. Since certain British subjects, negroes from Barbadoes, were implicated in these charges, Mr. Casement, then British consul-general at Rio de Janeiro, was commissioned in 1910 to proceed to Iquitos and the Putumayo and institute inquiries on the spot.

As a result of the report submitted by him a Select Committee of the House of Commons investigated the matter, and its report was issued on June 9 1913 as a White Paper (148). This analysed the evidence with great care, and, as the result, decided that Señor Julio C. Arana (who had come over to give evidence), together with other partners of the firm, was responsible for the atrocities committed by his agents in the Putumayo. The Committee, however, was satisfied that he did not communicate his knowledge of them to the British directors of the company before the *Truth* revelations. These directors were severely censured for culpable negligence in respect of the labour conditions under the company, but it was found that they had not individually laid themselves open to any charge under the Slave Trade Acts. The Committee further reported that existing enactments might be extended so as to cover the gravest offences against the person and against the practices of forced labour which are akin to slavery. A committee, consisting of members of Parliament and others, subsequently met to devise and press forward legislation to this effect; but its labours were interrupted by the outbreak of the World War.

The Putumayo atrocities called attention to the whole system of "loan slavery" and forced labour as practised throughout Latin America. For it was clear that the treatment of the Putumayo Indians was exceptional only in the maddest demonstrations of its inhumanity, and that the slave-driving habit which made it possible was not confined to one region of the continent. The Putumayo region, though vast, is but a small part of the rubber-producing territory of the Amazon; and in all there was evidence that similar conditions prevailed to a greater or less degree. The root of the whole evil was the so-called *patrón* or "peonage" system—a variety of what used to be called in England the "truck system"—by which the employee, forced to buy all his supplies at the employer's store, is kept hopelessly in debt, while by law he is unable to leave his employment until his debt is paid. Not only natives but many foreigners—including British immigrants—have been caught by this system. The *peon* is thus, as often as not, a *de facto* slave; and since in the remoter regions of the vast continent there is no effective government, he is wholly at the mercy of his master. His main safeguard against the worst forms of cruelty is his commercial value; for labour is scarce and, as was said to the present writer by a planter from the Beni in Bolivia, "You do not kill a man who is worth £80."

This safeguard has, however, in effect, proved insufficient; for the rubber-gatherers have been more concerned to make rapid fortunes than to look to the future. One result has been a hideous wastage of labour. In 1906 the Indian population of the Putumayo was estimated to number 50,000; five years later Mr. Casement put it at 10,000 at most; while a writer in the *South American Supplement* of *The Times* (Feb. 25 1913) spoke of the labour difficulty in the Brazilian rubber districts, due to "the dying-out of the native races from disease and bullets."

That the same process of extermination was proceeding in other districts is shown by a pastoral letter "on the amelioration of the actual condition of our Indians," issued on March 14 1913 by Dr. Manuel Polit, Bishop of Cuenca in Ecuador:—

"Our Ecuadorian Oriente has nevertheless not been free from the man-hunts (*correrías*), and outrages of these inhuman traffickers, rubber-gatherers (*caucheros*) and others, who, ascending unhindered our navigable rivers, have despoiled of their poor possessions and of their liberty hundreds of savage Indians, torturing and killing those who resist. And if formerly the action of our missionaries, supported by the Government, was able to prevent or to remedy a great part of these evils, nowadays, when the missionary has been expelled, the hunters of men can operate unchecked; and the banks of the Napo, Aguarico and Curaray, of the Pastaza, Morona and Santiago, have more than once presented scenes similar to those enacted on the Putumayo."

Similar evidence is given in the reports of Padre Estanislao de Las-Corts, Apostolic Prefect of the Caquetá and founder of the Colombian settlement of Puerto Asis on the upper Putumayo, who speaks of "the arms of the devil for dragging the poor Indians down to hell, some with the title of *corregidor*, others calling themselves doctors, and all in league with the *caucheros*, who style themselves *patrónes*."

In addition to the martyrdom and partial extermination of the Amazon Indians, this savage exploitation of the wealth of the Amazon forests has produced another result—the rapid destruction of the wild rubber trees, tapped by unscientific methods, never replaced, and of late years deliberately destroyed by the Indians as the source of all their woes. Many solutions of the problem have been suggested, of which the most notable is perhaps the proposal of an international control of the whole rubber-producing region by a commission representing the Amazon States, and scientific exploitation of these regions by means of imported Chinese and Japanese labour. There are already Japanese colonies on the upper Amazon, and both Chinese and Japanese mix and intermarry freely with the more civilized native "Indians," whose ultimate affinity with the Mongol race is at least highly probable.

The Putumayo revelations led to movements for reform in Latin America itself. Apart from the devoted work of Capuchin Friars, Marist Fathers and Franciscan Sisters in the Colombian districts of the upper Amazon, by the Salesian Fathers in the recently established diocese of Cuenca in Ecuador, by the community of the "Discalced" Franciscans of Lima in Peru, or by the Franciscan missions of Guarayos in Bolivia,[1] lay effort has not been wanting. In Peru the Sociedad Pro-Indigena of Lima took up the cause of the natives with great zeal, and the Colombian and Bolivian Governments both passed remedial legislation. But the Colombian reforms were necessarily limited in scope—and, indeed, till the international boundaries are fixed all effective reform is impossible—while the Bolivian decree of Nov. 25 1913 regulating "loan slavery" remained a dead letter in a country whose vast distances made any effective supervision impossible. To provide that "all contracts between master and man shall be registered at the nearest police office" is not much use in a country where the police offices are scattered hundreds of miles apart, and "where a journey of 200 m. by launch is a serious undertaking, and much more so when runners and canoes are alone available."

AUTHORITIES.—Hardenburger, *The Putumayo;* G. Sidney Paternoster, *The Lords of the Devil's Paradise* (1913); N. Thompson, *The Putumayo Red Book* (1913), inspired partly by desire to vindicate the Colombian claims to the Putumayo region; Joseph F. Woodroffe, *The Upper Reaches of the Amazon* (1914), the outcome of eight years of personal experience; J. F. Woodroffe and H. H. Smith, *The Rubber Industry of the Amazon* (1915). Several valuable articles on the Amazon rubber industry, the peonage system, etc., were published in *The Times South American Supplement* during 1913 (see index, in the issue of Jan. 27 1914). (W. A. P.)

PYLE, HOWARD (1853–1911), American artist and writer (*see* 22.679), died in Florence, Italy, Nov. 9 1911.

PYROMETRY (*see* 22.693).—The term "pyrometer" is now applied to any device intended to measure temperatures beyond

[1] The work of these missions, actively supported by the Government at La Paz, has produced astonishing results. At Urabicha, a "model town," for instance, silverware and jewelry are made, and there are workshops for cutting and polishing ebony to be used in making fine furniture. At Yotau expensive machinery for crushing and refining sugar has been installed. At Ascension carpentry is taught on a large scale. The "Discalced" Franciscans of Lima conduct a flourishing school of agriculture. The Capuchins of Colombia, turned sappers and engineers, constructed a wonderful mule-road over the Andes from Pasto to Mocoa. These and other instances of effective zeal are, however, it must be confessed, exceptions which only serve to heighten by contrast the effect of the inertia of the Church in Latin America.

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the upper limit of the mercury thermometer. The success of many metallurgical and other operations carried out in furnaces often depends upon correct regulation of temperature, and for this reason pyrometers are extensively used to control processes conducted at high temperatures. A number of different types of pyrometer are in use, each having its special advantages; and the choice of instrument depends upon the nature of the operation. In order that pyrometers of every pattern may agree in their readings, each is calibrated by reference to a number of fixed points, determined by the gas thermometer. The National Physical Laboratory scale is used in Great Britain, and represents the melting-points or boiling-points of a number of pure materials, chosen so as to be separated by convenient intervals of temperature. Suitable points for graduating pyrometers are the melting-points of zinc (419·4° C.), antimony (630°), common salt (801°), silver (961°), copper (1083°), nickel (1452°) and palladium (1549°). Above 1550° C. direct comparison with the gas scale is not possible at present, and instruments designed to read higher temperatures than this are calibrated by reference to the laws of radiation. The features of the different types may conveniently be considered in separate categories.

Thermo-electric Pyrometers.—These depend upon the electromotive force developed when a junction of two dissimilar metals is heated. The couple used should show a steady increase in E.M.F. with rise in temperature, and should not be destroyed or show an alteration in E.M.F. on prolonged heating. These conditions are best fulfilled by couples made of the platinum series of metals, but owing to the high cost of these, "base" metal couples are now largely used, which can be renewed when necessary at a trifling expense. The upper limit of temperature at which a thermocouple may be used must be some degrees below the point at which destruction or change in E.M.F. would commence. Thermocouples in common use are platinum and rhodio platinum (10 % Rh), which may be used to 1400° C. and generates an E.M.F. of 1·1 millivolts per 100° C.; iron and constantan, upper limit 900° C., E.M.F. 6·7 millivolts per 100° C.; and two different nickel-chromium alloys (Hoskin's alloys), upper limit 1100° C., E.M.F. 7·4 millivolts per 100° C. Various other couples are also used. It will be noted that the base-metal couples develop a much higher E.M.F. than those made from the platinum group. Most couples require protection from furnace gases, which would cause corrosion, and are provided with shields of silica, porcelain, fireclay, or other refractory material, which should be non-porous.

The indicator used with a thermocouple is usually a millivoltmeter, the range of which is determined by the couple used, and the temperature to be measured. The deflections shown when the couple is subjected to the standard temperatures enable the scale to be marked so as to read temperatures directly. Due allowance must be made for the temperature of the other junctions in the circuit, as the deflection, in general, depends upon the excess temperature of the heated junction over the "cold" junction or junctions. Errors in this direction may be avoided by (1) locating the cold junctions in oil in a thermos flask, so as to maintain a constant temperature; (2) by water-cooling the cold junctions; (3) by the use of compensating junctions (Peake and others); or (4) by compensated indicators (Bristol, Paul, Darling and others). For measuring special ranges—such as 500° to 1000°—an opposing E.M.F. from an external source is applied to the indicator, so that deflection does not commence until the junction has attained 500°. Instead of a millivoltmeter, the indicator may take the form of a potentiometer, in which the E.M.F. due to the junction is balanced against a known difference of potential (Northrup, Brown, Rosenhain and others), with the advantages that a delicate galvanometer may be used, and that the indications are independent of the resistance of the leads.

Continuous records of temperature may be obtained by photographic means (Roberts-Austen), a mirror galvanometer being used as indicator, and the spot of light directed on a sensitized paper moving at a known rate. Records in ink are obtained by depressing the pointer of the indicator at regular intervals, and causing it to make a dot in ink on a chart moving at a known rate, thus recording the deflection at any moment. In the "Thread" recorder (Cambridge and Paul Instrument Co.) an inked thread is pressed onto the chart; in Siemens' and Paul's recorders an inked ribbon is made to touch the paper; in Foster's recorder a special pen, at the end of the pointer, makes the dot. Recorders may be actuated by clockwork or electric motors.

The present practice is to employ thermo-electric pyrometers for all ordinary work up to 1100 or 1200° C., when an accuracy of 5 or 10° suffices. This range embraces the temperatures involved in the heat treatment of ordinary steel and other metals and alloys.

Resistance Pyrometers.—These instruments were introduced by Siemens in 1871, and are still in use. The principal utilized is the increase in resistance to electricity shown by elementary metals when heated, which, in the case of platinum, has been proved by Callendar to bear a definite relation to the rise in temperature. The working part consists of a coil of platinum wire, suitably shielded from furnace gases, and connected by platinum leads to one arm of a Wheatstone bridge, or to one branch of a differential galvanometer circuit. Compensation for the leads is effected by dividing the bridge at one end of the coil, so that the leads are in opposing arms (Siemens), or by dummy leads connected to the opposing arm of the bridge (Callendar). The reading consists in adjusting the bridge until a balance is obtained, when the resistance of the coil may be read, and the corresponding temperature deduced. For industrial use, indicators are provided in which the temperature is indicated on a dial when the bridge is adjusted to balance, so as to avoid calculation (Whipple, Siemens). Paul's indicator is a special form of ohmmeter, which requires no adjustment, and gives direct readings of temperature. Callendar's recorder is an automatic Wheatstone bridge, controlled by the galvanometer, a pen moving over the bridge wire giving an inked record. The Leeds-Northrup recorder achieves the same end by automatically balancing the pyrometer resistance against an opposing resistance in a differential galvanometer circuit. The resistance pyrometer is not now greatly used for industrial purposes, and is not suited for continuous use above 1000° C., owing to an alteration in its indications due to the vaporizing of the platinum (Crookes). It is more costly and difficult to use than a thermo-electric pyrometer, but is capable of giving closer readings under steady conditions.

Total-Radiation Pyrometers.—The energy radiated by a "black body" or full radiator is proportional to the fourth power of the absolute temperature, and if the energy be measured the temperature can be deduced from the above relation. An enclosure at a constant temperature, such as a furnace, gives black-body radiations, and enables the laws of radiation to be applied to measuring temperatures without serious error. In most existing forms of total-radiation pyrometers, the rays from the heated enclosure are directed on to a blackened thermal junction, the temperature of which is raised in the proportion of the energy received. A galvanometer in circuit with the junction serves to indicate, by its deflections, the relative amounts of energy absorbed by the junction, and its scale may therefore be marked to read temperatures directly by applying the fourth-power law.

In the form due to Féry, the rays are focussed by means of a concave mirror on to a small metal disc to which the junction is attached, a different focus being required for different distances from the furnace. In Foster's fixed-focus instrument a concave mirror is placed at the closed end of a narrow tube, the radiations being admitted through a diaphragm at the open end, and reflected on to a thermocouple. So long as the lines joining the extremities of the mirror with the edges of the diaphragm fall, if produced, within the heated source, the reading will be the same at any distance. In the form due to Thuring, and made by Paul, the rays are made to enter a polished cone, at the apex of which a thermal junction is placed. Various other modifications have been used by different makers. Records may be taken by attaching the junction to any form of thermo-electric recorder, and employing a chart divided in terms of the fourth-power law.

Radiation pyrometers are used for temperatures ranging from 800° to 2000° C., and are particularly valuable under circumstances which preclude the introduction of an instrument into the furnace, as in the case of rotary cement kilns.

Optical Pyrometers.—In the most reliable of these instruments the brightness of the red rays from the heated source is matched against a standard, and calibration effected by applying Wien's laws for the distribution of energy in the spectrum. The red rays from standard and source are obtained either by spectroscopic means, or by viewing through monochromatic red glass. In Wanner's pyrometer, and the Cambridge optical pyrometer, a polarizing device is used for matching the colours, the position of the analyser being made to indicate the temperature. In the Holborn-Kurlbaum type, made by Siemens, the filament of an electric lamp is placed in the focal plane of a telescope, and the image of the heated object brought into the same plane. The adjustment consists in increasing or decreasing the brightness of the lamp by means of a rheostat in its circuit, until the filament disappears into the background, the current taken by the lamp being then read and the temperature deduced from a law connecting this current with temperature. In Féry's optical pyrometer equality of tint of standard and source is obtained by means of absorbing wedges of glass which slide over each other. In all these cases experience is needed to secure an exact match. Optical pyrometers of the "extinction" type depend upon the complete absorption of the rays from the heated object, which may be effected by lowering a wedge of dark glass in front of the image as received in a telescope, as in the "Wedge" pyrometer, or by using a layer of densely coloured liquid, the depth of which may be adjusted, as in Heathcote's pyrometer. The temperature calibration in both these cases is obtained by taking readings at standard temperatures, and marking the instruments accordingly.

No satisfactory recording apparatus for optical pyrometers has yet been devised. Their chief advantages are the indefinitely high range—from 800° C. upwards—and the possibility of obtaining readings from a considerable distance, and under conditions which would make it difficult to use any other type of pyrometer.

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Miscellaneous Devices.—Amongst these may be mentioned: (1) Fusion pyrometers, which consist of pieces of materials of progressive melting-points, which are placed in the furnace, the temperature of which is represented by the melting-point of the highest in the series that undergoes fusion (Seger cones, Sentinel and Watkin's pyrometers); (2) Calorimetric or Water pyrometers, in which a piece of hot metal taken from the furnace is dropped into a known quantity of water, and the temperature deduced from the extent to which the water is heated; (3) Expansion pyrometers, based on the linear expansion of solids; and (4) the Clay-Contraction pyrometer of Wedgwood. All these methods are at best approximate, and are not employed to the same extent as formerly, when accurate instruments were not available.

REFERENCES.—*Measurement of High Temperatures*, Burgess and Le Chatelier (contains bibliography). Transactions of the Faraday Society, vol. xiii., Part 3; discussion on *Pyrometers and Pyrometry*, with bibliography by Sir Robert Hadfield. *Pyrometry*, Darling (deals with industrial uses). Also accounts of research in pyrometry in the publications of the National Physical Laboratory, the U.S. Bureau of Standards, and the Reichsanstalt. (C. R. D.)

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QUARITCH, BERNARD ALFRED (1871–1913), British bibliophile, son of Bernard Quaritch, the famous book-collector (*see* 22.711), was born Jan. 13 1871. He was educated at Charterhouse, and afterwards went to Leipzig and France. He joined his father's business in 1889, becoming its head in 1899. He played a very important part in the development of the firm, and purchased many rarities. He paid several visits to America, exhibiting there a large number of valuable books and MSS., and was a prominent purchaser at the Hoe sale (1911). He died at Brighton Aug. 27 1913.

QUEBEC (*see* 22.724*).—Through the addition of Ungava in 1912 the area of the Canadian province of Quebec was doubled, and it became the largest in the Dominion. From 227,500 sq. m. in 1891 it had increased to 351,873 sq. m., which with the addition of 354,961 sq. m. of Ungava (known as New Quebec) gives a total area of 706,834 sq. m. (about one-fifth of Canada), of which 690,865 sq. m. are land and 15,960 sq. m. water.

The pop. was 2,003,232 in 1911. It was estimated in 1921 at 2,350,000. About 98% are Canadian-born, and of these over 80% are of French descent.

The number of Indians in the province (including Ungava) was 13,366. The principal tribes are: Iroquois at Caughnawaga, Lake of Two Mountains, and St. Regis (the Indians of Lorette are also of Iroquoian stock); the Montagnais, who are of Algonquin stock, at Persimis, Mingan, Lake St. John, and Seven Is.; the Abenakis, also of Algonquin stock, at Becancour and St. Francis; the Micmacs, of Algonquin stock, at Maria and Restigouche; and the Malecites, Algonquin, at Viger.

Quebec, the capital of the province, had in 1917 a pop. of 103,000. Montreal (pop. in 1917, 700,000) is the largest city in Canada.

Hull (pop. 28,392), just across the Ottawa river from Ottawa, is a lumber centre with a rapidly growing population. Three bridges connect it with Ottawa. The water-power of the Chaudière Falls furnishes power for electric railways and for the lighting system as well as for saw mills, pulp and paper mills and match factories.

Sherbrooke (pop. 22,583) is a close rival of Hull in industrial importance. It is located in the Eastern Townships, and its cotton and woollen factories and machine shops are amongst the largest in Canada. St. Hyacinthe (pop. 16,540) and Valleyfield have also large manufacturing establishments. Three Rivers (pop. 25,000) and Sorel have large shipping interests.

The Government of the province consists of a lieutenant-governor, a Legislative Council of 24 members appointed by the lieutenant-governor in council, a Legislative Assembly of 81 members elected by the people, and an Executive Council of 11 members chosen from the Legislative Assembly and the Legislative Council. The province is represented in the Dominion Parliament by 65 members in the House of Commons, and 24 senators. Either French or English may be used in addressing either House of Parliament, but French is the language largely used. The Civil law is the old French code existing prior to the conquest in 1760. The Criminal law is the same as exists throughout the Dominion.

Education.—Very difficult problems presented themselves to the statesmen of Canada in connexion with education in the province of Quebec, for not only are 85% of the population Roman Catholics but 80% speak French as their mother tongue; and had it not been for the wise provision made as a condition precedent to confederation the Protestant minority of 15% would have found themselves in a very uncomfortable position. The superintendent of education for the whole province, who is a non-political officer, is assisted by a council divided into a Roman Catholic and Protestant committee, each with a secretary who is the chief administrative officer for both classes of schools respectively. These committees meet separately as a rule, though they may, and occasionally do, meet together as a council. Each committee supervises the expenditure of the proportion of public money allotted to it, and each has its own normal school, appoints its own teachers and exercises control by inspectors over its own schools under the general law. The legislative grant for higher education is divided according to population, the Protestants receiving one-seventh; of the grant for normal schools the Protestants receive one-third, and the elementary school branch is divided according to population. This is supplemented by a local municipal taxation through trustees. In 1918 there were 6,103 elementary schools, with a teaching staff of 8,189 and a total enrolment of 247,531; the expenditure on education was $14,481,494.

A leading feature of the educational system is that all the public schools are denominational. Instruction in religion and morals given in Protestant schools is based on reading from the Old Testament, the Gospels and the Acts, and the children commit to memory portions of the Gospels and Psalms, together with the Apostles' Creed, the Decalogue and the Lord's Prayer. The religious instruction in the Roman Catholic schools is substantially part of the educational system, the Roman Catholic schools being controlled by the clergy, the episcopate forming, *ex officio*, one-half of the Catholic section of the council.

The chief universities are McGill at Montreal, founded in 1820; Laval (R.C.), founded in 1852, the headquarters being in the city of Quebec; and the newly founded university of Montreal, which was formerly the Montreal branch of Laval. McGill University stands very high academically, and has an especially well-equipped department of applied science. Laval has a professorial staff of 79, the university of Montreal 525, and McGill 322. The total numbers of students were in 1918 686, 5,460 and 2,444 respectively. Bishop's College, Lennoxville, is a small Anglican university in connexion with which is a school on the lines of an English public school. To McGill is affiliated the well-equipped agricultural college established at Ste. Anne de Bellevue by Sir William Macdonald, who is also noted for his liberal endowment of McGill University; and to Laval an agricultural school at Oka founded by the Trappist Fathers. There are numerous model and normal schools, the most important being that of Ste. Anne de Bellevue in connexion with Macdonald College.

Agriculture.—In recent years great progress has been made in agriculture, especially in dairying and live stock. The products of the soil are abundant, and large quantities of hay and oats are exported from Montreal and the city of Quebec; live stock, bacon, beef, eggs, butter, and especially cheese, to the value of millions of dollars yearly, are also shipped abroad. The field crops reach an annual value of $271,600,000. Apples, plums and melons are produced in large quantities, together with many varieties of small fruits. Nearly $7,000,000 is realized annually from the maple trees in sugar and syrup. In 1920 there were 813 butter and cheese factories in operation. More than 92,000,000 lb. of butter and cheese, worth over $35,000,000, are produced each year. Fully two-thirds of the tobacco grown in the Dominion comes from Quebec. The live stock of the province was in 1920 valued at more than $205,000,000, and the total annual value of the field crops, principally hay, oats, barley, and some wheat, at about $305,000,000.

Forests and Lumber.—Quebec, though second to Ontario in the production of lumber, exceeds it in the value of its pulp and paper products. Of the enormous forest area but a small portion has been cut over, and since Quebec has been a pioneer in scientific methods of forest conservation, copying the method of old France, the timber resources promise to be maintained indefinitely. In the N. the predominating trees are pine, spruce, fir, and other coniferous varieties, while farther S. appear maple, poplar, basswood, oak and elm trees and many other hardwoods. The value of the lumber cut in 1918 was $20,916,604, of which spruce formed 66·3% of the output and white pine 13·1, the other commercial varieties in a smaller way being hemlock, balsam fir, birch and cedar. The capital invested in the lumbering industry amounted to $57,201,820.

Fish and Fur.—The value of the annual catch of fish is estimated at $3,000,000, the industry employing more than 3,000 men. Fish hatcheries have been established by the Dominion Government at several places for the purpose of stocking the lakes and rivers of the province. With considerable tidal waters along its coast Quebec may be regarded as one of the Maritime provinces. The principal fish are cod, lobsters, herring, salmon and mackerel. The mainland waters abound in trout, pickerel, whitefish, pike and sturgeon.

The forests, especially in the northern part, abound in game, both fur-bearing and otherwise. Nearly 200,000 sq. m. of territory in

** These figures indicate the volume and page number of the previous article.*

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Quebec have been set apart by the Legislature for forest reserve and for the preservation of fish and game. Quebec is scarcely surpassed in Canada in its interest for sportsmen. In the Laurentides National Park, a district of 2,640 sq. m. N. of Quebec, caribou, partridge and trout are found in abundance. Bear and moose are also numerous.

Minerals.—Of the economic mineral product, cement alone yields $3,000,000 annually. Molybdenite was mined extensively, during the World War, in the district of Quyon, Pontiac county, this mine becoming the largest producer in the world. Magnesite, found in the vicinity of Grenville, Argenteuil county, was also a valuable war-time mineral. The annual production of minerals in Quebec is valued at about $23,000,000.

Manufactures.—Quebec ranks next to Ontario in the amount and value of its manufactures. There is limitless water-power almost everywhere, and at Shawinigan and Valleyfield power is being developed for commercial purposes. The chief manufactures are sugar, woollen and cotton goods, pulp and paper, tobacco and cigars, furs and hats, machinery, leather goods, boots and shoes, railway cars, rifles, musical instruments, cutlery and gunpowder. The annual value of the manufactured products of the province has reached $920,000,000. The pulp mills in 1918 produced 288,952 tons valued at $12,018,258, and the total product of all mills, paper and pulp, was valued at $19,620,051. Paper of all kinds was manufactured to the extent of $27,546,791, of which $17,500,000 was newsprint. The total capital invested amounted to $24,490,175, and 11,793 persons employed in the industry received $11,546,596 in salaries and wages.

Communications.—The province is well provided with railways. The headquarters of the Canadian Pacific railway is at Montreal, and various lines of this railway connect Montreal with Toronto, Ottawa, Winnipeg, Vancouver, Quebec and St. John. The Canadian National railways connect Montreal with Halifax, passing across the St. Lawrence at the city of Quebec, and the line from Moncton, in New Brunswick, to Prince Rupert, in British Columbia, also crosses the St. Lawrence at the city of Quebec, and proceeds on its way through the northern part of the province. The National lines connect various local points, and by means of the old Grand Trunk system reach important centres in the United States, while there are a number of other railway companies, with lines running in various directions, especially in the extreme eastern section of the province.

Both Montreal and Quebec are connected by steamship during the summer months with all parts of the world. The St. Lawrence route, which by reason of its shortness is a favourite both for freight and passengers proceeding to Europe, has been rendered perfectly safe for navigation. During the summer season steamers ply on the rivers and inland waters, carrying a great deal of freight and taking care of the tourist trade. (W. L. G.*)

QUEBEC (*see* 22.727), the oldest city in the Dominion of Canada, had a pop. of 78,710 in 1910 and 116,850 in 1920. Quebec had for some years prior to 1911 been displaced by Montreal in the shipping trade, but after 1911 the older port steadily improved its commercial and industrial position. As a manufacturing centre Quebec has profited by the cheap electric power supplied from the Shawinigan and Montmorency Falls. The harbour has been improved, and the largest dry-dock in the world has been built at a cost to the Dominion Government of $7,000,000. Important factors contributing to the increased commercial importance of Quebec were the successful completion of the famous Quebec bridge, and the building of the Grand Trunk Pacific railway from Prince Rupert on the west coast of Canada to Quebec on the east. The distance from Quebec to Winnipeg by this railway is 145 m. shorter than that from Montreal to Winnipeg by any other line. The Quebec bridge, connecting the north and south shores of the St. Lawrence river at Cap Rouge, 9 m. from the centre of the city, was completed in 1917 by the St. Lawrence Bridge Co. for the Dominion Government. This achievement marked the end of more than 10 years of effort, two accidents to portions of the huge structure having delayed the work in 1907 and again in 1917. The Quebec bridge is larger than the Forth bridge in Scotland, which was previously the world's largest bridge. Its total length is 3,239 ft., the cantilever span is 1,800 ft. long and the suspended span 640 ft. long. The weight of the suspended span is 5,510 tons. The completion of the bridge made possible the running of six railways simultaneously into Quebec from the south shore. Quebec has always been a base of supplies for a large region of mines, lumber camps and farms, but has gained further importance in this regard of late years owing to the rapid development of the water supplies of the province for purposes of electric power, particularly for the manufacture of wood pulp. The Lake Saint John district north of the city, a centre for pulp-milling, finds its outlet through Quebec. Buildings erected recently in Quebec include a large Government technical school, the erection and equipment of which cost $150,000.

QUILLER-COUCH, SIR ARTHUR THOMAS (1863–), English man of letters (*see* 22.750), published subsequently to 1910 *The Vigil of Venus and other poems* and an anthology, *The Oxford Book of Victorian Verse* (1912), as well as books *On the Art of Writing* (1916), and *On the Art of Reading* (1920); a memoir of *Arthur John Butler* (1917); a volume of Shakespearean studies in 1918; *Hocken and Hunken, a new Tale of Troy* (1912); and various collections of short stories, including *Hicky-Nan, Reservist* (1915).

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RACHMANINOFF, SERGEI VASILIEVICH (1873–), Russian composer and pianist, was born at Onega, in Russia, March 20 1873; his grandfather, an excellent pianist, had been a pupil of the Irish musician John Field. He began his studies under his mother, but at nine he became a pupil of Anna Ornadtskaya. In 1882, however, the Rachmaninoff family removed to St. Petersburg, and Sergei entered the Conservatorium, where he remained till 1885, when, on the family again removing to Moscow, he joined the Conservatorium there, and was on terms of friendship with Scryabin, Siloti, Taneyeff and Arensky. When, in 1892, Rachmaninoff left the Conservatorium, he won the large gold medal for a one-act opera *Aleka* and followed it by many other works. About 1893 he composed a pianoforte suite, another for two pianos, a dozen songs, his first piano concerto, the symphonic picture *The Rock* and the elegiac trio on the death of Tschaikovsky. Next there followed his first symphony, produced by Glazounoff at St. Petersburg. In 1897–8 Rachmaninoff became conductor of Mamoutoff's private opera, a post he resigned after the season, and in 1899 he came to London to conduct a Royal Philharmonic concert. A second piano suite, another concerto and a violoncello sonata were quickly composed, and were followed by the one-act opera *The Miser Knight* (Moscow 1900, Boston 1910) and *Francesca da Rimini* (Moscow, same evening); during 1904–6 he directed the Moscow Opera, and from 1906 to 1908 he lived in Dresden as composer and pianist, visiting Paris in 1907. In 1909–10 he visited the United States for the first time, and then returned to Russia, where he wrote *The Island of Death*, the D minor piano Sonata, and the third and fourth piano concertos (1909 and 1917). In 1912 he produced *The Bells*, which was produced in Liverpool by Sir Henry J. Wood in 1921. Among his other compositions *Spring*, for chorus and orchestra, is particularly noteworthy, and his devotional music includes a wonderful setting of the Liturgy of St. Chrysostom (1910). In 1917 Rachmaninoff left Russia, and in 1918 he settled in New York.

RADIOACTIVITY (*see* 22.793*).—Among points of special interest that have arisen since the earlier article was written may be mentioned the preparation of metallic radium by Mme. Curie and Debierne by electrolysis of a radium salt with a mercury cathode. Radium resembles metallic barium, melts at about 700° C. and is rapidly attacked when exposed to the air.

The atomic weight of radium was found by Mme. Curie to be 226·45, using for the purpose about 0·4 gram of pure radium chloride. A recent careful redetermination by Hönigschmid with about one gram of radium gave a value 225·9 and is probably correct to 1 in 1,000. An International Radium Standard consisting of about 22 milligrams of pure radium chloride has been prepared by Mme. Curie, and is preserved in the Bureau International des Poids et Mesures at Sèvres, near Paris. Secondary radium standards have been issued to all governments who wished to purchase them. These have been calibrated by γ-ray methods both in Vienna and Paris and are supposed to be correct within 1 in 200. During the last few years the purchase and sale of radium have generally been conducted on certificates given in terms of this international standard.

The wide use of radium for therapeutic purposes, and its high cost—from £25 to £30 per milligram element—have led to close search for uranium deposits. The amount of radium in an old mineral is always proportional to its content of uranium in the ratio of 3·3 parts of radium by weight to 10 million parts of uranium. Consequently an old mineral containing 1,000 kgm. of uranium should contain 330 milligrams of pure radium. Initially several grams of radium were separated from the uraninite deposits in Joachimsthal, Bohemia, and some of the material, which was the property of the Austrian Government, was generously loaned to representative workers in radioactivity in England. A part of this radium is in the charge of the Radium Institute of Vienna, which is specially devoted to radioactive investigations. The increasing demand for radium has led to the working of low-grade uranium ores on a large commercial scale. Much of the radium to-day is derived from the mineral carnotite, of which there are extensive deposits in Colorado and other parts of the United States. Although the carnotite contains only a few per cent of uranium and a correspondingly small quantity of radium, the separation of the latter is a profitable industry operating on a large scale. Large quantities of radium were employed by the Allies during the World War for night compasses, gun-sights, etc. The radium is mixed with phosphorescent zinc sulphide to form a paint which becomes continuously luminous, but, owing to the destruction of the zinc sulphide by the rays, this luminosity gradually decays.

Radium Emanation.—The atomic weight of the radium emanation is now known to be $226-4=222$, as was inferred earlier. This was confirmed by direct weighing with micro-balance by Ramsay and Gray.

The radium emanation has proved of great service not only in radioactive researches but also in therapeutic work. The radium salt is dissolved in an acid solution and the emanation is pumped off with the large quantity of hydrogen and oxygen liberated by the action of the radiations on water. After sparking the mixture, the emanation can be purified by condensation with liquid air. A very intense source of β and γ radiation can be obtained by introducing the purified emanation into fine capillary tubes. Such emanation needles have been widely used for therapeutic purposes, while the use of very thin-walled tubes provides a powerful line source of α rays. The β and γ activity of such tubes rises to a maximum about four hours after introduction of the emanation and then decays with the period of the emanation, viz. 3·85 days. The quantity of emanation liberated from one gram of radium is called a *curie* and from one milligram a *millicurie*. The quantity of radium emanation in a tube can be accurately determined by comparison of its γ-ray activity with that of a radium standard, since the penetrating γ rays, both from the radium and the emanation in equilibrium, arise mainly from the same product radium C.

As regards other radioactive substances large quantities of mesothorium have been obtained as a by-product in the separation of thorium from monazite sands. This substance, which is half transformed in about 6·7 years, emits only β rays, but gives rise to radiothorium and subsequent products which emit α rays and penetrating β and γ rays. As a source of powerful β and γ radiation, this substance is very analogous to radium and can be obtained in about the same concentration. Since radium and mesothorium are isotopic elements, they are always separated together. Most commercial sources of thorium contain also uranium and radium, and consequently radium is always separated with the mesothorium and in relative amount depending upon the proportion of uranium to thorium in the mineral. Since mesothorium has a radioactive life short compared with radium, it commands a smaller price. The amount of mesothorium is standardized by comparison of its γ-ray effect with a radium standard.

Mme. Curie separated the polonium from several tons of pitchblende and obtained an exceedingly active preparation of a few milligrams, but was unable to obtain it in a pure state, although several of its spectrum lines were detected. It was hoped by this experiment to decide whether polonium was transformed directly into lead, but this was found difficult to establish owing to the presence of impurities with the very small quantity of polonium.

The three types of radiation, known as the α, β, γ rays, emitted by radioactive substances are analogous in many respects to the types of radiation observed when a discharge passes through a vacuum tube, but are of much more penetrating character. It may be noted here that for the electrons in a vacuum tube to obtain the velocity of the swift β rays from radium, a potential difference of at least two million volts would have to be applied. The very penetrating γ rays are identical in all respects with X rays of very short wavelength. Intense γ rays are only observed in substances which emit swift β particles, and apparently owe their origin to the passage of the swift β particle through the distribution of electrons surrounding the atomic nucleus. To produce X rays as penetrating as the γ rays, about two million volts would have to be cut on the discharge tube.

The α rays, shown in 1903 by Rutherford to consist of a stream of positively charged atoms projected with high velocity, are now known to consist of charged atoms of helium which are projected with velocities of about 10,000 m. per second. While the majority of products break up with the expulsion either of an α particle or a swift β particle, in a few cases no detectable radiation has been observed. Such products were at first called " rayless " products, but the sequence of

** These figures indicate the volume and page number of the previous article.*

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chemical properties, discussed later, shows that a β particle must be liberated but at too low a speed to detect with certainty. Actinium and mesothorium are examples of such products.

A number of new products have been discovered, particularly in the uranium and actinium series. The results are included in the appended table of radioactive elements.

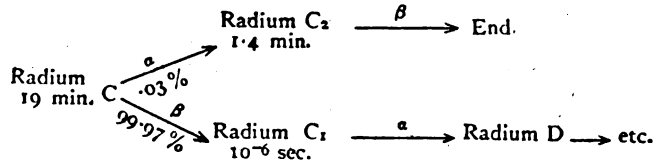
TABLE OF RADIOACTIVE ELEMENTS

Element	Atomic Weight	Atomic Number	T	Rays	Range cms. α rays (15° and 760 mm.)
Uranium-Radium Series.					
Uranium I.	238·18	92	$4·5\times10^9$ yrs.	α	2·50
Uranium X_1	234	90	23·8 days	β, γ	—
Uranium X_2	234	91	1·15 min.	β, γ	—
Uranium II.	234	92	about 2×10^6 yrs.	α	2·90
Uranium Y (3 per cent)	230	90	24·6 hrs.	β	—
Ionium	230	90	about 9×10^4 yrs.	α	3·07
Radium	226	88	1700 yrs.	α	3·52
Radium Emanation	222	86	3·85 days	α	4·16
Radium A	218	84	3·05 min.	α	4·75
Radium B	214	82	26·8 min.	β, γ	—
Radium C	214	83	19·5 min.	α, β, γ	6·94
Radium D	210	82	16 yrs.	β, γ	—
Radium E	210	83	4·85 days	β, γ	—
Radium F (Polonium)	210	84	136·5 days	α	3·83
Radium G (end-product uranium-lead)	206	82	—	—	—
Thorium Series.					
Thorium	232·1	90	$2·2\times10^{10}$ yrs.	α	2·72
Mesothorium 1	228	88	6·7 yrs.	β, γ	—
Mesothorium 2	228	89	6·2 hrs.	β, γ	—
Radiothorium	228	90	1·90 yrs.	α	3·87
Thorium X	224	88	3·64 days	α	4·30
Thorium Emanation	220	86	54 secs.	α	5·00
Thorium A	216	84	0·14 sec.	α	5·70
Thorium B	212	82	10·6 hrs.	β, γ	—
Thorium C	212	83	60 min.	α	4·80 8·60
Thorium D	208	81	3·2 min.	β, γ	—
Thorium E (end-product thorium-lead)	208	82	—	—	—
Actinium Series.					
Protoactinium	230	91	about 10^4 yrs.	α	3·31
Actinium	226	89	20 yrs.	β	—
Radioactinium	226	90	19 days	α	4·6
Actinium X	222	88	11·2 days	α	4·26
Actinium Emanation	218	86	3·9 secs.	α	5·6
Actinium A	214	84	·002 sec.	α	6·3
Actinium B	210	82	36 min.	β, γ	—
Actinium C	210	83	2·16 min.	α	5·15
Actinium D	206	81	4·76 min.	β, γ	—
Actinium E (end-product actinium-lead)	206	82	—	—	—

In the table T is the time-period of a product or the time required for the product to be half transformed. It will be seen that the value of T, which is a measure of the relative stability of atoms, varies between $2·2\times10^{10}$ years (Thorium) and ·002 second (Actinium A). The atomic weights and atomic numbers of uranium, radium, uranium-lead, thorium, thorium-lead have been directly determined. The atomic weights and atomic numbers of the others are deduced on the assumption that the expulsion of an α particle (helium atom) of charge 2 and mass 4 lowers the atomic number of the succeeding element by 2 units and the atomic weight by 4. The expulsion of a β particle raises the atomic number by 1 unit, but it is not supposed to influence the atomic weight to a detectable degree.

Branch Products.—In the great majority of cases each of the radioactive elements breaks up in a definite way, giving rise to one α or β particle and to one atom of the new product. Undoubted evidence, however, has been obtained that in a few cases the atoms break up in two or more distinct ways, giving rise to two or more products characterized by different radioactive properties. A branching of the uranium series was early demanded in order to account for the origin of actinium. While the latter is always found in uranium minerals in constant proportion with the uranium, Boltwood showed that the activity of the actinium with its whole series of α-ray products in a uranium mineral was much less than that given by a single α-ray product of the main radium series. The head of the uranium series is believed to be uranium Y, the branch product of the uranium series first observed by Antonoff. The branching is supposed to occur in the product uranium X_1, 4% going into the actinium branch and the other 96% into the main uranium series. The atomic weights of actinium given in the table are calculated on this basis. The recently discovered product, *protoactinium*, is the hitherto missing link between uranium Y and actinium.

The most striking cases of branching occur in the "C" products of radium, thorium and actinium, each of which breaks up in two or more distinct ways. In the case of radium C, a new substance called radium C_2 was obtained by recoil from a nickel plate coated with radium C. This product emitted only β rays and had a period of 1·4 minutes. Fajans estimated that the amount of the product was only 1/3,000 of that of radium C. To account for these results, the following scheme of transformation has been proposed:—



where in the main branch a β particle is first expelled, giving rise to radium C, which emits an α particle. The reverse process is assumed to take place in the other branch. Radium C_1, which emits a swift α particle, is supposed to have an exceedingly short period of transformation. It is uncertain whether the radium C_2 branch ends after the expulsion of a β particle. The resulting product is an isotope of lead like radium D in the main branch.

In the case of thorium C, two sets of α particles are observed, one-third of the total number of range 5·0 cms., and the remainder of range 8·6 centimetres. Recently another set of rays, about 1/10,000 of the total, has been found by Rutherford and Wood to have the great range in air of 11·3 cms. and has been shown to consist of α particles. These results suggest that the thorium C atom breaks up in three distinct ways, each marked by the expulsion of an α particle with characteristic but different velocity. Marsden showed that actinium C emits two sets of α particles, 99·84% of range 5·15 cms. and 16% of range 6·4 cms., indicating a dual transformation of actinium C. It is quite possible that a close examination of radioactive substances may reveal other examples of such complex methods of transformation, for, after the violent explosion that occurs during the breaking-up of an atom, more than one state of temporary equilibrium may be possible for the residual atom.

Relation between Range of α Rays and Period of Transformation.—We have seen that each α-ray product emits α particles of characteristic velocity which have a definite range in air. It was early observed that there appeared to be a connexion between the period of transformation of a product and the velocity of the α particles emitted. The shorter the period of transformation, the swifter is the velocity of expulsion of the α particle. This relation was brought out clearly by the measurements of Geiger and Nuttall, where it was shown that if the logarithm of the range was plotted against the logarithm of λ, the constant of transformation, all the points lay nearly on a straight line. A similar result has been observed for the thorium and actinium products. This relation is at present purely empirical and no doubt only approximate, but it is of great interest as indicating a possible relation between the stability of the radioactive nucleus and the velocity of the expelled helium atom. This relation has proved very useful in forming estimates of the period of transformation of ionium and other substances before the results of more direct determinations were available. From this relation also the change which gives rise to the swift α particle of radium C is believed to be exceedingly rapid, and a similar conclusion is drawn for the products emitting the very swift α particles from thorium C.

Chemistry of the Radioelements.—Apart from uranium and thorium and a few special cases like radium and polonium, the radioactive products of short life exist in too small quantity to examine by the ordinary chemical methods, but, by the use of the radioactive method of analysis, it was possible to form some idea of their chemical behaviour. Certain very interesting points

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soon came to light. Soddy found that the two elements, radium and mesothorium, although quite dissimilar in radioactive properties, were chemically so identical that it was impossible by chemical methods to separate one from the other. Other cases of this kind had long been suspected, viz. thorium and radiothorium, thorium and ionium, and radium D and lead. He named such inseparable elements isotopes, since they appeared to occupy the same place in the periodic classification of the elements.

Following the chemical study of the radioelements by Soddy, Fleck and von Hevesy, an important generalization connecting the chemical properties of the radioelements was announced independently in 1913 by Russell, Fajans and Soddy. After the expulsion of an α particle from a radioactive substance, the resulting product shifts two places in the direction of diminishing mass when the elements are arranged in families according to the Mendeleef classification.

The expulsion of a β particle causes a shift of one place in the opposite direction. For example, by the loss of an α particle from ionium of group IV., the resulting product, radium, belongs to group II., while the loss of another particle gives rise to the emanation which occupies the group O, and so on. By this method the chemical properties of all the known radioelements can be predicted from a knowledge of the radiations emitted from the products. This generalization can be viewed from another important standpoint. From the work of Moseley, the properties of an element are defined by the atomic number which is believed to represent the resultant positive charge on the nucleus. The loss of an α particle of mass 4, carrying two positive charges, lowers the atomic number by two units, while the emission of a β particle raises it by one unit. On looking through the table of the radioelements given above, it will be seen that many of them can be grouped under the same atomic number. These represent the radioactive isotopes, of which some of the more important are given below, preceded by the atomic numbers:—

81 Tellurium (204), thorium D (208), actinium D (206).
82 Lead (207), uranium-lead (206), thorium-lead (208), radium D (210), thorium B (212), radium B (214), actinium B (216).
83 Bismuth (208), radium E (210).
84 Polonium (210), thorium A (216), radium A (218), actinium A (214).
86 Radium emanation (222), thorium emanation (220), actinium emanation (218).
88 Radium (226), thorium X (224), mesothorium (228), actinium X (222).
90 Thorium (232), radiothorium (228), ionium (230), uranium X_1 (234), uranium Y (230), radioactinium (226).

It will be seen that many of the radioactive elements are isotopic with known chemical elements. These radioactive isotopes differ not only in atomic weight but also in radioactive properties. The isotopes of lead are of special interest as they include the end-products of the uranium, thorium and actinium series—a question that will be discussed more fully later. It has been found that the X-ray spectrum of the γ rays from radium B is identical with that given by ordinary lead exposed to cathode rays in a vacuum tube, a result to be anticipated from the identity of their atomic number. It is of interest to note that polonium is a new type of chemical element which has no counterpart among the ordinary inactive elements.

Transformation of Uranium.—In 1900 the late Sir W. Crookes found that the β-ray activity of ordinary uranium could be removed by a single chemical operation and concentrated in an active residue. This is due to the separation of the product uranium X, of period 24 days, which emits β and γ rays. A complete analysis of the transformations of uranium has been a matter of much difficulty. Boltwood showed that the α-ray activity of uranium was about twice as great as that of a corresponding α-ray product in the uranium-radium series, indicating that uranium contained two successive α-ray products. This was confirmed by Geiger, who showed that the α rays from uranium consisted of two groups with ranges 2·5 and 2·9 cms. respectively. These two α-ray substances, called uranium I. and uranium II., are isotopic, with atomic weights 238 and 234 respectively. The latter, whose period is estimated at about 2 million years, exists in relatively very small quantity compared with uranium I. Following the generalization connecting the radiations and chemical properties of the series of radioelements, Fajans predicted the presence of a new product with properties analogous to tantalum, and promptly succeeded in isolating it experimentally. The new product uranium X_2, sometimes called brevium, has a period of 1·15 minutes and emits swift β rays. The series of changes is thus:—

$$\text{Ur. I.} \longrightarrow \text{Ur. X}_1 \longrightarrow \text{Ur. X}_2 \longrightarrow \text{Ur. II.} \longrightarrow \text{Ionium.}$$

We have seen that Antonoff discovered another β-ray substance called uranium Y, separated with uranium X_1, which has a period of 24·6 hours. This exists in too small quantity to be in the main line of succession, but is to be regarded as a branch product of uranium X_1 and is believed to be the first element of the subsidiary actinium series.

Rutherford and Geiger found the number of α particles emitted per gram of uranium per second to be $2{\cdot}37 \times 10^4$. From this the period of uranium is calculated to be about 6,000 million years.

Thorium.—The first product observed in thorium was the emanation of period 54 seconds, and this gives rise to the active deposit, which has been shown to consist of at least four successive products called thorium A, B, C, D. The emanation, after the emission of an α particle, changes into a product of very short life emitting α rays. Its period was found by Geiger and Moseley to be about 1/10 second. The succeeding product, thorium B, emits only weak β and γ rays with a period of 10·6 hours, changing into thorium C of period one hour. We have seen that thorium C breaks up in a complex way, emitting three distinct groups of particles. Thorium D is readily separated from C by the method of recoil. It emits penetrating β and γ rays with a half-period of 3 minutes. The active deposit as a whole decays ultimately with the period of thorium B, viz. 10·6 hours.

A special interest attaches to the product thorium X, first separated by Rutherford and Soddy, since experiments with it laid the foundation of the general theory of radioactive transformations.

A close analysis of thorium has led to the discovery by Hahn of a number of other important products. When the thorium X is separated from a thorium mineral or old thorium preparation, there appears with it another product called mesothorium 1, of period 6·7 years, which is transformed with the emission of weak β rays into mesothorium 2, of period 6 hours, which emits swift β particles and penetrating γ rays. This changes into an α-ray product, radiothorium, of period 2 years, which is transformed into thorium X.

Radiothorium is an isotope of thorium, while mesothorium 1 is an isotope of radium. The radiothorium can readily be separated from a solution of mesothorium and obtained in a concentrated form. Mesothorium when first separated would show a very weak activity, but in consequence of the growth of its subsequent product radiothorium, its activity would increase for several years. After reaching a maximum it would ultimately decay with the period of mesothorium, viz. 6·7 years.

Actinium.—Actinium of period about 20 years is believed to emit weak β rays changing into radioactinium, an α-ray product of period 19 days, first separated by Hahn. This changes into actinium X, an α-ray product of period 11 days, discovered by Godlewski. Then follows the actinium emanation of period 3·9 seconds, which gives rise to four further products named actinium A, B, C, D. Actinium A has the shortest life of any product whose rate of transformation has been directly determined. Its period, as determined by Geiger and Moseley and Fajans, is ·002 second. After emitting an α particle, A changes into B, a product of period 36 minutes emitting weak β and γ rays, analogous to thorium B. Actinium C of period 2·16 minutes undergoes a complex transformation, giving rise to two distinct groups of α particles. The main branch gives rise to actinium D of period 4·8 minutes, which is readily isolated by the recoil method. Actinium D, which emits β and γ rays, is analogous in all respects to thorium D.

In the discussion above on branch products it has been shown that the parent of actinium, called *protoactinium*, has been recently isolated by Hahn and Soddy. This substance emits α rays and has an estimated period of 10,000 years. We have seen that the actinium series is believed to have its origin in a dual transformation of uranium X. The first branch product, representing about 4% of the total, is believed to be uranium Y, a β-ray product of period one day. This is directly transformed into protoactinium.

While very active preparations of actinium have been made, it has not been found possible to separate it entirely from the rare earths with which it is mixed. Protoactinium exists in much larger amounts and should be ultimately obtained in a pure state.

End-products of the Transformations (re-stated).—After the radioactive transformations have come to an end, each of the elements uranium, thorium and actinium should give rise to an end or final product, which may be a known element or an unknown element of very slow period of transformation. Since the expulsion of an α particle lowers the mass of the atom by four units, and there are eight α-ray products, the atomic weight of the end atom should be $238 - 8 \times 4 = 206$. The atomic weight of radium by this rule should be $238 - 3 \times 4 = 226$, a result in good accord with experiment. The atomic weight of the end-product of uranium is close to that of lead, viz. 207, and Boltwood early suggested that lead was the end-product of radium. Since in

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old minerals the transformations have been in progress for intervals measured by millions of years, the end-product should collect and be an invariable companion of the radioelement. Boltwood showed that lead is always present in old radioactive minerals and in amount to be expected from their uranium content and geologic age.

In recent years this problem has been definitely attacked in the light of the chemical generalization already given. It was clear from this that the end-products of uranium, thorium and actinium should all be isotopes of lead but with atomic weights 206, 208 and 206 respectively. In other words, uranium-lead if uncontaminated with ordinary lead should show a smaller atomic weight than ordinary lead (207), while thorium-lead should give a higher value. By the work of Richards, Soddy and Hönigschmid, these conclusions have been definitely confirmed. The lowest value for uranium-lead is 206, and the highest for thorium-lead 207·7.

Since any admixture with ordinary lead tends to give a value nearer 207, these results may be considered as a definite proof of the nature and atomic weight of the end-products. In minerals containing both uranium and thorium the atomic weight of the mixture of the isotopes will depend on the relative amounts of these two elements and their relative rates of transformation. In unaltered minerals the determination of the amount of lead coupled with its average atomic weight allows us to determine the amount of uranium-lead even if some ordinary lead be present. In this way it should be possible to make a reliable estimate of the age of selected minerals and thus indirectly the age of the geologic strata. The amount of helium in the mineral gives a minimum estimate of its age, for, except in the most compact minerals, some of the helium must undoubtedly escape.

Nature and Properties of the α Rays (re-stated).—Although the α rays from active substances are of small penetrating power compared with the β or γ rays, they are responsible for most of the energy evolved by radioactive substances and contribute most of the ionization. Rutherford showed in 1903 that the α rays were deflected in a powerful magnetic and electric field and consisted of positively charged particles projected with high velocity. From the first it seemed probable that the α particle was an atom of helium and this was subsequently confirmed in a number of ways. The value of e/m—the ratio of the charge on the particle to its mass—and the velocity can be determined from observations on the deflection of the pencil of rays by a magnetic field and electric fields. In this way Rutherford and Robinson showed that the α particle, whether from the radium emanation, radium A or C, gave a value of $e/m = 4820$ *e.m.* units, while the electrochemical value of $e/m = 4826$, assuming that the mass of the helium atom is 4·00 and that it carries two unit positive charges. The magnitude of the charge carried by each particle was measured by Regener and Rutherford and Geiger and found to be twice that carried by the electron. The velocity of the α particles expelled from radium C (of range 7·06 cms.) was found to be $1{\cdot}92 \times 10^9$ cm. per second, or about $1/15$ the velocity of light. From this result the velocity of expulsion of all α particles can be calculated from the relation found by Geiger, that $V^3 = KR$ where V is the velocity of the particle and R its range in air. The evidence indicates that the α particles from active products are in all cases atoms of helium. The α particles from a given product are all emitted with constant velocity which is characteristic for that product. We have already mentioned that the velocity of expulsion appears to be connected with the period of transformation of the element. The laws of absorption of the α particle were first worked out by Bragg and Kleeman. On account of their great energy of motion, the α particle travels in nearly a straight line through the gas, producing intense ionization along its track. The effects produced by the α particle, whether measured by ionization, phosphorescence or photographic action, vanish suddenly after the α particle has traversed a definite amount of matter. This definiteness of the end of the range of the α particle of given velocity is remarkable. The range of the α particle is usually expressed in terms of cms. of air traversed at 15° C. and 760 mm. pressure.

On account of its great energy of motion the effect due to a single α particle can be detected in a variety of ways. Sir William Crookes first noted that the α rays produce scintillations when they fall on a screen of phosphorescent zinc sulphide. It is now known that each of these scintillations is due to the impact of a single α particle. The number of scintillations can be counted with the aid of a suitable microscope, and this method has proved of great utility in many investigations. Scintillations due to α rays are observed in certain diamonds, but they are usually not so bright as in zinc sulphide. Kinoshita has shown that a single α particle produces a detectable effect on a photographic plate. When the α rays fall on a plate nearly horizontally the track of the α particle is clearly visible under a high-power microscope. By the expansion method developed by C. T. R. Wilson, the track of the α particle through the gas is made visible by the condensation of the water on each of the ions produced. In a similar way the track of a β particle can be easily shown. The photographs of these trails bring out in a striking and concrete way not only the individual existence of α and β particles, but the main effects produced in their passage through matter.

Properties of β and γ Rays (re-stated).—We have seen that the β particles, which are emitted by a number of radioactive products, consist of swift negative electrons spontaneously liberated during the transformation of active matter. The velocity of expulsion and the penetrating power of β rays vary widely for different products. For example, the rays from radium B are much more easily absorbed by matter than the swift β rays from radium C. Moseley showed that in the case of these two products each disintegrating atom gave rise on the average to one β particle.

There is undoubtedly a close connexion between β and γ rays, and swift β rays are usually accompanied by penetrating γ rays. For example, radium C, which emits very swift β rays, some of which reach a velocity more than 0·98 of the velocity of light, gives rise to the most penetrating γ rays observed in the uranium-radium series. There is one very notable exception, viz. radium E, which emits swift β particles but weak γ rays. Gray has shown that β rays in passing through matter give rise to γ rays, and that these in some cases correspond to the characteristic X radiations observed by Barkla. The absorption of the γ rays has been determined by the electrical method. Radium B has been found to emit several groups of γ rays which differ widely in penetrating power. The greater part of the rays from radium C consist of penetrating γ rays which are exponentially absorbed by matter. The ionization in an electroscope falls off according to the equation $I/I_0 = e^{-\mu d}$ where d is the thickness of matter traversed and μ the coefficient of absorption. When lead is used as an absorbing material the value of $\mu = 0{\cdot}5$ for the most penetrating γ rays from radium C. The absorption coefficient for different kinds of matter is roughly proportional to the density, indicating that the absorption depends only on the mass of matter traversed.

The general evidence indicates that the γ rays consist of types of characteristic radiations which are excited by the passage of the β rays through the electronic system of the atom, but the γ rays from radium C are far more penetrating than any type of characteristic radiation observed in X rays generated in a vacuum tube.

Rutherford and Andrade have determined the spectrum of the γ rays from radium B and C by reflection from rock-salt. The most intense lines due to radium B are identical in wave-length with the X-ray spectrum of lead. This is to be expected, since radium B is an isotope of lead. The lines due to the "K" characteristic radiation are also observed. General considerations, however, indicate that the wave-length of the most penetrating γ rays is much too short to resolve or detect by the crystal method. In order to excite such rays in an X-ray tube potential differences of the order of two million volts will be necessary.

When the γ rays from a product like radium B or radium C are bent by a magnetic field and fall on a photographic plate, a kind of magnetic spectrum is obtained. Superimposed on the continuous spectrum due to particles of all velocities (between certain limits) certain sharp lines are observed, each of which represents a definite group of β rays which are emitted at the same speed. The velocity corresponding to each line in the spectrum has been determined for a number of β-ray products by Hahn and Miss Meitner. The magnetic spectrum of radium B and radium C was examined in detail by Rutherford and Robinson and more than 50 lines were observed, representing β particles projected over a wide range of velocity. The appearance of these lines in the spectrum appears to be connected with the emission of γ rays and is believed to be due to the conversion of the energy of the γ ray of definite frequency into the energy of an electron according to the quantum relation. When a thin layer of absorbing material is placed over the source, the primary β rays diminish in velocity and the lines become broad and diffuse. At the same time, however, new groups of β rays are formed by the conversion of γ rays into β rays in passing through the absorbing material, and these give well-marked bands on the photographic plate, occupying very nearly the same position as those due to the primary β rays before absorption. Results of this kind have an important bearing on the general problem of radiation, and give us indications of the facts to be accounted for in dealing with the conversion of swift β rays into γ rays of high frequency, and vice versa.

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Production of Helium.—It was stated in the earlier article that, since the particle is an atom of helium, all radioactive matter which emits α particles must produce helium. This has been found to be the case for every α-ray product that has been examined. The rate of production of helium by radium in equilibrium has been measured with accuracy by Dewar, Boltwood and Rutherford. In terms of the International Radium Standard, the rate of production of helium by one gram of radium in equilibrium with its three α-ray products has been found to be 164 cub. mm. per year. This value is in excellent accord with that calculated from the rate of emission of α particles, viz. 163 cub. millimetres. The rate of production of helium by the radium emanation, ionium and polonium has been found by Boltwood to be in fair agreement with calculation. Soddy has observed the production of helium by purified uranium, while Strutt showed that the rate of production of helium in uranium and thorium minerals accorded with calculation.

Strutt has made a systematic examination of the amount of helium present in many minerals and rocks which contain minute quantities of radium and has utilized the results to estimate the age of the geological deposits. On account of the tendency of the helium to escape from minerals in the course of geologic ages, this method gives only a minimum estimate of the age of the mineral, except in the case of very dense and compact specimens. The measurement of the lead content should ultimately prove a more reliable method of estimating the age.

Heat Emission of Radioactive Matter.—As was stated earlier, there is no doubt that the evolution of heat by radium and other radioactive matter is mainly a secondary phenomenon, resulting mainly from the energy of the absorbed radiation. Since the particles have a large kinetic energy and are easily absorbed by matter, all of these particles are stopped by the radium itself or by the envelope surrounding it and their energy of motion is transformed into heat. The evolution of heat from any type of radioactive matter is thus proportional to the energy of the expelled α particles, together with the energy of the β and γ rays absorbed in the envelope. The energy supplied by the recoil of the radioactive atom after the expulsion of an α particle is about 2% of the energy of the α particle.

These conclusions have been confirmed by the measurements of Rutherford and Robinson, who found that each of the α-ray products gave a heating effect proportional to the energy of the α particle and absorbed β and γ rays. The emanation and its products when removed from radium were responsible for three-quarters of the heating effect of radium in equilibrium. The heating effect of the radium emanation, radium A and radium C decayed at the same rate as their activity. From their measurements they found that the total heating effect of radium in equilibrium surrounded by sufficient material to absorb the α rays was 134·7 gram-calories per hour per gram. Of this, 123·6 gram-calories were due to the α particles, 4·7 to the β rays and 6·4 to the γ rays. The energy of the β and γ rays comes from radium B and radium C, but on account of their great penetrating power it is difficult to measure the β energy with accuracy. The results, however, show that the energy of the γ rays is even greater than that of the β rays, and the two together are equal to about 28% of the energy of the α particles from radium C.

Measurements have been made of the heating effect of radium, uranium and thorium and of uranium and thorium minerals. In each case the evolution of heat is of about the magnitude to be expected from the energy of the radiations.

Radioactivity of Ordinary Matter.—Apart from the well-known radioactive elements of high atomic weight, only two other elements have been shown to exhibit the property of radioactivity to a detectable degree, viz. potassium and rubidium. Campbell showed that these elements emit only β rays and in amount small compared with uranium. This property appears to be atomic, but no evidence has been obtained of any subsequent changes. If the β particle comes from the nucleus of the atom, potassium should be transformed into an isotope of calcium, and rubidium into an isotope of strontium.

Radium and thorium have been found to be distributed, but in very minute amount, in the surface rocks and soil of the earth. The emanation from the soil diffuses into the atmosphere and causes a small ionization which can be readily measured. A penetrating γ radiation, no doubt due to the presence of radium and thorium in the earth's crust, has been observed near the earth's surface, but becomes very small over a lake or the sea.

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RADIOTHERAPY.—Since 1910 there have been notable developments, extending the practice of X-ray treatment (*see* 28.887) into the wider field now included in radiotherapy, a term which had not then come into general use. Strictly speaking, under this term should be included treatment by all kinds of rays; thus treatment by heat, by sun's rays, by ultra-violet rays, by X-rays and by the rays of radio-active substances, all come under the etymological term of radiotherapy. In practice, however, it is restricted to the application of ultra-violet rays, X-rays and radium rays. Amongst radiologists, the term has undergone an even sharper definition, so that radiotherapy is applied by them to treatment with X-rays alone, the terms radiumtherapy (or, in France *curietherapy*, in honour of the discoverer of radium) being applied to treatment with the rays of radium and other radio-active substances. Treatment by means of high frequency currents and diathermy are included rather under the term electrotherapy.

Ultra-violet Rays.—These rays to a large extent are the essential feature of those forms of medical treatment which depend upon exposure to sunlight (heliotherapy). Probably this is not the whole story. Even though heat rays may also play some part, experience of the treatment of wounds by sunlight in France during the World War indicated that a degree of benefit arises from exposure to sunlight which cannot be entirely attributable to warmth and ultra-violet rays. On the other hand, in the Finsen light treatment of lupus and in the treatment of tuberculosis at high altitudes, ultra-violet rays probably play a predominant part. It is uncertain how these rays act; they penetrate but a fraction of a millimetre into the epithelium and yet the fact that in tropical countries where sunlight is great, the white races show a proverbial irritability which does not characterize the pigmented native races, suggests that in the one, effects are produced by the ultra-violet rays which the pigment of the other is able to eliminate. Certain it is that under ultra-violet light, persons vary in the appearances they present, those who freckle or tan easily when exposed to sunlight showing the potential freckles or bronzing of their skin by dark marks which are absent from the skins of those who do not freckle or tan easily. In this connexion, it is noteworthy that those tuberculous persons are said to derive greater benefit from a sojourn at high altitudes who normally tan easily under sunlight, than those who do not. The rays are bactericidal, but whether part of their action lies in this direction, is unknown.

X-rays.—The X-rays which were discovered by Röntgen in 1895 are employed in medicine in two ways, firstly, as an aid to diagnosis when they form those branches of the subject known as radioscopy and radiography, and secondly, for the actual treatment of conditions when diagnosed. Thus by means of radioscopic or radiographic examination it may be found that there is a tumour in the chest, and as a result of that diagnosis it may be decided to institute treatment (radiotherapy) by means of X-rays or radium rays or the two combined.

X-radiation has the advantage that considerable doses can be employed. It has the disadvantage that the X-rays are frequently not of sufficiently penetrating power to serve for the treatment of tumours deep within the body. Three varieties of X-rays are used, the difference consisting in variations in wave lengths and in penetrating power. These varieties are known clinically as "soft," "medium" and "hard" X-rays, the soft rays being those of longer wave length and less penetrating power, and the hard rays being those of shorter wave length and greater penetrating power. The softest X-rays are not used clinically; those employed in the treatment of ringworm for example are "medium soft" since it is necessary for penetration to reach as deeply as the hair follicles. Medium

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hard and hard X-rays are used where a layer or mass of tissue some little distance beneath the surface is to be treated.

For the better treatment of new growths removed some distance from the surface of the body, there is a tendency at the present time (1921) to increase the hardness of the rays to the utmost extent with the object of producing a radiation that approximates in some degree to the gamma rays of radium in penetrating power. Chief amongst the new growths that are the subject of this "deep therapy" with intensely penetrating X-rays are uterine fibroids. The production of soft to medium X-rays requires an apparatus capable of generating about 100,000 volts, for deep therapy a voltage of about 200,000 is necessary and the aim of radiologists is to get a still higher voltage. The method employed is essentially use of a series of transformers.

It is unnecessary here to enter into a detailed examination of the methods whereby X-ray dosage is determined, but it is obvious that estimation of the dose is one of the most important points in connexion with radiotherapy. In the case of radium, the matter is relatively simple, for the output of rays from the radium is constant, but in the case of the X-ray bulb, quite apart from variations in the primary current, the conditions of the bulb vary within wide limits, and the output of the bulb in X-rays varies accordingly. An important advance has been made in recent years by the introduction of the Coolidge tube in which by means of a different working principle the output of X-rays can be kept fairly steady. Under all circumstances, the output of an X-ray bulb is heterogeneous, the bundle of rays emitted is partly penetrating, partly soft, and in order to produce a more or less homogeneous bundle of rays for purposes of treatment, it is necessary to eliminate the softer varieties by means of filters. These filters are of different kinds but the chief are aluminium, zinc, copper and lead. For absorption of the specific secondary radiations produced when gamma or X-rays impinge upon metals, such substances as rubber, gauze, cardboard are used.

When a more or less homogeneous beam has been produced, it is necessary to calculate the dose employed in any given case for comparison with other cases. Various means have been adopted to this end, of which the commonest is the Sabouraud's pastille which consists of barium platinum cyanide and changes colour from green to yellow under a certain dosage of the rays. It was thought at first that this colorimetric test would be generally applicable, but it was soon found that the change is not brought out by X-rays of all degrees of penetration and is fallacious as a guide to gamma radiation of radium. It is now largely employed as a test of dosage during the X-ray treatment of ringworm and other skin diseases, but it is recognized that it must only be employed with caution, with rays of medium hardness, and for superficial conditions. Another form of test is electrical (ionto quantimeter) in which the rate of discharge of a charged gold leaf forms a measure of the output of X-rays. Another method depends upon the chemical reduction of iodine from iodoform in a chloroform solution and is probably the most scientifically accurate of all the methods which have been devised. Yet other methods depend upon the correlation between the effects produced by X-rays on the one hand and the gamma rays of radium on the other. Here the production of identical degrees of fluorescence on the fluorescent screen or of silver deposit on the photographic plate or of biological effects on the animal cell has been aimed at in standardization.

So far as treatment is concerned, it is obvious that a biological test is the most satisfactory. The one commonly used is known as the "erythema dose," meaning thereby that dose of X-rays which leads to a reddening of the skin a few days after application and subsequently to slight bronzing, without blistering or other damage. On the other hand there is no doubt that the various cells of the body do not react to radiations in the same degree and partly on this account and partly because of the operation of the law of inverse squares, it is obvious that the skin over a tissue being irradiated may itself receive an injurious dose while the tissue in question is receiving the correct dose. Hence when a tissue some distance beneath the surface is under treatment it becomes necessary to irradiate it through different portals, so that each area of skin shall receive less than the erythema dose, although the tissue in question gets the full amount that the radiologist wishes to give it; this method of cross fire is largely employed.

Radio-active Substances.—Treatment by means of radio-active substances largely resolves itself into treatment by means of the beta and the gamma rays of radium or occasionally mesothorium. Just as X-rays vary in degree of penetration, so do the rays of radium. The so-called alpha rays are little penetrating, being stopped by about 3½cm. of air. The beta rays, which are particulate negative electrons, are more penetrating but their penetrating power varies over a wide field, some of the softest being as easily absorbed as alpha rays, some of the hardest approximating to the soft gamma rays in penetrating power. Gamma rays are aether vibrations and they, too, vary in degree of penetrating power. Their wave length is the shortest of any form of vibration known, and the most penetrating gamma rays can be detected through several inches of lead.

The alpha rays are but little used, the only methods of employment being in the way of radium emanation dissolved in saline solution, or of needles upon which "active deposit" from radium emanation has been collected. In either case the emanation water or the active deposit needles must be introduced into the system—whether intravenously or into the solid tissues—otherwise the alpha rays would have no power to act. In either case, too, they act along with the beta and gamma rays produced by the active deposit.

Beta radiation is always used in conjunction with gamma radiation, but inasmuch as the ionizing power of the beta ray is about 50 times as great as that of the gamma ray, it follows that when beta radiation is being employed, the gamma radiation may probably be ignored. Beta radiation is used for merely superficial conditions and the radium salt which supplies it is spread over a flat or curved applicator and is covered with a thin layer of varnish, mica or aluminium or is placed in a thin glass tube; the beta rays which traverse thin solid filters act upon the tissue in the neighbourhood of which the radium is placed. Instead of a radium salt one of its products, viz. radium emanation is often employed clinically. No essential difference is introduced by the use of this emanation excepting that its intensity undergoes a progressive diminution with time since it falls to half value in 3·85 days. Early rodent cancer, certain conditions of the eyelids, some cutaneous non-malignant tumours and birth-marks, are treated successfully in this way.

Gamma radiations are used where deep penetration is required, but the law of inverse squares approximately holds good in their case also, a matter of fundamental importance in treatment. The substances used as filters when radio-active materials are employed in treatment are not quite the same as those used along with X-rays. Since one of the main objects in employing radium is to utilize the highly penetrating gamma rays, the filters employed are generally of the higher atomic weights, silver, brass, gold, lead, platinum, and there is some reason for believing that the more highly penetrating the rays, (*i.e.* the denser the filter through which they have passed) the less is undesirable damage suffered by the tissues.

Mode of Action of Radiations.—The method by which X-rays and radium rays produce their effects are not thoroughly understood, but it is certain that dosage must vary according to the type of cell which it is desired to influence. Thus the vulnerability of skin is not the same in different individuals nor even in different regions in the same individual; the vulnerability of the squamous cell is not the same as that of the columnar cell; the vulnerability of renal cells differs in the convoluted tubules and in the conducting tubules. Even in the fur of animals it is possible to recognize a differentiation, for a certain amount of X-radiation will lead to a destruction of the pigment forming cells in the hair of a black rat, while a little more radiation will affect the cells themselves. In the former case there is no epilation but the hair comes white instead of black, in the latter the hair falls out and baldness results.

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If the question be carried still further back and the behaviour of the cells themselves under radiation be considered, it has been found that the rays may act principally, though not exclusively, upon the nucleus or upon the cytoplasm or upon the cell membrane or upon any paraplastic material within the cell. The greater amount of work in this direction has been carried out with radium but there is little doubt that the effects of X-rays are similar. In part, changes are produced owing to the fact that the radiations break down complex chemical substances into simpler constituents. In this way, the osmotic tension of the cell or nucleus affected is raised and a dropsical condition results which can often be recognized microscopically. Other forms of degenerative change produced are fatty and mucoid. Thus radiation, if in great doses, will lead to fatty change in voluntary muscle of man and most animals or in renal cells of the cat. Under large doses of radium, mucoid changes are excessively common in all parts which normally produce mucus, but in addition, there is a great tendency for cells which ordinarily do not form mucus to undergo mucoid degeneration. Sometimes the cytoplasm of the cells disappears, though not obviously by way of either of these changes, with the result that the nucleus lies naked in the middle of the cell and separated from the cell membrane by a considerable distance. So far as the nucleus is concerned, changes produced by radiations may be intense. In cells such as those of testicle or intestine which are often found in mitotic division, mitosis is arrested or abolished. In other nuclei there may be evidence of vacuolation or the nucleus may be converted into a mere empty *sac*, or the nuclear membrane may disappear, or the entire nucleus may be represented by a few points of stained material or, finally, the nucleus may disappear altogether.

Thus in one or other way, changes are produced as the result of irradiation in the tissues upon which those rays impinge and the effects produced will depend upon (1) the type of cells affected, (2) the quantity of rays employed, (3) the length of time those rays have acted.

It must be remembered that the biological cell usually acts in one or other of two opposite directions when exposed to a physical agent according to the intensity with which the agent acts. Thus we distinguish between a stimulating or beneficial effect and an irritative or injurious effect. There is reason to believe that both of these may follow upon irradiation. In the case of malignant new growths, there is no doubt that death and destruction of the neoplastic cells occur where the rays act in all their intensity, but there is equally no doubt that because of the law of inverse squares and the specific absorption by the tissues a point is reached at which the injurious effect on the malignant cells which we desire passes into a stimulant effect which we may have reason to deplore. If this stimulus act on young and actively growing malignant cells at the periphery of the growth our irradiation will do more harm than good to the patient. There can be little doubt that in the early days of radiotherapy, some cases of malignant disease ran a more rapid course as the result of the irradiation treatment than otherwise they would have done. For this reason, the essential point of their treatment by means of radium consists in an endeavour to deal with the peripheral neoplastic cells.

On the other hand, changes may be produced in cells which we are unable to recognize microscopically. Recently the treatment of exophthalmic goitre has been largely and for the most part, successfully, carried out by irradiation and yet if the thyroid body be examined from animals exposed for many hours to the gamma radiations of radium bromide, it may be doubtful whether histological changes can be detected. Similarly, intense gamma radiation of the male frog produces no testicular changes that can be detected with certainty, and yet far less radiation produces marked changes in the tadpoles derived from normal *ova* fertilized by such radiated spermatozoa.

It follows from what has been said above, that radiotherapy is not without its special dangers. Amongst the disadvantages to which the irradiations may give rise, too extensive destruction of tissue on the one hand or stimulation of new growth on the other are relatively obvious but the dangers are more insidious. Recent work has shown that long continued exposure to minute doses of radiation (in addition to the well-known occasional production of skin cancer) leads to blood changes which in course of time become a pronounced menace to life. Not only are red and white blood cells destroyed, but the rays appear to exert a deleterious effect upon the blood-forming tissues with the result that an aplastic anæmia becomes established. Obviously, the protection of the personnel in hospitals and similar institutions where X-rays and radium are used becomes a matter of great importance.

It is probable that X-rays and radium will always continue to be employed side by side owing to the special advantage which each form of radiation possesses, and in some cases it is certain that the best results are obtained in combination.

It will have appeared from what has been said above that radiotherapy is largely—though by no means exclusively—concerned with the treatment of new growths. Irradiation by one or other method is used in cases of uterine fibroid and, in cases of inoperable cancer, sometimes with astonishingly good results. It is also used in conjunction with operation for cancer with the object of warding off recurrences. Sometimes cancers, inoperable when they first come under observation, are rendered operable by treatment with radium. And, frequently, when surgery has done all that is possible a considerable degree of relief is given by irradiation.

In addition to their use in the treatment of new growths, X-rays and radium have been tried in most of the chronic forms of disease. When surgery or medicine fails to relieve a case, it is usual to try irradiation. Sometimes the results are surprisingly beneficial, but the limits of utility of the rays still need to be determined. (W. S. L-B.)

RAEMAKERS, LOUIS (1869–), Dutch cartoonist, was born at Roermond, Holland, April 6 1869. He received his education in art at various schools, and finally at Amsterdam, where he obtained several prizes. He subsequently became director of an art school at Wageningen, in Gelderland. About 1908 he started drawing political cartoons, but it was not until the outbreak of war in 1914 that his work attained world-wide reputation, by his anti-German cartoons, illustrative of the devastation of Belgium and Northern France. Many special exhibitions of his war cartoons were held, and his work had a great effect as propaganda. Several volumes of his work have been published: *The Great War in 1916; The Great War in 1917; Devant l'Histoire* (1918); *Cartoon History of the War* (1919).

RAILWAYS (*see* 22.810; *also* LIGHT RAILWAYS, MILITARY).—UNITED KINGDOM.—In 1910 British railways had reached a high standard of completeness and development, and, although a number of new lines were subsequently brought into use, two only are of primary importance in regard to through main-line traffic. One of these is the first section of the Enfield-Stevenage line of the Great Northern railway, opened for traffic as far as Cuffley on April 4 1910. On the same date the Ashenden-Aynho line of the Great Western railway was brought into use for goods traffic. The former was part of a new line designed to afford an alternative route into London avoiding duplication of the Welwyn Viaduct and, by adopting a new route, opening up a new district near London for suburban development. From 1916 onwards the northern portion was laid with a single line and used for goods traffic, and towards the end of 1920 a second track was laid. In June 1921 this section had not yet been opened for passenger traffic, but was already being largely used for goods and mineral trains. The Ashenden-Aynho line was, however, on July 1 1910, brought into regular use as part of a shortened main route between London and Birmingham, and a two-hourly schedule then came into force for the principal Great Western expresses.

Among other important new lines brought into use the following may be mentioned: June 1 1910, Filton Junction and Avonmouth Docks, and the Camerton and Limpley Stoke lines, G.W.R.; Armagh, Keady & Castleblaney railway, worked by G.N.R. (I.), completed December 1 1910; April 13 1911, Shropshire & Montgomeryshire light railway; May 12 1911, Lampeter and Aberayron

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line, G.W.R.; May 1 1912, Goole and Selby line, N.E.R.; June 3 1912, Dearne Valley railway (worked by L. & Y.R.); June 16 1913, Mansfield railway opened for goods traffic, and on April 2 1917 for passenger traffic (worked by G.C.R.); and July 1 1913, Kirkstead and Little Steeping Line, G.N.R. On July 1 1912 the London & North-Western railway brought into use a part of the "Watford new lines," and the branch to Croxley Green, the remainder being opened on Feb. 17 1913. On June 2 1913 the Great Western railway opened part of the remarkable series of lines designed to improve railway communication in South Wales and referred to generally as the Swansea District lines. Other sections were added at various later dates. On Sept. 26 1915 the North British railway brought into use a series of new lines in the Edinburgh district, designed mainly to facilitate mineral traffic working, known as the New Lothian lines. On May 22 1916 the Great Central railway opened the Keadby deviation line, including a new bridge over the Trent with a Scherzer rolling-lift bridge of 200 ft. span. In July 1915 a section of the old Ravenglass and Eskdale railway in Cumberland was reopened on the 15-inch gauge, using locomotives of model or "exhibition" types, but catering to public passenger and goods traffic. Extensive reconstruction works at Waterloo, L. & S.W.R., were nearing completion in 1921.

Electric Railway Extensions and New Lines.—On July 27 1912 the Central London railway was extended to Liverpool Street. On December 1 1913 the "Bakerloo" section of the London Electric railway was extended to Paddington, and on February 11 1915 to Queen's Park, there connecting with the L. & N.W.R. On April 6 1914 the loop under the river at Charing Cross on the "Hampstead" section of the London Electric railway was brought into use. On May 31 1915 the four-track section, from Finchley Road to Harrow, of the Metropolitan railway was completed over Kilburn Viaduct. On Aug. 3 1920 the Ealing and Shepherd's Bush railway, connecting the Central London railway at Wood Lane with the G.W.R. at Ealing Broadway, was completed and opened for traffic.

Railway Electrification (*see also* ELECTRICAL ENGINEERING).—Equipment of existing railways for electric working has been considerably extended. On May 12 1911 the L.B. & S.C.R. commenced to work electric trains between Victoria and the Crystal Palace. On March 1 1912 the London Bridge routes *via* Tulse Hill were added, the complete electric service becoming operative on June 1 1912. Since that date equipment of various other routes has been in hand but owing to interruption of the war no further sections are yet electrically operated. On the London & South-Western railway electric traction was inaugurated between Waterloo and Wimbledon, *via* East Putney, on Oct. 25 1915; on the Kingston "Roundabout" route Jan. 30 1916; on the Hounslow loop March 12 1916; to Hampton Court June 15 1916; and to Claygate Nov. 20 1916. Electric working on the North London and L. & N.W. railways was commenced between Willesden Junction and Earl's Court on May 1 1914, and between Broad Street and Richmond and Kew Bridge on Oct. 1 1916. On May 10 1915 the London Electric railway commenced to work through to Willesden Junction *via* Queen's Park, and from April 18 1917 this service was continued to Watford over the "Watford New Lines," though it was not until 1920 that the L. & N.W.R. was able to take its share in the working of this service, as the specially constructed joint rolling stock began to be delivered after the war from the makers. During 1919 L. & N.W.R. electric trains began to work from Broad Street to Watford *via* Hampstead Heath. Work was in 1921 well advanced upon the new "tube" tunnel under Primrose Hill and the entire reconstruction of L. & N.W.R. lines at Chalk Farm to enable "flying" or "burrowing" connexions to be made between the Euston and Broad Street routes and between the three sets of running lines, but electric operation could not be inaugurated *via* Chalk Farm and from Euston until this was sufficiently completed. On March 31 1912 Metropolitan railway electric trains commenced to work over the East London railway between Shoreditch and the two New Cross stations, with through trains, *via* Aldgate East, to and from Hammersmith. Principal developments in regard to electric traction in the provinces are the electrification in 1916 of the Newport-Shildon section of the North-Eastern railway to enable heavy mineral traffic to be operated by electric instead of steam locomotives, and of the L. & Y.R. route from Manchester (Victoria) to Bury, *via* Prestwich, in Feb. 1916, following the experimental high-tension electrification between Bury and Holcombe Brook which had been used from July 1913.

Mention may also be made of the installation in 1911 of escalators at Earl's Court, connecting the "Piccadilly" section of the London Electric railway with the Metropolitan District station above. Escalators were also provided at Liverpool Street on the opening of the Central London railway extension in July 1912, since which date these have been systematically adopted at all new tube railway stations. They have also been introduced at several existing stations, as at Oxford Circus, London Electric railway, and on the L. & S.W.R. at Waterloo to connect the Waterloo and City station with the terminus above.

Dock Improvements.—Principal developments in regard to dock and similar facilities affecting railways are the opening of Immingham Dock, G.C.R. (by the King and Queen) on July 22 1912; of the new Methil Docks, N.B.R., on Jan. 22 1913; of the King George Dock at Hull, H. & B. and N.E. railways (by the King and Queen) on June 26 1914; and the opening of a new lock entrance, designed to enable the largest vessels to enter at all states of the tide, at Newport, Alexandra Docks & Railway, on July 14 1914.

New Locomotive Works.—During 1910 and 1911 the new locomotive works at Eastleigh of the L. & S.W.R. were brought into use, and the old works at Nine Elms dismantled and the area thus cleared handed over to the Goods Department. The Great Eastern railway added several new workshops to the rolling-stock plant at Stratford in 1914–6.

Signalling.—Automatic and power signalling had already become well established in 1910, but only a limited amount of further development can be recorded. In Jan. 1911 two-position upper-quadrant electric signals were introduced on the Metropolitan railway, and have since been adopted where semaphores are retained on the "Underground" sections. On the Keadby deviation line of the G.C.R., already mentioned, three-position upper-quadrant signals have been in use since May 1916, while the Ealing & Shepherd's Bush railway is the first line in the United Kingdom to be opened with all signals of this type. In Jan. 1920 a complete power signalling installation on three-position upper-quadrant principles was brought into use at Victoria, S.E. & C.R.

Express-Train Running.—During the years 1910–4 express passenger-train facilities reached their highest level, and the time-tables arranged for the summer of 1914 showed the following numbers of non-stop runs of 100 m. or more: *Caledonian railway* 10 runs, the three longest being between Carlisle and Perth, 150¾ m.; *Great Eastern railway* 7 runs, the two longest being of 131 m. between Liverpool Street and North Walsham; *Great Northern railway* 29 runs, the longest being from Wakefield to King's Cross, 175¾ m.; *Great Central railway* 6 runs, the longest being from London to Sheffield, 164¾ m.; *Great Western railway* 40 runs, the longest from Paddington to Plymouth (North Road), 225¾ m.; *London & South-Western railway* 4 runs, three of which were operated between Waterloo and Bournemouth (Central), 108 m.; *London & North-Western railway* 74 runs, the longest being between Euston and Rhyl, 209½ m.; *Midland railway* 25 runs, the longest from St. Pancras to Shipley (a stop to change engines only, not advertised) 206 m.; *North-Eastern railway* 14 runs, all between Newcastle and Edinburgh, working through over N.B.R. north of Berwick, 124¼ m. Average speeds for the best of these runs were respectively: C.R. 49·7; G.E.R. 49·7; G.N.R. 57; G.C.R. 55·85; G.W.R. 54·8; L. & S.W.R. 54; L. & N.W.R. 52·7; M.R. 50·86; and N.E.R. 54·1 m.p.h. On several of these lines, however, trains making somewhat shorter runs provided even higher averages. The following non-stop runs exceeding 55 m.p.h. may be noted:—

		Miles	Minutes	Average
N.E.R.	Darlington to York	44½	43	61·7
G.C.R.	Leicester to Arkwright St., Nottingham	22½	22	61·3
L. & S.W.R.	Dorchester to Wareham	15	15	60
G.W.R.	Paddington to Bristol	118½	120	59·2
L. & N.W.R.	Willesden to Coventry	88½	92	57·7
G.N.R.	Grantham to King's Cross	105½	110	57·5
C.R.	Forfar to Perth	32½	34	57·2
M.R.	St. Pancras to Kettering	72	76	56·8
G.E.R.	Halesworth to Woodbridge	21¾	23	56·6
C.L.C.	Manchester to West Derby	31½	34	55·1

It may be remarked that the short L. & S.W.R. run mentioned was due to an error in time-table compilation, but was worked to for some time. The S.E. & C.R., L. & Y.R., and G. & S.W.R. had runs exceeding 54 m.p.h., while the Great Southern & Western and the Great Northern railways in Ireland, the L.B. & S.C.R., the London, Tilbury & Southend section of the Midland railway, and the Hull & Barnsley railway also had runs averaging 50 m.p.h. or over.

Many of the runs mentioned had been operated for several years before the outbreak of war in 1914, but in two cases at least, the highest level was reached between 1910 and 1914. Thus, on the Great Western railway, the opening of the Ashenden-Aynho line, shortening the distance between London and Birmingham to 110½ m., provided four down non-stop trains in the even two hours. These conveyed from one to three slip coaches, detached at Banbury, Leamington or Knowle, but the over-all time of two hours was also given to several up trains, though these had to include stops at Leamington or Banbury or both. On the London & North-Western railway a number of London-Birmingham trains were similarly accelerated to 120 minutes for the distance of 113 miles. On the London & South-Western railway two hours became the standard for Waterloo-Bournemouth non-stop trains as from July 3 1911.

Train Service Developments.—The following developments in train service facilities may be noted. On Feb. 1 1910 the L. & N.W.R. introduced "city-to-city" expresses between Wolverhampton and Birmingham and Broad Street. A novelty on these trains was the provision of a typewriting compartment, in charge of a qualified stenographer. In the following May similar arrangements were

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introduced on certain Birmingham-Euston expresses. In July 1910 restaurant cars were introduced on through trains between Manchester, Birkenhead and Bournemouth, L. & N.W., G.W., and L. & S.W. railways. In July 1910 certain Midland Anglo-Scottish expresses were diverted to run over the L. & N.W.R. between Penrith and Carlisle. At the same time several Caledonian expresses to and from Aberdeen began to use Glasgow Central Station instead of Buchanan Street. In Oct. 1910 the G.W.R. introduced through trains *via* the Ashenden-Aynho line between Wolverhampton and Victoria, S.E. & C.R. In July 1910 the L. & S.W.R. improved their Southampton-Havre route to the European Continent. In May 1911 the S.E. & C.R. Continental service from Queenborough to Flushing was transferred to Folkestone. On June 1 1911 tea cars were introduced on the afternoon expresses between London and Manchester and Liverpool, L. & N.W.R. From July 3 1911 through carriages forming parts of S.E. & C.R. Kent Coast and other expresses were run to and from King's Cross, G.N.R. On the same date the N.E.R. introduced hourly expresses between Newcastle, Sunderland, West Hartlepool, Stockton and Middlesbrough. In March 1910 Metropolitan District trains commenced to work through over the Metropolitan railway to Uxbridge, and in June of the same year through trains between Ealing and Southend were added. In July 1913 the G.W.R. introduced the "Devon and Cornwall Special" express (third class only) between London and the West of England.

Pullman Cars.—Hitherto used only on the L.B. & S.C.R., on March 21 1910 Pullman cars were added to certain S.E. & C.R. Continental expresses *via* Dover, and in the following December to those *via* Folkestone. In June 1910 they were adopted by the Metropolitan railway on the extension line to Aylesbury. In June 1914 Pullman cars were introduced on a considerable scale by the Caledonian railway, some of them replacing first- and third-class restaurant cars, while others were available only for first-class passengers on payment of a supplement as usual. In Sept. 1915 the L.B. & S.C.R. added third-class Pullman cars to certain trains. From June 16 1919 Pullman cars were added to Folkestone and Kent Coast expresses, S.E. & C.R. In July 1921 the S.E. & C.R. added a special Pullman express, the "Thanet Limited," between Victoria and Ramsgate Harbour on Sundays. From Nov. 11 1920 Pullman cars began to run on the G.E.R. Both first- and second-class cars now run on its Continental expresses, and first- and third-class cars on other routes.

Withdrawal of Second-Class Accommodation.—Several railways had already withdrawn second-class accommodation, partially or wholly, before 1910, but in Oct. of that year the G.W.R. discontinued provision for second-class passengers. From June 1 1911 the L.B. & S.C.R. adopted the same course; the L. & N.W.R., Cambrian, North Staffordshire, and Maryport & Carlisle from Jan. 1912, and from July 22 1918 the L. & S.W.R.

Season Tickets.—In regard to season tickets several interesting items may be referred to. In May 1910 the G.W.R. commenced to issue season tickets at stations on application. In Dec. of the same year the G.N.R. discontinued calling for deposits on season tickets, this practice being now general on most lines. From Jan. 1 1912 the Metropolitan railway issued "limited season tickets" to the wives of season-ticket holders, a corollary to the shopping tickets which had been issued from Jan. 1910, available only between 10 A.M. and 4 P.M., the first-class fares being little more than for third class.

Working Arrangements.—Several important working arrangements and agreements between leading railways were already in operation as between the L. & N.W., L. & Y. and Midland railways, and in May 1910 a similar working arrangement was entered into between the G.W. and L. & S.W. railways. In Aug. 1912 the London, Tilbury & Southend railway was taken over by the Midland company, being thereafter known as the L.T. & S. section. In Oct. of the same year the Great Northern & City railway was incorporated into the Metropolitan system, and in Nov. 1912 the City & South London and Central London railways were brought into the group controlled by the Underground Electric Railways Co. of London, Ltd. In Jan. 1915 a reorganization of the "Underground" companies, co-ordinating the several managements, was adopted. In April of the same year the Great Eastern railway adopted a reorganization of the chief departments, while the operating and commercial departments were separated as from July 1 1915.

Strikes, etc.—In Aug. 1911 there was a short strike of railwaymen which led to the appointment of a special Royal Commission. The principal result of this was the establishment of Conciliation Boards, including representatives of the respective managements, of the various grades of staff and of the Board of Trade, for the purpose of dealing with questions of pay, duties and other problems affecting railway staff. In Sept. 1911 there was a strike of Irish railwaymen. In March 1912 a coal strike entailed many difficulties upon the railways, the Great Eastern being the only large company which was able to maintain approximately full train services throughout. In Dec. of the same year there was a strike on the North-Eastern railway owing to the suspension of a driver named Knox, for alleged drunkenness, but this did not spread to any serious extent. Knox was actually fined for being drunk by the Newcastle magistrates on Oct. 26. He was off duty at the time. But eventually an inquiry by Mr. Chester Jones, the London police-magistrate, resulted in his reporting (Dec. 14) that Knox (though "not quite sober") had not been "drunk in the police-court sense," and he was then reinstated. In March 1913 the National Union of Railwaymen was formed from the Amalgamated Society of Railway Servants, the General Railway Workers' Union, and the United Signalmen's and Pointsmen's Society. In Oct. 1913 a Royal Commission on Railways began its sittings, which were not completed at the outbreak of the war.

Railway (Accounts and Returns) Act 1911.—Commencing Jan. 1 1913, the Railway (Accounts and Returns) Act 1911 came into force, from which date the methods of preparing the annual returns of all railway companies were unified and systematized, and the previous half-yearly periods, with their Scottish variations, gave place to accounts and returns for the calendar year, providing for annual meetings in Feb. in every case. The year 1913 is the only one for which complete accounts and returns were prepared in accordance with the Act, the conditions of railway control and guarantee during and subsequent to the war having prevented later returns being presented in complete form. Indeed, during the actual war period the accounts and returns were reduced to bare essentials, and some tables are still necessarily in abeyance.

"Safety First."—In 1914 the Great Western railway adopted systematic "Safety First" propaganda, immediately followed by the London "Underground" railways, and since that date the matter has been closely followed up by other companies, several having issued publications to their staff setting forth "Safety First" principles. On Dec. 1 1916 the London "Safety First" Council was constituted, including representatives of several railways.

Locomotive Development.—Superheating was already recognized as a desirable feature of locomotive practice in 1910, and has since become firmly established as an essential part of almost every locomotive design, including tank and shunting as well as main-line passenger and goods classes. The Schmidt and Robinson types are both widely employed, the former in the hands of the firm known as Marine & Locomotive Superheaters, Ltd., and the latter in those of the Superheater Corp., Ltd. Both have been developed, and dampers or draft retarders are now seldom employed, improved designs of release, snifting and other valves or adjuncts, or the use of a steam circulating system, being found to meet the needs of the situation. The designs mainly used in each case are the types A and B of the respective firms. Several other designs are, however, now in considerable use; Mr. G. J. Churchward's "Swindon" apparatus on the Great Western railway; Mr. G. Hughes's "top and bottom header" and "twin plug header" designs on the Lancashire & Yorkshire railway; Mr. R. W. Urie's "Eastleigh" superheater on the London & South-Western railway; Mr. H. N. Gresley's "twin-tube" superheater on the Great Northern railway; Mr. R. E. L. Maunsell's special form of header (M.L.S. superheater, Type C) on the South-Eastern & Chatham railway; and Mr. E. A. Watson's design on the Great Southern & Western railway of Ireland. Mr. J. G. Robinson, of course, uses the "Robinson" pattern on the Great Central railway and his designs are largely used also on other railways. High-degree superheating is now invariably employed.

Feedwater heating is used to a limited extent on certain lines, and the Weir apparatus has been experimentally installed on several others, but the practice is still far from general. The use of oil for fuel continues to be the subject of experiment, but is still exceptional, though during the 1921 coal strike engines were adapted on many lines. Mention may be made of trials of the "Scarab" system on the L. & N.W.R. and other lines, while on the Great Central railway Mr. J. G. Robinson is stated to have obtained notable results from pulverized fuel and a "colloidal" mixture of pulverized coal and oil, also with the "Unolco" oil-burning equipment.

Recent locomotive practice tends towards the systematic adoption of the 4–6–0 type for express and ordinary passenger and fast-goods locomotives, while the 2–6–0 type has appeared on several lines for mixed-traffic duties. The former is often associated with the use of four high-pressure cylinders, and on several railways three-cylinder locomotives of various types have been placed in service, but the ordinary two-cylinder system is still the most general. Walschaert valve gear is becoming more and more widely used. On many railways large tank engines have been introduced, notably of the 4–6–2, 2–6–4, 4–4–4, 0–6–4, and 4–6–4 wheel arrangements, with 0–8–2 and 2–8–0 locomotives for heavy local goods and shunting work.

Rolling Stock.—In the carriage department there have been no special developments since 1910, though improvements in designs already in use have, of course, been made. To some extent, steel panels are being employed, and for electric rolling stock steel construction is now largely used. On the L. & Y.R. all-steel coaches are used on the Manchester-Bury electric route. To provide for rapid detraining and entraining of passengers at busy "Underground" stations, new designs of rolling stock have been adopted, including three sets of double doors on each side, one midway and the others towards, but some distance from, the ends. Steadying pillars and hand-holds are superseding the straps hitherto provided for the convenience of standing passengers. On the goods and mineral side no special developments in rolling stock need to be referred to, except that the use of high-capacity wagons up to 50 tons' capacity is extending, though as yet to a limited extent only.

Miscellaneous.—During 1910 express locomotives of the G.W. and L. & N.W. railways were exchanged for comparative trial; also

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between the Highland and North British, the L. & N.W. and North British, and the Great Southern & Western and Great Northern in Ireland. On April 4 1914 the well-known horse "Dandy," which had so long worked the Port Carlisle branch of the North British railway, at last gave place to a steam train. On Dec. 19 1915 occurred the disastrous landslide at "The Warren," Folkestone, necessitating the closing of the S.E. & C.R. main line between Folkestone and Dover throughout the war period. It was not reopened until Aug. 11 1919.

British Railways under War Conditions

Railway Executive Committee.—As far back as 1865 an Engineer and Railway Staff Corps had been formed to provide an organization of railway managers, engineers and contractors who, in the event of war, would, under the direction of the military authorities, superintend the operation of railways and carry out such additional works as might be necessary. In 1896 the Army Railway Council was constituted, this body being known from 1903 as the War Railway Council. From these bodies was formed in Nov. 1912 the Railway Executive Committee, comprising the general managers of certain leading railways. The work of the Committee was mainly advisory, but included certain preparatory measures which bore good fruit when, on Aug. 4 1914, on the declaration of war, nearly all railways in England, Scotland and Wales were taken over by the Government under the Regulation of the Forces Act 1871, and directed on behalf of the State by the Railway Executive Committee. It may be explained that this Committee was never intended to supersede the actual management of railways, but to issue directions and to coördinate the working of all lines concerned as required by the various emergencies as they arose. Otherwise, and notwithstanding the many uncontemplated developments in the scope and operation of the Committee throughout the war period, the ruling principle was always that the officers of the respective railways should continue to operate their lines without State interference.

Railway Control and Guarantee.—The Act of 1871 provided that, to avoid the complexities of payment for services rendered and other difficulties which necessarily would have arisen, the Government guaranteed to make up any ascertained deficiency in the aggregate net receipts of all the railways taken over as compared with the aggregate for the corresponding period of 1913. Throughout the war period, therefore, all ordinary financial arrangements on the operating side ceased, and the work of the Railway Clearing House in regard to the division of receipts according to ownership of lines and various arrangements between companies was discontinued. The original agreement provided for adjustment according to the conditions during the first half of the year 1914 as compared with the corresponding period in 1913, but, when the question of war bonuses to railway workers to meet the higher cost of living arose early in 1915, it was agreed that this proviso should cease to operate in consideration of the first 25% of the war bonus conceded in Feb. 1915 being borne entirely by the companies, though all subsequent increases were undertaken by the State. In Aug. 1915 the Government accepted the principle of making allowances to the railway companies supplementary to the periodical compensation payments in respect of deferred maintenance and renewal. At a later stage agreements were made as to the payment of interest upon various capital works unproductive at the time of the outbreak of war, or completed and brought into use during the earlier war period, and in regard to many other complicating factors which arose. Some of these agreements occasioned severe strictures by Lord Colwyn's Committee on Railway Agreements, whose report was issued early in 1921, but during the period of hostilities, and notwithstanding the very wide and to some extent undefined scope of control which was eventually forced upon the Railway Executive Committee, the arrangements made by the Committee on behalf of the State with the railway companies are generally regarded to have been reasonable and equitable.

The Government Profit on Railways.—It may be pointed out that, according to a Government return issued under date of April 30 1919, if all Government traffic had been charged for at authorized pre-war rates the amounts would have been as follows for the periods stated:—

Aug. 5 to Dec. 31 1914	£ 3,500,000
Year 1915	10,279,104
Year 1916	20,649,126
Year 1917	35,698,554
Year 1918	41,917,024
Total	£112,043,808

For the corresponding periods the amounts which the Government had to provide by way of compensation were:—

Aug. 5 1914 to Dec. 31 1915	£15,946,839
Year 1916	14,039,674
Year 1917	24,075,768
Year 1918	41,251,326
Total	£95,313,607

Beside the actual working of the railways, the use of railway steamers, docks, canals, etc., represented a value estimated at from £10,000,000 to £15,000,000, while munition and similar work done (to the value of about £17,000,000) in railway workshops at cost price and therefore without profit to the companies, also the provision of locomotives, rolling stock, permanent way, etc., for use overseas, indicate the complexities of the arrangements ultimately entailed and the tremendous scope the utilization of the home railways for war purposes eventually attained. The Irish railways were not concerned at first in the Government control and guarantee. They were, however, taken over under similar conditions from Jan. 1 1917. The appended table shows the manner in which the control of railways in association with the Government guarantee operated.

In other words, the aggregate of all the freight, munition, troop and passenger traffic carried on Government account, if charged for, would greatly have exceeded the sum payable by the Government to bring up the annual net receipts to the pre-war level. It has to be remembered, however, that arrears of maintenance and cost of replacement of stock, etc., apart from what was essential at the time, could not figure very prominently in the accounts until after the termination of hostilities. After the Armistice, however, heavy costs were entailed under these and other headings, while the reduction of Government traffic to the relatively very small figures of the post-war period converted the profit of the war years into a serious deficit. The fact remains, however, that while the war emergency continued the bargain made was a very good one for the State, and it was only in 1918 that the, by then, generous wage and war-bonus concessions to the railway staff tended to convert the profit to the State into a deficiency—even then a relatively small one.

War Bonuses and Concessions to Staff.—As showing the tremendous effect of these concessions it may be mentioned that for the financial year ended March 31 1920, as compared with 1913, the increased cost of working the railways was estimated at £57,000,000 on account of war wage and other concessions, and

Operation of Government Guarantee

	1915	1916	1917	1918
	£	£	£	£
Revenue earned by railways over expenditure[1]	45,171,403	49,420,063	53,885,849	44,068,105
Amount of compensation paid by Government to railway companies on basis of published accounts for 1913	46,130,000	46,319,000	46,515,000	46,576,000
Profit or Loss to Government	−958,597	+3,101,063	+7,370,849	−2,507,895

[1] Includes estimated value of services rendered by railways to the Government free of charge, as shown in White Paper, Cmd. 402, apart from value of services rendered to the Government in respect of steamboats, canals, docks, hotels, etc., estimated at from £10,000,000 to £15,000,000 for the war period.

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from £20,000,000 to £25,000,000 due to the eight-hour day and further concessions then recently granted or under discussion. In the opinion of experts it is thought, however, that even these difficulties would not have arisen, at least in so acute a form, had it not been for the maintenance of pre-war rates and charges for goods traffic throughout the war period, while it was not until Jan. 1 1917 (June 1 1918 in Ireland) that ordinary passenger fares were increased by 50 per cent., and then mainly with the object of restricting travel rather than of raising revenue. Had adjustments been made stage by stage, as was done in the case of prices in general trade and industry, the financial situation in regard to railways would have been very greatly improved, and there would have been relatively little objection to the increase which became imperative in the post-war period.

Mobilization Traffic.—Very complete plans for mobilization had been prepared by the Railway Executive Committee long before there was any probability of war, and continually revised and brought up to date, so that everything was ready for the wonderful transportation achievements which followed the declaration of war. Thus between Aug. 10 and 31 no fewer than 670 trains, coming from all parts of the country and conveying horses, guns, baggage and stores, as well as approximately 120,000 men of all ranks, were dealt with at Southampton Docks with little interference with ordinary civilian traffic. Throughout the war period achievements of this character were regularly accomplished at all the chief embarkation centres and there is no instance on record of the breakdown of railway arrangements at any time, even when the tremendous volume of munition and other traffic conducted in national interests, but not directly for war purposes, was also placed upon the railways.

Public Railway Transport.—During the war period it was necessary to impose many restrictions upon both passenger and goods traffic. Excursion and many cheap-fare facilities were early discontinued, as also tourist and certain other classes of tickets carrying special facilities. Continental traffic was, of course, subject to special regulations and from the outbreak of war Dover became a closed area, such continental steamer services as were maintained being diverted to other ports. In fact, at all the great railway ports there were severe restrictions upon civilian traffic. During 1916 further regulations came into force for passenger travel, following a process of deceleration of express trains, partly due to the insertion of stops to enable them to serve the purpose of trains which were withdrawn in order to free the lines for Government traffic, and partly in view of the exceptional loading which became general, and to ease the strain on permanent way, bridges, etc., which could not be maintained to usual standards. From Jan. 1 1917 still further restrictions were imposed upon railway travel and conveyance of luggage; restaurant cars were withdrawn entirely on many lines and reduced on others, and passenger traffic was allocated to specific routes where alternatives had hitherto been available for the same journeys. An increase of 50 per cent. was made upon ordinary passenger fares and from 10 to 20 per cent. on season tickets, the issue of which was regulated, while it was required that they should be shown by each passenger on every journey made. Certain branch lines were closed, most of the rail-motor intermediate services withdrawn, and a large number of stations closed.

Release of Railwaymen.—An important object of these reductions in train services and facilities was to enable railwaymen to be released to serve with the forces, and altogether no fewer than 184,475 men were thus contributed. This figure represented 49 per cent. of the staff of military age in railway employ on Aug. 4 1914. Large numbers of men, apart from Reservists and Territorials, had, of course, joined voluntarily quite early in the war, but the general enlistment of railwaymen was not favoured until 1916, by which time a definite scheme of release had been adopted on a system which reduced inconvenience to the railway companies to a minimum and yet enabled reasonable proportions of men to be supplied.

Railway Officers in Government Service.—Throughout the war railway officers of many grades were freely utilized by the Government, some for special duties involving commissioned rank in the army or navy, and others for rendering expert assistance in civilian capacities to various Government departments. In fact, a considerable number of railway officers in high positions were given important Government appointments in connexion with various existing and new State departments. In other instances, railway officers were temporarily loaned to the Government.

Employment of Women.—Comparatively early in the war women were introduced into many ranks of the railway service, and in due course they were seen on a wide variety of work—at passenger and goods stations and depots, in engine sheds, on electric trains as "gatemen" and in a few instances as guards, on cartage and delivery vans, and in the railway workshops, in addition to more obvious employment as clerks, waitresses and in booking-offices. To some extent these measures were rendered practicable by the discontinuance of the more complicated travel facilities, the reduction of record-keeping to a minimum, the abolition of detailed statements between railway companies and Railway Clearing House work; but to a great extent women were employed in direct replacement of men who had been released with but little adjustment of their duties. A total of 55,000 women were thus employed in railway working, and about 6,000 on munition work in railway shops.

Goods and Mineral Traffic Allocation.—Goods and mineral traffic, especially when the manufacture of munitions on a very large scale was going on all over the country under Government direction, became of vital importance, and all other traffic was made subservient thereto. For the control of non-Government traffic a system of allocation was widely adopted, requiring consignors to despatch their goods by specified routes and from particular depots and sometimes on particular days, according to destination, while at times it was necessary to refuse to accept traffic for a time. Arrangements had already been made between the leading railway companies in regard to "common user" of wagons of ordinary type, while private owners' wagons were brought into the "pool."

Coal Control.—A system of coal control was adopted in 1917, partly due to the necessary discontinuance of a large proportion of the normal coastal water-borne conveyance of coal, by which each part of the country drew its coal supplies from specified colliery areas, and this traffic alone represented an enormous burden.

Military and Naval Traffic.—For the needs of the Army and Navy facilities on a very large scale had to be provided. Apart from the movements of troops for service overseas, continual streams of traffic passed to and from the training camps. Leave travel, however restricted, was inevitably a very big factor, and, as the war progressed, ambulance trains passed very frequently between the Channel ports and hospitals in various parts of the country. Among special facilities which had thus to be afforded may be mentioned the naval leave trains which ran regularly between the north of Scotland and London in connexion with the fleet in northern waters, while a continuous stream of coal trains had to be run between South Wales and other suitable coal areas and the far north of Scotland for the use of naval vessels. One of the chief difficulties, indeed, was the need for using the Highland railway for naval traffic on so large a scale, and parts of this were doubled during the war in order to relieve the congestion which necessarily followed the lengthy single-track mileage of this, as it proved, vitally important line.

Munition Traffic.—Widespread munition manufacture necessarily occasioned a great deal of civilian traffic directly and indirectly in national interests, while in a number of places ordinarily quiet stations or branches became very busy owing to the erection of army camps or of munition works. A few stations had to be specially erected and several new branch lines made.

Railway Docks and Harbours.—As owners of several of the best-equipped docks and harbours, including new ones such as Immingham, G.C.R., and the King George Dock at Hull, H. & B. and N.E. Railways, and the new lock entrance at Newport, Alexandra (Newport & South Wales) Docks & Railway, brought into use shortly before the outbreak of war, in addition to the older ones, such as Southampton, the railways provided the nation with some of the most complete embarkation depots. Most of these became closed areas, and all of them were used to their fullest capacity, either for direct war traffic or when the submarine menace diverted shipping traffic from its accustomed ports.

Railway Steamers.—Railway steamers also were widely used, and of a total of 218 vessels 126 were taken over and 36 lost from various causes. They were used as transports, for the maintenance of national supplies, as minesweepers, and as hospital ships. Frequently even those which remained on regular services had to assist in meeting emergencies, such as the evacuation of Belgian refugees.

Railways and Air Raids.—An important difficulty with which the railways had to deal was that due to the numerous air raids over Great Britain. Relatively little serious damage was done, but the fact that traffic had often to be or worked under difficulties, the reduced lighting generally maintained throughout the more vulnerable parts of the country, and the congestion which followed each cessation of traffic constituted serious hindrances to railway working.

Armoured Trains.—Throughout the war period, too, the possibility of invasion had to be faced, and many special arrangements made with a view to the possible need for transferring the civilian population from the coast towns to the interior. Several armoured trains were constructed in the railway workshops, though they were never called upon for use under service conditions.

Miscellaneous.—At many of the principal railway stations free buffets were installed for the benefit of soldiers and sailors, and in

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some cases these provided special facilities, as at Victoria, S.E. & C.R., where arrangements were made for the exchange of French for English money, the amount dealt with reaching a total of approximately £10,000,000. At one period the railways were severely congested by the traffic due to the evacuation of Belgium, and one result of this was the continual stream of Belgian soldiers coming to England on leave to visit their families, a total of 237,000 thus travelling. At many stations local bodies, such as the V.A.D., etc., made very complete arrangements for providing refreshments to soldiers travelling through and for attendance upon the ambulance trains. Frequently valuable assistance was given by the various ambulance associations belonging to the railway service.

British Railway Work in the War

During the war period British railways rendered essential services on a very large scale, both in regard to traffic requirements at home and those associated with active service in the various war areas. To some extent the former has already been covered by general reference, but further details must be given.

Military and Naval Special Trains.—Between the declaration of war and the date of the Armistice all the larger railways were called upon to run special trains conveying officers and men, frequently with guns, ammunition, horses and equipment, when passing to a port for embarkation to France or other theatres of war. There were also transfers of units between camps, leave travel and special events, such as the arrival of Canadian, S. African and other contingents from abroad and their journeys from ports of arrival to training centres, together with that portion of the American army which passed through the United Kingdom. In the aggregate the numbers of special trains operated by the leading railways were very great, and the following table shows, as far as information is available, the number of special trains mainly, if not exclusively, on the passenger side, run by the railways mentioned, with the numbers of officers and men who travelled:—

	Trains	Officers and Men conveyed
L. & S.W.R.	58,859	20,223,954
L. & N.W.R.	56,470	22,268,000
G.W.R.	33,615	—
N.E.R.	24,172	11,810,290
L.B. & S.C.R.	27,366	—
G.E.R.	13,000	6,231,293
G.C.R	5,663	2,656,726

Three other railways may be mentioned, though their totals include also ambulance trains, goods and other specials:—

	Trains	Officers and Men conveyed
S.E. & C.R.	163,000	12,141,933
M.R.	11,502	2,282,000
N.B.R.	45,000	—

The numbers of special trains required on the freight side are more indefinite, as they included many trains run to meet the needs of the Government munition undertakings and of coal traffic passing from the colliery areas to the Fleet bases, and, to some extent, in connexion with the coal control scheme. However, it may be mentioned that on the London, Brighton & South Coast railway no fewer than 53,376 special trains were run mainly for traffic to and from the ports on the system. On the Great Western railway the total was 63,349 and on the Great Eastern railway 11,000. To meet the needs of the Fleet several railways ran 20 or even more trains per day conveying Admiralty coal. The arrival of the American army in Great Britain entailed the running of 1,684 special trains on the London & North-Western railway and 1,139 on the Great Western railway. When the Canadian contingents first arrived in England the London & South-Western railway was required to run 92 specials from Plymouth alone.

Ambulance Trains.—For home service a total of 20 trains was equipped for army use: G.C.R. 3; G.E.R. 2; G.W.R. 4; L. & Y.R. 2; L. & N.W.R. 5; L. & S.W.R. 2; M.R. 2. There were also two in Ireland, one each equipped by the G.N. and G.S. & W. railways. Five naval ambulance trains were also in use, these differing somewhat in regard to internal arrangements and equipment. Many individual vehicles were also fitted for the purpose of conveying small numbers of men in ordinary trains, and there were nine other trains sufficiently equipped to be brought into use as emergency ambulance trains. For service overseas 30 ambulance trains were equipped by the home railways, each consisting of 16 bogie coaches. These were supplied as follows: G.C.R. 1; G.E.R. 4; G.W.R. 8; L. & Y.R. 3; L. & N.W.R. 7; L. & S.W.R. 1; L.B. & S.C.R. 1; M.R. 2; N.E.R. 1; L. & N.W.R. and G.E.R.1 jointly; L. & N.W.R. and L.B. & S.C.R. 1 jointly. Two trains presented by the United Kingdom Flour Millers' Association were constructed by the G.E. and G.W. railways jointly, and the Lord Michelham (or "Queen Mary") presentation train was equipped by the L.B. & S.C. and L. & N.W. railways. A further train, known as the Princess Christian Hospital Train, was built by the Birmingham Carriage & Wagon Company. A majority of these trains was employed in France, but two went to Egypt and one to Salonika. When the American army came arrangements were made for 19 other trains, of the same general type as those previously supplied for overseas service, to be equipped by British railways for the use of the U.S.A. forces in France, as follows: G.C.R. 1; G.E.R. 1; G.W.R. 4; L. & Y.R. 3; L. & N.W.R. 4; L. & S.W.R. 1; M.R. 5. Twenty-nine others were on order at the date of the Armistice, when, of course, work was at once suspended. Including spare and extra vehicles, a total of 822 vehicles was thus adapted for the Government trains, and 304 for the U.S. trains.

The following numbers of journeys made by ambulance trains on various railways will indicate the enormous volume of this traffic, these figures applying, of course, only to the ambulance trains running on the home railways: L. & N.W.R. 13,318; L. & S.W.R. 10,173; S.E. & C.R. 7,515; G.W.R. 5,000; M.R. 3,982; N.B.R. 1,800; G.E.R. 1,172. This traffic was dealt with at various ports, but it is worthy of note that no fewer than 3,166 were despatched from the new Marine station at Dover, uncompleted at the time of the outbreak of war, but finished off at an early date sufficiently to serve for the transfer of wounded men.

Troop Movement and other Military Traffic.—The numbers of special trains given above will indicate the enormous dimensions which the traffic entailed by troop movement involved. At suitable places large numbers of both passenger and goods vehicles had to be kept in reserve to provide for movements of troops at short notice, and many of the cross-country or connecting lines proved of special value in enabling through journeys to be made from one system to another and by providing alternative routes to avoid congestion. The North London, Hampstead Junction, and North and South-West Junction railways carried nearly 14,000 special trains, and on several dates public traffic was entirely discontinued. The "widened" lines of the Metropolitan railway, through Farringdon Street and the connexion to the South-Eastern & Chatham railway at Ludgate Hill, were used by no fewer than 626,000 special passenger or goods trains, though this route was restricted by the limited loading gauge and could not, therefore, be used for ambulance trains and certain other traffic. The West London railway dealt with about 150 troop or special trains per month, and the East London a gross total of about 1,000. Bearing in mind that the magnitude of the forces involved a tremendous amount of leave travel, it may be mentioned that, during 1917 only, over 28,000,000 of H.M. forces travelled free by warrant on the home railways, while nearly 2,000,000 journeys were similarly made by civilians in Government service.

Traffic at Ports.—Dover was largely used as a centre for ambulance train traffic, but at Southampton a very large volume of stores, munitions and other material was dealt with, besides a considerable amount of shipping traffic necessarily continued. The Southampton train ferry to Dieppe was brought into use in Nov. 1917, that at Richborough, near Sandwich, being completed in Feb. 1918. Both enabled goods wagons to be sent across without transshipment, and they were especially useful for the conveyance of tanks, heavy guns, locomotives, etc. Avonmouth, Devonport and Liverpool were used as ports for supplying the Mediterranean and Mesopotamian forces. Immingham and other East Coast ports were largely used for supplying the fleets in more southern waters, while Leith, Aberdeen, Invergordon, Thurso and other Scottish centres were kept very busy in meeting the demands of the Grand Fleet. Newhaven and Littlehampton together dealt with nearly 7,000,000 tons of traffic on war account. In addition to the steamer traffic across the Channel the South Coast ports, including Richborough, sent over 1,000,000 tons by means of sea-going barges.

Munition and Admiralty Coal Traffic.—Besides the traffic directly required for the army and navy, the railways had to meet many other traffic requirements, as indicated by the following: The South-Eastern & Chatham railway alone conveyed nearly 200,000 tons of army mails, parcel-post packages and lighter stores not dealt with in bulk, *via* Dover and Folkestone. On the London & North-Western railway nearly 16,000 trains were run for the conveyance of Admiralty coal. In many parts of the country extensive forestry work was undertaken, and the conveyance of the cut timber amounted to hundreds of thousands of tons on many railways. On the North-Eastern railway the tonnage of goods conveyed on Government account amounted to 5,500,000, and of Admiralty coal nearly 12,000,000 tons, while to serve the numerous munition centres in the north-eastern area involved the conveyance of some 84,000,000 workpeople. On the Great Western railway at one time no fewer than 360 additional trains had to be run daily, solely for the conveyance of workers to the various war factories.

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Locomotives and Rolling Stock sent Overseas.—A number of locomotives under construction for various colonial and foreign railways were commandeered by the Government and diverted for use in France and elsewhere, while large orders were given for the building of engines by British firms for use in France. A total of 247, of a contemplated order for 500 of the 2-8-0 type alone, was constructed. But to meet immediate needs it was necessary for British railways to supply considerable numbers of engines from their own stocks, mainly for France, though some went to Egypt, Mesopotamia, and Salonika. The total locomotives thus supplied numbered 675, of which the L. & N.W.R. provided 111; G.W.R. 95; M.R. 78; N.E.R. 50; G.C.R. 33; and G.N.R. 23; the remainder being sent by other companies. In addition, 30,000 goods wagons were sent overseas, together with 100 special wagons and 40 30-ton coal wagons. The Great Central railway constructed six engines to the design adopted for the War Department 2-8-0 locomotives which were, in fact, substantially to G.C.R. designs; 2,500 20-ton covered wagons were built in railway workshops.

Besides the standard-gauge rolling stock, large numbers of steam, petrol, and petrol-electric locomotives of small types, and wagons of various designs, for use on the light railways in France, were built by various firms, though not much of this work was done by the railway companies beyond the equipment of Ford cars as rail tractors at Crewe Works. A considerable amount of permanent way was, however, sent overseas by the home railway companies, partly by taking up certain light-traffic branch lines or by converting double lines to single track, and also to a considerable extent from stock. A great quantity of bridge parts, machinery, cranes and other material was also supplied from stock, while the equipment of the army railway workshops in France was largely provided by the various railway companies.

War Work in Railway Shops.—As already mentioned, this was undertaken to the value of about £17,000,000, and covered a wide range of products—from ambulance stretchers, road vans and gun-carriages to the repair of cartridge cases and the production of shell cases, frequently of large sizes. Several travelling workshop trains were also equipped in the British railway shops. In a number of instances, too, railway companies undertook the repair of Belgian and other locomotives sent over from France.

The Railway Troops.—As already mentioned, a total of 184,475 men was released from railway service to join H.M. forces. They were largely utilized in the formation of, or transferred to, the various sections known generically as the Railway Troops attached to the Royal Engineers. A number of the companies were recruited mainly from the men of a particular railway, especially in the case of the L. & N.W.R. (115th) and the G.W.R. (116th, 262nd and 275th), while the 118th was recruited chiefly from the G.E. and N.E. railways. There were two principal sections, the Railway Construction Troops and the Railway Operating Division, the former numbering 35 companies and the latter 42½ companies, including those dealing with the light railways. Besides these there were Labour, Roads, Canadian Overseas Construction, Canadian Operating, S. African and Australian companies, bringing the total to 118½ companies. The various camp railways were also supplied from these bodies.

The Post-Armistice Period

On the cessation of active hostilities the pressure of war traffic at once eased, though it was some weeks before Government traffic materially decreased in volume. Necessarily, for some time afterwards the completion of work in hand and the traffic occasioned thereby kept the railways fairly busy, though with less urgency and strain. Leave travel was even more freely given, and the demobilization of the forces for many months placed a big strain upon the railways on the passenger side. National traffic on the goods side, too, remained heavy, as systems of control of food-stuffs, coal and necessities could not at once be discontinued, and was further complicated by the public call for the return of unrestricted transit conditions, for improvements in facilities, and for a resumption of the relative freedom of pre-war conditions. There were also tremendous arrears of construction and maintenance of railway permanent way and rolling stock to be overtaken.

Demobilization of the Forces.—This traffic was a very big thing in itself, and numerous special trains had to be run between the ports and the demobilization centres. It was estimated that 40,000 men would be dealt with daily, and that was about the number realized. But the effect of public pressure caused great irregularity, and, as a result, the railways had to deal with much of this traffic—which also included the dispersal journeys of men from the demobilization centres—as best they could. One dispersal depot alone thus dealt with over 1,000,000 men. Horses had also to be conveyed in large numbers, many being brought back in through trucks *via* the Channel train-ferries. Their sale, also the large traffic occasioned by the return of rolling stock and material from overseas, and the sale of army stocks of all kinds under the direction of the Disposals Board, added appreciably to the work of the railways.

Arrears of Maintenance and Construction.—The work thus involved was necessarily of great volume and expense. It entailed relaying of lines, repair and reconstruction of bridges, completion of deferred new works, repair of locomotives and rolling stock, and the construction of overdue replacements. In addition certain war extensions had to be dismantled, and workshops cleared of special machinery, and not a few new machines added in place of those which had become worn out. Public opinion ceased to look quite so favourably upon the large expenditure thus incurred. The companies had, of course, placed to reserve large sums in view of this work, but as they had been limited to net receipts on a pre-war basis, these were necessarily on pre-war standards, though usually with increases as far as practicable, whereas when the money had to be spent costs of materials and labour had increased approximately threefold. Agreements made between the Government and the companies provided for the difference being made up, but the amounts involved became so great that in Oct. 1920 a Committee was appointed to report upon these agreements. In large measure this was little more than a sop to public opinion, for the report of Lord Colwyn's Committee, as it is generally called, took little account of the merits of the case, and appeared mainly concerned with a solution which presented very much the appearance of repudiation of agreements when they became unpleasantly expensive. However, it was generally realized that these costs were the inevitable corollary to the great benefits, and actual profit as shown in a previous section, obtained by the nation from the railways during the war period; and a settlement was ultimately arrived at in May 1921, providing for the payment in two instalments of £60,000,000, after the termination of Government control in Aug. 1921. Until then the arrangements already adopted for monthly payments in respect of arrears of construction and maintenance were continued. This solution avoided much prospective litigation and represented a reasonable degree of give-and-take on both sides. The Colwyn Report suggested that a total of £156,000,000 would thus be involved, but this was given without data and was almost certainly overstated. Payments already made must be considered in conjunction with the £60,000,000 accepted in settlement. The corresponding amount agreed upon in respect of the Irish railways was £3,000,000.

Railway Guarantee and the Subsidy.—As Government traffic diminished in volume, and more and more national traffics were returned with de-control to private enterprise, the effect of the high cost of materials and supplies, and the generous wage and other concessions, quickly resulted in the railways requiring considerable subsidies. At the end of 1919 belated action was taken to increase railway charges to an economic level, the lack of which action had largely caused the very serious position which arose after the conclusion of active hostilities. Thus, whereas the amount of Government compensation in 1918 was £46,576,000, and the receipts, including the estimated value of Government traffic, £44,068,105 on account of railway working alone, for the year ended March 31 1920 the realized deficit amounted to £41,349,530, even after allowing for certain increases in charges which came into force during that period. And for the 1920-1 period the net Exchequer liability was estimated at £54,500,000.

Wage Concessions and Increased Costs.—These provide the chief explanation for the large subsidies entailed, expenses having risen nearly 200% and receipts an average of only 80% as compared with 1913, the year upon which the Government guarantee of net receipts was based. Thus the gross receipts, expenditure and net receipts for 1913, 1919 and 1920 were:—

	1913	1919	1920
Gross Receipts .	£129,194,000	£226,363,000	£298,249,000
Expenditure . .	£83,385,000	£180,098,000	£251,575,000
Net Receipts (Railway) . . .	£45,809,000	£46,265,000	£46,674,000

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In the case of four representative railways, English, Scotch, Irish and Welsh, wages and salaries alone showed the following increases:—

	1913	1920
London and North-Western . .	£6,000,000	£20,000,000
North British	£1,660,000	£6,600,000
Great Northern (Ireland) . .	£357,000	£1,406,000
Taff Vale	£384,000	£1,187,000

War-time concessions consisted mainly of the flat-rate allowances of 33s. per week, reached by successive increases in view of the rising cost of living, but after the Armistice action was taken by the Railwaymen's Unions in respect of the eight-hour day (granted from Feb. 1 1919), standardizing of wages and grading. The eight-hour day caused many difficulties and is necessarily costly, especially as it had to be equalized for many men whose wages were not calculated on that basis. Throughout 1919 there were continual labour difficulties, and a serious strike lasted from Sept. 26 until Oct. 5, settled by an agreement that no reductions in wages should occur before Sept. 30 1920, and the whole matter thoroughly explored. In Oct. 1919 Central and National Wages Boards were set up. In Jan. 1920 an agreement was announced providing for an addition to the wages of each grade of 38s. per week and for cost of living allowances rising or falling in accordance with Board of Trade figures, with standardized rates of pay which should not fall below 100% over pre-war rates. This was at first objected to, but was accepted on Jan. 15 1920. Subsequent negotiations dealt with supervisory and other grades. Certain further advances were given in June 1920, and in view of the accompanying costs of materials and supplies it will be understood that these additions much more than balanced the alleged railway "subsidies."

Ministry of Transport.—An announcement, apparently unauthorized, by Mr. Winston Churchill in Dec. 1918, that nationalization of the railways was contemplated caused a great deal of misunderstanding. There were, however, many matters requiring attention, and these together resulted in the bill for establishing a Ministry of Ways and Communications presented to Parliament in Feb. 1919. As first introduced its contemplated scope and powers were considered to be too far-reaching, but in a modified form it was passed as the Ministry of Transport Act, receiving Royal Assent on Aug. 26 1919, the Ministry being established as from Sept. 23 1919. The Ministry took over several sections of existing departments, including the Railway Department of the Board of Trade and the Roads Board. The Railway Executive Committee continued as such until Jan. 1 1920, but most of its members were retained on the Railway Advisory Committee. Various other advisory and reporting committees have since been established.

Rates, Fares and Charges.—Apart from the 50% increase in ordinary passenger fares, and of 10 to 20% increases in season-ticket charges, railway rates remained as in pre-war years until the Ministry of Transport announced increases in demurrage rates as from Jan. 1 1920, and of 50% on goods rates as from Jan. 15 1920. These were followed on Aug. 6 by further increases bringing ordinary passenger fares up to 75% and season tickets 50% over pre-war rates, and from Sept. 1920 workmen's tickets were increased, and goods rates raised to substantially 100%. On Dec. 22 1920 the Rates Advisory Committee of the Ministry of Transport reported on the general question of rates and charges, and their recommendations materially influenced the Railway Bill placed before Parliament on May 11 1921.

Grouping and the Future of Railways.—One of the provisions of the Ministry of Transport Act was that a policy for the future of the home railways should be promulgated within two years. An outline of proposals was issued in July 1920, suggesting, *inter alia*, the amalgamation of railways into groups as follows: (1) *Southern*, combining the South-Eastern & Chatham, the Brighton, and the South-Western; (2) *Western*, the present Great Western system with the Welsh lines; (3) *North-Western*, combining the North-Western, the Midland and the Lancashire & Yorkshire, North Staffordshire and Furness; (4) *Eastern*, combining the Great Northern, the Great Central, and the Great Eastern; (5) *North-Eastern*, the present North-Eastern system and the Hull & Barnsley; (6) *London Group* (local lines); and (7) a *Scottish Group* for the whole of Scotland. These proposals were severely criticized, and the Railway Companies' Association adopted the following alternative: *Group 1*, London & North-Western, Midland, Lancashire & Yorkshire, North Staffordshire, Furness, Caledonian, Glasgow & South-Western, and Highland railways; *Group 2*, Great Central, Great Northern, Great Eastern, Hull & Barnsley, North-Eastern, North British, and Great North of Scotland railways; *Group 3*, Great Western and Welsh lines; *Group 4*, London & South-Western, London, Brighton & South Coast, and South-Eastern & Chatham railways; *Group 5*, London railways (local lines). On May 11 1921 the promised bill was placed before Parliament, and embodied the following modified scheme: (1) *Southern Group*, London & South-Western, London, Brighton & South Coast, South-Eastern, and London Chatham & Dover railways; (2) *Western Group*, Great Western and Welsh railways; (3) *North-Western and Midland Group*, London & North-Western, Midland, Lancashire & Yorkshire, North Staffordshire and Furness railways; (4) *North-Eastern and Eastern Group*, North Eastern, Great Central, Great Eastern, Great Northern and Hull & Barnsley railways; (5) *West Scottish Group*, Caledonian, Glasgow & South-Western and Highland railways; (6) *East Scottish Group*, North British and Great North of Scotland Railways. During proceedings in Committee of the House of Commons the 5th group was combined with the 1st, and the 6th with the 2nd, substantially as proposed by the Railway Companies' Association, and the Act, which received Royal Assent on Aug. 19 1921, therefore provides for four groups only:—Southern; Western; North-Western, Midland and West Scottish; North-Eastern, Eastern and East Scottish. Amalgamation is to become effective on July 1 1923. The proposed London group was dropped in view of proposals for the setting-up of a London Traffic Board. Provisions were also made for the inclusion of representatives of the Railwaymen's Unions in association with railway officers on advisory councils, etc. (not as directors as at first claimed), and for the continuance of the Central, National and local Wages Board. It was considered that these provisions, some of which represented agreements already made in conjunction with the fare and rate increases in force according to the proposals of the Rates Advisory Committee, would enable the railway companies to operate under solvent and economic conditions on the termination of control on Aug. 15 1921. In regard to amalgamation it may be mentioned that early in 1921 preliminary arrangements of this character had already been made in regard to the North-Eastern and Hull & Barnsley railways, and the London & North-Western and Lancashire & Yorkshire railways, in addition to several smaller companies to be absorbed by their larger neighbours. The chief difficulty, in fact, was in regard to Scottish railways, which, it was claimed, would be so seriously affected that they could not hold their own in a group by themselves, the alternative of amalgamation with appropriate associated English companies being favoured. Hence the altered grouping adopted by the Act as finally passed. Control was actually terminated at midnight on Aug. 15 1921.

Restoration of Facilities.—During the war many usual facilities of travel were withdrawn, but during 1920–1 a number were restored, as follows: pre-war luggage allowance for passenger-train traffic, June 14 1920; passengers' luggage in advance, July 1 1920; day excursion tickets, Aug. 12 1920; period excursion tickets, Dec. 24 1920; week-end tickets, May 11 1921 (deferred, owing to the coal strike, until Aug. 20, and Aug. 19 in the case of commercial travellers). G.E.R. continental services were resumed Feb. 25 1919; L.B. & S.C.R., June 1 1919; the Dover-Calais route, S.E. & C.R., Jan. 8 1920; and the Hull and Zeebrugge route, N.E. and L. & Y. railways, May 14 1920. Express-train running was rapidly restored to a good level during 1920, and though still below pre-war standards the main line services on all routes became very creditable in July 1921, both for speed and number. On some lines, indeed, pre-war schedules were definitely reinstated, and in certain instances facilities were even better than before the war. The suburban traffic problem was, however, still serious. On the "Underground" lines new rolling stock, when delivered, materially eased the inevitable congestion. An arrangement had been made during the war whereby the associated "Underground" railways, of which the

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Metropolitan District only was controlled and subject to Government guarantee, should pool their receipts, including also the London General Omnibus Company. To meet the peculiar conditions of the situation a special Act of Parliament was passed, and from Sept. 26 1920 these lines were empowered to charge "revised fares," the Metropolitan District railway ceasing to come under the guarantee. Allocation of passenger travel to specific routes, already partly in desuetude, partially disappeared during the early months of 1921, and finally in July of that year.

Goods Traffic.—During 1920 most of the special regulations imposed under war conditions disappeared, though the common-user of wagons still continued, and by coöperative action it had become possible to realize a higher standard of wagon loading. Commencing with the four weeks ending Jan. 29 1920, the Ministry of Transport commenced to issue detailed statistics of goods traffic operation, and on the completion of twelve months these were altered to agree with the calendar months, in combination with corresponding passenger traffic statistics. (J. A. K.)

United States

The decade 1910–20 was marked by many fundamentally important developments in organization, management, and public regulation of American railways. During the early part of the period a tendency, which had begun during the latter half of the preceding decade, toward a decreasing rate of return on the investment in railways caused serious financial distress and a marked decline from the normal rate of development of railway facilities, equipment and service. The years 1915 and 1916 brought large increases in freight tonnage through the transportation of war materials for the Allies. The active participation of the United States in the World War, beginning in April 1917, made even greater demands upon facilities already overtaxed. To meet these demands the railways tried the experiment of voluntary unification through a committee of railway presidents clothed with plenary power by the boards of directors of practically all railway companies to operate the railways as one national system during the war. In the national emergency, in which the closest possible coördination of the agencies of transportation with the several branches of the Federal Government was absolutely essential, the experiment of voluntary unification was not satisfactory, and on Jan. 1 1918, as a temporary war measure, the railways were taken over by the Government, to be operated by a director-general responsible to the President. Federal operation continued until March 1 1920, when the railways were returned to private operation under the terms of the Transportation Act of that year. That Act fundamentally amended the existing policy of national regulation of railways and extended the powers of the Interstate Commerce Commission. Principally because of the serious business depression of 1920–1, and the decline in the volume of railway traffic, the results of the first year of operation under the Transportation Act were disappointing. In the summer of 1921 the subject again was commanding national attention. A choice among three policies was then incumbent upon Congress: (1) to rely upon private ownership and operation under the principles of the Transportation Act (hereinafter described) to take care of the situation when business conditions became normal; (2) to make some compromise between a policy of private control and initiative and Government operation or ownership; and (3) completely to nationalize the railways.

Pre-War Conditions and Legislation.—The 1910 amendment to the original (1887) Act to regulate commerce (*see* 22.830) created the Commerce Court to act upon appeals from decisions of the Interstate Commerce Commission. The new court was intended to specialize in the technique of transportation and to expedite the determination of cases theretofore passed upon by Federal courts of general jurisdiction with crowded dockets containing cases of all kinds. In many of its early decisions the Commerce Court overruled the Interstate Commerce Commission and, because it appeared to limit the effectiveness of the Commission, the Court became unpopular. The public attitude toward railways at that time was unfriendly, and Congress responded to public pressure by abolishing the Commerce Court in 1913.

In response to an insistent public demand, growing out of the belief that the railways were being allowed to earn returns on fictitious capitalization, the Federal Valuation Act was passed in 1913. The Act required the Interstate Commerce Commission to determine the physical valuation of the railways individually, as of June 30 1914, and to cause records to be kept which would accurately reflect all changes in property values after that date. Three bases were prescribed tentatively: (1) original cost to date, in the cases where the information could be obtained; (2) estimated cost of reproduction, new; and (3) estimated cost of reproduction, new, less depreciation. The work of determining values had been in progress since 1914, but no final figures were available in 1921 or expected until 1923 at earliest, although tentative valuations of a few properties had been made public.

Another piece of legislation, known as the Clayton Act, of 1914, contains a section which has an important bearing upon railways. The Act was intended to strengthen the so-called Anti-Trust Act and to prevent collusion between directors and officers of railways and directors and officers of manufacturing and other concerns dealing in railway equipment, coal and other supplies. It requires that contracts for supplies which will cost more than $50,000 must be open to competitive bids invited by advertisements. A railway company is prohibited from having dealings in excess of $50,000 per year with a concern having a director, officer or agent who is also a director, officer or agent of the railway. The Act was to be in force from 1916, but because of war conditions the effective date was postponed until Jan. 1 1921.

About 1906 a downward tendency began to be apparent in the rate of return on railway investment. This change restricted the flow of new capital into railway development—new lines and improvements of existing lines. The traditional policy of American railways had been to keep their facilities well ahead of the demands of growing traffic. In view of the fact that the volume of freight traffic doubles about every 12 years, and that the numbers of passengers carried one mile doubles about every 15 years, the need of such a policy is apparent. The practice of the conservative railways was to "plough in" a substantial part of their net income each year by making improvements out of income instead of issuing new securities. Such a policy, however, could not be continued with constantly diminishing net income. The downward tendency in the rate of return was caused in part by a hardening of the rate structure through a more inflexible policy of public regulation, in part by steadily increasing costs of wages and materials, and in part by the greater difficulty of finding means through economies and new operating methods of overcoming increasing costs. With declining net returns, and a general lack of confidence on the part of the public toward railways, railway securities lost their attraction, and investors sought other fields. The railways experienced much difficulty in obtaining new capital for the additional facilities required to keep their plants in step with traffic growth, and many of the weak lines reached such financial straits that they could not maintain their solvency. The cumulative effect of these tendencies reached the climax in 1915 when 42,000 m., or about one-sixth of the entire mileage of the country, was in the hands of receivers, and when less new mileage was built than in any year since the period of the Civil War.

Effects of the World War.—This was the situation when the effect of the World War was first felt by American railways. The orders from the Allies for munitions and other war supplies caused a sudden increase in freight tonnage. The additional revenues acted as a stay against financial distress, but the railways found their traffic-carrying capacity taxed to the full. Then came the added traffic burden when the United States entered the war in April 1917.

To meet the emergency the railways, through the American Railway Association, organized a railroad war board and delegated to its five members complete control over operation. The purpose was to coördinate management under private ownership and control so that the railways, during the war emergency, would merge their merely individual and competitive activities in the effort to produce the maximum of transportation efficiency. The board did much to increase the capacity of the railways through unified operation and common use of facilities, and during the first six months following voluntary unification, the heavily increased traffic was handled satisfactorily. But during the late autumn and early winter of 1917 acute traffic congestion occurred at the Atlantic seaboard ports, through which the greater part of the war supplies was exported, and the blockade extended back to the important inland industrial centres. The congestion was caused by several factors, among which two were outstanding. One has already been mentioned—the financial inability of the railways to keep up their former programmes of providing additional facilities in advance of traffic needs. The second was the lack of effective coördination between the railways and the several branches of the Government, each of which demanded priority of movement for its freight, thereby creating great confusion. The congestion and its interference with traffic, the perilous financial condition of the railways, the spirit of unrest among railway employees because of the greatly increased wage rates paid by manufacturing and ship-building plants, and the need of better coördination of all agencies essential to the successful prosecution of the war, led to the President's proclamation of Dec. 26 1917, taking over the railways to be operated by the Government from Jan. 1 1918. The Government could advance the funds required to provide the additional facilities urgently needed for war purposes; by paying a rental equivalent to pre-war net operating income it could prevent further bankruptcy of railway companies; by paying higher wages than the railway companies were able to pay, it could remove the cause of unrest among em-

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employees; by making the railways a branch of the Government it could more effectively coördinate transportation with other Government activities; and by the complete temporary elimination of lines of corporate interest a more effective unification of all facilities and equipment would be possible.

Federal Control in the War.—The Federal Control Act of 1918 provided that the railways should be operated for the President by a director-general of railroads. Practically all of the railways were taken over, and were operated, with little change in the individual units, by Federal managers (in nearly all cases the former operating executive) reporting to regional directors, seven in all, who in turn reported to the director-general. The latter was assisted by staff-directors in charge of the several divisions—law, finance, purchasing, traffic, operation, labour, accounting, public service and capital expenditures. With few exceptions the entire organization, from the Federal managers to the regional and division directors, was made up of men carefully selected from the railway service. Political influence had no play in appointment. The Act provided that the railways should be returned to their owners for private operation within 21 months after the signing of the treaty of peace. The Government during the period of Federal control was required to keep up the usual standards of maintenance, so that the properties would be returned at the end of Federal control in as good condition and as complete in equipment as when taken. Failing to do this, the railway companies were to be compensated for the deficiencies. The annual rental was set as a sum equal to the average annual net operating income earned by the companies during the three years ended June 30 1917. The principles of unification and consolidation of facilities and equipment were carried much further by the director-general than by the Railroad War Board. Terminals and other facilities, and locomotives and cars, were used in common. Advertising, soliciting, off-line agencies, and other normal competitive activitives were abolished. Traffic was routed by the most convenient lines, regardless of shippers' directions, or of the effect of diversions on the earnings of the individual units in the national system. The aim was to utilize every instrumentality of transportation to the highest degree of traffic-handling efficiency.

The results of Federal control during the year 1918 while the war was in progress were satisfactory in that they met the emergency. The traffic of that year, both in ton-miles and in passenger-miles, exceeded all previous records. What was more important, the coördination of railway management with other branches of the Government had the effect of producing the kind of transportation most necessary for war purposes. The congestion of the early winter of 1917 was quickly relieved. The heavy demands of troop movements were completely met. The loaded cars on hand at the seaboard were always a little ahead of the ocean-going tonnage capacity, and the railways, after May 1, kept up their part of the programme of moving export food supplies for the civilian population of the Allies. The insistent preference given to war traffic naturally entailed some curtailments in service for civilian population of the United States. These curtailments were patriotically accepted. A system of centralized control established priority for the various kinds of freight and controlled traffic at the source by requiring permits before freight would be accepted. Such permits were not issued unless transportation conditions at destination were such that the freight could be quickly unloaded. Manufacturers and dealers were asked to load cars with larger shipment units, or otherwise to conserve car space by changing methods of packing. One of the first acts of the director-general was to appoint a commission to make recommendations as to wage increases. The commission made its report in May and its recommendations were adopted and made retroactive to Jan. 1 1918. The increases in pay-roll expenditure were substantial. Coincident with the promulgation of the new wage scale, the director-general created the Board of Railway Wages and Working Conditions and later he appointed three Boards of Adjustment to pass upon disputes as to working rules and discipline. Both the wage and the adjustment boards were bi-partisan with equal representation from the officials, representing management, and from the executives of the labour organizations, representing the employees. During 1918 there were no strikes or other labour disturbances. The director-general was given almost autocratic authority to increase freight and passenger rates and other transportation charges or regulations. The Interstate Commerce Commission and the state commissions temporarily were shorn of power. An increase of 25% in freight rates and about 20% in passenger rates was made effective in June, a few days after the wage increases were announced. While in a general way it was hoped that the advances in rates, coupled with the expected economies in unified control, would offset the higher wage rates and other increases in operating costs, the net financial results were regarded as of secondary importance as compared with the increase of transportation capacity. The rate advances were insufficient to meet rising costs and the final result of the first year of Federal control, with no allowances for deficiences in maintenance or depletion in stocks of materials and supplies, was a deficit of over $200,000,000. In other words, the net operating income earned by the director-general was that much less than the rentals paid to the railway companies. This deficit, however, may properly be regarded as one item of the cost of carrying on the war. In view of the satisfactory transportation service, particularly during the summer of 1918 when the armies of the United States were at the height of their activities, and comparing the deficit with the expenditures of other branches of the Government, the cost was not great.

The second phase of Federal control was the period from the signing of the Armistice in Nov. 1918, until March 1 1920, when the roads were returned to private management. This post-war period of Federal control was not marked by results as satisfactory as those of 1918. It would have been much better if the period of Federal control had ended Dec. 31 1918. Immediately after the Armistice the moral factor of patriotism, which had been so effective during the first ten months of Federal control, almost entirely disappeared. As soon as the war was over the employees through their organizations began a campaign to hold and to extend further the concessions which had been made freely under the exigencies of war; the thoughts of the officers began to turn to their corporate and personal interests; and among a minority of the administration officials active steps were taken to bring about an indefinite extension of Federal control with the ultimate aim of nationalization. The public, however, had little patience with the director-general's proposal to Congress that Federal control should be extended five years, and the suggestion had little support outside of the labour organizations and the political forces aligned on the side of nationalization. Chambers of commerce, shippers' organizations, and the general public, in the natural reaction against perpetuating war-time governmental control of business, insisted that the railways should be returned to private control. This general attitude toward the subject, and the alarming deficits which were being added to that of 1918, influenced Congress to take active steps to restore the railways to their pre-war status, but great difficulty was experienced in agreeing upon a plan which would be satisfactory in detail to both the House and the Senate. While the hearings and the debates dragged throughout the year 1919, the transportation service suffered in efficiency and among the more radically inclined employees there were frequent and serious strikes. It was found necessary to grant further increases in wages and to enter into the so-called "national agreements" containing many burdensome and restrictive rules such as, for example, the abolition of piece-work in shops. Most of these national agreements were made almost on the eve of the return of the railways. They were drawn by the labour advisors to the director-general and were adopted over the protest of the railway operating officials. These national agreements were partially abrogated July 1 1921, by order of the Railway Labor Board created by the Transportation Act of 1920.

The final cost to the Government for the 26 months of Federal control was estimated by the director-general at a minimum of $1,200,000,000. It seemed probable that it would be much

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greater, as this estimate allowed only about $300,000,000 for under-maintenance and for differences in the quantities of materials and supplies on hand at the beginning and at the end of Federal control.

A great deal of controversy arose over the question of relative maintenance during and prior to Federal control, but the differences hinge mainly upon the degree of under-maintenance. There can be no doubt that the condition of the properties was not so good at the end of Federal control as at its beginning, but the exact degree of deterioration cannot be determined as no inspection or survey was made when Federal control began. The records show conclusively that the normal rate of renewals of rails, ties and ballast was not kept up during Federal control, and the universal complaint of the railway executives that freight cars were not maintained at normal standards is supported by the opinions of experts. On the whole, the conditions of locomotives did not suffer, but less than the normal amount of work was done on passenger cars. Bridges and buildings suffered because of neglect in painting, but on the other hand many improvements were made in shops and in engine-house facilities. Whatever may be the degree of under-maintenance it should be remembered that it was impracticable during the greater part of the period of Federal control to obtain the necessary amount of materials and full forces of men. These difficulties were partly removed in 1919, but in that year the serious decline in traffic and in earnings made it inexpedient, in the judgment of the director-general, to attempt to make up the deficiences. A proviso in the contract between him and the railway companies gave the director-general the option of measuring his maintenance obligations by the amounts actually spent by each company during the three years prior to Federal control, these amounts to be properly equated to allow for increases in the cost of wages and materials, and he chose to limit the expenditures so as to keep them within that obligation, leaving the accounting and the settlement to be worked out after the termination of Federal control. Instructions were issued, however, that nothing essential to safety in operation was to be left undone. An inspection of the amounts spent for maintenance, particularly for maintenance of equipment, indicates that even with a generous allowance for the higher wage rates and material costs, the director-general expended amounts which were equivalent to those spent by the railway companies prior to Federal control. This method of comparison, however, takes no account of the important factor of relative efficiency of labour. During 1918, when so many railway men were drafted or had volunteered for military service, the percentage of inexperienced employees was abnormally large, and during 1919 the general lowering of the morale and the frequent strikes of men engaged in maintenance work led to a much lower degree of efficiency. The director-general held to the view that the Federal Control Act and the standard contract based upon it did not require him to take account of relative efficiency—that his obligation ended when he had expended an amount equivalent, when properly equated for the higher wage rates, to that spent in the test period. The railway companies on the other hand insisted that if in the test period 100 man-hours cost $30 and produced 10 units of work, and if during the year 1919 the same number of man-hours cost $60 but produced, say, 8 units of work instead of 10, the spirit of the Act is not followed unless the director-general spent enough in excess of $60 to produce 10 units of work. This is the real point of difference. In the settlements made since the termination of Federal control this issue has been avoided by a policy of compromise and by lump-sum adjustments in which maintenance is but one factor, but it is probable that some of the companies which have large claims for under-maintenance pending may prefer to take the case to the courts for decision.

Too much emphasis, however, should not be placed upon the financial results of Federal control. Deficits might have been reduced or entirely avoided, and a surplus laid aside for the settlement of claims, if the 1918 advances in rates had been greater or if supplementary advances had been made in 1919 to take care of the further wage increases granted in that year. The attitude of the administration was that it made little difference whether the higher operating costs were met indirectly through taxes or were directly collected from shippers and passengers in higher rates. As between the two alternatives the administration chose the first on the ground that another rate advance would have a serious effect upon the already much disturbed business conditions, and would be made the excuse for further profiteering. Speaking in general terms it may be said that the policy of the Government in taking the railways and operating them while the war was in progress was vindicated by the favourable operating results which flowed from a centralized and unified control. On the other hand it may be said that the experience of the post-war period of Federal control was not such as to justify a peace-time policy of Government operation or ownership under a democratic form of Government which relies upon the free play of the forces of competition. The unfavourable reaction of public opinion may be traced primarily to the elimination of competition in service. The railways were finally returned in response to an overwhelming public demand that private operation be restored, and almost immediately after its restoration, the desire for competitive service caused the abandonment of practically all the innovations of unification under Government control and operation.

The Transportation (Esch-Cummins) Act of 1920.—The conditions under which the railways were returned, and the policies of public regulation as they existed in 1921 were fixed by the Transportation Act of Feb. 1920, amending the original (1887) Act to Regulate Commerce. Besides providing for the restoration of operating control to the owning companies the Act provided that during the first six months, the so-called transition period, while railway rates and wages were in process of further upward revision, the Government would continue the guaranteed rentals paid during the period of Federal control. A Railroad Labor Board was created to pass upon wage matters, and made substantial increases in July 1920. The Interstate Commerce Commission was instructed to establish rates so that on the basis of current costs and under honest, economical and efficient operation, they would yield net operating income sufficient to pay a fair rate of return upon the value of the railway properties held for and used in the service of transportation. For the first two years the fair rate of return was set at 5½%, with an extra 0·5% (6% in all) to make provision for improvements chargeable to capital accounts. This mandate to the Commission, however, applied to the railways as a whole, or as a whole in territorial groups. For the purposes of the Act the Commission later divided the railways into three general groups, the eastern, the western and the southern. The mandate did not apply to individual roads in a group. Obviously a rate scale which will yield 6% to all of the railways in a group will yield more than 6% to some and less than 6% to others. No relief is provided for the railways which earn less than 6%, but when more than 6% is earned by a railway, the excess is to be evenly divided with the Government. The railway is to hold its proportion of such excess in a reserve fund and the one-half which goes to the Government is to be held by it as a general railroad contingent fund to be administered by the Commission in assisting the weak roads by loans. The reserve fund created by a railway from its excess earnings is to be held for interest charges or dividends in lean years, but whenever that fund is more than 5% of its property value, the excess over 5% may be used for any lawful purpose.

The problem of the weak railway has been for many years the principal obstacle in the path of a satisfactory solution of the railway question. In the determination of competitive rates, for example, a scale which will give a reasonable return upon the value of a weak railway will give too much to the strong railway. Conversely, when the scale gives a reasonable return, but not more, to the strong railway, the weak one cannot live. In practice the regulating authorities have been forced to adopt a middle ground with, perhaps, a tendency to lean more toward preventing an unreasonably high return to the strong than an unreasonably low return to the weak. An attempt has been made to meet this problem in the Transportation Act which provides for the ultimate elimination of the weak railways by consolidation with the strong. The Commission is ordered to prepare and adopt a plan for the consolidation of railway properties into a limited number of systems. Such a plan is to preserve a reasonable degree of competition and to maintain so far as practicable the existing routes and channels of trade and commerce. The desiderata are that the several systems shall be so arranged that the cost of transportation as between competing systems, and as related to the values of the properties, shall be approximately the same, so that these systems can employ uniform rates in the movement of competitive traffic, and can earn, under honest and efficient management, substantially the same rate of return upon the value of their respective properties. The Commission in June 1921 was engaged upon the formulation of such a plan, but as the Act pro-

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vided no way in which its recommendations might be enforced when objections were raised against its terms, there seemed likely to be long-drawn-out controversy and additional legislation before an ideal scheme of consolidation into a small number of systems of fairly equal financial strength would be made effective. The new Act enlarges the powers of the Commission over financial management and requires it to exercise a general supervision over all new issues of securities. The Railway Labour Board (consisting of nine members divided equally among representatives of management, labour and the public) is empowered to fix wages and working rules.

The foregoing outline mentions most of the important new features in the 1920 legislation amending the original Act to Regulate Commerce and the amendments up to 1920. The fundamental provisions of the original Act remained in force in 1921 and had been extended or otherwise strengthened. Briefly, the Commission is required to see that rates and charges are just and reasonable; to prescribe the rules under which rates may become effective; to prevent unfair discriminations between shippers, carriers or localities; to prevent, except when specifically authorized, the charging of a higher rate for a short haul than for a longer haul over the same route in the same direction; to prevent the pooling of freight or earnings; to require complete reports from carriers in prescribed form; and to prescribe and enforce uniform rules for accounting and for compilation of statistics of operation.

In addition to the Federal legislation just described, each state exercises its powers of regulating intrastate traffic and of exercising what may be termed "police powers" over railway management and service within its own borders. The line between Federal and State regulation is not clearly drawn, and controversies between the two authorities have been frequent. On the whole, the tendency of court decisions during the decade 1910–20 was toward according greater powers to the Federal commission and less power to the State commissions, as it has been shown that the states, when exercising control over intrastate rates and service, may indirectly discriminate against interstate traffic and service.

In addition to the changes in the Act to regulate commerce, new legislation was enacted during the decade which strengthened and extended the laws pertaining to safety appliances and accident prevention. These laws govern certain features of design and maintenance of locomotives and cars and of operating methods in train service. For example, the use of high-power headlights has been made compulsory, and the requirements as to boiler inspection and the general condition of locomotives have been made more rigid. The scope of the laws governing maximum hours of service was enlarged. The eight-hour basic day, prescribed for train service employees by the Adamson Act, passed by Congress in 1916, was extended during the period of Federal control to apply to practically all classes of railroad employees.

Statistics.—The salient features of mileage, investment, income and transportation production in ton-miles and passenger-miles, are shown in Table I. compiled by the Bureau of Railway Economics, Washington, D.C., under date of March 21 1921. The figures apply only to Class I. railways, i.e., those which have operating revenues in excess of $1,000,000 per year. These railways comprise about 92% of the total main-track m., about 95% of the total capitalization, and they earn about 97% of the total operating revenues.

In interpreting the figures in Table I. it is necessary to bear in mind that the results of 1917–20 were very much affected by war conditions, and by Federal operation of railways from Jan. 1 1918 until March 1 1920. The period was one of abnormally high operating expenses and of greatly diminished net income, notwithstanding the large operating revenues. Obviously a continuation of the low income of 1919 and 1920 would cause universal railway bankruptcy. The aim of the Transportation Act of 1920 was to restore the pre-war earning power, to enable the railways to give better service, and to provide revenues which with reëstablished credit would permit expansion and improvements in facilities and equipment.

Details for 1917.—Instead of figures for a later year, those of 1917 are selected to give an indication of the normal characteristics—financial, operating and public service of American railways.

On Dec. 31 1917 the total route mileage of railways of all classes was 253,626 miles. This was equivalent to 8·53 m. of railway for each 100 sq. m. of territory, or 24·39 m. for each 10,000 inhabitants. The relation of route mileage to track mileage (for Class I. roads only) is shown in Table II.:—

TABLE II. ROUTE AND TRACK MILEAGE. CLASS I. ROADS, DEC. 31 1917

Item	Miles	Per cent. of route miles
First main track (route m.)	232,697	100·0
Second main track	29,913	12·9
Third main track	2,775	1·2
All other main tracks	2,190	·9
Yard tracks and sidings	101,108	43·5
Total all tracks	368,683	158·5

The total route m. for railways of all classes in 1917 was owned by 1,874 separate companies. Of these, 186 were railways of Class I. with route mileage as shown in Table II., made up of 178,707 m. owned and 53,990 route m. operated under lease or similar arrangement. The average route mileage operated per Class I. road was 1,251 miles. For railways of Classes II. (those with operating revenue $100,000 to $1,000,000 per year) and III. (those with operating revenues below $100,000 per year, including switching and terminal railways) the average was 44 miles. The greater part of the mileage owned by the large number of small companies is leased to and operated by Class I. roads.

Finances.—The total railway capital outstanding Dec. 31 1917 was $21,249,357,241. This, however, included certain duplications in securities of one company held by another company and used by the second company as the basis for additional securities. Eliminating the intercorporate holdings and other duplications, the net capitalization on that date was $16,401,786,017, or $66,699 per route mile. Of this net capitalization, $39,930 per route m., or 59·9% of the total, was in capital stock, and $26,769, or 40·1% of the total, was in bonds or other forms of funded debt. In that year the average dividend paid on all stock was 4·24%, but no dividends whatever were paid on 36·7% of the stock. The average dividend rate on the dividend paying stock alone was 6·81 per cent. The average rate of interest paid upon funded debt may be estimated as about 4 per cent. The number of stockholders was approximately 670,000 and the number of bondholders about 300,000.

Table III. gives the income account of all railways considered as one system, including switching and terminal companies, for the year ended Dec. 31 1917:—

TABLE III. INCOME ACCOUNT, ALL RAILWAYS, 1917

Railway operating revenues	$4,178,784,652
Railway operating expenses	2,956,770,809
Net revenue from railway operations	1,222,013,843
Railway tax accruals	227,301,093
Uncollectable railway revenues	711,879
Railway operating income	994,000,871
Equipment and joint facility rents (net deduction)	26,573,773
Net railway operating income	967,427,098
Other income (non-operating)	101,808,148
Gross income	1,069,235,246
Net interest charges	475,646,748
Other deductions from gross income	24,371,700
Net income	569,216,798
Net dividends (including dividend appropriations from surplus)	293,291,805
Income above dividends	275,924,993

Of the total operating revenues about 70% came from the transportation of freight and about 25% from passenger-train service including mail and express. The remaining 5% was miscellaneous operating revenue. The operating expenses were divided as follows: maintenance of way and structures, 15·6%; maintenance of equipment, 24·2%; traffic (solicitation, advertising, etc.), 2·3%; transportation (operation of stations, yards, terminals and trains), 53·6%; general expenses, 3·4%; and miscellaneous, 0·9%.

On Dec. 31 1917 the equipment owned by railways of all classes was as follows:—

Steam locomotives	65,699
Other locomotives	371
Freight train cars	2,408,518
Passenger train cars	55,939
Company service cars	193,916
Steamboats and tugboats	411
Barges, car-floats and canal boats	1,868
Other floating equipment	163

The item "other locomotives" is made up almost entirely of electric locomotives. "Freight train cars" do not include private freight cars (numbering about 80,000) owned by meat-packers, oil companies and similar industrial concerns. "Passenger train cars" do not include parlour and sleeping cars owned by the Pullman Co., of which there were 7,706. "Company service cars" include ballast cars, construction cars, wrecking cranes, etc.

The average number of employees during the year 1917 for all railways was 1,833,732. For Class I. railways only, the number was 1,732,876, divided as follows:—

Class	Number	Per-centage
General and divisional officers	18,446	1·1
Clerks, messengers and attendants	192,569	11·1
Maintenance of way employees	448,720	25·9
Maintenance of equipment employees	388,837	22·4
Traffic department employees	8,333	·5
Dispatchers and telegraphers	67,455	3·9
Station employees	132,562	7·6
Yard and engine-house employees	183,877	10·6
Train-service employees	226,936	13·1
All other employees	65,141	3·8
Total	1,732,876	100·0

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TABLE I. MILEAGE, INVESTMENT, REVENUES, EXPENSES, 1911–20, INCLUSIVE, OF CLASS I. RAILWAYS

	Fiscal Years ended June 30.					Calendar Years ended December 31.				
	1911	1913	1914	1915	1916	1916	1917	1918	1919	1920
Miles of track operated — main track	244,300·77	254,821·20	259,139·53	262,424·88	264,920·40	265,802·97	267,574·12	269,174·54	270,556·62	*
Property investment — Class I. roads and their non-operating subsidiaries (investment in road & equipment, exclusive of materials and supplies)	$14,246,167,475	$15,284,763,489	$15,842,127,273	$16,257,146,632	$16,688,440,056	$16,884,440,038	$17,762,152,127	$18,213,629,613	$18,474,197,914	*
Total operating revenues	2,752,497,297	3,108,361,215	3,031,326,963	2,871,563,047	3,381,597,866	3,596,865,766	4,014,142,748	4,880,953,480	5,143,589,998	*a* $6,171,493,301
Total operating expenses	1,902,994,333	2,173,463,563	2,203,423,812	2,021,160,614	2,210,892,786	2,357,398,412	2,829,325,124	3,982,068,197	4,398,408,414	5,768,720,013
Operating ratio—%	69·14	69·92	72·69	70·39	65·38	65·54	70·43	81·58	85·51	93·47
Net operating revenue	849,502,964	934,897,652	827,903,151	850,402,433	1,170,705,080	1,239,467,354	1,184,817,623	898,885,283	745,181,584	402,773,288
Railway tax accruals	98,626,848	118,386,859	135,572,579	133,276,330	145,517,034	157,113,372	213,920,095	223,175,379	232,704,545	278,868,668
Uncollectable railway revenues	—	—	—	649,917	806,747	797,486	700,090	613,821	915,300	1,224,980
Railway operating income	750,876,116	816,510,793	692,330,572	716,476,186	1,024,381,299	1,081,556,496	970,197,438	675,096,083	511,561,739	122,679,640
Hire of equipment —net balance	Dr. 15,577,534	Dr. 15,611,817	Dr. 17,686,287	Dr. 19,128,943	Dr. 23,564,582	Dr. 23,767,262	Dr. 17,999,098	Dr. 15,676,577	Dr. 33,451,523	Dr. 33,086,318
Joint facility rents —net balance	Dr. 11,113,874	Dr. 13,288,541	Dr. 13,626,138	Dr. 14,242,410	Dr. 15,943,758	Dr. 17,704,717	Dr. 18,129,570	Dr. 20,850,903	Dr. 23,119,388	Dr. 27,664,696
Net railway operating income (Stand. ret. basis)	724,184,708	787,610,435	661,018,147	683,104,833	984,872,959	1,040,084,517	934,068,770	638,568,603	454,990,828	61,928,626
Rate of return on investment—%	5·08	5·15	4·17	4·20	5·90	6·16	5·26	3·51	2·46	*b* 0·34
Other income (including miscel. operating income)	272,638,887	241,629,540	243,768,847	186,232,946	192,709,534	210,066,879	233,252,283	309,067,492	265,261,955	*
Total income	997,952,317	1,029,239,975	904,786,994	869,337,779	1,177,582,493	1,251,151,396	1,167,321,053	947,636,095	730,252,783	*
Rent for leased roads	124,960,314	133,018,154	122,592,248	122,528,657	139,215,095	158,377,958	132,082,177	126,977,239	123,276,609	*
Interest on funded debt	345,843,570	368,134,889	373,296,354	387,029,566	399,348,125	406,667,567	403,305,438	396,465,997	404,430,691	*
Interest on unfunded debt	18,116,228	23,045,616	35,958,511	27,509,366	15,066,312	14,854,425	15,704,857	29,933,496	44,597,880	*
Other deductions	19,996,896	19,295,321	22,218,263	16,114,112	20,730,068	23,370,773	23,197,975	125,598,013	203,236,819	*
Net income available for dividends, etc.	489,035,309	485,745,995	350,721,618	316,156,078	603,222,893	646,880,673	593,030,606	268,661,350	Def. 55,289,216	*
Total dividends declared out of income and surplus	397,068,724	322,300,406	376,098,785	259,809,520	281,936,372	306,176,937	320,395,779	275,336,547	278,386,909	*
Revenue ton-miles	249,843,166,302	297,722,528,693	284,924,749,718	273,913,006,569	339,870,323,675	362,444,397,129	394,465,400,493	405,379,284,206	364,236,957,761	409,587,680,000
Revenue passenger-miles	32,371,444,793	33,875,085,958	34,566,985,414	31,789,928,187	33,645,908,150	34,585,952,026	39,476,858,549	42,676,579,199	46,351,863,983	46,686,275,000

*Not available in 1921. *a* Total operating revenues for 1920 includes approximately $55,000,000 of back mail pay collected in 1920 but applicable to services rendered in 1918 and 1919. *b* Computed on investment of 1919.

NOTE: Net Railway operating income as shown above for 1918, 1919, and 1920 represents the actual earnings from operation of the Class I. railways. The "standard return" for these roads (*i.e.* the net operating income after collecting rental from the U.S. Government) amounted to approximately $898,500,309 for the years 1918 and 1919, and for 1920 amounted to approximately $825,000,000, taking into account two months of Government operation, six months of Government guarantee and four months of private operation.

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The subsequent application, during Federal control, of the eight-hour day (instead of the former basis of 10 hours for a large proportion of employees) to practically all of the classified employees had the effect of increasing the number of men required to do a given number of hours of work. At the end of Federal control the total was about 2,000,000 employees, not including conductors and porters on Pullman cars employed by the Pullman Company.

Construction and Equipment.—The tendency in the decade 1910–20 was toward the use of heavier rails. On heavy traffic lines, using the most powerful locomotives, rails weighing 100 lb. per yd. were being replaced by rails weighing 105 to 110 lb. On other lines which had used 85-lb. rails, the tendency was toward 100-lb. rails. Greater attention was paid to the relative proportions of the chemical elements in steel and the mills were turning out rails of improved design and of greater strength and wearing qualities. The marked development in the weight of locomotives and cars placed much greater strains on the track superstructure and roadbed. In 1921 American Railway Engineering Association standards for depth of ballast had not been changed recently, but some of the heavy traffic roads were increasing the amount of ballast from 12 in. to 20 in. below the ties. The experiments in the use of steel and concrete ties as substitutes for wood ties (sleepers) had not given satisfactory results under the heavy axle loads of American equipment, and there was little inclination to use substitutes for wood, notwithstanding the marked depletion of the lumber supply. There was, however, a more general use of preservatives in treating ties chemically to strengthen their resistance to decay, and a more general use of tie plates, between the base of the rail and the top of the tie, to lessen the mechanical wear on the tie. The screw spike, in place of the cut spike, for fastening the rails to the ties, was having greater use, but was not common. The heavier axle loads required a general strengthening of bridges, and throughout the whole field of maintenance engineering the adoption of higher standards during the decade was noticeable.

There was a marked development in the art of signalling. The use of electrically controlled automatic block signals is distinctively an American characteristic. There was a steady tendency to substitute automatic block signals for the older type which are manually operated. In 1911 there were about 29,000 m. of main track equipped with automatic block signals. In 1920 the mileage so equipped was over 61,000 miles. The use of these modern signals not only increases the safety of train operation but it also has the effect of increasing the capacity per mile. In the interest of safety there was a popular demand that block signalling should be made compulsory by law, and the Interstate Commerce Commission has repeatedly recommended legislation which would require the railways to adopt an annual programme under which all railways would eventually be completely equipped with block signals. Congress, however, had not by Jan. 1921 legislated on the subject, mainly because of the difficulty of formulating a plan which would fit the varying needs of roads with differing degrees of traffic density, and because of the heavy financial burden which compulsory block signalling would place upon the railways. There was also a widespread demand for the adoption of a device of some kind which would automatically stop the train when the engineman failed to observe the signal and ran past one which was in the stop position, but Congress appears to take the position that it is more important first to extend the installation of block signals before insisting upon the expensive supplementary safeguard of the automatic stop.

In 1910 the average weight of all locomotives, exclusive of tender, was about 73 short tons. In 1920 it was about 90 short tons. The tendency was steadily toward the use of more powerful locomotives and the retirement of the lighter types. The locomotives ordered in 1920 weigh from 100 to 200 tons, with a few of the Mallet compound type of much greater weight. The use of steel passenger cars calls for larger locomotives in that class of service, and the American policy, consistently followed for years, of increasing the freight-train load, required the use of more powerful locomotives in freight service. The average freight-train load, in tons of freight, grew from less than 400 tons in 1910 to more than 700 tons in 1920. Not all of this increase is to be attributed to the heavier locomotive. Reductions in grades and curvature have made heavier trains possible. There was also a general improvement in the technique of tonnage ratings for locomotives. In addition there was a more general use of the superheater on locomotives. This device reduced the loss in steam pressure between the boiler and the cylinder and increased the drawbar pull. The use of automatic stokers on the most modern type of freight locomotive removed one limiting point: the capacity of the fireman in shovelling coal into the fire box. A recent device for increasing locomotive capacity is known as the "booster." It is a small auxiliary engine geared to the trailing axle (on locomotives which have a pair of wheels not connected with the main drivers) and may be used in starting the train or in giving an extra drawbar pull on the limiting grades.

While not so marked as in the case of the locomotive, there has been a steady increase in the weight and capacity of freight cars, particularly in those designed to carry coal, ore, or steel or iron products. The standard coal car of 1921 had a capacity of 100,000 lb., and in some cases cars of double that capacity were used locally on the owning road in coal or ore traffic. There was no appreciable increase in the capacity of box cars as the commercial standards do not call for larger units than 60,000 to 80,000 lb. per car.

Reference has already been made to the more general use of steel in passenger-car construction. Virtually no new wooden cars were built for passenger service after 1915. On Jan. 1 1911 the passenger-train equipment consisted of 50,201 wooden cars, 1,636 of steel underframe construction, and 3,133 of all-steel construction. On Jan. 1 1919 the numbers were: wood, 36,810; steel underframe, 8,805; all-steel, 18,652. The use of the old wooden cars was generally confined to local trains and branch lines.

Accidents.—A comparison of the latest available complete accident statistics (in *Bulletin 74, Interstate Commerce Commission*, published in Nov. 1920) with the statistics for 1907 and 1908 (*see* 22.832) indicate a gratifying improvement. The casualties in 1919 were less than those of 1907 or 1908, notwithstanding the fact that the volume of traffic in 1919 was nearly double that of 1907. The improvement may be attributed to several factors, but it is difficult to list them in the order of their importance as the influence of any one factor cannot be measured separately. Among them are (1) higher standards of construction and maintenance of way, structures and equipment; (2) enforcement of laws relating to safety appliances, boiler inspection, and hours of service; (3) extension of block signalling; (4) other improvements in operating methods; (5) the psychological effect of the "Safety First" movement, begun about 1910 (a nation-wide movement to interest railway employees in accident prevention); and (6) the publication of results of investigations made by the Interstate Commerce Commission in specific accidents. The data contained in the appended table were taken from *Bulletin 74*.

CASUALTIES TO PERSONS IN TRAIN ACCIDENTS AND TRAIN SERVICE ACCIDENTS

Item	1919		1918		1917	
	Killed	Injured	Killed	Injured	Killed	Injured
Passengers:—						
In train accidents	110	4,549	286	4,655	131	4,460
In train service accidents	191	3,598	233	3,427	212	3,914
Total passengers	301	8,147	519	8,082	343	8,374
Employees on duty:—						
In train accidents	359	2,955	547	4,179	439	4,214
In train service accidents	1,334	33,325	2,212	42,782	2,177	48,022
Total employees on duty	1,693	36,280	2,759	46,961	2,616	52,236
Employees not on duty:—Total	66	321	169	595	165	544
Other persons, not trespassing:—						
In train accidents	9	61	117	433	109	473
In train service accidents*	1,873	5,134	1,878	5,268	2,091	5,514
Total other persons	1,882	5,195	1,995	5,701	2,200	5,987
Trespassers:—						
In train accidents	32	63	39	67	68	76
In train service accidents	2,521	2,595	3,216	2,738	4,175	3,753
Total trespassers	2,553	2,658	3,255	2,805	4,243	3,829
Grand Total	6,495	52,601	8,697	64,144	9,567	70,970

*Includes persons struck by trains at highway crossings.

The analysis of train accidents in 1919 shows that the total number was 25,596, divided as follows:—collisions, 6,904; derailments, 15,897; locomotive accidents, 674; and miscellaneous, 2,121. These figures include all train accidents, with and without personal injury. Collisions caused the death of 238 persons and the injury of 3,931. The casualties in derailments were 175 deaths and 2,979 injuries. The casualties in locomotive and miscellaneous accidents were relatively few. (W. J. C.)

RAILWAY STATIONS.—The improvements made during the decade 1910–20, especially in the United States, in the construction and operation of railway passenger stations, may be said to have revolutionized railway terminal construction; and the newer stations, of which the Grand Central terminal in New York is the outstanding example, demonstrated even after a short period of operation their superiority from practically every point of view. The substitution of electricity for steam as a motive power was the basic factor in the newer methods of construction. As long as steam was used little could be done to mitigate the noise or noxious gases that made the old-fashioned railway yard a public nuisance. It was virtually necessary to operate these yards on the surface where the products of combustion could make a free escape to the open air. In any confined space steam operation is not only dangerous, owing to the tendency of smoke to obscure the signals, but unpleasant for pas-

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sengers. The use of electricity eliminates the noxious gases and reduces the noise of the locomotive. An electrified yard can be depressed and completely covered over. This permits the reclamation of streets and valuable areas hitherto obstructed by tracks, with the result that what was formerly a railway yard filled with steam and smoke can be utilized for public and private buildings of the finest character.

In Europe, the completion of the passenger station at Leipzig (1915) was practically the only terminal improvement that was not interrupted by the World War, although the Gare St. Lazare in Paris was somewhat enlarged, and in London, Waterloo station was partly reconstructed and a number of tracks equipped for electric operation. The Leipzig station was under construction from 1907 to 1915, and cost £6,500,000, of which, following the German practice, £2,900,000 was borne by Saxony, £2,550,000 by Prussia, £810,000 by the city of Leipzig and £240,000 by the imperial Post Office Department. The main building has a frontage of 984 ft. and occupies an area of 172,000 sq. feet. The train shed has a high roof of steel and glass, built in the form of six arches; it is 785 ft. long, with an area of 710,500 sq. ft., and covers 26 tracks. The station serves as a junction for the passenger traffic of Magdeburg, Thuringia and Dresden, and the larger part of the traffic between Prussia and Saxony passes through it.

At the close of the decade the Leipzig station was the largest, though not the busiest, station in Europe. It was smaller than the Grand Central and Pennsylvania stations in New York, and was in 1920 handling considerably less than half as much traffic as the Gare St. Lazare, the busiest station in the world. It was said in 1916 that the number of persons passing through the St. Lazare in a single month equalled the total number of soldiers fighting on all fronts. Plans were then undertaken to electrify the suburban traffic, which is very heavy, and to depress the suburban tracks to a level beneath the steam trains. Even without these increased facilities, the station furnished accommodations for 200,000 to 250,000 passengers a day, a record, however, very nearly equalled in London by Liverpool St. station. Both the Gare St. Lazare and Liverpool St. station handled on busy days twice as much traffic as the South station in Boston, the busiest American station.

TABLE I. *Largest Railway Stations.*

Station	Ac.	No. of Tracks	Trains per day	Passengers per day
Grand Central, N.Y.	80	67	600	110,000
Pennsylvania, N.Y.	28	21	500	75,000
Leipzig	20	26	400	—
St. Lazare, Paris	12	31	1,700	200,000
Liverpool St., London	10	20	1,500	175,000
Waterloo, London	9	18	1,100	100,000
South, Boston	10	28	1,000	125,000
Kansas City	18	18	400	65,000
Northwestern, Chicago	8	16	450	70,000

Outside of Europe and North America two important stations were erected, one in Argentina and one in Japan. The Retiro station of the Central Argentine railway at Buenos Aires, said to be the finest station in South America, was opened in the latter part of 1915. The terminal, including buildings, train sheds and approaches, occupies 744,000 sq. ft., and in point of size and design compares with any of the newer stations elsewhere. Much of its equipment was supplied by English contractors. The Central Railway station in Tokyo, completed in 1915, was erected at the very small cost of £270,000, although it is built on a scale which in the West would cost 10 or 20 times as much. The explanation lies in the extremely low price paid for Japanese labour, 10d. ($.20) a day (of 10 to 12 hours) for common labourers, and £5 a month for carpenters and masons. Estimated in days' labour, the cost was 730,000 labourer-days. The main building is of brick and granite, 1,104 ft. long, 66 to 132 ft. wide and 54 ft. high, with a dome (152 ft.) at either end. The terminal took the place of three stations which formerly served the three main-line Government railways.

In the United States and Canada a constantly increasing railway traffic made necessary the construction of a large number of new stations. Terminals that had been erected with the expectation that they would serve their purpose for 50 years or longer became inadequate in less than half that time. The result was that the newer stations were built on what would otherwise be considered too extravagant a scale. The designers were looking to the future.

One distinctively American contribution to the advance of terminal architecture was the invention of an improved roof to take the place of the great arched train shed, once considered the most necessary adjunct of a railway station. Cold in winter and hot in summer, these sheds were expensive to build and expensive to maintain. Even at the height of their popularity there were some designers who preferred the umbrella or butterfly types of shed, consisting of a series of low arches which, viewed in cross section, suggest the names by which they are known. After 1905 the Bush type of shed began to supersede all others, especially where steam was still tolerated in the terminal area. This shed was the invention of Lincoln Bush, who made the first installation at the Hoboken terminal of the Delaware, Lackawanna & Western railway, of which he was chief engineer. The Bush shed is similar to the butterfly and umbrella sheds; it differs principally in that it affords a continuous roof except for an overhead slot above the centre of each track for the escape of steam and gases from locomotives. A shed of this pattern affords protection from the weather, is free from smoke and dirt, and costs about one-half as much as the large arched shed. Within ten years after its invention the Bush shed had been adopted in 11 American and Canadian terminals, notably the Michigan Central station at Detroit, the Northwestern at Chicago, the Grand Trunk at Ottawa and the Canadian Pacific at Montreal. In England there was developed a somewhat different type known as the "ridge and furrow," of which the Snow Hill station of the Great Western railway at Birmingham, reconstructed in 1914, furnishes an example. The Snow Hill train shed consists of a series of transverse girders (275 ft. long with four supporting columns) spanning the entire width of the station. The best results, however, can be attained only where the smoke and dirt of steam operation are eliminated altogether. The problem of the train shed was most completely solved in the Grand Central terminal, New York, where electricity was adopted as a motive power. Here the "sheds" closely resemble the stations on a subway or underground railway.

Less successful in this respect, though of first-rate importance among the new stations of the period, was the Pennsylvania station in New York. Being of the so-called through-station type, this station is essentially a monumental bridge over the tracks, which traverse Manhattan Island in tunnels under the city. The main building was designed after the Roman Doric style of architecture and occupies two complete blocks (8 ac.), on Seventh Avenue from 31st to 33rd Streets. The general waiting-room is 277 ft. by 103 ft., with a height of 150 feet. The train yard or shed (340 ft. by 210 ft.) is an "undisguised example of modern engineering in glass and iron," and suggests somewhat the old-fashioned train shed. The station was built primarily to provide the Pennsylvania railway with a terminus in New York (before 1910 the terminus was in Jersey City), and the construction of the river tunnels, which were necessary to make a connexion with Manhattan Island, was an engineering feat of considerable magnitude. The improvement extends from Manhattan Transfer, 1 m. east of Newark (about 7½ m. from the terminal), to a connexion with the Long Island railroad at Woodside, L.I., which also used the Pennsylvania station as a terminus. At Manhattan Transfer incoming Pennsylvania trains change to electric operation and are hauled by electric locomotive, operating with a direct current of 600 volts from a third rail. At the New Jersey shore they descend into one of the two approach tunnels and proceed under the Hudson river and New York to the Pennsylvania station. As soon as empty they leave the station to the east, still travelling underground in one of four tunnels which pass under eastern Manhattan and the East river to Long

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Island, where they emerge not far from the railway yards. The terminal was completed in 1910 at a cost of $115,000,000.

The Grand Central terminal, undoubtedly the most successful modern terminal of any type, was begun in 1903 and opened to the public in 1912. The primary purpose was to provide not only the necessary traffic facilities for an enormous number of passengers—ultimately expected to reach at least 250,000 a day—but to ensure pleasant and comfortable accommodations for every passenger, even at times when the crowds were heaviest. Subsequent development of the terminal area has made the Grand Central terminal not merely a railway station but a civic "center" of impressive beauty and utility. A railway station should form a harmonious unit in the architectural development of the city, but the designers of the Grand Central terminal accomplished something more than that: they actually transformed the architectural aspect of a very considerable section of New York. They achieved this result partly by setting a high standard themselves and partly by causing practically every property owner and builder within that section to measure up to it. The achievement was the more remarkable in that the entire project was conceived and carried out by the New York Central lines, a private corporation, without assistance of the city or state. The extraordinary architectural and economic success of this terminal was largely due to the intensive utilization of areas immediately adjoining the tracks and even over the tracks themselves—areas that were formerly incapable of being used or were suitable only for cheap dwellings or certain kinds of factories. Early plans did not contemplate buildings of a greater height than six stories in the immediate terminal area, but as soon as it was evident that noise, smoke and dirt had been successfully eliminated there arose a demand for hotels and office and apartment buildings of 25 and even 30 stories. This development was favoured by the fact that in constructing the terminal the engineers were able to restore to public use a number of streets that had hitherto been entirely done away with or existed only as foot bridges. The underground areas, yards, etc., occupy about 80 ac., which above the surface are covered with a great variety of buildings. It was not long before the enormous expenditure on the terminal, about $150,000,000, came to be economically justified by reason of the high return obtained from the lease of the space over the yards, etc., for building purposes, the so-called "air rights." In 1920 this return was sufficient to meet the fixed charges on the entire investment. The problem of building the station was extraordinarily complicated, and the closest coördination between the operating and engineering departments was necessary to carry out the new construction while tearing down the old station and at the same time keeping in operation some 800 trains a day, including those run for construction purposes. There were excavated 3,250,000 cub. yds. of material (more than two-thirds of which was solid rock), and in the construction there were used about 1,000,000 bar. of cement; and all this work was performed without interruption to the service rendered the public. The architects, Reed & Stem and Warren & Wetmore, adopted a modified Doric style. The "head house," or station proper, is of monumental proportions and the façade (on 42nd St.) consists of three great portals designed to carry out the idea of a gateway. The exterior is granite and Indiana limestone. The main concourse, with a length of 275 ft. and a width of 120 ft., can accommodate 30,000 people at one time. Its great height (125 ft.) gives it an effect of unusual spaciousness. From the concourse the passenger walks directly out on the same level to the "express" platforms. In winter the main concourse is kept warm by indirect heating, and the station platforms are protected against inclement weather so that even on the coldest days the passenger can board his train in comfort. The tracks occupy two levels. The express level is 20 ft. below the level of the street (Park Ave.) and occupies 45·4 ac.; the suburban level is 44 ft. below the street and occupies 32·8 acres. There are 42 tracks on the upper level and 25 on the lower; a special waiting-room (the suburban concourse) gives access to the latter. Leading from the main concourse are connexions with the incoming waiting-room (or station), the Commodore and Biltmore Hotels, the Yale Club, the Vanderbilt Concourse office building and various other buildings. The incoming waiting-room, located beneath the Biltmore Hotel, has separate passage-ways of its own leading to the concourse, the subways, the street, etc., so that passengers arriving in the terminal do not interfere with the flow of people to trains. The use of ramps, or inclined passage-ways, instead of stairways, facilitates the movement of passengers and lessens the danger of accident. Nearby hotels include the Belmont and Chatham.

A vital necessity in designing the Grand Central terminal was a signalling system for each level that could be operated by a director who could not possibly see the train movements which he controlled. Interlocking machinery, which in its simplest form is locking mechanism designed to control the signals so that they will automatically indicate the position in which the switch is set, was originated in England about 1856, but its use did not become general for many years. To operate the complicated network of trackage in a modern terminal requires interlocking machinery of an extremely elaborate character; the mechanism must safely control traffic and permit train movements with the greatest possible despatch. In the Grand Central terminal the interlocking machinery is of the all-electric type. Each track level is controlled by a director who is guided by a diagram on which the movement of trains is indicated by small electric lights. The largest of the signal machines is operated by 400 levers, each of which moves electrically a switch or signal, and to each 40 levers is assigned a man working under the instruction of the train director. The machinery is as nearly automatic as possible. Alternating-current track circuits are used to prevent the operation of switches while trains are moving over them and to indicate the presence of trains in proximity to danger zones. These circuits also operate electric locks which automatically hold the levers so that they cannot be moved except when the track is clear. Alternating current is used because of the 660-volt direct-current circuit employed for electric motive power. There are five main interlocking stations. The procedure in the case of an incoming train is as follows: At Harmon (33 m.) the steam locomotive is detached and an electric locomotive substituted. From Mott Haven Junction (5·3 m.) the train is announced to the director by telegraph or loud-speaking telephone (a telephone instrument with a horn similar to that of a gramophone instead of a receiver). After the train has passed 72d St. the director can trace its further progress by means of the electric buttons on his diagram, and he then decides upon which track to receive the train and gives his order to the levermen accordingly. When the incoming track is determined an announcement is made by means of the telautograph to various parts of the terminal. This instrument notifies the attendant at the incoming bulletin board and, in the case of through trains, serves to summon the station porters.

The Grand Central terminal was built by the New York Central lines under the direct supervision of W. H. Newman, then chairman of the board of directors. The terminal is owned 60% by the New York Central lines and 40% by the New York, New Haven & Hartford railway, and is used by both railways under a detailed operating agreement. In 1920 the traffic capacity of the station was far from being reached, yet more than 110,000 passengers used the station, arriving and departing on some 600 trains daily. Besides these there were every day from 50,000 to 100,000 people who passed in and out of the station without using the trains. Of the daily traffic about 65,000 were suburban passengers, and this kind of traffic was steadily increasing. From 1903, when the construction was begun, to 1920 the total passenger traffic very nearly trebled.

Reference to Table II. will indicate the more important new stations besides those already described. In addition to the terminals listed, two new stations of large proportions were planned for Chicago. One of these, the new Union station, was already under construction in 1921, while the designs for the other, the Illinois Central or 12th St. station, had been approved by the railway and by the city authorities.

TABLE II.—*Representative Railway Stations erected 1907–22.*

Station	Date completed	Dimensions: main building ft.	Cost*
Washington, D.C.	1907	663 x 211	$120,000,000
Pennsylvania, N.Y.	1910	430 x 430	115,000,000
Northwestern, Chicago	1911	320 x 218	24,000,000
Grand Central, N.Y.	1912	673 x 301	150,000,000
Ottawa, Quebec	1912	281 x 141	—
Michigan Central, Detroit	1913	345 x 266	7,000,000
Kansas City	1914	510 x 150	55,000,000
Havana, Cuba	1914	240 x 70	—
Buenos Aires	1915	850 x 606	—
Tokyo	1915	1,104 (Frontage)	1,350,000
Leipzig	1915	984 "	32,500,000
St. Paul, Minn.	1922	315 x 220	20,000,000

*Includes entire cost of terminal development.

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Whether the expense of the more elaborate American terminals is justified in view of the limited profit obtained from passenger business is a question which gave rise to no little discussion. Estimates were made as to the number of miles of new track that could be laid with the money expended for terminals, and it was demonstrated in some instances that terminal charges were making serious inroads on passenger profits. "As showing what some railways are up against," said John A. Droege, general superintendent of the New York, New Haven & Hartford railway, writing in 1916, "it is worth noting that the New Haven has to pay 29 cents for each passenger it brings into the Grand Central terminal in New York."[1] The U.S. Interstate Commerce Commission, in its report in the Anthracite case (35 I.C.C. 270), under the head of "Unproductive Betterments," said: "The Pennsylvania has expended on its new passenger terminal properties in New York City approximately $114,000,000. These properties are operated by the Pennsylvania Tunnel & Terminal railway company, and the operations result in a deficit each year. The deficit in the year ended June 30 1913 was $2,087,000. . . . Thus the question is presented: Must the present effective freight rates of the Pennsylvania earn an annual return of 6% on the investment in these terminal properties? The record shows that $47,000,000 of the expenditures in this property has been charged to profit and loss and to income of the Pennsylvania—that is, its past surplus income has already contributed $47,000,000 to the cost of this property." In answer to such criticisms Samuel Rea, president of the Pennsylvania lines, stated in 1917 that in seven years the traffic of the Pennsylvania station had increased from 9,862,434 to 18,135,311 annually, and that if the probable period of its usefulness was considered it could not be regarded as an unproductive betterment. He pointed out also that had the Pennsylvania waited longer to purchase a site in Manhattan the prices would have become prohibitive.

By leasing "air rights" and retail privileges within the station, the owners of the Grand Central terminal were able in 1920 to make an effective answer to criticisms of this sort. Following the example of the Grand Central, many railways sought to make their stations productive investments. Thus the Michigan Central constructed a seventeen-story office building in connexion with its station at Detroit, while the designers of the proposed Union station at Chicago, estimated to cost nearly $100,000,000, altered their plans to provide for a huge office building over the head house and train shed.

Closely connected with the criticism of expense was the criticism on the score of excessive size. Ironic references were made to the "magnificent distances" which passengers were compelled to walk between the street and trains. Examples of the distance walked by passengers purchasing tickets and checking baggage were given as follows: South station, Boston, 1,100 ft.; Northwestern, Chicago, 940 ft. and 20 ft. climb; Pennsylvania, New York, 480 to 950 ft., depending on the entrance used; Grand Central, New York, 450 ft.; Union, Washington, 1,200 feet. It should be said, however, that space is required if immense crowds are to be handled, and a slight extra walk is a small price to pay for freedom from the discomfort of crowded passage-ways. Nevertheless there were some leading railway men who believed that future development would be in the direction of more and smaller terminals located at various parts of a city. One proposal was to construct a system of subways, making each stop a Union Railway Station.

See J. A. Droege, *Passenger Terminals and Trains* (New York, 1916).

(H. B.*)

RAINER, Archduke of Austria (1827–1913), noted as one of the most cultivated and liberal-minded members of the Austrian imperial house, was born on Jan. 11 1827. His father, also named Rainer, the seventh son of the Emperor Leopold II. and of his consort Maria Luisa of Spain, was born in Florence in 1783, and from 1818–48 was viceroy of the kingdom of Lombardo-Venetia; his mother was the Princess Elizabeth, sister of Charles Albert, King of Sardinia. After serving in the army, the Archduke Rainer was in 1857 placed at the head of the permanent Imperial Council organized in 1851, which stood immediately under the Emperor and had among its functions the preparation of laws, and his experience in this office convinced him that the transition to a constitutional form of government on a liberal and centralized basis was necessary. In 1860 he conducted the negotiations for a strengthened Imperial Council; in 1861 he became head of the Government as president of the council of ministers of the Liberal Schmerling administration. His name is associated with the promulgation of the charter of the Constitution of Feb. 26 1861. In the same year Rainer became curator of the Academy of Sciences, a position which he filled till his death. In July 1865, when politics had shifted from the basis of the 1861 Constitution, he laid down office, and retired from public affairs. In 1872 he was appointed to the supreme command of the newly established Austrian *Landwehr*, to the organization of which he devoted many years of work. He continued to take a keen interest in art and science. As patron of the Arts and Crafts Museum (1862–98), and as curator of the Academy of Sciences, he won a high reputation. He greatly furthered the general knowledge of antiquity by the purchase of the papyrus discovered at Fayum, which was called, after him, the "Rainer papyrus." He married in 1852 Marie Caroline, daughter of the Archduke Charles, the victor of Aspern. There were no children of the union. He died on Feb. 27 1913.

RALEIGH, CECIL (1856–1914), English actor and playwright, was born Jan. 27 1856. He was the son of Dr. John Fothergill Rowlands, and took the stage name of Raleigh. He played for a time in musical comedy, but deserted acting for playwriting and, either alone or in collaboration, produced an immense number of melodramas, staged at first chiefly at the Comedy theatre, London, and in later years at Drury Lane. *Cheer, Boys, Cheer* (1895); *Hearts are Trumps* (1899); *The Best of Friends* (1902) and *The Whip* (1909–10) are typical examples. He also acted as dramatic critic to two or three London papers, and became secretary to the School of Dramatic Art in Gower St., London. He died in London Nov. 10 1914.

RALEIGH, SIR WALTER (1861–), English man of letters, was born Sept. 6 1861 in London, and was educated at University College, London, and King's College, Cambridge. He was professor of modern literature at University College, Liverpool, and professor of English literature at Glasgow, and in 1904 was appointed professor of English literature at Oxford. He was knighted in 1911 and elected to a fellowship at Merton College in 1914. His publications include *The English Novel* (1894); *The English Voyagers* (1904); *Six Essays on Johnson* (1910); *Romance* (1917) and many essays on literary subjects.

RAMPOLLA, COUNT MARIANO DEL TINDARO (1843–1913), Italian cardinal (*see* 22.877). When Pius X. was elected Pope, Cardinal Rampolla resigned all his appointments, retiring into the background. He had always been filled with a high sense of the dignity of his office, and while secretary of state had entertained in princely style; but personally he was a man of austere habits, and after his retirement he led the simplest life. A sound scholar, he devoted his last years to study, particularly to hagiography and Christian archaeology. He died in Rome Dec. 17 1913.

RAMSAY, GEORGE GILBERT (1839–1921), British classical scholar, was born at Fontainebleau July 19 1839, the third son of Sir George Ramsay of Banff and a member of a well-known family of scholars. He was educated at Rugby and Trinity College, Oxford, where he graduated first-class in *Literae Humaniores* (1861). He then became assistant to his uncle William Ramsay, professor of Humanity at Glasgow, and succeeded him in 1863, occupying the chair until 1906 and becoming a great teaching force in defence of a classical education. He was the first president of the Classical Association of Scotland which he helped to found. He was also a keen politician and a considerable athlete. His published work includes a *Manual of Latin Composition* (3 vols., 1st ed. 1884, 4th ed. 1897); an annotated version of *The Annals of Tacitus* (2 vols. 1904–9) and of the *Histories* (1915), as well as translations of Juvenal and Persius for the Loeb Library. He died at St. Andrew's March 8 1921.

RAMSAY, SIR WILLIAM (1852–1916), British chemist (*see* 22.880), died at High Wycombe July 23 1916. In 1904 he was awarded the Nobel prize, and in 1911 was president of the British Association. In 1913 he resigned his professorship of chemistry at University College, London. After his death a fund amounting to £53,772 was raised to perpetuate his memory by providing a laboratory of chemical engineering in connexion with University College, London, and founding Ramsay Memorial research fellowships of £300 a year each, tenable in any university in the United Kingdom for the advancement of chemical science.

RAMSAY, SIR WILLIAM MITCHELL (1851–), British archaeologist (*see* 22.880), resigned his professorship at Aberdeen

[1] In 1921 36 cents (23 cents terminal entrance and 13 cents tollage), representing charges from Woodlawn (11 m.), not including cost of operation.

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in 1911, and subsequently published *The Imperial Peace* and *The Teaching of Paul in Terms of the Present Day* (1913); *Recent Research and the New Testament* (1914); *The Making of a University* (1915) and the *Life and Letters of William Black* (1918).

RANDEGGER, ALBERTO (1832–1911), musical composer and conductor, was born in Trieste April 13 1832. He settled in London in 1854 after holding various musical appointments in Italy. Both as an orchestral conductor, and as a teacher of music and singing he held for many years a leading position in London. Besides conducting on various occasions at the Royal Opera, musical festivals and elsewhere, he did much, as conductor of the Carl Rosa company from 1879, towards the popular revival of opera in England. He died in London Dec. 18 1911.

RANGE-FINDERS AND POSITION-FINDERS (*see* 22.888).—Recent improvements have rendered many of the earlier types of range-finders obsolete, and the following features are common to all modern coincidence range-finders. The range-finder usually consists of two main parts, viz:—a strong outer tube and an inner frame which supports the delicate telescopic system, any slight derangement of which would seriously upset the accuracy of the range-finder. The outer tube is made as strong and rigid as possible, having regard to the weight which can be allowed. The inner frame is supported in such a way that any slight bending of the outer tube will not affect it.

Some form of double end reflector is always used. This at one time consisted of a pentagonal prism, but large pentagonals are very costly; they absorb a good deal of light and are liable to slight distortion with changes of temperature. There is therefore a tendency to replace them by a combination of two silvered plane mirrors inclined to one another at 45°, and either fixed in a mount made of a metal having the same coefficient of expansion as glass, or rigidly attached to an upper and lower glass support, to prevent change in their relative positions.

The central reflectors usually take the form of two or more prisms balsamed together, and are known as the centre prism combination. Their object is to deflect the rays received through the two ends of the range-finder into the eye-piece, and to present the two images of the target in the field of view immediately above and below a thin separating line. Their construction is usually rather complicated. The fine separating line is as a rule obtained by means of a special separating prism; or by the edge of a silvered surface on one of the prisms, so arranged that the rays forming one image pass through the prism, and those forming the other image are reflected by the silvered surface.

The centre prism combination is also used for erecting or inverting the images, and for defining the limits of the fields of view received from each half of the range-finder. The arrangements of fields of view usually met with are the following:—

1. The field of view is divided into two equal halves and the images in both are erect. When a coincidence has been made, the separating line cuts straight through the image of the target. This system is used with naval and coast defence range-finders which have to deal with targets having long vertical features, *e.g.* masts and funnels. It is known as the " erect " system.
2. The field of view is divided into two parts by the separating line. One field (in field range-finders usually the lower) is erect, and the other one is a replica of it, being inverted up for down but not right for left. With this system it is much easier to make an accurate coincidence on small targets, but it has the slight drawback that the total actual field of view is necessarily considerably smaller than with the erect system, and a slight elevation or depression of the range-finder may cause the target to pass the separating line and disappear. This, however, is not of much importance if the target is a stationary or slowly moving one. The upper field is often made smaller than the lower, so that as much ground as possible may be seen in the field of view. This system is known as the " invert," and is used in many field range-finders.
3. The whole field is erect with the exception of a small central rectangle in which the image is inverted. The advantage of this system is that the field of view is as large as that of a range-finder of the erect type, except that the part covered by the rectangle is missing. It is known as the " invert rectangle " and is used in many field range-finders, especially in foreign armies.
4. The whole field is erect with the exception of a narrow horizontal strip which passes right across its centre. The field in the strip may be either erect or inverted. This system, known as the " strip " system, is used in the British height- and range-finder.

In early range-finders the axis of the eye-piece was horizontal when targets in the horizontal plane were being viewed. It is now usually inclined downwards at angles of 45°, 60°, or even 90° for anti-aircraft work, so that the range-taker can observe from a more comfortable position. Eye-pieces can be focussed for individual observers, the two images of the target and the separating line coming to focus simultaneously. Coloured and neutral tinted glasses are useful in cutting out excessive glare, haze, etc. In some range-finders, the magnification of the eye-piece can be altered so as to obtain the best effect under various atmospheric conditions. Astigmatisers are sometimes used for drawing out a point of light or small object into long lines or bands. Coincidence, which without their use would be almost impossible to effect, can then easily be made. They consist of two negative cylindrical lenses with horizontal axes, one being placed at each end of the range-finder between the pentagonal and the objective.

Range-finders are provided with halving and coincidence adjustment heads, which, when turned slowly, move the optical systems mentioned above. Correct adjustment is of course essential for accurate work.

Accuracy of One-man Range-finders.—The accuracy of the range-finder, other things being the same, depends upon its base length and magnification; but there are limits to the magnification which can be conveniently used. It is usually between 10 diameters (for the smaller range-finders) and 30 (for the largest). Under good conditions, two images can be aligned across a fine separating line, with an error of only a few seconds. There is little doubt that this degree of accuracy can be obtained under the best atmospheric conditions and when the target is stationary, as the mean result of several observations being taken as the range. If, however, the atmospheric conditions are bad and the target is moving rapidly, such accuracy cannot be expected.

The base lengths of range-finders used in the field usually vary between half a metre and two metres. The Barr and Stroud range-finder with a base of one metre, which is used for field artillery by the British and other armies, is typical.

German field coincidence range-finders, such as the Zeiss and Goerz, are used in a similar way to the Barr and Stroud, although their construction differs materially in details. Many of these were introduced to avoid infringements of earlier patents. The chief features of Zeiss coincidence range-finders are that they have only one eye-piece in which are seen a small rectangular inverted field in the centre of a large erect field and on the left of these a range scale. Coincidence is effected by revolving a working head which rotates two wedge-shaped prisms in opposite directions.

Stereoscopic Range-finders.—The principle of the stereoscopic range-finder is entirely different. Stereoscopic range-finders have not found much favour in the British services; but they have been extensively used by the Germans. Speaking generally, a stereoscopic range-finder contains the elements of a stereoscopic telescope rigidly mounted in a tube. It is very similar in outward appearance to a coincidence range-finder with two eye-pieces. Objects viewed through a stereoscopic range-finder are seen to stand out in stereoscopic relief; and it is comparatively easy for the observer to judge their relative distances. The actual distance of a target is obtained with the assistance of one or more marks which are seen in stereoscopic relief in the field of view. By means of suitable optical arrangements the stereoscopic relief of either the objects in the field of view or of the mark can be varied until the target and mark appear to the observer to be the same distance away from him. The range of the target can then be read off a range-scale attached. The mark which is seen in stereoscopic relief, really consists of two similar marks which are photographed on glass diaphragms mounted in front of the eye-pieces of the range-finder. If the two marks are on the optical axes of the two halves of the range-finder, they will appear to the observer as one mark at an infinite distance. If the two marks on the diaphragms are made to approach one another, the resulting single mark will appear to come towards

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the observer. In the later stereoscopic range-finders, marks in the eye-pieces are adjusted so as to appear to be at a fixed distance when seen stereoscopically. The view containing the target appears to approach or recede from the observer when the working head is turned; and the range is read off from an external range scale or drum.

Stereoscopic range-finders suffer from the disadvantages that very few people are able to see stereoscopically with sufficient exactness to obtain good results and the degree of accuracy obtained by a range-taker appears to vary from time to time. Under the same atmospheric conditions, stereoscopic range-finders do not appear to give such good results as coincidence ones. Owing to the marks on the diaphragms in the eye-pieces being more distinct than the image of the target, there is difficulty in deciding when they are at the same apparent distance. On the other hand, owing to both eyes being used, the target should be seen more distinctly than through a coincidence range-finder. Ranges of targets with the sky as a background, *e.g.* aircraft, masts of ships, and trees on a crest line, are comparatively easy to take with a stereoscopic range-finder; but those of comparatively indistinct objects, objects with near backgrounds and objects in a shadow, *e.g.* a gun under a tree, are very much more difficult to take.

Directors.—The director is an instrument employed chiefly for the measurement of azimuth angles and angles of sight. There are numerous patterns of these instruments. Some are of simple form; while others are complicated and are provided with quick and slow motion movements for their azimuth and altitude movements and for laying on a gun or target without the setting of their azimuth scales being altered. Some are used as directors pure and simple, whilst others are provided with powerful telescopes for observing fire. British directors are graduated in degrees and minutes, whereas those of nearly all other powers are graduated in millièmes. Instruments graduated in millièmes can be made much more compact than those graduated in degrees and minutes, as the main azimuth plate has only 64 divisions instead of 360. The azimuth scales of some German directors are graduated in 16ths of a degree and 16ths of a degree are also sometimes used for angle-of-sight scales.

The German director for field artillery is a good example of modern types of this instrument. Powerful telescopes like the stereoscopic or scissors telescope are often provided with fittings which enable them to be used as directors as well as for observing fire. Azimuth angles can be measured by means of an azimuth scale, and angles of sight by means of a small bubble and scale. In one pattern of German stereoscopic telescope, the angle of sight is measured by means of a device which is compactly placed between the two arms of the telescope, above its elevating gear.

The Field Plotter is an instrument used for obtaining the gun range when the range-finder is not near the gun. It consists of two similar nickel-plated steel plates, having azimuth scales and a scale of yards (upon which the distance of the gun from the range-finder can be set) engraved upon them, and two range arms which are pivoted at the centres of the azimuth scales and connected by means of a slider. The two plates are slid along one another until the distance between the gun and the range-finder is opposite the reader. The slider is then moved until an arrow upon it reads on the arm the distance from the range-finder to the target. The arm is then moved until another arrow reads the angle, recorded by the director, between the target and the gun. The plotter is then turned over, and the range from the gun to the target and the angle at the gun between the target and the director are read off. When fire has been opened, it is necessary to observe the results, so that corrections for both range and direction may be made. Also if time fuzes are used, the angular height above the target at which they burst the shell must be observed and corrected if necessary. Various instruments, *e.g.* graticuled binoculars, stereoscopic telescopes and periscopes, are used for this purpose.

The binoculars used in the British service are of the prismatic type having a magnification of six diameters and are fitted with a glass diaphragm in front of the right eye-piece on which are engraved the vertical lines ½° apart; their heights above the horizontal line being alternately ½° and 1°. The central line is longer, extending 1½° above, and ½° below the horizontal line. When observing fire, the point of intersection of the centre vertical line with the horizontal line is laid on the target; and, when the burst of the shell is observed, its angular distance to the right or left of the target and above it can be ascertained by noting its position with reference to the lines on the diaphragm. Graticules used by other continental powers vary very much in design and often consist of a very large number of short lines at definite distances from the axis of the telescope.

The stereoscopic or scissors telescope was very largely used in the World War, especially by the Germans. The British pattern has a magnification of 10 diameters and a field of view of 4°. The two arms can be used either vertically for observation from below cover, or in line with one another for observation from behind vertical cover.

For Coast Defence

Coast defence range-finding instruments are usually either range-finders or position-finders. A range-finder measures ranges *from itself* to the target and may also record the bearing of the target. A position-finder measures ranges and bearings to the target *from the point for which it has been adjusted.* This would usually be a gun which may be many hundred yards away from the position-finder. The position-finder sometimes also records the range and bearing of the target from its own position. Coast defence range-finding instruments may be divided into classes, depending upon the nature of their bases, as follows:—

1. Depression instruments, having vertical bases (either range-finders or position-finders) the accuracy of which depends upon their height above the sea-level. They measure ranges with equal accuracy in all directions; and, if sufficient height is available, they are most reliable instruments. It is usually considered that, to obtain ranges with an error not exceeding 1%, 100 ft. of height is required for every 5,000 yd. of range. All that the range-taker has to do is to keep a cross wire in the telescope of his instrument laid on the water line of the target.

2. Instruments having a fixed horizontal base (usually position-finders). Each usually consists of two instruments installed at the ends of a base which may be several thousand yards in length, the length required depending upon the range and arc of fire of the gun for which the instrument has been installed. The instrument at one end of the base is known as a transmitter and usually consists of a telescope mounted above an azimuth circle. It measures the bearing of the target and transmits it to the instrument at the other end of the base which is known as the receiving instrument. The bearings may be transmitted by telephone; or, as the telescope is traversed, electric impulses may cause some portion of the receiving instrument, *e.g.* a metal arm or a dial, to move automatically. The receiving instrument is usually an accurate, solidly constructed plotter, made to a certain scale, *e.g.* 500 yd. to an inch. In its simplest form it would consist of a base plate upon which two straight arms were pivoted, the relative positions of the pivots being, to the scale of the instrument, the same as those of the transmitter and receiving instrument. The first arm would be kept set to the azimuth angles received from the transmitter, and the second arm would be kept in line with the target by means of a telescope attached to it. The point where the two arms intersect would represent the relative position of the target. The arms being graduated in ranges and moving over azimuth scales, the range and bearing of the target from either end of the base could be read off. By means of a third arm, pivoted to the base plate in the position representing the position of the gun, the range and bearing of the target from the gun could be ascertained if the arm were brought above or below the point of intersection of the two other arms. Horizontal-base range-finding instruments are often designed to allow of several alternative bases being used, the pivots of the arms in the receiving instrument being set for the base which is most suitable for the conditions prevailing at the time. Thus for very long ranges a very long base would be used; but, if the visibility were bad, a much shorter one might be preferable. Horizontal-base instruments have certain disadvantages. For a definite range, their accuracy varies with the position of the target. It is greatest when the target is opposite the centre of the base, decreases as the target moves to the right or left, and disappears altogether when the target is in line with the base. It is somewhat difficult for the receiving instrument to indicate to the transmitter the target whose range is to be found. There are difficulties in passing azimuth angles from the transmitter to the receiving instrument. If they are telephoned, delay and errors are involved, and owing to the fact that they may

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alter at greatly varying rates there is usually some uncertainty as to the most suitable intervals in which they should be called out. If they are electrically transmitted, so as to move some part of the receiving instrument, the mechanism must be capable of moving in small steps of, say, one minute, in order to obtain the required accuracy, and at the same time it must be capable of moving quickly through a large angle when getting on to a target.

3. *One-man Range-finders* used for coast defences are constructed on the same general principles as those used in the field; but, as their weight and size must not be limited to the same degree, many modifications to make them as accurate and convenient as possible are introduced. Their base lengths are usually between 9 ft. and 10 metres, but even longer bases have been considered. They are practically always of the coincidence type with both fields erect.

The Mark III Depression Range-finder (fig. 2) will be taken as a type of a depression instrument. In this range-finder the range-finding triangle is reproduced in the instrument on a small scale. Figure 1 shows diagrammatically how this is effected by means of

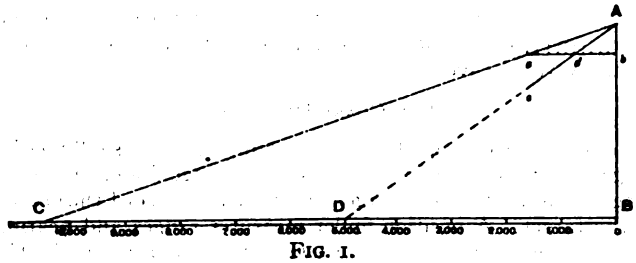

FIG. 1.

two arms. AB represents the height of the axis of the telescope above the surface of the sea BC. Ab represents the distance between the pivot of the telescope arm Ac and the range arm bc, and this to the scale of the instrument, represents the height AB. When the instrument is level, the arm cb is horizontal, and therefore parallel to the

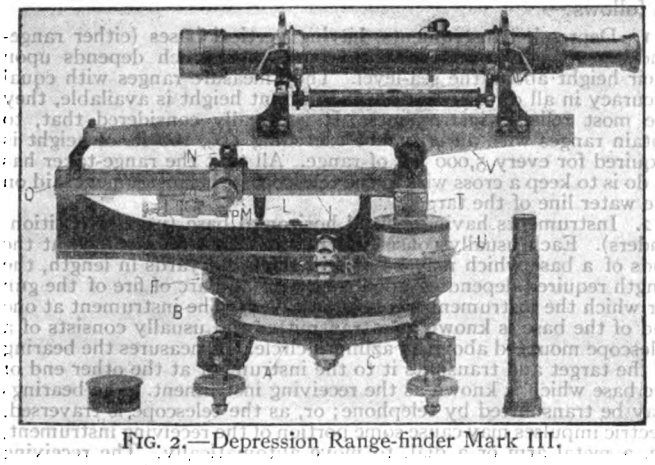

FIG. 2.—Depression Range-finder Mark III.

surface of the sea. cb is subdivided and graduated in equal divisions to the scale of the instrument. Ac, which has a telescope mounted on it, is pivoted at A and can be directed on to the water-line of a target at C. The triangles ABC and Abc are similar, and the length of bc therefore represents to the scale of the instrument, which is 1,000 yd. to an in., the actual range BC. Similarly bd will represent the range BD of a target at D. If the instrument is required for use at any other height than AB, the telescope arm pivot A would be raised to a height above cb corresponding to the new height of the range-finder above the sea. In the foregoing, the surface of the sea has been considered as a plane surface, whereas it is really the surface of a sphere with its centre at the centre of the earth. Allowance for this curvature could be made by making the arm bc the arc of a circle instead of a straight line. It is, however, found to be more convenient to curve the telescope arm Ac in the opposite direction, the effect being the same. Corrections for mean refraction are made in the same way as those for the curvature of the earth, but in the opposite direction; the arm Ac being curved to allow for the combined effect of curvature and refraction.

The Small German Position-finder may be taken as a typical position-finder. It was used during the World War for coast artillery on low sites. Very much larger instruments based on the same general principles were also used. Air communication was by telephone. Other nations often use automatic electrical transmission for moving parts of the receiving instrument when the transmitter telescope is traversed, and for actuating range and bearing dials on the gun mountings when the gun arm is traversed.

The Barr and Stroud Range-finder having a base-length of 30 ft. is typical of the one-man range-finder used for coast defences.

None of the range-finders or position-finders mentioned above is of any use if it cannot see the target; the position of a moving target can then only be ascertained by aerial observation.

Naval Range-finders, which must necessarily be of comparatively small size, are nearly always of the one-man type. They are generally similar to those used in coast defences, but in order to obtain better illumination their optical parts are often made larger. Their mountings are designed to enable the range-finders being kept on the target in a sea way. They are nearly always of the coincidence type with both images erect; but some stereoscopic range-finders have been used by the Germans. It is thought by some that a range can be more rapidly taken from a ship having considerable motion with a stereoscopic range-finder than with a coincidence range-finder; as with the latter it is difficult to keep the separating line across the target. The coincidence range-finder will, however, give more accurate results. Range-finders with a base-length of 10 metres are the largest which can conveniently be used on board ship. Base lengths vary with the size of the ships on which the range-finders are employed and the uses for which they are intended; one of less than a metre being employed for navigational purposes. Anti-aircraft range and height-finders used on ships must be provided with some form of pendulum to keep certain of the parts horizontal, as the mountings cannot be kept level. Certain small range-finders have been made which can measure the range to a ship if the height of its mast or funnel is known. This height is used as the base of the range-finding triangle, the angle of parallax being measured by the instrument and read off it as a range. Such a base is obviously longer than that of a range-finder which could be carried on a ship. This type, however, has not been generally adopted.

For Air Defence

Range-finders and height-finders used in connexion with anti-aircraft guns have a much more difficult task to perform than the range-finding instruments used in the field or in coast defences. In the latter cases the target, if it moves at all, will move in one plane only and its speed will not approach that of aircraft. As the result of experience, the range of an aerial target which may alter by several thousands of yards in a minute is not taken into account; but its height, which will not vary to the same extent, is used as the basis of laying δ and is measured by a height-finder. The rate of burning of the fuze has also to be considered, as it will not be the same for a definite range if the target is at different heights.

When laying a gun on aircraft, the setting of the sight is therefore based on the height and angle of sight of the target and on the setting of the fuze. At the beginning of the World War, no height-finders were available, so existing one-man range-finders, *e.g.* the Barr and Stroud, were used, and long base height-finders which could be rapidly made were introduced.

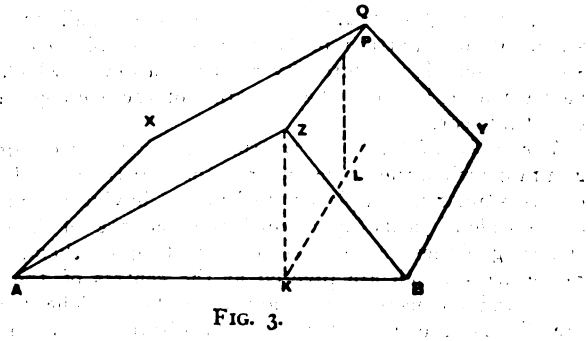

FIG. 3.

One-man range-finders were usually of two metres base length, and coincidences were made on the target in the usual way. In order to convert the ranges into heights, a slide-rule attached to the range-finder was employed. One scale of this slide-rule was automatically set to the angle of sight of the target, by means of a cam, as the elevation of the range-finder was altered. The other scale was set to the range recorded by the range-finder, and the height of the target could then be read off.

Long base height-finders usually consist of two instruments at the ends of a base about a mile in length. Sighting planes in these instruments are kept laid on the target; the triangle formed by the intersection of a vertical plane with three planes, one of which is a horizontal plane passing through the base and the other two are extensions of the sighting planes, is mechanically solved; and the height of the point where the two planes of sight intersect (*i.e.* the height of the target above the base) is plotted at the same time.

The principle of this method is shown in fig. 3. AX and BY are two horizontal lines, parallel to each other. The sighting planes of

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the instrument would be attached to axles whose axes were on any parts of AX and BY. AXQZ and BYQZ represent planes of which the sighting planes form small parts. It is obvious that QZ is horizontal, and that ZK, PL or any vertical line between QZ and the horizontal line KL (which is parallel to the axes of the sighting planes) represents the height of an aircraft in the line ZQ, say at P. In the simplest form of height-finder, the plotting is done on a board fixed beneath B, the triangle AZB being reproduced there on a small scale and upside down. A straight edge is attached to the sighting frame at B and consequently moved round B in front of the board as the elevation of the frame is altered. Another straight edge is pivoted on the right of B at a distance from it which represents AB to the scale of the instrument. It is kept set to the altitude angle which is measured at A and telephoned to B. The point where the two straight edges intersect consequently represents the point Z. Upon the board below B, a series of horizontal lines are marked, their distance from a zero line passing through the pivots of the straight edges representing heights above the ground, to the scale of the instrument. The height of the target can therefore be ascertained by noting against which of the horizontal lines on the board the intersection of the two straight edges comes. Such height-finders have serious disadvantages, the principal one being the difficulty in getting the two instruments on to the same target.

Height- and Range-finder.—Towards the end of the war Messrs. Barr and Stroud produced a most ingenious instrument which recorded both the height and range of aircraft, and which was at once adopted by the British Government.

It is used in a similar manner to an ordinary one-man range-finder, and the observer has only to keep the aircraft in the field of view and make coincidences. As will be explained later, if the height of the aircraft remains constant the coincidence will not alter as the range alters. The field of view is so arranged that the rays of light entering by the left window of the instrument form an erect image over the whole field, with the exception of a narrow central horizontal strip in which an inverted image is formed by the rays entering by the right window. The lower separating line is the one on which coincidences are made. The advantage of this "strip" system is that it is considerably easier to keep the aircraft in the field of view than if the field were divided into two equal parts, one of them being inverted. As in field instruments, the inversion of the image in the field above the separating line is found to facilitate making accurate coincidences.

The eye-piece of the range-finder is placed at right angles to the plane of triangulation, so that if the angle of sight to the target is 60° the observer looks down at an angle of 30°. It is provided with two lens combinations on a rotatable cap which give magnifications of 15 and 25 diameters, and also with light filters for varying atmospheric conditions. There is a window above and to the left of the eye-piece, through which the usual ivory range scale can be seen.

In a small casing on the top of the range-finder there is a most ingenious mechanism which converts ranges into the heights corresponding to them as the angle of sight varies. The ranges and heights can be read through two windows in close proximity to one another. This mechanism actually solves the trigonometrical formula $r \sin \alpha = h$; where r is the range of the target, α the angle of sight to it, and h its height. This formula may be written as: $\log r + \log \sin \alpha = \log h$; and it is mechanically solved as follows:—a differential gear is employed, the upper member of which is rotated in accordance with a logarithmic sine scale of angles of sight, and the lower member is rotated in accordance with a logarithmic scale of ranges, the jockey wheel accordingly revolving around the axis of the differential with a motion corresponding to a logarithmic scale of heights. It will be noted that the angle of elevation and the range are known, or rather are determined by the instrument, so that the duty of the gears is to convert the angle and range scales to logarithmic form and then to add them together by means of the differential gear as explained above. The conversion of the reciprocal range scale motion of the range-finder deflecting prism gear into logarithmic range scale motion, and the angular motion, of the range-finder in elevation into motion corresponding to a logarithmic scale of sines, is done in each case by means of toothed spiral gears.

The gearing is connected through three couplings to the working head, the elevation gear and the deflecting prism gear respectively. By means of suitable gearing the jockey wheel of the differential is driven from the working head, the upper member by the elevation gear, and the lower member by the deflecting prism gear. The range scale is connected to the lower member, and the height scale to a level wheel carrying the jockey wheel.

The advantage of arranging the working head to operate the jockey wheel is that in the frequent case of aircraft flying at a constant height the images in the field of view, when once set, can be kept in coincidence by simply elevating the instrument so as to keep the target in the centre of the field, without any rotation of the working head. The movement of the instrument in elevation automatically controls the position of the deflecting prism, the height scale remaining unaltered so long as the working head is not rotated. When the target rises or falls, the images will move out of coincidence and must be brought back into alignment by rotating the working head, thus altering the reading of the height scale by the appropriate amount. The working head and elevating gear may, of course, be worked at one time, in which case the combined effect of the spiral gears and the differential is that the two scales always read correctly as long as the coincidence is maintained.

The instrument has a base length of two metres, and is carried in the mounting forks in two eccentric bearing rings, the object of the eccentricity being to balance the weight of the height-scale gear box as the instrument is rotated in elevation. The elevating gear with a handwheel on the left of the observer, is of the worm-wheel type. The handwheel is provided with a two-speed clutch; the speed being changed by merely pressing in or releasing, with the palm of the hand, a small lever connected with the hand grip.

The azimuth training gear is also of the worm and worm-wheel type and has a two-speed clutch. Its handwheel is on the right of the eye-piece, and in a convenient position for the man who, looking through a small prismatic telescope near the right-hand end of the instrument, keeps it laid for direction on the target.

The worm wheels for movements in both azimuth and altitude are mounted on friction slip-bearings, so that the instrument can be rapidly moved and the target brought into its field of view. An elevating lever is fitted near the left-hand end of the instrument to allow of rapid elevation. An adjustable azimuth scale and reader are provided; and a means of levelling the upper part of the mounting. Before using the instrument, its correct levelling must be attended to and checked by means of two bubbles attached to the upper part of the mounting. The lower part of the mounting is a very rigidly constructed tripod with pointed feet having discs to prevent their sinking into soft ground.

Three operators are required for working the instrument, viz.: (1) The observer who makes "coincidences" by turning the working head on the top of the instrument with his right hand, and who also keeps the separating line on the target by turning the elevation handwheel with his left hand. (2) The operator for line who, looking through the prismatic sighting telescope, traverses the instrument with the handwheel and keeps the cross line in his telescope accurately laid for line on the target; and (3) the scale reader, who, standing in front of the instrument, reads heights off the height scale; and, if required, also reads the range and angle of sight scales.

In anti-aircraft gunnery, where the target may move at a speed of two or more miles a minute, there is great difficulty in ascertaining what deflections are required to compensate for the travel of the target during the time of flight of the projectile. There is not only the lateral deflection to be considered, as with a ship moving in one plane; but also a vertical one. It is obvious that if an aircraft is flying at a constant height, the angle of sight to it from the gun will not remain constant. Vertical deflection equal to the alteration of the angle of sight during the time of flight of the projectile must therefore be allowed for. Another difficulty arises in connexion with the setting of the fuze. The fuze will not burn at the same rate if the projectile is fixed at different angles of sight, owing to the variation of atmospheric pressures at different heights. To help to overcome these difficulties a most ingenious apparatus was brought out during the war by Messrs. Brocq of Paris, and was adopted by most of the Allied Powers.

The general principle of the instrument is as follows:—The height of the target must first be measured by a height-finder and set on the instrument. Two operators, who face one another, follow the target, looking through two telescopes which are rigidly connected. One keeps a vertical cross line in his telescope in line with the target by turning a traversing handle; and the other keeps a horizontal cross line in line, by turning an elevating handle. Connected with the traversing and elevating handles are the armatures of two magnetos which, when turned, generate electric currents, the voltages of the currents depending upon the speed at which they are turned. These currents are transmitted to two special voltmeters (attached to the gun mountings near the layers) from which the lateral and vertical deflections required can be read off, and then applied to the sights. On their way to the voltmeters the currents pass through rheostats which modify them in such a way that the deflections recorded are correct for the time of burning of the fuze. The exact length of fuze required to burst the shell at the target can also be read off another part of the instrument.

The general arrangement of the apparatus is shown diagrammatically in fig. 4. It consists of three main parts, viz.:—

1. The double telescope, which consists of a metal drum upon which are mounted, on the same spindle, the two right-angle telescopes referred to above. The traversing and elevation handles are placed conveniently for the two operators. Each has a quick and slow motion (four to one), the alteration from one to the other being effected by pushing in or putting out the handle. When a quick release knot at the top of the instrument is pressed down, the gears are put out of action, and the telescope can be quickly moved until the target is in their fields of view. Angles of sight and bearings can be read off conveniently placed scales, if required. When the handles are turned, the currents generated by the magnetos pass along

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cables to the "fuze indicator and time rheostat" and thence to the "deflection voltmeters."

As the body of the "double telescope" traverses about a vertical axis, but laying is done in the plane of sight, it is necessary to multiply the angular velocity of the body of the instrument by the cosine of the angle of sight in order to obtain the angular velocity of the target. This is effected electrically by passing the current from the lateral magneto through a rheostat, whose resistance is varied by a rubbing contact passing along it, as the telescopes are elevated or depressed.

Another rheostat and an accumulator (connected to the fuze indicator and time rheostat) cause an angle of sight needle in the fuze indicating voltmeter to move to the same angle of sight as that of the telescopes; this needle is controlled by another circuit.

2. The fuze indicator and time rheostat consist mainly of the time rheostat, a fuze indicating voltmeter, a microphone and an external accumulator of three cells.

As explained above, the currents generated by the magnetos pass through rheostats on their way to the deflection voltmeters. These rheostats are situated beneath the time adjusting dial, and their resistance is altered as the dial is turned. The setting of the dial is dependent upon the height of the aircraft and the setting of the fuze, and is effected as follows:—A graduated height arm is moved by means of a milled head until it reads the height obtained from a height-finder. On its right-hand upper edge is a reader for reading the fuze curves on the time adjusting dial. The latter is turned until the reader of the height arm is on the fuze curve representing the length at which the fuzes have been set.

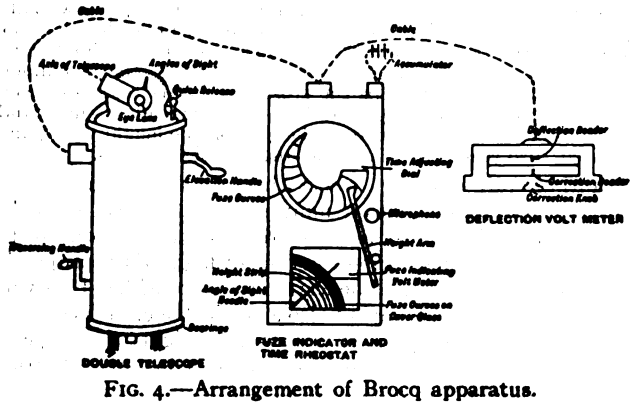

FIG. 4.—Arrangement of Brocq apparatus.

The angle of sight needle in the fuze indicating voltmeter is controlled by two circuits, viz.: that referred to in (1) which tends to set it at the angle of sight of the telescopes, and another in which are the vertical magneto armature in the double telescope, the rheostat beneath the time adjusting dial and another rheostat which automatically adds eight seconds to the time of flight. This eight seconds is an allowance for the time taken to set the fuze, load, lay and fire the gun. The angle of sight needle therefore makes with its zero or horizontal line an angle equal to the angle of sight to the predicted position of the target at which the shell will burst. When the height arm is moved, a height strip inside the fuze indicating voltmeter is also moved. Its height above the zero line of the angle-of-sight needle represents, to the scale of the instrument, the height of the target. The intersection of the needle and strip therefore represents the position of the target at the moment of the shell burst. Fuze curves are marked on the glass cover of the voltmeter, and the curve which is nearest to the intersection of the needle and strip will indicate the length at which fuzes are to be set. This fuze length is called down the microphone to the fuze setters, and is transmitted to the sight setter by the man taking up the shell.

3. The deflection voltmeters are of the dead-brat type and read to 10° on either side of zero. Two are provided for each gun; one for lateral and the other for vertical deflection. As a rule, two guns can be worked by one Brocq equipment, four deflection voltmeters being provided. The required deflection is read by the upper pointer. Corrections for wind are applied by moving the scale by means of a knob beneath the voltmeter, the amount of correction being indicated on the scale by the lower pointer.

Stereoscopic range-finders were extensively used by the Central Powers for anti-aircraft work. (A. C. W.)

SOUND-RANGING

The method of locating hostile guns by the sound, or sounds, consequent on their discharge was introduced on the British front in France during 1916. It had at that time already been in use in the French army for many months. It speedily proved its usefulness, especially in circumstances which rendered other methods of location very difficult or impossible. The system of concealment known as "camouflage" added considerably to the difficulty of finding the position of gun-pits on photographs taken from the air, and, further, these photographs offered no certain method of deciding whether a gun position, once identified, were occupied or no. The locations given by sound-ranging frequently enabled well-concealed positions, which had previously been missed on air photographs, to be detected, and offered a sure index as to whether known positions were active at a given time. Although air photographs always offered valuable confirmation of the sound-ranging locations, and were, when available, consulted with this object in view, the method is, of course, quite independent of such support. It works as well at night, or when, owing to fog, mist, or smoke, the visibility is poor, as on clear days; it can detect batteries so well hidden as to be invisible from the air or on air photographs; it is always ready when once the apparatus has been installed; and a location can be obtained, under favourable conditions, within a minute or two of the arrival of the report of the piece. On the other hand the instalment of the apparatus necessitates the laying of several miles of wire, and involves considerable preliminary labour in other ways; the method will not work during a heavy bombardment; and certain weather conditions, to be discussed later, render locations almost impossible. The difficulty first mentioned will quite possibly be surmounted or diminished; the other two seem, at present, insuperable.

The method has been elaborated to permit the directing of fire on a hostile piece by comparing the record of the sound of discharge of the piece with that of the burst of the shell directed against it. With 12-in. and 9·2-in. howitzers destructive shots have been directed very successfully by sound-ranging.

Principles.—The method generally adopted in the British, French, and American armies is to record the instant of the arrival of the sound made by the hostile piece at certain fixed and carefully surveyed posts, spaced at intervals varying from 1,000 to 2,000 yards. If it be assumed that the sound spreads out from the source with a known velocity, the same in all directions, then a known interval between the arrival of the sound at two fixed posts will determine a curve on which the source must lie. This curve is a hyperbola with the two posts P_1 and P_2 as foci, for the determining condition is that the difference of the radii vectores SP_1, SP_2 be constant. If, in addition, the time of arrival at a third post be known, then the interval between this and the time of arrival at either P_1 or P_2 will fix a second hyperbola on which the source must lie, and so determine the position of the source. In practice three posts are not sufficient, since any uncertainty caused by the recording of a spurious sound at a post would falsify the location. In general six posts are used, which, taken consecutively in pairs, give five lines which should all intersect. Any accidental selection of the record of a spurious sound at one or more of the posts is then at once detected by the non-intersection of the curves. Records of the sound at five, or indeed four, of the posts are generally sufficient for the experienced sound-ranger, even when several guns are being recorded at short intervals, so that the use of six posts allows for the sound not being successfully recorded at one or two of the posts.

Nature of Sounds from High-Velocity Guns.—In the preceding argument it has been assumed that the sound spreads out with uniform velocity in all directions from the source. There is little doubt that this is true, in a still atmosphere of uniform temperature, of the sound of the discharge of the piece. With the modern high-velocity gun, however, a second sound, originating in the motion of the shell through the air, always accompanies the sound of discharge. This second sound is due to a pulse of compression set up by the shell, known as the "shell-wave," or "*onde de choc.*" It is perceived by an observer in front of the gun as a sharp crack, which is followed after an interval depending on the type of gun, the elevation of the gun, and other factors, by the duller, heavier sound of the discharge, or gun-wave. To examine the formation of the shell-wave by the passage of the projectile, consider the resultant disturbance produced by the pulses of compression travelling out with the velocity of sound from every point of the path of the shell. For simplicity take in the first case a projectile travelling horizontally with a uniform velocity greater than that of sound; let G be the position of the gun, S_1, S_2, . . . S_{10} be the positions of the projectile at the end of the 1st, 2nd, . . . 10th second (fig. 5). When the shell is at S_{10} the compression originating at G has travelled out as a spherical shell with G as centre for 10 seconds, that originating at S_1 has travelled out as a spherical shell with S_1 as centre for 9 seconds, and so on. The envelope of all these spheres is a cone with its apex at S_{10}; if the shell be travelling close to the surface of the earth the trace of this cone on the surface is $AS_{10}C$, which represents the pulse of compression under discussion. If the velocity of the shell be considered to decrease with time, as in any actual case, the

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interval of space between centres of successive generating spheres will decrease as the shell travels, and the enveloping cone will be modified (fig. 6). The form of the shell-wave will resemble roughly a paraboloid of revolution, the vertex being at the shell as long as the latter has a velocity exceeding that of sound, and consequently travelling with a velocity greater than that of sound. After the velocity of the shell has dropped below that of sound the shell-wave travels out in all directions with the velocity of sound normal to the surface.

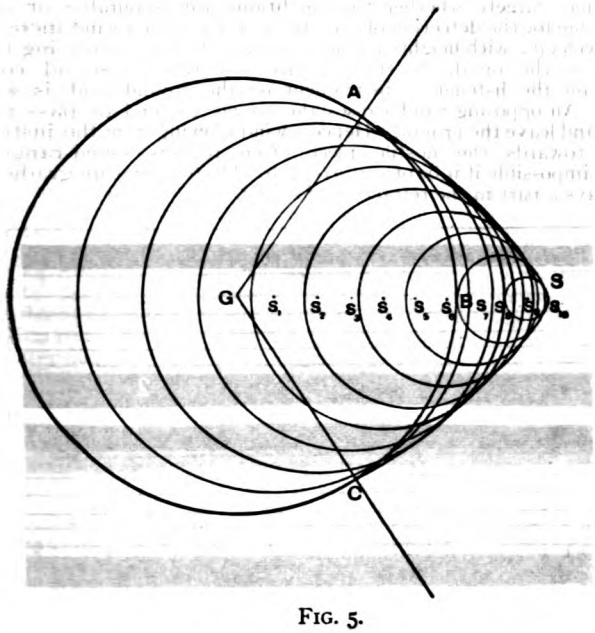

FIG. 5.

The exact form of the shell-wave will depend upon the range table of the gun and the interval since the shell left the gun, and cannot be specified as being any familiar surface. The trace of the wave on the plane of the earth's surface, with which the observer is in general concerned, depends further upon the elevation at which the gun is firing. Since the sphere representing the position of the gun-wave is one of the generating spheres the shell-wave will touch this sphere. In fig. 6 where G is the gun, ABC the trace of the gun-wave on the horizontal plane, ASC the trace of the shell-wave, within the cone represented by AGC both sounds will be heard, outside the cone only the sound of discharge. The interval between the two sounds is

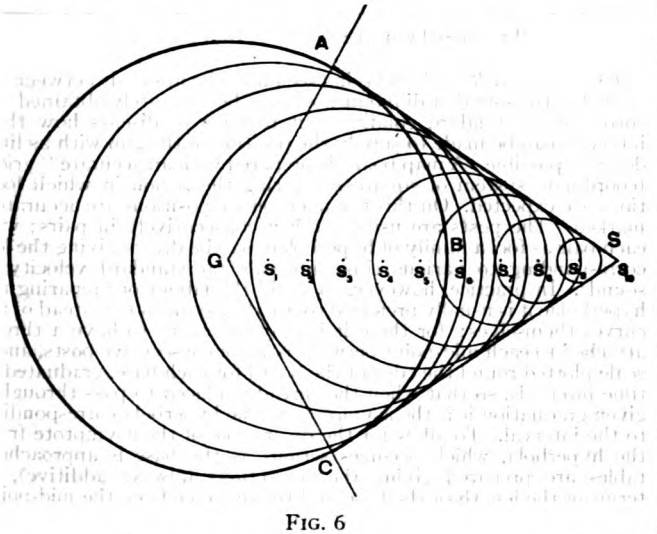

FIG. 6

clearly greatest on the line of fire, decreasing as the observer moves to a flank. As the gun is elevated the interval detected by a listener in a fixed position decreases, the trace of the shell-wave approaching that of the gun-wave. This is illustrated in fig. 7. If the gun be sufficiently elevated no shell-wave is heard by a listener at any position on the ground, though it may be heard in an observation balloon. Thus the double sound has been heard by an observer so situated in the case of a 9·2-in. howitzer, firing with full charge (M.V. 1,500 f.s.), while observers on the ground heard only the single sound.

Owing firstly to the selective sensitiveness of the human ear, and secondly to the fact that the shell-wave is generated well above the surface of the earth, and travels down to the ear without meeting obstacles and without being hindered by refraction effects, the shell-wave alone is usually heard when the hostile piece is distant, and is spoken of as the sound of the piece by the casual listener. Any attempt to take rough bearings on a gun by estimating the direction from which the sound appears to be coming then leads to a very erroneous result, since it is the normal to the shell-wave that is selected. Unless the listener is on the line of fire such a bearing will pass considerably in front of the piece. To calculate the position of a gun from the intervals between the arrival of the shell-wave at different posts requires a knowledge of the exact form of the wave in question at various times of flight, and this presupposes a knowledge of the range table of the gun, and the elevation at which it is firing (given by the approximate range). It is clear that to apply the sound-ranging method to records made by the shell-wave is a matter involving information not always available, and considerable preliminary work on the construction of curves representing shell-waves for different hostile guns firing at various elevations when it is available.

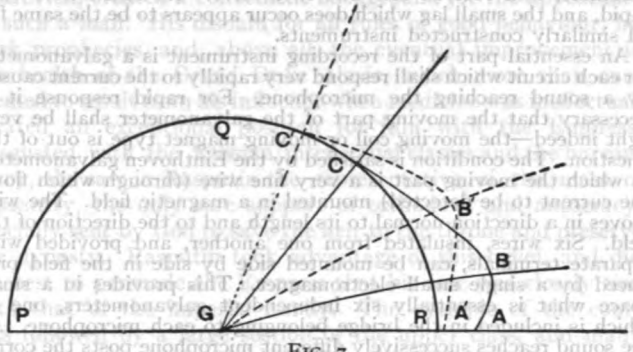

FIG. 7.

In the case of howitzers the horizontal component of the muzzle velocity is less than the velocity of sound in all ordinary cases, so that only one sound, the gun-wave, is heard on the ground.

Instruments.—The instruments comprise: (*a*) detectors, placed at each of the six surveyed posts, which give an electrical response to the arrival of the sound, and (*b*) a recording instrument, placed at a central station and connected by a separate circuit to each detector, which registers the exact time at which each detector responds.

When the method was first tried by the French the detector used was a soldier, who pressed a key when he heard the sound of a hostile piece, the key closing a circuit which actuated a pen on a smoked paper chronograph at a central station. This method

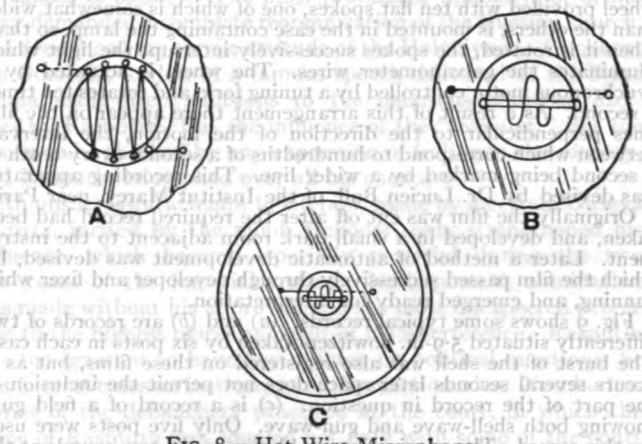

FIG. 8.—Hot-Wire Microphone.

involves inevitable errors due to the personal equation of the observer, and is further invalidated by the fact that, in the case of guns, the observer frequently hears only the shell-wave. The difficulties of working from records of this kind have already been discussed. Later, carbon microphones with large wooden diaphragms were introduced, small cells being included in circuit with the microphone and a primary coil, all at the post; the circuit leading back to the recording instrument included a secondary coil wound on the primary. These microphones suffered from the fact that they had a range of sensitiveness similar to that of the human ear; they responded readily to chance sounds, such as the clatter of equipment, or to shaking, and they registered the shell-wave in preference to the gun-wave. They were superseded (first in the British army, and ultimately in all the Allied armies) by the hot-wire microphone invented by Maj. W. S. Tucker (British patent No. 13123 of 1916,

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and No. 8948 of 1918: see also *Phil. Trans. Roy. Soc.*, A, vol. 221, p. 389). This depends on the principle utilized in the hot-wire anemometer, *i.e.* the change of electrical resistance consequent on the change of temperature of a heated wire which ensues when the air round it is set in motion. A very fine wire of platinum, whose resistance at atmospheric temperature approaches 100 ohms, is mounted in the form of a grid over a circular hole some 7 mm. in diameter (fig. 8). It is provided with terminals. It is included in one arm of a Wheatstone bridge, and sufficient current passed through the network to heat the wire to a dull red. The bridge is balanced so that when the air round the wire is undisturbed no current passes through the galvanometer. Motion of the air causes the resistance of the wire to decrease, upsets the balance, and so causes a current to pass through the galvanometer.

The microphone wire is mounted in front of an air container of some 16 litres capacity. Resonance effects in this container may be partly eliminated by small openings made in the wall. The instrument so completed is insensitive to all sounds of speech, musical sounds, traffic, or even rifle fire. It responds readily, however, to gun sounds (which are low frequency disturbances), even when they are inaudible, and records also the shell-wave. Its reaction is very rapid, and the small lag which does occur appears to be the same for all similarly constructed instruments.

An essential part of the recording instrument is a galvanometer for each circuit which shall respond very rapidly to the current caused by a sound reaching the microphone. For rapid response it is necessary that the moving part of the galvanometer shall be very light indeed—the moving coil or moving magnet type is out of the question. The condition is satisfied by the Einthoven galvanometer, in which the moving part is a very fine wire (through which flows the current to be detected) mounted in a magnetic field. The wire moves in a direction normal to its length and to the direction of the field. Six wires, insulated from one another, and provided with separate terminals, can be mounted side by side in the field produced by a single small electromagnet. This provides in a small space what is essentially six independent galvanometers, one of which is included in the bridge belonging to each microphone. As the sound reaches successively different microphone posts the corresponding galvanometer wires move in rapid response.

The instant at which each wire begins to move is registered on a moving photographic film. The camera in which the film runs vertically is furnished with a horizontal slit, a cylindrical lens in front of the slit reducing its effective breadth. Shadows of the perpendicular galvanometer wires, cast by means of an electric lamp and an optical system mounted in the pierced poles of the galvanometer magnet, fall on the slit, and are focussed on the film, appearing there as six points of shadow on a horizontal line of light. As long as the wires are still each point leaves on the running film a straight line; the movement of a wire registers itself as a break in this trace.

If the film ran at a uniform speed measurement on the developed film of the distance between the breaks would give the required time intervals. As this is not the case the following device is adopted: a wheel provided with ten flat spokes, one of which is somewhat wider than the others, is mounted in the case containing the lamp, so that, when it is rotated, the spokes successively interrupt the light which illuminates the galvanometer wires. The wheel is actuated by a synchronous motor controlled by a tuning fork, and rotates ten times a second. As a result of this arrangement there appear on the film lines perpendicular to the direction of the motion, the intervals between which correspond to hundredths of a second, every tenth of a second being marked by a wider line. This recording apparatus was devised by Dr. Lucien Bull, of the Institut Marey, near Paris.

Originally the film was cut off after the required record had been taken, and developed in a small dark room adjacent to the instrument. Later a method of automatic development was devised, by which the film passed successively through developer and fixer while running, and emerged ready for interpretation.

Fig. 9 shows some typical records. (*a*) and (*b*) are records of two differently situated 5·9-in. howitzers taken by six posts in each case. The burst of the shell was also registered on these films, but as it occurs several seconds later space does not permit the inclusion of the part of the record in question. (*c*) is a record of a field gun, showing both shell-wave and gun-wave. Only five posts were used for this record. The varying interval between the two sounds at the different microphones is well shown: at the flank microphone, corresponding to the lowest trace, only one sound is heard. (*d*) is a record of the burst of a British shell on a German position.

Influence of Weather Conditions.—The method in use demands that to every time interval shall correspond an exact distance, a standard velocity of sound being assumed, which corresponds to some standard temperature, and still air. (The velocity of sound does not, of course, vary with the pressure, and the effect of humidity is in general negligible.) Hence the time interval read off from the film has to be corrected for temperature and wind before it is used on the board prepared for location. For the temperature variations which occur in ordinary circumstances the increase of velocity of sound may be taken as proportional to the increase in temperature, so that the temperature correction is easily applied. Simple geometrical considerations show that the correction for wind depends only on the velocity and direction of the wind and the position of the microphone, and not at all on the position of the gun. With given microphone positions a diagram can be prepared which allows the rapid graphical determination of the correction for a known wind.

It has been found by experiment that the temperature and wind which are concerned in these corrections are not those prevailing at ground level, but at a height of between 250 and 500 ft. up.

Owing to the refraction of sound by wind the record of a given sound at ground level is greatly influenced by the variations of wind velocity at different heights above the ground. This wind gradient determines largely whether the conditions are favourable or unfavourable for the detection of sounds. In the case of a wind increasing in velocity with height, a following wind, besides increasing the velocity of the sound, tilts the wave front so that the sound converges on the listener or instrument on the ground, and is well heard. An opposing wind causes the sound to tend to pass upwards and leave the ground. Hence a wind blowing from the instruments towards the hostile piece often renders sound-ranging almost impossible if it be of any strength. The temperature gradient also plays a part in the refraction of sound.

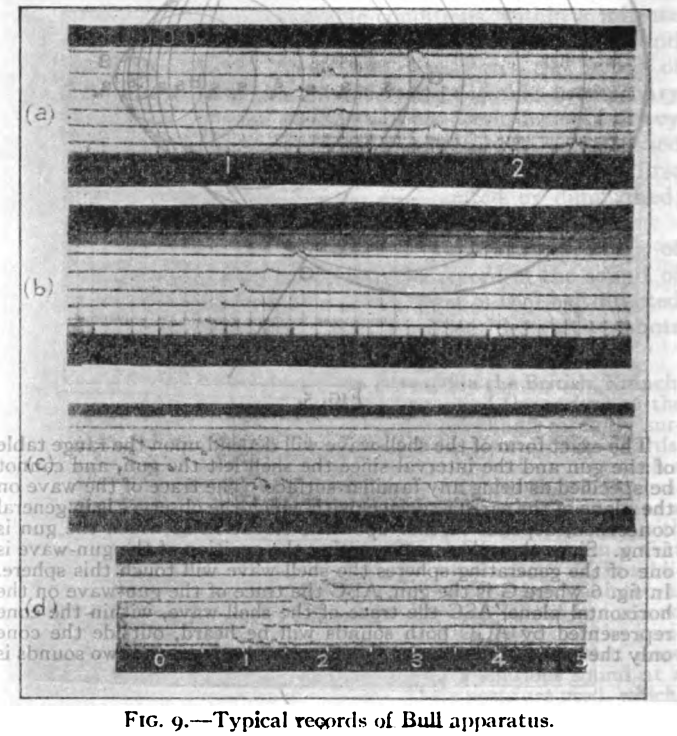

FIG. 9.—Typical records of Bull apparatus.

Location from Record.—Having seen how the intervals between the arrival of the sound at different posts can be accurately obtained and corrected to standard conditions it remains to discuss how these intervals can be made to supply the position of the gun with as little delay as possible. A map board is prepared with an accurate "grid" (coördinate system of squares) covering the region in which locations are expected. On this the microphone positions are accurately marked. The posts are usually taken consecutively in pairs; with each pair as foci a family of hyperbolae may be drawn giving the loci corresponding to various time intervals (at standard velocity of sound). In practice, however, to avoid the labour of preparing the hyperbolae it is usually preferred to use the asymptotes instead of the curves themselves: for these it is only necessary to have a thread attached to each mid-point between pairs of consecutive posts, and a scale plotted round the edge of the board for each base, graduated in time intervals, so that when the thread is placed to pass through a given graduation it is the asymptote to the hyperbola corresponding to the interval. To allow for the divergence of the asymptote from the hyperbola, which becomes serious as the base is approached, tables are prepared giving the corrections (always additive), in terms of the length of the base and the distance from the mid-point of the base, to be applied to the time intervals obtained from the record. The asymptote corrections having been applied to the various intervals, already corrected for temperature and wind, the asymptote corresponding is laid out for each base. The various lines should all intersect at a point: in general they do not, but form a small polygon from which the position of the gun can be estimated.

Estimation of Calibre.—The position of the hostile burst may be obtained from the record of its sound in the same way as the position of the piece, and the interval between the departure and burst of the shell, *i.e.* the time of flight, can be computed from the record on one microphone. Thus the record gives the time of flight corresponding to a given range, which affords an indication of the calibre of the piece. In the case of guns, as distinct from howitzers, a further indi-

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cation can be obtained from the interval between shell-wave and gun-wave at the different posts.

Work in the Field.—It is not feasible to have the film running continuously during any period when records are expected. It should be started a second or two before the sound reaches the first microphone. In the field this is effected by having two forward observers in front of the line of microphones, so placed, one to each flank, that either the one or the other of them must hear the sound of the hostile piece a few seconds before it reaches any of the microphones. These observers are provided with keys, the depression of which starts the film running. They also report by telephone informations judged useful as to the estimated calibre, the approximate location of the burst, if seen, and so on.

The line of microphones in general covers a front of some 8,000 yd. and is some 2,000 yd. or more from the front line. It is usually preferred to place the instruments at approximately equal intervals on a smooth curve, which may be a straight line, or the arc of a circle either convex or concave towards the enemy, according as guns well to a flank have to be located, or attention is concentrated on a more central group of guns. Such arrangements lead to greater ease of identification of a record than is possible if the microphones are very irregularly placed.

The microphones may be placed anywhere where the hearing is good: the only obstacles which seem to cast sufficient sound shadow to affect them are high hills just in front of them. They may be put in shallow depressions dug for them, and should be protected from splinters, and also from wind and draughts. Canvas and hurdles may be used for this latter purpose without appreciably affecting the sensitiveness of the instruments.

Ranging on Hostile Pieces.—A heavy burst near a hostile gun position will furnish a sound record of its position just as does the gun itself. Fire may be directed on a piece which is in action by comparing the records which it supplies with those of the bursts of one's own answering shell. Since both gun and burst are located by the same method all uncertainties introduced in an ordinary location by ignorance of the precise atmospheric conditions are eliminated.

A differential method is adopted, the difference of times of arrival of the sound of the hostile gun and of the friendly burst at each microphone being plotted as ordinates against a certain simple function of the relative positions of the microphones and the hostile gun as abscissae. A horizontal line then corresponds to a direct hit; a straight line sloping to left or to right to an error of line to one side or the other; a curve (approximately an elliptical arc) convex or concave downwards to an error of range. The magnitude of the corrections necessary is easily estimated from curves previously prepared. (E. N. DA C. A.)

RANGER, HENRY WARD (1858–1916), American painter (*see* 22.891), died in New York City Nov. 7 1916.

RASPUTIN, GREGORY EFIMOVITCH (1871–1916), Russian monk and court favourite, was born in 1871 in the village of Pokrovskoe, near Tyumen, in the province of Tobolsk, Siberia. He was the son of a poor peasant whose disorderly behaviour resulted in his being given the name of Rasputin, meaning "debauchee." He received no education, and till the end of his life was unable to write properly. He spent the first part of his life till the age of 33 in his native village; he married in 1895 a well-to-do girl, Olga Chanigoff, and they had two daughters and a son. In 1904 Rasputin resolved to change his mode of living. He left his family and devoted himself to religious exercises, declaring to his people that he was inspired by God. His passionate nature, his great physical strength, and the superstitious atmosphere in which he had been brought up, gave an unexpected direction to his religious exaltation. He adopted the views of the sect known under the name of "Khlysty," the leading idea of whose teaching was that salvation could be achieved only by repentance.

"Sin in order that you may obtain forgiveness"—was the practical rule which he drew from this doctrine. "A particle of the Supreme Being is incarnated in me"—he told his hearers. "Only through me you can hope to be saved; and the manner of your salvation is this: you must be united with me in soul and body. The virtue that goes out from me is the source of light, the destruction of sin" (E. J. Dillon, *The Eclipse of Russia*). This extravagant and dangerous teaching, which resulted in practice in the most wild orgies, not only created for Rasputin immense popularity and the reputation of a holy man among his fellow-peasants, but opened before him the doors of some of the most fashionable Russian houses and even those of the Imperial Palace. Looking for new experiences Rasputin left his native village, and made long pilgrimages to various holy places, and even went to Mount Athos and Jerusalem. He spent some time in different monasteries and applied himself to the study of holy books, but his lack of elementary education reduced the results of his labours almost to nothing. He only retained by heart some incomprehensible passages, and often used them in his prophecies. He had, however, a strong magnetic power, the influence of which was recognized by his bitterest opponents.

In 1907, during a stay in St. Petersburg, Rasputin was introduced to the Archimandrite Feofan, rector of the Theological Academy and confessor to the Empress, who took an interest in the story of his conversion. The Archimandrite, with the assistance of the Grand Duchesses Militza and Anastasia, presented Rasputin at court, and he produced a deep impression on the Empress and Emperor. The mystic atmosphere which always prevailed at the Russian court, and which was especially strengthened by the disasters of the Japanese War, the internal troubles in 1905, and the constant fear for the health of the Tsarevich, created a convenient background for the appearance of such a man. His disdain for all rules of good behaviour, his dark prophecies, and, above all, the eventual improvement in the health of the Grand Duke Alexis, which more than once seemed to result from his influence when medicine was ineffectual, created an exceptional position for him with the Empress. Disgusted with the Russian intellectual classes and the bureaucracy, she saw in Rasputin the representative of the mass of peasantry, the only sure support of orthodoxy and autocracy, specially sent by God to save the heir to the throne and preserve the dynasty. Rasputin took advantage of this belief, and did his best to persuade the Empress that his fate was closely tied with that of the imperial family. The example of the court was followed by a large section of the upper class, and many doors were opened for the "Saviour," as the Empress used to call him. For some time Rasputin was satisfied by this side of his social success, and at first he did not interfere in politics. But his activity was felt in church questions. His friendship with the famous monk, Heliodor, and the Bishop of Saratov, Hermogen, which resulted in a complete rupture between them and in a series of scandals, had a painful echo in the country. The appointment of Varnava, an illiterate peasant and a friend of Rasputin, to be Bishop of Tobolsk in 1911, and the extraordinary servility with which the Holy Synod followed the wishes of the favourite, provoked a strong opposition among all classes of society. The most prominent upholders of orthodoxy demanded a complete reorganization of the Russian church, and denounced the servile attitude of the Holy Synod. Guchkov, the Octobrist leader, in a famous speech delivered at the State Duma, made direct allusions to the nefarious influence exercised by Rasputin. But the influence of the "Saviour" was too strong to be checked by any expression of feeling in the country, and Rasputin triumphed over all his enemies.

An unsuccessful attempt to kill him, made by a certain Guseva in 1914, incited by the monk Heliodor, only strengthened his influence, which became especially powerful during the two last years of the imperial regime. No important nomination was made without his approval, and the most unexpected people rose to the highest offices as result of his interference. Rasputin was too ignorant to have any opinion on political questions: he was in most cases an instrument of the reactionaries. Numberless stories of the debauchery practised at the court, in which the name of Rasputin was coupled not only with some of the court ladies but even with that of the Empress herself, became a common topic of conversation in all classes of Russian society. At length a supreme effort to free the Empire and the dynasty from his influence was made by a small group of men of the highest social position, which included the Grand Duke Dimitri Pavlovich, Prince Yussupoff and M. Purichkevich. Rasputin was invited to a supper at the Yussupoff Palace on Dec. 15 1916, and shot dead, after an attempt at poisoning him with a strong dose of cyanide potassium mixed with wine had not produced the desired effect. His body was thrown under the ice of a canal. The death of Rasputin was a terrible shock to the Empress; she transferred his body to the park of Tsarskoye Selo, where a special chapel was erected, and came every night to

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pray on his grave. The Grand Duke Dimitri Pavlovich was sent to Persia to join a fighting column. Yussupoff was ordered to leave Petrograd, and interned in his estate. Purichkevich, protected by his immense popularity in the army and by his title of member of the Duma, returned to his work on the front.

(P. Vi.)

RATHENAU, WALTER (1867–), German industrialist and political economist, president of the Allgemeine Elektricitäts-Gesellschaft, was born Sept. 29 1867 in Berlin. He came into prominence in Aug. 1914 as the founder and director of organizations for providing raw materials, during the World War, for Prussia and the German Empire. On the formation of the Wirth ministry in May 1921 he was appointed Minister of Reconstruction, and in that capacity negotiated with the French minister, Loucheur, a convention for supplying German materials for the restoration of the devastated area in France, and thus paying in kind part of the reparation which the German Reich had undertaken to pay in gold. Rathenau published various books, pamphlets and articles, on social and economic questions, some of which attracted world-wide attention, especially his *Von kommenden Dingen* (1920). In Jan. 1922 he became Foreign Minister in the Wirth Ministry.

RATHMORE, DAVID ROBERT PLUNKET, 1ST BARON (1838–1919), Irish lawyer and politician, was born Dec. 3 1838, the third son of John, 3rd Baron Plunket (1793–1871). He was educated at Trinity College, Dublin, taking his degree in 1859, and was called to the Irish bar in 1862. He was made Q.C. in 1868, and the same year became legal adviser to the Irish government. In 1870 he stood successfully as Conservative member for Dublin University, holding the seat for twenty-five years. From 1874 to 1877 Plunket was solicitor-general for Ireland, and in 1880 was for a short time paymaster-general. In 1885 he was first commissioner of works in Lord Salisbury's ministry, and resumed this post in 1886, when the Conservative party returned to power, holding it till 1892. In 1895 he was raised to the peerage. He died at Greenore Aug. 22 1919.

RATIONING.—In the articles FOOD SUPPLY and SAVINGS MOVEMENT the general question of food control during the World War is dealt with. During 1914–8 most of the European states, belligerent and neutral, were driven, by shortage of supplies, to ration the consumption of the more important foods, and in some cases of other articles, by the civilian population. "Rationing," of course, is a term of military origin; it denotes the supplying to each member of a fighting force or a beleaguered population of a definite "ration," based upon calculation of his needs, of the supplies available, and of the period for which they must serve. The process of rationing, therefore, has two sides—negative and positive: the negative side of preventing any individual from obtaining, by purchase or otherwise, more than the authorized quantity of the rationed article, and the positive side of making it possible for each individual in fact to obtain that quantity. It is thus a problem both of restriction and of distribution, and the success of any rationing system may be judged even more by the degree to which the positive side is carried out, than by the completeness with which the prohibition upon excessive consumption is enforced.

In this respect the British system of food rationing had for the reasons mentioned below a relatively high measure of success and is therefore described here in some detail. The modified system adopted in the United States is dealt with in a final section. Besides food and feeding stuffs for animals, fuel and light were rationed in the United Kingdom, and both these and many other things, such as clothing, tobacco, matches and housing accommodation, were rationed in various enemy and neutral countries in Europe.

BRITISH FOOD RATIONING

Historical Sketch.—The earliest steps to the introduction of compulsory rationing in Great Britain were taken in relation to sugar. Since the first month of the war sugar had been subject to Government control, under a Royal Commission on the Sugar Supplies, constituted in Aug. 1914. By the end of 1916 the quantity of sugar that could be obtained for the United Kingdom as a whole began to fall far short of the public demand, and in the first part of 1917 this reduced quantity was being distributed on the basis of giving so far as possible to each trader, whether wholesale or retail, 50% of the quantity which he had received in 1915, it then being left to the retailer to divide his supplies as best he could among his customers, subject to a limit of price. This simple system was necessarily very imperfect in action, and grew steadily less satisfactory owing to changes in the distribution of the population. With the development of the munitions campaign new towns sprang up as at Gretna or Birtley; old towns like Coventry or Sheffield or Woolwich doubled or trebled their population or acquired new suburbs; from many country districts and provincial or university towns in the south of England the population ebbed away. Distribution of sugar or any other article of food on the 1915 basis became manifestly inequitable.

During the first half of 1917, while the acute difficulties of the new munition areas were being relieved by temporary palliatives, such as the dispatch of additional supplies after enquiry by inspectors in each case, schemes for recasting the whole system of distribution on the basis of a complete fresh registration of the population were worked out and several alternative schemes were submitted to the War Cabinet in June 1917. The Cabinet adopted one of the alternatives, under which each household was to be invited to register for sugar with a particular retailer, to whom supplies of sugar would be sent in accordance with the numbers and size of the households registered with him, at a specified ration per head, but under which there would be nothing to prevent a retailer from using any surplus sugar in his hands to supply others, or to prevent persons from getting sugar, if they could, in excess of the ration, or from any retailer other than the one with whom their household was registered.

The scheme, while applied in the first instance only to sugar, involved the setting up of extensive administrative machinery, which could thereafter be used both for rationing other foods and for any other local work of the Ministry. This machinery consisted in essence of some 1,800 Food Control Committees appointed by the local authorities, but with their expenditure met from national funds, together with Divisional Food Commissioners appointed directly by the Ministry of Food for the 15 main divisions into which the country was divided, and having the special function of supervising, assisting, and coördinating the work of the committees. Immediately after the presentation of these proposals to the Cabinet (June 1917) the first food controller, Lord Devonport, resigned his office, and the proposals were approved by the Cabinet, subject to their receiving the subsequent assent of his successor, Lord Rhondda. The latter did in fact assent, and proceeded at once with the schemes both for redistribution of sugar and for divisional and local organization. The 1,800 local sanitary authorities in Great Britain were invited by circular (issued Aug. 2 1917) to appoint Food Control Committees, and did so during Aug. and the first part of September. Each committee set up a local "Food Office," usually in one of the municipal buildings, appointed an "Executive Officer," and during Sept. and Oct. issued to each household in the district a sugar card showing the number of persons in the household, and having a counterfoil to be detached and deposited with the retailer from whom the householder proposed to get his sugar. There was thus carried out a complete registration of the population by households in each district. The intention was to bring the distribution of sugar to each district on to the new (population) basis, as opposed to the old (1915 trade) basis as from Jan. 1 1918.

The sugar scheme, however, was never brought into force in the form approved by the Cabinet. In that form it was a distribution not a rationing scheme, was based on households not individuals, and deliberately made no formal provision for transfer of individuals from one household to another, or for persons too migratory to form part of any household. An alternative scheme for rationing by means of individual cards, entitling the holder to a fixed quantity and no more, had been

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submitted to the Cabinet in June 1917 but was rejected, because at that time the Cabinet was not prepared for rationing as such. It seemed doubtful whether the public would submit to compulsory restriction of their food consumption; there was further an objection to giving the enemy the encouragement of seeing Britain apparently driven to extremities by the success of the submarine campaign.

By the end of Sept. it became clear that the public were prepared and anxious for definite rationing, that is to say for a system under which nobody could get more than a certain quantity and everybody could be certain of getting that. In Oct. and the following months accordingly the scheme was entirely revised and provision made for the household sugar cards to be exchanged for individual cards, and for any person who belonged to no household to obtain a document which should be the sole title to sugar supplies.

Another and more drastic change was also contemplated, namely, the substitution of a single centralized register of sugar consumers, that is to say of the whole population, for the 1,800 separate local registers which had resulted from the registration of households under the original scheme. The first steps to the formation of this central register—in the Imperial Institute buildings at South Kensington—were taken in Nov. 1917, and a good deal of preliminary work was done. The change over from local to central registration, however, was only to be made gradually, and was in fact never completed. After the success of the schemes described below—for rationing fats and meat on the basis of local registration (Feb.–April 1918), the idea of making a central register of the population was abandoned. The public, though at times mildly puzzled by the changes of the cards with which they had to deal, remained for the most part unconscious of the successive revolutionary changes in the ideas which dominated the administration of rationing.

The scheme, which had been started as one for the distribution of sugar to households in July 1917, came into force as a scheme of rationing by individuals on Jan. 1 1918 without a hitch. The reserve stocks at the disposal of the Sugar Commission were at that time considerable, and, since sugar is not highly perishable, the Commision had been able to distribute those stocks widely and to provide each retailer with an ample margin to meet contingencies. With insignificant exceptions, every person in every part of the country was able from the outset to get week by week the ration of half a pound of sugar to which his ration document entitled him.

Meanwhile, in the last quarter of 1917, the public became aware of serious shortages of other commodities, in particular tea, margarine, bacon and cheese. These shortages led to the appearance of queues at the shops and threatened to arouse grave industrial unrest. The centralized rationing scheme which was then the accepted policy in London could not come into force for many months. On the other hand the Food Control committees were established and at work; it was natural for Lord Rhondda to ask the committees to deal with the difficulty of the queues in the interim as best they could. One or two of the committees, among whom the Birmingham committee was conspicuous, started their own schemes for registering consumers with retailers and controlling the distribution of supplies to the retailers by the exercise of powers of requisition granted by the Ministry. General provision for such schemes was made by an Order of the Food Controller of Dec. 22 1917, which was called a Food Control Committees (Local Distribution) Order, but was in fact an order authorizing committees to introduce complete local rationing of any or every article, subject to approval of the scheme by the Ministry of Food. An important memorandum issued to the committees on Dec. 29 1917 outlined model schemes and gave advice and suggestions. The formulation of local schemes in congested industrial areas at once showed the impracticability of purely local action. It was clearly impossible for several Food Control committees in neighbouring districts forming part of a single industrial town to have different rationing systems, or for some to ration while the others did not. It was equally impossible for local committees to control the distribution of foods, such as frozen meat or margarine, which are stored or manufactured at a few main centres for distribution throughout the country. These difficulties came to the fore at once in London and its suburbs.

At a general meeting of executive officers of the London committees held on Jan. 4 1918, it was resolved to have a single rationing scheme for the whole Metropolitan area and to ask the Ministry of Food to prepare such a scheme for approval by the committees as a whole. It became clear almost immediately that no convenient break could be made between London and the districts immediately surrounding it, and the home counties were included. The scheme was originally asked for to deal with fats (margarine and butter) alone, but the meat shortage became acute at a moment's notice in Jan., and estimates of the quantities available in the first quarter of 1918 made it imperative to include meat as well.

A scheme covering both fats and meat was worked out accordingly by the Ministry, approved at another meeting of executive officers, embodied in a "London and Home Counties (Rationing Scheme) Order," and brought into force on Feb. 25 1918 for an area containing something like 10,000,000 people. It involved the issue of two ration cards to each individual, one with detachable coupons for meat, and one for butter and margarine, without coupons, but with numbered spaces in which the retailer marked off the customer's purchases as they were made; each card had a counterfoil to be deposited with a retailer, and the supplies were distributed to retailers on the basis of the counterfoils deposited with them. The scheme had an almost melodramatic success. The London queues, which, according to the observations made by the Metropolitan Police, had included, in each of the weeks just before rationing, over 1,300,000 people, fell to 191,000 in the first week and to 15,000 in the fourth. Before rationing about 550,000 persons stood in food queues every Saturday in London; on the first Saturday after rationing the number was 110,000, on the next 24,000, and on the fourth Saturday under 7,000. In effect the queues for meat and fats disappeared altogether; there remained only queues for cheese, jam and other unrationed articles. The success of rationing was one of organization; the total amount of meat and fats available for consumption and actually consumed in London was not greater after rationing than before. It was simply better distributed and made obtainable without the labour of standing in a queue.

Meanwhile local schemes under the Order of Dec. 22 1917 had made considerable headway in the diminution or abolition of queues for butter and margarine outside London and the home counties. The local rationing of meat, however, presented insoluble difficulties, and even before the introduction and success of the London scheme the decision had been taken to introduce a national scheme for meat rationing as soon as possible. This was done on April 7.

The extension of meat rationing to the whole country was as successful as its introduction in London. The queues disappeared and everyone everywhere got his ration. This result decided incidentally the fate of the sugar scheme. The attempt to form in London a central ration register of the population was abandoned; the staff, till they could be dispersed, were used on other work in the checking of coupons, and arrangements were made to include sugar in the uniform scheme of national rationing through local committees which was introduced on July 14 1918, when each member of the public received a single book with different coloured leaves of uniform coupons for meat and bacon, fats, sugar, and lard. These, with jam included for the first time in Nov. 1918, were the only articles of food which were rationed nationally, *i.e.* throughout Great Britain. In addition tea was rationed in most of the great industrial centres under local schemes, and came within an ace of being included under the national scheme of July 1918. Cheese was rationed by a number of committees, but the varying consumption in different parts of the country and by different classes of consumers made any uniform system difficult; it continued to the end to be distributed on a "trade basis," that is to say by giving

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to each trader a fixed percentage of his supplies in a datum year. Tea, on the other hand, though never rationed nationally, came to be distributed on a registration basis, *i.e.* in accordance with the actual population in 1918. In addition to articles for human consumption, feeding stuffs for animals were also controlled by the Ministry of Food, and in the latter part of 1918 were brought under a formal rationing system; this system hardly had time to come into full operation when the war ended.

The first national ration book had a currency of 16 weeks, and was succeeded by a fresh issue with no material change except an extension of currency to six months on Nov. 4 1918. After May 3 1919 coupons were abolished, but a limited system of rationing without coupons, by means first of the old ration books and later of identification cards, was continued for many months. Bacon and ham were freed from rationing in July 1918, lard in the following Dec., margarine in Feb. 1919, jam in April 1919, and meat in Dec. 1919. With the freeing of butter in May 1920 and sugar in Nov. 1920 rationing came to an end.

The foregoing sketch applies only to Great Britain. No rationing of meat or fats was attempted in Ireland, but a sugar distribution scheme, on the lines of the first British scheme, was put into force in Ireland by the Irish Food Control committee under powers conferred by the Food Controller.

National Rationing Scheme.—The Rationing Scheme, as finally established in July 1918, was a uniform national system administered by autonomous local committees, and having as its main features the use of individual ration books, the tie of each customer to a particular retailer, and the systematic supply to each retailer of the quantities required to meet the needs of his registered customers. A single application form had to be filled in by each household and forwarded to the Food Office, which thereupon issued a separate ration book for each member of the household. The ration book was a book containing different coloured leaves for various foods. Each leaf consisted of (*a*) a counterfoil to be signed, detached and given to the retailer with whom the holder of the book wished to register, and (*b*) coupons for each week's supply to be detached by the retailer when actual purchases were made. On registration of the customer the retailer besides detaching the counterfoil was required to enter his name and address on the appropriate part of the ration book. In addition to the leaves for foods rationed, such as sugar or meat, there were spare leaves which could be used for rationing other foods at short notice, and one of these was in fact adapted to deal with bread should the occasion ever arise. The book contained also a reference leaf, which served as an application form for subsequent issues. There were special books for children under six years of age (who got half rations of meat), books authorizing supplementary rations of bacon for manual workers and growing boys, and special books or leaves of coupons for invalids, travellers, vegetarians, Jews, soldiers and sailors on leave, and other particular classes.

The tie of each customer to a particular retailer was the essence of the scheme, the main safeguard against fraud, and the basis of distribution. Behind rationing as the public saw it—a paper affair of application forms, counterfoils and coupons—was a not less extensive and intricate machinery for distribution of the appropriate supplies through all the complex channels of trade week by week to every retailer in the country. The precise form of this machinery was naturally different for different articles of food; the common feature in all cases was that the retailer had to make an indent on a wholesaler in accordance with the number of persons registered with him, and each wholesaler in turn made application to a primary supplier (manufacturer, importer or other) based upon and accompanied by copies of the retailer's indents. The supplies flowed downwards through the various channels of trade in accordance with the applications and indents. The retailer's indents had in some cases to be approved in advance by the Food Control committees; in all cases their correctness was liable to be checked by examination of their registers of customers and of the counterfoils detached from the ration books.

In the case of meat, where the civilian supplies were mainly homegrown, there was needed in addition an elaborate organization, under Livestock Commissioners appointed by the Ministry of Food, for controlling the bringing of beasts to market, and their slaughtering and distribution, and for supplementing home supplies from the reserves of imported meat. In the case not only of meat, but of butter and margarine, there was a further difficulty—that the food was highly perishable and the retailers could not carry reserve stocks.

The importance of the tie to the retailer became apparent when it came to be realized that it would be perfectly possible to have a rationing scheme without coupons at all, if every individual consumer had to register at a particular shop and the supplies to that shop were adjusted strictly to the registration. The value of the detachable coupon was, first, in enabling the retailer to know whether he had already given a particular customer his supply for that week, and second, in affording a check upon the retailer, who could be required to make returns of supplies received, sold or retained, and to account for the supplies sold by producing an equivalent number of coupons. The staff collected for central rationing was used from April 1918 onwards to check the retailers' accounts by counting the coupons they had collected.

Apart from the points mentioned the technical details of most importance in the rationing scheme were the following:—

(1) The fixing of the ration for uncooked butcher's meat by value rather than by weight. Under the London scheme and the general meat scheme of April 1918 each card had for each week three coupons entitling the holder to buy 5d. worth per coupon, *i.e.* 1s. 3d. worth altogether of uncooked butcher's meat. As the price per lb. for each cut of meat was regulated by an elaborate schedule having regard to quality, to proportion of bone and to other matters, the fixing of the ration by value afforded an automatic means of adjusting the ration according to the cut selected. This device proved quite satisfactory and was continued in all subsequent schemes.

(2) The classification of "establishments," ranging from prisons and asylums to schools, hotels, living-in establishments, tea-shops and seaside boarding houses. With the single exception of the problem of the "self-supplier" this is technically the most difficult part of rationing, and the relatively efficient treatment of establishments in the British system was a considerable element in its general success. It is probably true to say that Britain was the only European country which made serious inroads on the comfort of living in first-class hotels or lunching at first-class clubs during the war.

(3) The provision for transfers of registration from one retailer to another, or from one district to another. This part of the scheme was framed with considerable care; the widespread organization of the Food Control committees bringing a food office within easy reach of every considerable number of inhabitants, and the reasonable latitude allowed to their officers in dealing with local and personal emergencies, prevented registration formalities from becoming intolerable.

The problems of "self-supply" and "direct supply," *i.e.* of persons producing food for themselves or obtaining food direct from the producer and not through a trader, arose in Great Britain only to a limited extent, and cannot be said to have been fully solved. Restrictions were imposed but were not pressed to the utmost.

The articles rationed and the amounts allowed at various dates are set out in the appended table.

Comparison with Other Countries.—The problem of rationing was simpler in Britain than in most European countries, and far simpler than in Germany and Austria, for the following main reasons: first, the deficiency of supplies below normal was less; second, the bulk of the British supplies were imported, not home-grown; third, the supplies of cereals could be and were kept at a point high enough to allow rationing of bread stuffs to be avoided altogether.

The difference in supplies is clearly illustrated by a table given in the article FOOD SUPPLY and published by the Ministry

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of Food at the end of 1918, comparing the estimated consumption per head of certain essential foods in the United Kingdom, Germany and Holland before and during the war. Another striking contrast emerges in the report of a committee appointed at the Ministry of Food at the end of 1917 to prepare a comprehensive scale of rations covering meat, cereals, fats and sugar. The committee based their scale on estimates of the minimum numbers of calories per day required by various classes of persons, according to age and occupation, and of the proportion that, having regard to other foods available, should be provided by these essential foods. Comparing their scale with the actual rations in force during 1917 in Hamburg (taken as typical of German industrial conditions), the committee found that the latter scale represented in respect of these essential foods and potatoes not more than ⅔ of the minimum requirements, while the shortage of less essential foods was probably even greater. The German ration of fat was reduced still further as from Jan. 1 1918, making the Hamburg rations per week for ordinary adults as follows:—Bread 4⅜ lbs.; Meat 9 oz.; Fats 2½ oz.; Sugar ⅛ lb.; Potatoes 7⅛ lbs. Men engaged in physical labour received a supplementary ration of 1¾ lbs. of bread (per week), and those engaged in exceptionally hard physical labour received altogether 7⅜ lbs. of bread, ¾ lb. of meat, 4½ oz. of fats, ⅓ lb. of sugar and 9⅜ lbs. of potatoes. These men would be few in number.

The weekly rations in Vienna by the end of 1918 were even lower:—Bread 2½ lbs. (with an additional 2 lbs. for heavy workers); Meat 4½ oz.; Fat 1½ oz.; Sugar nil, and Potatoes 1⅛ lbs.

The Austrian figures represent a breakdown of supplies and society. The German rations are those on which the civilian population of Germany sustained the war and made munitions during 1917 and 1918. They show a power in the human body to endure over months and years, at whatever cost in permanent loss of health and vigour, a scale of nutrition far below the minimum prescribed by scientific authority. They indicate at the same time the intensity of the strain to which the rationing regulations of the enemy countries were subjected.

The advantage to the British food controller in obtaining so large a part of his supplies from overseas was equally decisive. Imports were all brought automatically and completely under public control; nothing remained save distribution and the fixing of prices. The German and Austrian food controllers had to rely almost exclusively on home-grown supplies; they were faced by and failed to solve the problem of obtaining from the home producers a fair proportion of their produce for distribution under the rationing system. To a small extent this fact must be taken as a correction of the previous statement of rations as showing the actual consumption; an appreciable part of the total supplies escaping public control altogether was sold as contraband (*Schleichhandel*) to the urban consumers. The actual consumption in each family was the ration plus a varying proportion of contraband. The contraband trade, however, in Germany at least cannot have benefited more than a small proportion of the industrial population and was mainly an advantage to the well-to-do and to the hotels. It had a disastrous reaction on the general respect paid to the rationing regulations, and deprived them of that support of public opinion which was so marked in Great Britain.

The third great advantage of the British food controllers was that, by securing adequate tonnage for cereals, they were able to avoid the rationing of bread stuffs, and the elaborate and contentious system of graduated rations for different classes of workers which would otherwise have been inevitable. So long as rationing is confined to articles other than bread, a flat scale of rations for all adults, whether engaged in sedentary or in severe physical work, is possible; the larger amount of calories which the latter classes must have, in order to perform their work, can be obtained by increasing their consumption of bread. If bread as well as meat, fats and sugar are rationed this individual adjustment of consumption, according to the physical energy required, becomes impossible. The rationing system itself must provide differentiated rations for men doing varying kinds of physical labour or doing little or no physical work at all.

All the continental countries which rationed bread-stuffs had accordingly to introduce "supplementary" rations for heavy workers of different grades; the classification of the population for this purpose was one of the most difficult and contentious

Rationing in Great Britain 1917–20.

Article.	Period of Rationing (whether local or national).	Amount of Weekly Ration per Head.
Sugar . . .	Nationally—from Dec. 31 1917 to Nov. 29 1920	8 oz. Dec. 31 1917 to Jan. 27 1919; thereafter sometimes 12 oz. and sometimes 8 oz. with a drop to 6 oz. for a few weeks in Sept.–Oct. 1919, and again Jan.–March 1920.
Butter and Margarine . .	Locally from Dec. 14 1917 to July 1918 (38,000,000); thereafter nationally to Feb. 16 1919 for both fats, and to May 30 1920 for butter alone.	5 or 6 oz. for both fats under national scheme. The London scheme started with a ration of 4 oz. The separate butter ration after Feb. 1919 varied from 1 to 2 oz.
Lard . . .	Locally from Jan. 1918 (1,500,000); nationally from July 14 1918 to Dec. 16 1918.	2 oz. nationally and in most local schemes.
Meat (Uncooked Butcher's Meat)	London and home counties from Feb. 25 1918 (10,000,000) with a few other local schemes; nationally from April 7 1918 to Dec. 15 1919.	Under the London Scheme 3 coupons entitling to 4d. worth each, or 1s. altogether (about 1 lb. with average bone), subsequently changed to 1s. 3d. Under the national scheme varying values as follows: 1s. 3d., 1s., 1s. 4d., 1s. 8d., 1s. 4d., 1s. 8d., 2s.
Bacon and Ham.	London and home counties from Feb. 25 1918 (10,000,000) with a few other local schemes; nationally from April 7 1918 to July 29 1918.	Under the London scheme 4 oz. with bone per coupon. Under the national scheme 5 oz. and 8 oz.
Other Meats . .	All meat (including preserved meat, poultry, game, offal, venison and horse-meat) was included in original London scheme, but control was gradually relaxed.	Varying rations.
Jam . . .	Locally from early part of 1918 (500,000); Nationally from Nov. 4 1918 to April 15 1919.	4 oz. under national scheme.
Cheese . . .	Locally from early part of 1918 (2,000,000).	1½ oz. to 2 oz.
Tea . . .	Locally from Dec. 1917 (17,500,000).	1½ oz. to 2 oz.

Notes.—The numbers in parentheses give the maximum numbers covered by local schemes of rationing. The number covered by national rationing, *i.e.* the civilian population of Great Britain, in 1918 was 39,000,000.

In the London scheme and the first national meat scheme (April 7 1918) four coupons were provided to cover all meat of every kind. Three of these coupons only might be used for uncooked butcher's meat; any of them could be used for bacon, poultry, preserved meat, etc. The normal ration at the outset was thus 1s. worth (=¾ lb. with average bone) of uncooked butcher's meat, together with 4 oz. of bacon with average bone, or in place of the bacon, varying quantities of offal, poultry, game, etc. Later the rations were raised.

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parts of the whole system; it appears to cut at the root of the principle of equality upon which rationing is based. In Great Britain a scheme of supplementary rations of bacon, for growing boys and for men engaged in physical labour, was introduced in April 1918, not so much for its own sake as in order to get the recipients classified, and so to prepare the ground, in case bread rationing became necessary, as at that time appeared possible. Fortunately the danger to the British bread supplies passed over; the supplementary rations of bacon, though they received the general support of the Food Control committees and were clearly right in principle, were strongly criticized by labour representatives, and were abolished when bacon was freed from rationing in July 1918.

While for the three reasons stated it must be recognized that the British rationing problem was immeasurably simpler than the German or the Austrian one, it may still be claimed that even allowing for this the British system was definitely superior in itself. First, the proper balance between centralization and decentralization of responsibility was attained. The British system was national and therefore uniform and fair in principle, but was carried out by local authorities with ample power to adjust it to local conditions. German rationing was local in origin; the central authorities had the impossible task of securing coördination subsequently; the traveller from one part of the country to another found himself under different regulations in every town. Second, the British food controllers never issued a ration book without a distribution system to back it. Third, the British system was probably superior in the ingenuity of many technical details. In respect of one of the main articles of food, namely meat, the British like the German controllers had practically to rely upon home-grown produce for the civilian population and had the same problem of collecting supplies from the producer. Fourth, and finally, the British system was more successful in giving equal treatment to rich and poor. This was its corner stone. Lord Rhondda had many doubts as to the practicability of rationing. He feared that the public would never submit to being limited in their purchases, tied to one retailer and subjected to transfer formalities every time they moved from one district to another. He found that the British people in war were prepared to submit to any and every restriction on their freedom of action so long as it applied fairly to all alike. (W. H. B.)

United States

Food rationing, properly speaking, was resorted to in the United States during the World War only in a modified form, and as to two commodities, wheat flour and sugar. That is to say, the rationing system under which a strict limit was set by law and regulation to the amount of food any person might purchase, as was the case in European countries where the rationed foods were issued only on presentation of official food cards, was practically unknown in the United States. The food saving there was accomplished in general as explained in the articles Food Supply: *United States* and Savings Movement: *United States*, through the voluntary self-denial of citizens in response to Government appeals and recommendations.

Sugar.—In the last three months of 1917 a serious shortage of sugar developed, and American householders, particularly in the eastern states, had difficulty in obtaining even small quantities for table use. This shortage emphasized the necessity for special attention to its conservation. As a first step, manufacturers of "soft" drinks, candy and related commodities, were directed to reduce their consumption to 80% of the amount used by them during the first six months of 1917. This attempt at conservation was not wholly successful in its operation as some of the less patriotic manufacturers ignored the direction. On May 15 1918, when the urgent need for shipping had resulted in a diversion of tonnage from traffic with Cuba to longer voyages, regulations were issued requiring that sales of sugar to manufacturers of the less essential foods and drinks should be made only upon presentation, by these manufacturers, of certificates which they were required to obtain from the federal food administrator of the state. These certificates were issued only upon proof that the applicant had not used since Jan. 1 1918, 80% of the amount of sugar used by him in the first half-year of 1917, and the certificate enabled the manufacturer to obtain only enough sugar to bring his total to this 80 per cent. The sugar shortage became still more serious, and with the prospect of a repetition of the experience of the fall of 1917, a rationing plan modelled upon certain European systems was put in force beginning July 1 1918. The refiner or manufacturer of sugar was forbidden to ship sugar to a purchaser except upon the receipt of a certificate issued by the federal food administrators. These certificates were issued to retailers on the basis of the number of their customers. Customers were allowed to purchase only on the basis of 1 lb. per person per month. This was increased to 2 lb. on Oct. 15 1918, and the restriction was removed in Nov. 1918. The local administrators were also authorized at all times during the home canning season to issue certificates permitting housewives to buy sugar in 25 lb. lots for canning purposes after the giving of satisfactory proof that it was desired for such purposes. A further regulation for manufacturers using sugar divided them into classes, with respect to the necessity for their products, and they were permitted to buy only on the presentation of certificates issued to them on the basis of their classification. Comparing the figures for war-time consumption of sugar in the United States with pre-war and post-war consumption, a saving of from 400,000 to 600,000 tons is shown to have been accomplished through conservation measures. Assuming it to have been 500,000 tons, it would have supplied people in France for a year, at their ration of 35 lb. per head.

Wheat Flour.—In addition to the appeals for voluntary conservation, which were particularly stressed with reference to wheat flour, compulsory regulations were put in force as to certain dealers and distributors of this commodity in Jan. 1918. This step was determined upon as a result of a particularly serious appeal addressed in that month to Mr. Hoover by Lord Rhondda, British Food Controller. Lord Rhondda cabled that unless the United States could furnish 75,000,000 bus. of wheat by July to the Allies, he could not be responsible for their remaining steadfast in the war. Accordingly flour mills were required to raise their percentage of extraction to 74% and to eliminate altogether the sale of patent flours. On Feb. 3 1918, the bakers were required to use 5% of substitute flour in all bread, and this amount was raised to 20% on Feb. 24 and on May 3 to 25 per cent. Rules were also promulgated early in 1918 requiring manufacturers of cake, breakfast cereals, macaroni and the like to limit their consumption of wheat flour to 70% of the amount they had used in 1917 for the same purposes. Since more than 50% of the flour consumed in the United States is used in home baking, it was necessary to require housewives as well as bakers to use substitutes for wheat flour. Regulations were accordingly issued, about Feb. 1 1918, requiring that no dealer or miller should sell wheat flour to an individual consumer without an equal amount of substitutes. The substitutes specified included all substitute flours, corn meal, corn grits, oatmeal and rice. Although this was not, strictly speaking, a rationing measure, it is estimated that it accomplished a saving of approximately 25% in the household consumption of wheat flour. Notwithstanding a shortage instead of a surplus at the beginning of the year 1918, the American people saved out of their own consumption sufficient wheat to send to the Allies, between Jan. 1 and the harvest, not merely the 75,000,000 bus. for which Lord Rhondda pleaded, but a total of 85,000,000 bushels.

The rationing measures described were withdrawn in Nov. 1918, and after that date there was no governmental limit upon the purchase for consumption of any food commodity in the United States. Although a sugar shortage developed there in 1919 as a result of the continuing world shortage, no revival of control over consumers' purchases was attempted in the United States. The Sugar Equalization Board, which had been continued in existence for distribution of the 1919 crop, revived, for a short time and to a limited extent, its control over distribution by directing to what sections of the country refiners should ship their product. The fact remains, however, that such rationing measures as the U.S. Government employed were in force only for a few months in 1918. (W. C. M.)

RAVEL, MAURICE (1875–), French musical composer, was born at Ciboure, France, March 7 1875, and received his musical education at the Paris conservatoire, under Fauré, Pessard and Bériot. His compositions include, besides songs, pianoforte music, and chamber music, the *Schéhérazade* overture (1911), *Rhapsodie Espagnole* (1907), and the one-act opera *L'Heure Espagnole* (1907), first produced at Covent Garden in 1919.

RAVENSTEIN, ERNST GEORG (1834–1913), British geographer, of German origin, was born at Frankfort-on-Main on Dec. 30 1834, and was educated there. In 1852 he became a pupil of August Petermann, and came to England, where he served in the topographical department of the War Office from 1855 to 1872. As a geographer he was less of a traveller than a research student, and his studies led mainly in the direction of the practice and history of cartography. He compiled many original maps and atlases, bringing a fine critical faculty to bear

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upon the data where these were not of the first order of scientific accuracy, as in his series of eastern equatorial Africa, scale 1:1,000,000 (1881–3), and of British East Africa, 1:500,000 (1889). One of his earliest writings was *The Russians on the Amur* (1861), but he was concerned mainly with the history of geography, as exemplified in his *Vasco da Gama's First Voyage* (1898) and *Martin Behaim, his Life and his Globe* (1908), as also in his history of cartography in the *E.B.* (*see* 17.633). He was an active member of the Royal Geographical Society and of the British Association, over the geographical section of which he presided in 1890, and in which he served as chairman of a committee which made a valuable enquiry into the climatology of Africa. He had also a particular interest in gymnastics, and published a handbook on them in 1867. He died at Hofheim in the Taunus, Germany, March 13 1913.

RAWLINSON, HENRY SEYMOUR RAWLINSON, BARON (1864–), British general, was born Feb. 20 1864, son of Maj.-Gen. Sir H. Rawlinson, Bart. He joined the army in 1884 and a year later became A.D.C. to Sir F. Roberts in India on whose staff he served intermittently for some years. He took part in the Burma operations in 1886–7, and he was on the staff on the Nile in 1897–8, for which he was promoted brevet lieutenant-colonel; he had succeeded to the baronetcy in 1891. He went out to S. Africa on the staff in 1899, served through the defence of Ladysmith, and afterwards joined Lord Roberts and accompanied him to Pretoria and into the eastern Transvaal. Throughout the later stages of the war he commanded a column, and he was rewarded with a brevet colonelcy and the C.B. for his services. Then, after some months at the War Office, he became Commandant of the Staff College, passing on from there in 1906 to the charge of a brigade. He was promoted major-general in 1909 and commanded the 3rd Division from 1910 to May 1914.

He was at first employed at the War Office on the outbreak of the World War, but was in Oct. 1914 selected to command the IV. Army Corps that was being organized. He was in charge of the forces sent to assist Antwerp, and took part in the first battle of Ypres and in the Neuve Chapelle and the Loos offensives, being given the K.C.B. in 1915. He commanded the I. Army temporarily at the end of that year, was promoted lieutenant-general, and on the formation of a IV. Army was placed at its head. He commanded this during the battle of the Somme, achieving important successes, and was promoted general in recognition of his services. At the end of 1917 he was transferred temporarily to the command of the II. Army during Gen. Plumer's absence in Italy, and in Feb. and March 1918 he acted for some weeks as British representative on the Supreme War Council. But he was recalled from this to the field in April to resume command of the IV. Army before Amiens at a critical juncture. On Aug. 8 his troops in conjunction with the French attacked the enemy in this region and they gained a signal victory, which heralded the general advance of the Allies. His army played a prominent part a few weeks later in the storming of the Hindenburg line and in the subsequent victorious advance eastwards. On the final distribution of honours for the war he was raised to the peerage as Baron Rawlinson of Trent, received a grant of £30,000, and was given the G.C.B. In the latter part of 1919 he was sent to N. Russia to conduct the withdrawal of the Allies from Archangel and Murmansk, and on his return he commanded at Aldershot for a year. At the end of 1920 he went out to India as commander-in-chief.

RAYLEIGH, JOHN WILLIAM STRUTT, 3RD BARON (1842–1919), English physicist (*see* 22.933), died at Witham, Essex, June 30 1919. He was succeeded as 4th baron by his eldest son, ROBERT JOHN STRUTT (b. 1875), already so well-known as a physicist and F.R.S. that he is commonly cited as Strutt when references are made to his scientific papers.

REA, SAMUEL (1855–), American railway official, was born at Hollidaysburg, Pa., Sept. 21 1855. In 1871 he joined the engineering corps of the Pennsylvania railway as chain and rod man, working on several branch lines. From 1875 to 1877 he was engaged, as assistant engineer, in the construction of the chain suspension bridge over the Monongahela river at Pittsburgh. He was next appointed assistant engineer for the Pittsburgh and Lake Erie, then under construction. He returned to the Pennsylvania lines in 1879, but ten years later joined the Baltimore and Ohio. For the latter road he was chief engineer for construction of the belt-line tunnel under Baltimore. In 1892 he was appointed an assistant to the president of the Pennsylvania railway and five years later first assistant. In 1899 he was elected fourth vice-president of the Pennsylvania, rising through the various grades to first vice-president in 1911, and when the numerical grades were discarded in 1912 was made vice-president. In 1913 he was elected president. He was also president at times of several other lines, including the Philadelphia, Baltimore and Washington; the West Jersey and Seashore; the Long Island; the Northern Central; and the Pittsburgh, Cincinnati, Chicago and St. Louis. He was in charge of the construction of the Pennsylvania station in New York City (completed in 1911) and the connecting tunnel under the Hudson river, as well as the New York connecting railway and Hell Gate bridge over the East river (opened in 1917). In 1917, after the United States entered the World War, he was appointed by the American Railway Association a member of the special commission on national defense of the Railroads War Board. He was also appointed director of the department of railroads, electric railways, highways, and waterways, of the division of transportation of the Committee of Public Safety of Pennsylvania. In 1917 he presented his private yacht to the U.S. Government for patrol duty in the Atlantic. In 1918, when the railways were taken over by the Government as a war measure, he was replaced as operating head of his road, but remained in charge of its corporate affairs. He was a member of the New York Chamber of Commerce, the American Society of Civil Engineers, the Institution of Civil Engineers of London, and the Society of Naval Architects and Marine Engineers. He was the author of *The Railways Terminating in London* (1888).

READING, RUFUS DANIEL ISAACS, 1ST EARL OF (1860–), British lawyer and statesman, was born in London Oct. 10 1860, of a Jewish family. He was educated at University College school, and later at Brussels and Hanover, and after a brief experience of the London Stock Exchange he was called to the bar in 1887. He speedily earned the reputation of a brilliant lawyer, and in 1898 became a Q.C. In 1904 he entered the House of Commons as Liberal member for Reading, and in 1910 was made solicitor-general and knighted. The same year he became attorney-general, and in June 1912 was given a seat in the Cabinet—the first attorney-general to be so distinguished. In Oct. 1912, Sir Rufus Isaacs's name came under unfavourable discussion during the course of the enquiry into the Marconi contracts, but on the retirement of Lord Alverstone in 1913 he was appointed Lord Chief Justice of England. On the outbreak of the World War his advice on financial questions was of great value to the Government, and he was responsible for some of the most important measures immediately taken by the Treasury in connexion with the situation in the "City." Both at this time and later, his services in the sphere of national finance were, indeed, invaluable. In 1915 he went to the U.S.A. as head of the Anglo-French loan mission, earning golden opinions. He was raised to the peerage as Viscount Reading in 1916, and in 1917 again went as special envoy to America. On his return he was created Earl of Reading, and in 1917, on the retirement of Sir Cecil Spring-Rice, owing to ill-health, went to Washington for a brief period as high commissioner and special ambassador. At the beginning of 1921 he was appointed Viceroy of India in succession to Lord Chelmsford, and resigned the lord chief justiceship. Lord Reading married, in 1887, Alice, daughter of Albert Cohen. His only child, Gerald Rufus Isaacs, Viscount Erleigh (b. 1889), married in 1914 the daughter of Sir Alfred Mond.

RED CROSS WORK.—(1) BRITISH.—The British Red Cross organizations existing before 1905 were, in that year, amalgamated and formed into a new body called the British Red Cross Society. The immediate object of the society was preparation in time of peace for the ultimate work of rendering voluntary

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aid to the sick and wounded in war. The War Office, which in the past had been somewhat embarrassed by casual offers of similar help from private individuals, undertook that, in the future, all such offers, other than the supply of certain personnel, should reach them only through the channel of the B.R.C.S., which accordingly began its task under powerful auspices. But it was not at first easy to interest the necessary numbers of people in proceedings depending for fruition on a contingency which most of them believed to be remote. The advance of science, also, together with modern ideas of humanity, had naturally resulted in the creation of an efficient army medical service, possessed of its own military hospitals and nurses, as well as complete equipment for the transport and treatment of wounded men. It was uncertain, therefore, what scope there would be for only partially trained helpers, even if there should be another great war in the future. The formation of the Territorial Force in 1908 provided a solution of the difficulty. Being a volunteer body called into existence for the purpose of home defence, its medical department was not such as would be self-sufficing in a campaign. The War Office accordingly invited the British Red Cross to apply itself to the formation of what are now known as Voluntary Aid Detachments, both of men and women, for service in connexion with the Territorial Force. The members of these detachments were to be prepared by instruction in first aid, sanitation, nursing, ambulance, cooking and other work, and to make provisional arrangements in respect of transport and temporary hospitals for the assistance of regular medical units during military operations in Great Britain. When war broke out in 1914, the B.R.C.S. and the Order of St. John, which was also engaged in organizing V.A.D.'s, had between them 2,374 detachments with a personnel of 70,352. Before the Armistice they numbered 4,083 with a personnel of 125,993. The original idea of the V.A.D. providing supplementary aid to the Territorial medical service was, owing to the exigencies of a European war, thrown into temporary abeyance. Their usefulness, however, was quickly adjusted to the necessities of the hour. They turned to excellent account the arrangements already made in accordance with the War Office scheme, and took a leading part in the transport and reception into auxiliary hospitals of the wounded.

But although the British Red Cross owed to the V.A.D. the advantage of having been able to enroll and educate voluntary workers in time of peace, its main object extended much farther afield. The root idea of the Red Cross is that whatever it can do to save the life or limb of a wounded soldier, or to alleviate his suffering, it is willing to do, without question, whenever and wherever its assistance can be usefully employed; and whatever can be provided to cheer or comfort him, in addition to what the taxpayer supplies, it will provide so long as its funds permit. On the other hand, the medical service of the army exists in order to do all that is reasonably necessary for its patients. That service may fail under stress, as may the army itself; but in principle it does not admit that voluntary aid is indispensable, except in so far as some of it may avoid the necessity for compulsory measures. No doubt, however, arises in connexion with additional comforts. Common sense draws the line between what a Government can be expected to give its wounded men, and what luxury, which must be left to spontaneous generosity on the part of the public acting through the Red Cross. The ostensible appeal of the British Red Cross was therefore for funds to enable the sick and wounded to be given comforts which they would not otherwise receive. But in practice a large part of Red Cross expenditure never strictly meets this description, and much but not all of it relies for defence on the ground that it has been the means of saving life. Thus, the Red Cross war library, which during the war provided over 5,000,000 books for hospitals, etc., and the 2,800 Red Cross work parties and depots, in so far as the articles they produced were not among those in army schedules, may be described as pure Red Cross efforts. But the ambulance launches sent to Mesopotamia for the transport of wounded, though they saved innumerable lives and their cost probably yielded better results, pound for pound, than any other department of Red Cross work, were nearer the dividing line which separates the field of Red Cross activities from what should be army work. These launches alone carried 414,000 passengers and travelled 683,000 m., while at the various seats of war and in the British Isles Red Cross motor ambulance cars moved 10,000,000 sick and wounded cases. Yet, in fact, the transport of wounded, on which considerably more than £2,000,000 were expended by the Red Cross, was not strictly Red Cross work. It is the business of the army to clear up its own battle-fields at its own cost and take the wounded to hospital. Nevertheless, the enormous number of cases which the Red Cross was allowed to carry remains the best justification for the expenditure incurred until we know what would have happened had voluntary aid not been at hand. It is less easy to account for grants such as those made to the King George Hospital, a military establishment of 1,655 beds set up in the buildings of the Stationery Office, which was equipped by the Red Cross, and towards the expenses of which £154,000 were contributed, two-thirds of that sum being for payment of salaries, wages and ordinary expenses.

On the outbreak of war the B.R.C.S. appealed for funds, as did also the Order of St. John, which had rendered much service in the S. African War. The emergency was altogether exceptional, and the War Office soon broke away from its own regulation as to the sole agency of the B.R.C.S. in respect of voluntary assistance. In the result a joint war committee of the two organizations was formed, subscriptions were pooled, and this committee carried out all Red Cross war work undertaken in Great Britain with some exceptions. Scotland, which elected to proceed separately, raised over £2,000,000, thus providing for a fine independent effort. In addition the principal Dominions Red Cross societies sent commissions to the areas of war where their own contingents were serving, and made generous contributions to the work. Canada, Australia, S. Africa and Egypt were conspicuous examples. India was closely associated with the joint committee in connexion with Mesopotamia and E. Africa, and the American Red Cross gave valuable support. No voluntary collection in Great Britain had ever before reached the amount raised by the Red Cross during the war. Its success was very largely due to the generosity of *The Times*, which opened its columns freely to the advocacy of British Red Cross claims and the acknowledgment of subscriptions. *The Times* fund reached over £16,500,000 and covered many special efforts, such as the annual collections throughout the Empire, known as "Our Day." These produced for the four years in which they were held, over £8,500,000, of which more than five-eighths came from overseas. The farmers sent £1,000,000; the coal-owners and miners nearly £500,000; sales of pictures, jewels, etc., at Christie's amounted to £322,000; church collections to £283,000; and pearls given by ladies from their necklaces were sold for £94,000. Every class of society contributed either in money, work, or kind, and the sums received from individuals varied from 3d. to £25,000.

In addition to the cash which passed through *The Times* fund, gifts of stores to the value of £1,000,000 were made, and a very large unascertained sum was given locally through the auxiliary home hospitals above referred to. These latter, each of which was connected with one of the military centres, were set up in most of the principal towns throughout the country. Private houses, schools and suitable buildings of various kinds were converted into temporary wards, to which, in most instances, the minor cases were sent. They were, as a rule, served by V.A.D. members under a trained nursing staff and local medical men. In some a high degree of efficiency was reached, and to a few wounded were sent direct from the hospital ships. Rent and equipment were provided by subscriptions in the neighbourhood or private munificence, with, when necessary, grants from Red Cross headquarters; and the Government paid a capitation fee in respect of each patient, also affording through the country directors special facilities for rationed food supplies. It is estimated that over 3,200 auxiliary home hospitals were opened during the four years of the war. Their work received warm approval from the Army Council, who issued an inscribed scroll to each building as a permanent memorial of the patriotic purpose to which it had been devoted. That these institutions may claim to have afforded special comfort to wounded soldiers is indicated by the fact that the disciplinary measure most severely felt by refractory patients was their return to the military quarters from whence they came. Apart from the auxiliary home hospitals, a large sum was expended in equipping and maintaining hospitals abroad, special hospitals at home, and convalescent homes. Responsibility for the British Red Cross Society's hospital at Netley and the St. John Ambulance Brigade hospital at Etaples was undertaken by their respective associations. Mention should also be made of the British Red Cross Society's Star and Garter home at Richmond for totally disabled men, an institution intended to provide a harbour for those suffering from incurable spinal paralysis. In all, a sum exceeding

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£5,000,000 was spent by the joint committee on hospitals and stores, excluding local expenditure on the auxiliary home hospitals. The stores department covered a great variety of items under general headings, such as textiles, provisions, tobacco, furniture, medical requirements, etc., and involved extensive business arrangements, with warehouses, buyers, and all the machinery of a large commercial establishment. Speed in delivery was a distinguishing feature, and the services of this department were on many occasions invited by the War Office. It was claimed with justice that no reasonable request which it was possible to comply with was ever refused.

A kindred department to the stores was the Central Prisoners of War Committee. The necessity for sending food to prisoners of war had resulted in various efforts which required coördination. The Government, as such, being prevented by Germany from supplying food to British prisoners of war, approved the formation of a committee under the Red Cross, which, by resolution of one of its international conferences, was entitled, and was consequently allowed by the enemy, to regard prisoners as coming within its duties. The committee administered a sum of over £4,000,000 and regularly dispatched parcels of bread, other food and clothing to the prison camps. Enquiries for wounded and missing, undertaken by the Red Cross from early in 1915 onwards, were also a much appreciated effort, resulting in over 384,000 reports being obtained at a total cost of less than 3s. 6d. each. Work for interned prisoners in Switzerland and Holland was another undertaking of high character, one of its chief objects being educational and industrial training. Much attention was bestowed by the Red Cross on the after-care of disabled men, both in connexion with accommodation for convalescents, and institutional treatment for patients suffering from neurasthenia, epilepsy, tuberculosis, paralysis and the results of wounds. It is obvious that medical or surgical treatment in such cases may be prolonged and yet not be inconsistent with some form of employment. The Government, realizing this, was prepared to maintain the patients, but difficulties arose on the question of capital outlay: "In any case," says the report of the joint committee, "as far as the Government was concerned, we were faced by delay in circumstances where promptitude was of vital importance to the success of the work. Being ourselves unhampered by restrictions other than the broad objects for which the public had subscribed to the Red Cross, and our funds being immediately available, we were able to obtain the sanction of the Joint Finance Committee for grants which met the necessities of the case. Thus, once again, was demonstrated one of the most valuable uses of such a fund as that administered by the Joint War Committee."

The report from which the foregoing extract is taken deals in detail with Red Cross activities in the various theatres of war, at all of which the joint committee was represented by a commissioner and staff suited to the circumstances. The most extensive work, of course, was that carried out in France and Belgium. There the first commission was sent in Aug. 1914, while the last of many proceeded to Vladivostok a fortnight before the Armistice in 1918. Some idea of the number of people employed by the joint committee will be gained from the fact that the total staff at home and abroad on Oct. 20 1918, was 9,234. Of these 1,353 worked at headquarters in London, 850 of whom were paid and 503 were honorary workers. It is only possible in this article to mention some of the efforts which were specially associated with the Red Cross during the war and have not already been alluded to. The supply of provisional limbs was a useful measure; invalid diet kitchens at Malta, Salonika and Egypt were a new and very successful experiment; and in Italy the ambulance units, among which may be mentioned one devoted to X-ray work, attained some remarkable results. Wherever it was possible to set up recreation rooms or to entertain the wounded, especially at Christmas time, the Red Cross undertook to do so; and at the conclusion of the war, after assisting in repatriation at Berlin and elsewhere, it continued, as it will continue for some years, to look after and help wounded men, particularly while they are waiting for final decisions as to pensions. Although the general direction of Red Cross business was in the hands of men, it is not too much to say that its outstanding feature was women's work. By hospital nursing and organization at home and abroad, motor-driving, rest-station attendance, and general service—including the humblest domestic occupations, to which ladies turned their hands for long periods—British women established a lasting claim to national gratitude; and it may be said that the example they set did more to gain for them their present place in the constitution than several decades of propaganda.

At the end of the war the joint committee was left with a considerable surplus, which approximated roughly to the amount received from the "Our Day" collection taken a few weeks before the Armistice. An Act of Parliament enabled such part of this balance as might not be required for the sick and wounded to be applied to kindred objects. A sum of £1,339,700 was given to civil hospitals and other institutions in England and Wales, and £544,300 to similar purposes in the dominions and colonies.

A heavy distribution of, for the most part, well-earned honours was made to Red Cross workers during and after the war, the chief criticism in connexion with which was that the higher grades allotted to the honorary and paid staff at headquarters in London were out of proportion to those recommended for commissioners and others who had served for long periods abroad, often under trying conditions and sometimes in no small personal danger. On the whole it may safely be said that the Red Cross war fund was managed on sound business lines which gave general satisfaction to the subscribers, the Government, and the participators in its benefits, and reflected great credit on those who carried out the work.

AUTHORITIES.—Charters of Incorporation of the British Red Cross Society, 1908 and 1919; *Field Service Regulations*, Part II.; *Organization and Administration* (1905); *Royal Army Medical Corps Training* (1911). Schemes for the Organization of Voluntary Aid in England and Wales, 1909 and 1910. Reports of the Joint War Committee and the Joint War Finance Committee of the British Red Cross Society and the Order of St. John of Jerusalem in England on voluntary aid rendered to sick and wounded at home and abroad and to British prisoners of war, with appendices (1914–9, H.M. Stationery Office). (J. D. P.)

(2) UNITED STATES.—The "American Association of the Red Cross" was organized in 1881, by the special efforts of Clara Barton (*see* 3.452) and with the approval of President Garfield and Secretary of State Blaine. Miss Barton was its first president. In 1905 the name was changed to National Red Cross, and the organization was incorporated and nationalized; the President of the United States became its president, and the War Department its auditor. By 1912, state relief boards operating under the National Relief Board of the Red Cross had been organized in practically all of the states in the Union as well as in the Philippine Is. and Porto Rico. In 1913 there were 60 chapters with about 12,000 members. In that year the association provided "disaster relief" in response to 13 calls in the United States and five from abroad. $3,000,000 were used in relief operations, of which sum one and a third were contributed directly through the Red Cross. In the same year steps were taken to erect a national memorial building in Washington as a tribute to the heroic services, in connexion with the Sanitary Commission and other activities for the benefit of soldiers, rendered by women of the North and South in the Civil War. To an appropriation by Congress of $400,000, as much more was added by private gifts, and the corner-stone of the building was laid on March 27 1915. The building was occupied as national headquarters early in 1917.

World War Work.—Early in the World War, before America's entry, the Red Cross, with the consent of the Government and in conformity with the treaty of Geneva, offered through the State Department the aid of its trained personnel and contributions of hospital supplies to every country involved in the war. The offer was accepted by all the belligerents with the exception of Belgium, which at first desired only supplies and did not ask for personnel until the spring of 1915. Japan, at first accepting, later declined assistance, as its own Red Cross was able to meet all demands, while Italy, when it entered the conflict, asked only for certain supplies. The Red Cross called the attention of the American people to the contributions made by European Red Cross societies during the Spanish-American War, and the President made a public appeal for funds. As a result, sufficient money was soon at the disposal of the Red Cross to undertake active aid to the various belligerents. Large quantities of hospital supplies and about 200 nurses were sent to Europe and distributed in England, Belgium, France, Germany, Austria, Serbia and Russia. Seventy-one physicians and surgeons were also sent, and a special sanitary commission of 43 doctors and nurses went to Siberia to fight the typhus plague there. The value of the relief supplies sent to Europe by the Red Cross before the United States entered the war exceeded $1,500,000, of which about $350,000 worth went to Germany and Austria. In the latter part of 1915, when the sanitary and general medical services of the belligerents had become sufficiently developed to make outside personnel aid unnecessary, the American surgeons and nurses were withdrawn from Europe.

In May 1917, a few weeks after the United States entered the war, President Wilson, as titular head of the American Red Cross, appointed a special Red Cross War Council of seven nationally known men, headed by Henry P. Davison of New York, to direct all the activities of the organization during the war. The first task of this War Council, besides effecting an expansion and elaborate reorganization, was that of obtaining

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funds on a large scale to support the extensive work planned. It was decided to appeal at once to the people for a special war fund of $100,000,000, and President Wilson designated the week of June 18–25 as " Red Cross Week " for the collection of money. Quotas were assigned to each state and city and a vigorous nation-wide campaign was begun. The result was a popular subscription of over $114,000,000. The second great campaign undertaken by the War Council was a Christmas membership drive during the week of Dec. 17–24 1917. When the United States entered the war the Red Cross membership was about 500,000, comprised in about 500 chapters. By Nov. 1 1917 the membership had increased to 5,000,000, distributed among 3,287 chapters. The first aim of the special membership drive was for 5,000,000 further memberships, but when the campaign was actually launched the goal was set at 10,000,000. At the end of the drive week over 16,000,000 new members had been added to the organization. By the spring of 1918 it was found necessary to launch a new drive for funds, so extensive had been the war undertakings of the Red Cross. Again a nation-wide appeal was made, and during the week May 20–27, approximately $170,000,000 was subscribed. These two great collections of 1917 and 1918, together with membership dues of about $37,500,000 and special funds and supplies from various other sources, made up a grand total of a little more than $400,000,000, of which about two-thirds was available for the needs of the national headquarters and one-third for the special needs of the 3,500 chapters. These special needs were such as purchase of materials to be made into relief articles, local canteen and home service, general operating expenses, etc. The undertakings of the American Red Cross during the war-time and armistice period can be classified under two heads: first, the relations of the Red Cross to the armed forces of the Government both at home and abroad, and, second, civilian relief abroad. With regard to the first category a paragraph in a report of the American Red Cross, prepared for the tenth International Red Cross Conference at Geneva on March 30 1921, sets out so admirably the manifold activities carried on that it may well be quoted. It is as follows: " The primary function of the Red Cross in war, of course, is to provide volunteer relief to the sick and wounded, and to serve as a medium of communication between the soldiers, sailors and marines and their families and the American people, but in the late war the American Red Cross activities for the fighting men covered a much wider field. From the time the American soldier entered the service until he had been demobilized, the Red Cross, at the request of the War Department, assisted him in many ways possible only to a large volunteer organization officially recognized. The American Red Cross recruited, organized and equipped hospitals and ambulance units, assisted in the care of the sick and wounded in emergencies, and mobilized nurses for the army and navy. The labour of volunteer Red Cross women provided the men in the service with knitted garments not a part of the army equipment, as well as an unlimited quantity of surgical dressings and supplemental medical supplies. Canteens established at many points in the home country and in the war zone provided the soldier *en route* with food, tobacco and other creature comforts. Home Service helped to maintain *moral* by rendering assistance in many forms to soldiers' and sailors' families. American fighters held prisoners in enemy camps, after being located through the International Red Cross, were supplied by the American Red Cross with food and other comforts. The sick and wounded behind our own lines were cheered and aided in their convalescence, the home-coming and demobilized troops were helped in readjusting themselves to civil life, and, finally, the graves of the fallen were photographed at the request of the War Department for the comfort of the home folks."

The details of the manner and extent of these various activities cannot be described here in detail. Place can be given to only a few special facts. Fifty Red Cross Base Hospital units, each consisting of 22 surgeons and physicians, 65 Red Cross nurses, and 152 Enlisted Reserve Corps men, were sent to England and France and one to Italy for duty with the American Expeditionary Forces. Forty ambulance companies of 124 trained men each were likewise sent abroad. Over 23,000 trained nurses were mobilized, of whom nearly 20,000 saw active service, one-half of these in Europe. Sanitary service in America was carried on by 29 units of trained personnel assigned to districts in 16 states. A Woman's Volunteer Motor Corps of 11,000 members organized in 300 communities covered over 3,500,000 m. in their activities. Seven hundred canteens staffed by 55,000 women workers were operated in railway stations and camps. Ninety-two convalescent homes were built in the training and embarkation camps. One hundred and thirty canteens were established in France. Also, in France, the Red Cross maintained 24 military hospitals and 12 convalescent hospitals. Thirty-three canteens were established in Italy. Twenty-eight military hospitals and 82 canteens were established just behind the lines in that small part of Belgium never overrun by the Germans. A Home Service with 50,000 workers helped soldiers' families in many ways in America. Finally, 8,000,000 Red Cross women were engaged all through the war in producing comforts and hospital supplies for the American soldiers and sailors. Under the general category of " civilian relief abroad " is included the work done by the American Red Cross, from the time the United States entered the war up to 1921 when this work was still going on, in relieving the civilian populations of the war-ravaged regions of Europe. The distress during the war of the people of the Allied nations, especially in the devastated regions of Belgium, France, Italy, the Balkan States, Poland and Russia, seriously menaced the *moral* of those countries, so that this " civilian relief abroad " by the American Red Cross during the war period was of actual military assistance to the Allies. After the war this assistance, no less necessary, took on a more purely benevolent aspect and was extended in some measure to former enemy countries as well as to the Allies. The largest need and the largest response by the Red Cross was in France. A million and a half refugees from the 10 invaded French departments were scattered throughout other parts of the country. Besides, many Belgian refugees came into France. Disease, especially tuberculosis, threatened to become epidemic. The Red Cross undertook the task, for a time at an expense of $1,000,000 a month, of housing, clothing, feeding and extending hospital and general medical aid to these civilians. This work was constantly done in association with national and local French organizations. Over 150 such organizations were aided. Sixty-seven hospitals and dispensaries, primarily for refugees, were operated by the Red Cross. Over 30,000 tuberculosis patients were directly reached and helped. A child-welfare campaign was also undertaken, partly of educational character. Special doctors and visiting nurses not only directly helped the children but organized instructional meetings and held special child clinics where modern methods were explained to nearly 300,000 French attendants. Perhaps the second largest item in civilian relief during the war was that of aid to Russia. A special commission was sent to Petrograd by way of Vladivostok, arriving in 1917, while Kerensky was in power, and provided 500,000 cans of condensed milk for children. An ambulance train of 125 cars was also sent to Russia, and $1,500,000 was devoted to the assistance of Russian soldiers who were returning from the prison camps.

During the war the Red Cross lent assistance to 75 Belgian refugee colonies in free Belgium, France, Switzerland, Holland and England. In Italy 50 kitchens were maintained for needy civilians and direct financial assistance was given to the families of 326,000 Italian soldiers. In Rumania two hospitals and an orphanage were taken over and maintained, and in three districts 40,000 persons were fed daily. Special commissions went to Serbia and Greece and aided materially in caring for refugees and poor families in those countries. In 1918, at the height of the war activities, the American Red Cross had over 20,000,000 adult and 11,000,000 child (junior Red Cross) members comprised in over 3,500 chapters. Eight million of these members were listed as " war workers." The total revenues of the national headquarters and chapters together for the 20 months ending Feb. 28 1919 were $400,178,000, of which $272,676,000 was actually expended in war relief work in America and 25 foreign countries during the 20 months' period named, which covered all the time during which the United States was in the war plus the first three and a half months of the Armistice. Of this sum $169,096,000 was expended by the national headquarters and $103,580,000 by the various chapters. The former included $28,978,000 for relief in America; $57,207,000 in France; $63,841,000 elsewhere overseas; $4,660,000 for collections, enrolments, and publications; $2,727,000 for operation of relief bureaus; $5,530,000 for operation of bureaus handling relief supplies and transportation in America of these supplies; and $4,360,000 for operation of administrative bureaus at national headquarters and divisional headquarters. The expenditures of the chapters included $60,660,000 for materials purchased; $8,790,000 for home service; $3,070,000 for military hospitals and ambulances; $2,320,000 for canteen service; $1,680,000 for influenza relief; and $7,490,000 for general operating expenses. The total resources (cash and supplies) of the national headquarters Feb. 28 1919 amounted to $110,756,000, including unexpended appropriations of $16,714,000; in addition the chapters had in hand a balance of $33,460,000. A total of 101,000 tons of relief supplies had been sent overseas; 3,780 French and more than 1,500 Italian hospitals had been aided. The relief articles (surgical dressings, hospital garments and supplies, refugee garments, and various

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articles for soldiers and sailors) produced by Red Cross volunteer workers during this time numbered over 370,000,000 of an estimated value of nearly $100,000,000. Eleven million of these items were knitted articles given to soldiers and sailors in the United States.

Post-war Work.—On March 1 1919, the War Council dissolved and all authority and responsibilities were taken over by the Executive Committee with Dr. Livingston Farrand as chairman. The foreign commissions were gradually closed and withdrawn, although late in 1919 over 1,000 Red Cross workers still remained in Europe. The total membership after the roll-call of Nov. 1919 was about 10,000,000. After the Dec. 1920 roll-call it was about 7,000,000. Relief work was carried on after the war in Albania, Belgium, Bosnia and Herzegovina, Czechoslovakia, France, Great Britain, Greece, Germany, Italy, Montenegro, N. Russia, Palestine, Poland (where more than 100 workers were engaged), Serbia (where 30 doctors, 50 nurses and five dentists worked at various points), S. Russia, Switzerland (caring for American soldier prisoners coming from German prison camps), Siberia (where 600 workers fought against typhus, cholera and other epidemics), and western Russia and the Baltic states. During a part of 1920 operations still continued in most of these countries, but by the end of the year the list had been reduced to Poland, S. Russia, Czechoslovakia, Montenegro, Serbia, the Baltic states, Austria (Vienna), Hungary (Budapest) and Turkey (Constantinople). In Poland 258 hospitals with 26,123 beds were established in 1920. Thirty dispensaries and 207 orphanages were aided, clothing was distributed to over 80,000 children and 2,316 towns with a total population of more than 700,000 were given general relief. In Rumania six hospitals were operated, 322 soup kitchens maintained, and relief supplies provided for 219 schools and 232 orphanages. In western Russia and the Baltic states 300,000 civilian poor, 21,000 refugees and 2,500 war prisoners were helped. In Vienna 98 hospitals were aided. Similar work was done in Budapest. In Siberia the cargoes of 30 American relief ships, and part cargoes of 92 ships from other countries were distributed. Eighteen hospitals were operated and numerous sanitary trains organized and an average of seven articles of clothing was given to each of 387,500 women and 775,000 children. Late in 1920 it was decided to restrict further operations in Europe so far as possible strictly to medical care, and $5,000,000 was appropriated for this work. Twenty child medical units were put into the field. In America the peace programme of the Red Cross in 1920 contained as its most notable features the further development of its nursing service. Enrolment in this service increased in 1920 from 35,426 to 36,705. The number of Red Cross public health nurses grew from 162 to 908 and the number of women and girls completing the Red Cross course in home hygiene and care of the sick increased during the year from 34,033 to 93,093. There were 57 major disasters in the United States in 1920 which required Red Cross relief. Altogether $780,000 was expended in this relief. (V. L. K.)

REDESDALE, ALGERNON BERTRAM FREEMAN-MITFORD, Baron (1837–1916), British politician and writer (*see* 22.968), in 1906 accompanied Prince Arthur of Connaught on his mission to Japan to invest the Mikado with the Order of the Garter. In 1915 he published his memoirs. He died at Batsford Park, Glos., Aug. 17 1916. His eldest son was killed in action in May 1915, and he was succeeded as second baron by his second son, David Bertram Ogilvy Freeman-Mitford (b. 1877).

REDMOND, JOHN EDWARD (1851–1918), Irish politician (*see* 22.968*), obtained for the first time a position of real power in Parliament after the first general election of 1910. After he had amalgamated the two Irish Nationalist parties under his own lead in 1900, he had never hitherto been able, owing to the large Unionist majority of 1900, and the independent Liberal majority of 1906, to hold that balance of power in the House of Commons which had proved such a formidable weapon in the hands first of O'Connell and afterwards of Parnell. But the great reduction of the Liberal forces in Jan. 1910 made it impossible that Mr. Asquith's Government should long continue unless it found favour in Mr. Redmond's eyes. The first use which he made of this new authority was to insist that Mr. Lloyd George's famous budget of 1909, on which the dissolution had turned, but which was in itself not very congenial to the Irish party, should be postponed till after the constitutional resolutions directed against the House of Lords—his one object being to remove the veto of the Upper House, which was the main barrier against Home Rule. This order of procedure was also demanded by the Labour party and by the Radicals; and the Government complied. But Redmond did not trust them completely, and pressed for an assurance that the Royal prerogative would be at the Prime Minister's disposal to overbear any rejection by the Lords of the veto resolutions. He regretted King Edward's death as being a momentary "check to the onward march of the constitutional struggle," and he was impatient at the constitutional conference which was called early in the new reign in order to endeavour—vainly, as the result proved—to discover a solution by consent. He himself occupied the months of its session by a successful expedition to America to secure sympathy and funds. In spite of a harassing movement on his flank by a small party of Independent Nationalists who had Mr. O'Brien and Mr. Healy as their spokesmen, and who accused him of having sold the Irish vote to the Government, he subsequently conducted a strenuous campaign on behalf of the ministerial programme for the second general election of the year. He denounced the House of Lords as the special enemy of Ireland, and said that this was not only a Home Rule election, but the great Home Rule election. When the result of the polling had confirmed him in his tenure of the balance of Parliamentary power, he forwarded the progress of the Parliament bill in 1911 by the steady vote of his party rather than by speech. In the autumn he was regularly consulted on the details of the forthcoming Home Rule bill, and delivered speeches assuring the English that the Home Rule Parliament would be duly subordinate to the Imperial Parliament, and that the Protestants had nothing to fear from Roman Catholic domination, and assuring the Irish that they would find the provisions of the bill satisfactory. When the bill was introduced in April 1912, he welcomed it in the House on behalf of the Nationalists as a great and adequate measure. He disclaimed Separatism, and said that Irish Separatists, once numerous, were now very few, and would disappear when Home Rule was granted. He went over to Ireland and succeeded in almost silencing adverse Nationalist criticism of details, and procured an enthusiastic acceptance of the bill from a Nationalist convention. His speeches during the passage of the bill through Parliament were of a moderate character and accepted the measure as a final settlement; but, while professing goodwill towards Ulster, he resisted any attempt to take her out of the bill as a mutilation of Ireland. In token of the union of feeling between Nationalists and Liberals, he attended the autumn meeting of the National Liberal Federation at Nottingham in Nov. 1912, and spoke for the first time on the same platform as Mr. Asquith, saying that, on every great item of the Liberal programme, the Nationalists were sincerely with them. When, in the next year, these began to talk, in view of the determined attitude of Ulster, of a settlement by consent between parties, he was very slow to agree and was criticised by the Independent Nationalists for his unconciliatory attitude. He professed himself ready to discuss further safeguards; but he would not go into a conference at which Home Rule would be "put into the melting pot"; Ireland, he said, was a unit, and the two-nations theory an abomination. In a speech at Newcastle-upon-Tyne on Nov. 14, he denounced the passionate opposition of the Unionists and Ulster as "a gigantic game of bluff and blackmail." He would pay a large price for settlement by consent; but it must be consistent with national self-government for Ireland. He constantly insisted that the bill would, under the Parliament Act, automatically become law in 1914. But, in deference to the general feeling, he said in the debate on the Address in that year that he would consider in the broadest and friendliest spirit any proposals for an agreed settlement that the Government might make, though he protested against the idea of an Amending bill. When Mr. Asquith proposed the scheme of provisional exclusion, by county option, for six years, he treated this as the extreme limit of concession, and consequently this was the proposal which the Government embodied in their Amending bill. He absolutely refused to consider the total exclusion of Ulster. He had difficulties with the extremists in Ireland that spring and summer. The enrolment of the Ulster Volunteers had suggested the idea of similar formations in the other three provinces to defend the Nationalist idea; and under the fostering of leaders like Casement and of the rising Sinn Fein organization, these forces had reached large numbers—over 100,000 by the spring of 1914. Their growth had been discouraged by Mr. Redmond and his colleagues;

** These figures indicate the volume and page number of the previous article.*

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but he felt it necessary now to obtain control, and, after a somewhat sharp struggle with the extremists, succeeded in doing so in June. At the end of July he took part, in spite of Nationalist criticism, in the abortive Buckingham Palace Conference.

Then came the World War, and in the debate succeeding Sir E. Grey's famous declaration on bank holiday, Aug. 3, Redmond created a profound sensation by a speech in which he declared that the events of recent years had completely altered the Nationalist feeling towards Great Britain. The Government, he said, might withdraw its troops from Ireland, whose coasts would be defended by her own sons, Nationalist Volunteers joining with Ulster Volunteers in the task. This generous attitude was met by the decision of the Government to pass the Home Rule bill into law, suspending its operation till after the war. Redmond took an active part in promoting recruiting in Ireland. He stood on the platform in Dublin Mansion House on Sept. 25 by the side of the Prime Minister and the Lord Lieutenant, and said that Ireland would feel bound in honour to take her place beside the other autonomous portions of the King's dominions. "You have kept faith with Ireland," he said; "Ireland will keep faith with you." Unfortunately, owing partly to the anti-recruiting agitation promoted by Sinn Fein and other extremists, and partly to red tape at the War Office, his efforts were only moderately successful. But he constantly opposed the application of conscription in any shape to Ireland, and in consequence neither of the military service bills of the spring of 1916 applied to that country. He had refused Mr. Asquith's request for his help in office in the Coalition Government of June 1915; and the fact that he stood out, while Sir E. Carson was included, no doubt intensified the smouldering dissatisfaction in southern Ireland, which broke into a blaze in the Dublin Rebellion of Easter 1916. This was a stunning blow to Redmond, who had not realized the growing strength and virulence of the Sinn Fein movement. He expressed in the House of Commons his detestation of the crime, and lent his assistance to the attempt that was made by the Government in the summer through Mr. Lloyd George to arrange an agreed settlement of the whole Irish question. At first it looked as if the negotiations would be successful, on the basis of bringing the Home Rule Act into immediate operation, while excluding the six Ulster counties by an Amending bill which should cover all the period of the war, and a short interval after it. The consent was obtained of all Irish parties, except the southern Unionists; but certain modifications which the Unionists in the Cabinet demanded were treated by the Nationalists as amounting to a breach of faith; and Redmond announced his intention of criticising ministers for their procrastination not only with regard to Ireland but also with regard to the whole conduct of the war. The negotiations having failed, and the Government having restored the ordinary civil administration of Ireland, with Mr. Duke, K.C., a Unionist, as Chief Secretary, Redmond treated this as a fresh outrage on Ireland; and on Oct. 18 he moved a resolution charging ministers with maintaining a system of government in Ireland inconsistent with the principles for which the Allies were fighting in Europe. The result, he said, was that Irish regiments could not be kept up to their full strength, and that his efforts to aid recruiting had been nullified. The motion was, of course, rejected by a large majority. He criticised Mr. Lloyd George's administration in March 1917 on similar lines, and threatened a return by his party to the old obstructionist opposition. In May, however, the Prime Minister suggested among other alternatives that an Irish convention should be assembled for the purpose of producing a scheme of Irish self-government. To this Redmond agreed; and in the convention he played a prominent and conciliatory part, making in particular a favourable impression on the southern Unionists. During its sittings, however, his health failed. He died of heart failure in London on March 6 1918.

In private life, John Redmond was much liked among his friends, but he never went much into society. He was happily married to an Australian lady, Miss Dalton, by whom he had a son and two daughters.

His younger brother, WILLIAM HOEY KEARNEY REDMOND (1861–1917), intended, as a young man, to adopt the army as his profession, and in 1881 he was a lieutenant in the co. Wexford militia battalion of the Royal Irish Regiment. But he resigned his commission to take part in the Land League movement, was imprisoned as a "suspect" in Kilmainham, and went to Australia with his brother to raise funds for the Nationalist agitation. He was returned for Wexford borough in 1883, and sat in Parliament, though for different constituencies, from that time till his death. He was of an ardent and ebullient temper, which resulted in his spending three months in Wexford gaol in 1888 for inciting to resistance to the sheriff, on the occasion of an eviction, and in many agitated scenes at different times in the House of Commons, where, however, he was personally very popular. Like his brother, in the Nationalist split he adhered to Parnell, and also like his brother, on the outbreak of the World War he instantly recognized the duty of Ireland to fling herself into it on the side of the Allies. Though 53 years old, he joined at once the Irish Division, receiving a commission in the Royal Irish Regiment. He was promoted major for services at the front and mentioned in despatches. In his intervals of service he made two thrilling speeches in the House of Commons—one in Dec. 1916, in which he advocated a new Ireland built up out of the war, and declared that Nationalists and Ulstermen came together in the trenches and were friends, and that if they were brought together on the floor of an assembly in Ireland they would be friends too; the other in March 1917, when he besought the House to let the dead past bury its dead, and to make a new start between England and Ireland. He died of wounds in France on June 7 1917.

REDWOOD, SIR BOVERTON, BART. (1846–1919), British chemist, was born in London April 26 1846. He was educated at University College school, London, and by the Pharmaceutical Society, specialized in the study of petroleum and became in 1869 secretary to the Petroleum Association. In this connexion he gave evidence before a select committee of the House of Lords, and his investigations throughout Europe and America qualified him to be the adviser of the Government as to the best use of petrol and oil fuel both before and during the World War. He founded the Institution of Petroleum Technologists and became its first president. He was knighted in 1905 and created a baronet in 1911. He died in London June 4 1919.

REHAN, ADA (1860–1916), American actress (*see* 23.48), died in New York City Jan. 8 1916.

REID, SIR GEORGE (1841–1913), British painter (*see* 23.50), died at Oakhill, Som., Feb. 9 1913.

REID, SIR GEORGE HOUSTOUN (1845–1918), Australian statesman, was born at Johnstone, Renfrewshire, Feb. 25 1845. His father, a Presbyterian minister, emigrated to Australia seven years later, and the boy was therefore Australian by education though not by birth. At the age of 13 he became a junior clerk in a business house in Sydney, but later entered the N.S.W. civil service and began to read for the bar, being finally called in 1879. Politics attracted him more than law, and in 1880 he was elected member for E. Sydney, together with Sir Henry Parkes but above him in the poll. He stood as a free trader, a policy to which he adhered throughout his political career, and with one short break (1884–5) he represented E. Sydney in the N.S.W. Legislature until 1901 when he was elected its representative in the Federal Parliament. He first held office in N.S.W. for a brief period in 1883–4 as Minister of Public Instruction. In 1894 he became its Premier and during his term of office (1894–9) introduced reforms into the civil service and represented the Colony at Queen Victoria's Diamond Jubilee. He did much to promote Federation and from 1901–9 led the free-trade party in the Federal Parliament, becoming Premier for a short period (1904–5) but being for the most part leader of the Opposition. When the Act to constitute an Australian High Commissionership was passed in 1909 Sir George Reid became the first High Commissioner and was created K.C.M.G. He represented his country in London in genial fashion until 1916, and at the end of his term of office

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stood for the British House of Commons and was elected for the St. George's Hanover Square division of London Jan. 1916. He was created G.C.M.G. in 1911 and G.C.B. in 1916. He published *My Reminiscences* (1917), as well as *Five Free Trade Essays* (1875), and other economic papers. He died suddenly in London, Sept. 12 1918.

REID, WHITELAW (1837–1912), American journalist and diplomatist (*see* 23.52), died in London Dec. 15 1912. His last public address was delivered before the students of the University College of Wales, Aberystwyth, on "Thomas Jefferson." In 1912 appeared *The Scot in America and the Ulster Scot* and posthumously, in 1913, *American and English Studies*.

See Royal Cortissoz, *The Life of Whitelaw Reid* (1921).

REINACH, JOSEPH (1856–1921), French author and politician (*see* 23.55), was not reëlected to the Chamber of Deputies in 1914. During the World War his series of articles, "Les Commentaires de Polybe," in the *Figaro*, were remarkable for their clear vision. He died April 18 1921.

RÉJANE, GABRIELLE [CHARLOTTE RÉJU] (1857–1920), French actress (*see* 23.58), died in Paris June 14 1920. During the World War she visited England and appeared at the Court theatre, London, in a patriotic play, *Alsace*, and at the Coliseum in *The Bet*, when she played the part of a Frenchwoman visiting the English battle-zone. She was made Chevalier of the Legion of Honour for her war services.

RELATIVITY.—The progress of physical science during the decade 1910–20 was specially remarkable for the definite emergence into general public discussion of the principle of Relativity, as expounded by Prof. Albert Einstein, professor of Physics in the Kaiser Wilhelm Institut, Berlin. Its meaning and its history as part of present-day physical theory are discussed below.

Introduction.—The primary aim of the investigator in pure science is the discovery of natural laws. As a secondary and hardly less important aim, he tries to invent a mechanism which shall account for the laws already known. The secondary aim is forced upon him partly by the constitution of the human mind; our intellects, unsatisfied with a mere accumulation of facts, impel us ever to search for the causes underlying the facts: *Vere scire est per causas scire.* But to the working scientist the discovery of a mechanism has an additional and more practical value. When he has found a mechanism which will account for certain laws, he can proceed to examine the complete set of laws which the mechanism demands. If his mechanism corresponds with sufficient closeness to reality he may in this way be led to the discovery of new natural laws. On the other hand, the new laws deduced from the supposed mechanism may be false. If the falsity of the new laws is not at once revealed science may for a time be led into wrong paths. When more accurate experimenting or observation discloses that the laws are not true, a recasting of ideas becomes necessary, and the branch of science concerned may experience a time of revolution followed by a period of rapid growth.

An obvious illustration of these general statements is provided by the history of astronomy. The laws of the motions of the planets, as observed from the earth, were tolerably well known to the Greeks. They had also evolved an explanatory mechanism, starting from the metaphysical premise that the paths of the planets must necessarily be circles. The earth was the centre of the universe and round this revolved spheres to which the planets were attached. To explain the retrograde motion of the outer planets, these were supposed attached to secondary spheres revolving about points on the primary spheres which in turn revolved about the earth. This mechanism of cycles and epicycles held the field as an explanation of planetary motion for eighteen centuries. Finally the observations of Tycho Brahe provided a test which revealed the falsity of the whole structure. The position of Mars was found to differ from that required by the mechanism of epicycles by an amount as great as eight minutes of arc. "Out of these eight minutes," said Kepler, "we will construct a new theory that will explain the motions of all the planets."

The history of the succeeding century of astronomy need not be recapitulated here (*see* 2.811). The earth yielded its place as the centre of the universe, and the structure of cycles and epicycles crumbled away. The laws of planetary motion were determined with a precision which for the time appeared to be final. The mechanism underlying these laws was supposed to be a "force" of gravitation. This force was supposed to act between every pair of particles in the universe, its intensity varying directly as the product of the masses of the particles and inversely as the square of the distance separating them—the famous law of Newton.

In science, history repeats itself. Recent years have provided a further instance of the general processes we have been considering. Under the Newtonian mechanism every planet would describe a perfect ellipse about the sun as focus, and these elliptic orbits would repeat themselves indefinitely except in so far as they were disturbed by the gravitational forces arising from the other planets. But, after allowing for these disturbing influences, Leverrier found that the orbit of the planet Mercury was rotating in its own plane at the rate of 43 seconds a century. Various attempts have been made to reconcile this observed motion with the Newtonian mechanism. The gravitational forces arising from the known planets were demonstrably unable to produce the motion in question, but it was possible that Mercury's orbit was being disturbed by matter so far unknown to us. Investigations were made as to the disturbance to be expected from various hypothetical gravitating masses—a planet, or a ring of planets, between Mercury and the sun, a ring of planets outside the orbit of Mercury, a belt of matter extended in a flattened disc in a plane through the sun's centre, an oblateness, greater than that suggested by the shape of the sun's surface, in the arrangement of the internal layers of the sun's mass. In every case the mass required to produce the observed disturbance in the motion of Mercury would have also produced disturbances not observed in the motions of the other planets. The solution of the problem came only with the theory of relativity. Just as Tycho's eight minutes of arc, in the hands of Kepler and Newton, revolutionized mediaeval conceptions of the mechanism of the universe, so Leverrier's 43 seconds of arc, in the hands of Einstein, has revolutionized our 19th-century conceptions, not only of purely astronomical mechanism, but also of the nature of time and space and of the fundamental ideas of science. The history of this revolution is in effect the history of the theory of relativity. It falls naturally into two chapters, the first narrating the building of an earlier physical theory of relativity, and the second dealing with its extension to gravitation.

The Physical Theory of Relativity.—The earliest successful attempt to formulate the laws governing the general motion of matter is found in Newton's laws. The first law states that—

"*Every body perseveres in its state of rest or of uniform motion in a right line unless it is compelled to change that state by forces impressed thereon.*"

In this law no distinction is made between rest and uniform motion in a straight line, and the same is true of the remaining laws. Hence follows the remarkable property to which Newton draws explicit attention in his fifth corollary to the laws of motion:—

"*The motions of bodies included in a given space are the same among themselves, whether that space is at rest, or moves uniformly forwards in a right line without any circular motion.*"

As a concrete application of this principle, Newton instances "the experiment of a ship, where all motions happen after the same manner whether the ship is at rest or is carried uniformly forward in a right line." Just as a passenger on a ship in a still sea could not determine, from the behaviour of bodies inside the ship, whether the ship was at rest or moving uniformly forward, so we cannot determine from the behaviour of bodies on our earth whether the earth is at rest or not. We believe the earth to be moving round the sun with a speed of about 30 km. a second, so that there can be no question of the earth being permanently at rest, but we are unable to determine whether

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it is at rest at any specified point of its orbit, or, in the probable event of its not being at rest, what its absolute velocity may be. There is no more reason for thinking the sun, than the earth, to be at rest. Newton wrote as follows:—

"It is possible that in the remote regions of the fixed stars, or perhaps far beyond them, there may be some body absolutely at rest, but impossible to know, from the positions of bodies to one another in our regions, whether any of these do keep the same position to that remote body. It follows that absolute rest cannot be determined from the position of bodies in our regions."

The above quotations are all from the first book of the *Principia Mathematica*. Previous to them all Newton writes: "I have no regard in this place to a medium, if any such there is, that freely pervades the interstices between the parts of bodies." The two centuries which elapsed after the publication of the *Principia* witnessed a steady growth of the belief in the reality of such an all-pervading medium. It was called the aether, and by the end of these two centuries (1887) it was almost universally believed that light and all electromagnetic phenomena were evidence of actions taking place in this aether. Light from the most distant stars was supposed to be transmitted to us in the form of wave motions in the aether, and we could see the stars only because the sea of aether between us and these stars was unbroken. It had been proved that if this sea of aether existed it must be at rest, for the alternative hypothesis that the aether was dragged about by ponderable bodies in their motions had been shown to be incompatible with the observed phenomenon of astronomical aberration and other facts of nature (*see* 1.292). On this view it was no longer necessary to go to Newton's "remote regions of the fixed stars, or perhaps far beyond them," to find absolute rest. A standard of absolute rest was provided by the aether which filled our laboratories and pervaded all bodies. Owing to our motion it would appear to be rushing past us, although without encountering any hindrance—"like the wind through a grove of trees," to borrow the simile of Thomas Young. The determination of the absolute velocity of the earth was reduced to the problem of measuring the velocity of an aether current flowing past us and through us.

In this same year (1887) the first experimental determination of this velocity was attempted by the Chicago physicist A. A. Michelson. The velocity of light was known to be, in round numbers, 300,000 km. a second, a velocity which was believed to represent the rate of progress of wave motion through the aether. If the earth were moving through the aether with a velocity of 1,000 km. a second, the velocity of light relative to a terrestrial observer ought to be only 299,000 km. a second when the light was sent in exactly the direction of the earth's motion through the aether, but would be 301,000 km. a second if the light was sent in the opposite direction. In more general terms, if the earth were moving through the aether, the velocity of light, as measured by a terrestrial observer, would depend on the direction of the light, and the extent of this dependence would give a measure of the earth's velocity. The velocity of light along a single straight course does not permit of direct experimental determination, but the same property of dependence on direction ought to be true, although to a less extent, of the average to-and-fro velocity of a beam of light sent along any path and then reflected back along the same path.

It was through this property that Michelson attempted to measure the earth's velocity through the aether.

The apparatus was simple in principle. A circular table ABCD was arranged so as to be capable of slow rotation about its centre O. Light sent along CO was divided up at O into two beams which were made to travel along perpendicular radii OA, OB. The arms OA, OB were made as equal as possible and mirrors were placed at A and B to reflect the beams of light back to O. An extremely sensitive optical method made it possible to detect even a very slight difference in the times of the total paths of the two beams from O back to O. There would in any case be a difference owing to the necessarily imperfect equalization of the lengths of the arms OA, OB, but if the earth is moving through the aether in some direction OP, and if the table is made to rotate slowly about O, then this difference ought itself to vary on account of the earth's motion through the aether. Michelson, and afterwards Michelson and Morley in collaboration, attempted to estimate the amount of this variation. No variation whatsoever could be detected, although their final apparatus was so sensitive that the variation produced by a velocity through the aether of even 1 km. a second ought to have shown itself quite clearly.

Thus to the question "What is our velocity through the aether?" Nature appeared to give the answer "None." It was never suggested that this answer should be accepted as final; it would have brought us back to a geocentric universe. Clearly either the question had been wrongly framed or the answer wrongly interpreted. It was pointed out in 1893 by Fitzgerald, and again, independently, in 1895, by Lorentz, that the *null* result of the Michelson-Morley experiment could be explained if it could be supposed that motion through the aether altered the linear dimensions of bodies.

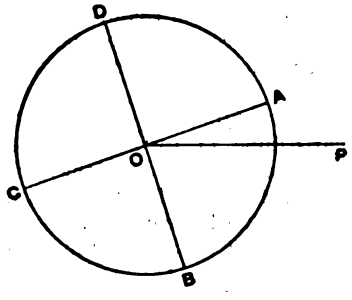

FIG. 1.

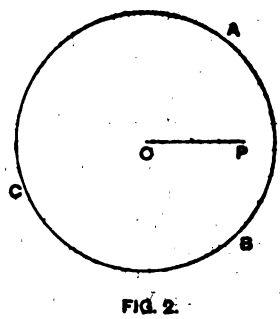

FIG. 2.

To be explicit, it was found that the experiment would invariably and of necessity give a *null* result if it was supposed that every body moving through the aether with a velocity u was contracted in the direction of its motion in the ratio $\sqrt{1-\frac{u^2}{c^2}}$, c being the velocity of light. The supposition that such a contraction occurred was not only permissible—it was almost demanded by electrical theory. For Lorentz had already shown that if matter were a purely electrical structure, the constituent parts would of necessity readjust their relative positions when set in motion through the aether and the final position of equilibrium would be one showing precisely the contraction just mentioned.

On this view, there was no *prima-facie* necessity to abandon the attempt to measure the earth's velocity through the aether. The answer to the problem had merely been pushed one stage farther back, and it now became necessary only to measure the shrinkage of matter produced by motion. It was obvious from the first that no direct material measurement could disclose the amount of this shrinkage, since any measuring rod would shrink in exactly the same ratio as the length to be measured; but optical and electrical methods appeared to be available. Experiments to this end were devised and performed by Rayleigh, Brace, Trouton and Noble, Trouton and Rankine and others. In every case a *null* result was obtained. It appeared then that if the earth moved through the aether this motion was concealed by a universal shrinkage of matter, and this shrinkage was in turn concealed by some other agency or agencies whose wit, so far, appeared to be greater than that of man.

At this time the word "conspiracy" found its way into the technical language of science. There was supposed to be a conspiracy on the part of the various agencies of nature to prevent man from measuring his velocity of motion in space. If this motion produced a direct effect x on any phenomenon, the other agencies of nature seemed to be in league to produce a countervailing effect $-x$. A long train of experiments had not revealed, as was intended, our velocity through the aether; they had merely created a conviction that it was beyond the power of man to measure this velocity. The conspiracy, if such there was, appeared to have been perfectly organized.

A perfectly organized conspiracy of this kind differs only in name from a law of nature. To the inventor who tries to devise a perpetual-motion machine it may well appear that the forces of nature have joined in a conspiracy to prevent his machine from working, but wider knowledge shows that he is in conflict not with a conspiracy, but with a law of nature—the conservation of energy. In 1905 Einstein, crystallizing an idea which must

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have been vaguely present in many minds, propounded the hypothesis that the apparent conspiracy might be in effect a law of nature. He suggested, tentatively, that there might be a true law to the effect that "it is of necessity impossible to determine absolute motion by any experiment whatever." This hypothetical law may again be put in the equivalent form: "The phenomena of nature will be the same to two observers who move with any uniform velocity whatever relative to one another." This may be called the hypothesis of relativity.

The hypothesis in itself was not of a sensational character. Indeed, from the quotations which have already been given from Newton's works, it appears probable that Newton himself would have accepted the hypothesis without hesitation: he might even have regarded it as superfluous. The true significance of the hypothesis can only be understood by a reference to the scientific history of the two centuries which had elapsed since Newton. The Newtonian view that absolute rest was to be found only "in the remote regions of the fixed stars, or perhaps far beyond them," had given place to a belief that absolute rest was to be found all around us in an aether which permeated all bodies. What was striking about the hypothesis was its implication—either that we could not measure the velocity relative to ourselves of a medium which surrounded us on all sides, or else that no such medium existed.

The hypothesis demanded detailed and exhaustive examination. It was for the mathematician to test whether the hypothesis was in opposition to known and established laws of physics, and to this task Einstein, Lorentz and others set themselves. If a single firmly established law proved to be in opposition to the hypothesis, then of course the hypothesis would require to be abandoned. It was unlikely that such an event would occur among the well-established laws, for if it did, the phenomena governed by that law would enable direct measurement to be made of the earth's velocity through the aether, a measurement which had so far eluded all attempts of experimenters. It was among the more obscure and less well-established laws, if anywhere, that discrepancies were to be looked for.

It is impossible here to give a complete account of the many tests to which the relativity hypothesis has been subjected. The result of all can be summed up in one concise and quite general statement:—Wherever the hypothesis of relativity has appeared to be in conflict with known or suspected natural laws, further experiment, where possible, has, without a single exception, shown the laws to be erroneous, and has moreover shown the alternative laws suggested by the hypothesis of relativity to be accurate. It is only in somewhat exceptional cases that the hypothesis of relativity of itself suffices to determine fully the form of a natural law; these cases constitute the most striking triumphs of the theory. As instances may be mentioned the determination of the law connecting the mass of an electron with its velocity; of the law expressing the velocity of light through a transparent medium in motion (Fizeau's water-tube experiment); and of the formulae for the magnetic forces on moving dielectric media (experiments of Eichenwald and H. A. Wilson).[1]

Before passing on from the general statement which has been made, particular mention must be made of one special case. A natural law which was at an early stage seen to be in conflict with the hypothesis of relativity was Newton's famous law of gravitation—namely, that every particle of matter attracts every other particle with a force proportional to the product of the two masses, and to the inverse square of their distance apart. Either, then, Newton's great law had to be abandoned, or else the hypothesis of relativity had to be discarded, in which case it would immediately become possible, in theory at least, to determine the earth's velocity through space by gravitational means. It is the choice between these two alternatives that has led to the most surprising developments of the theory of relativity; and to these we shall return later.

[1] For references to the original papers dealing with these and other tests of the hypothesis of relativity see Cunningham, *The Principle of Relativity*, or J. H. Jeans, *Mathematical Theory of Electricity and Magnetism* (4th ed.).

Space and Time.—The hypothesis of relativity, as has already been explained, postulates that the phenomena of nature will be the same to any two observers who move relative to one another with any uniform velocity whatever. The hypothesis has been so amply tested as regards all optical and electromagnetic phenomena that no doubt is felt, or can rationally be felt, as to its truth with respect to these phenomena. The hypothesis can be examined and developed in two opposite directions. We may, on the one hand, proceed from the general hypothesis to the detailed laws implied in it; this has already been done, with completely satisfactory results as regards confirmation of the hypothesis. Or we may regard the hypothesis of relativity as being itself a detailed law and attempt to generalize upward to something still wider. It is this possibility which must for the moment claim our attention.

In 1905 Einstein examined in full the consequences of the hypothesis that one simple optical phenomenon—namely, the transmission of a ray of light in free space—was, in accordance with the hypothesis of relativity, independent of the velocity of the observer. If an aether existed, and provided a fixed framework of reference, then light set free at any instant would obviously travel with a velocity which would appear to an observer at rest in this aether to be the same in all directions, and the wave front at any instant would be a sphere having the observer as centre. On the hypothesis of relativity the phenomenon of light transmission must remain unaffected by the motion of the observer, so that the light must appear to a moving observer also, to travel with a uniform velocity in all directions, and thus to the moving observer also the wave front must appear to be a sphere of which he will be the centre. It is, however, quite obvious that the same spherical wave front cannot appear to each of two observers who have moved some distance apart to be centred round himself, unless the use either of the common conceptions of science or of the ordinary words of language is greatly changed. In fig. 2 it is not possible in ordinary language that both O and P should at the same instant be at the centre of the sphere A B C. The change to which Einstein was forced is one which has an intimate bearing upon our fundamental conceptions of the nature of space and time; this change it will be necessary to explain in some detail.

Suppose that two observatories, say Greenwich and Paris, wish to synchronize their clocks, with a view to, let us say, an exact determination of their longitude difference. Paris will send out a wireless signal at exact midnight as shown by the Paris clock, and Greenwich will note the time shown by the Greenwich clock at the instant of receipt of the signal. Greenwich will not, however, adjust their clock so as to show exact midnight when the signal is received; a correction of about ·001 second must be made to allow for the time occupied by the signal in traversing the distance from Paris to Greenwich. To turn to mathematical symbols, if t_0 is the time at which a signal is sent out from one station, the time of receipt at a second station is taken to be $t_0+\frac{x}{c}$, where x is their distance apart, and c is the velocity of light. This represents the ordinary practice of astronomers, but it is clear that if the earth is travelling through a fixed aether with a velocity u in the direction of the line joining the two observatories, the velocity of transmission of the signal relative to the two observatories will not be c but $c+u$, and the time of receipt at the second station will be $t_0+\frac{x}{c+u}$. Thus it appears that it is impossible to synchronize two clocks unless we know the value of u, and that the ordinary practice of astronomers will not, as they expect, synchronize their clocks, but set them at an interval apart equal to

$$x\left(\frac{1}{c}-\frac{1}{c+u}\right)$$

which may, to an approximation, be put equal to $\frac{ux}{c^2}$.

According to the hypothesis of relativity, it is impossible ever to determine the value of u, and so is impossible ever truly

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to synchronize two clocks. Moreover, according to this hypothesis, the phenomena of nature go on just the same whatever the value of u, so that the want of synchrony cannot in any way show itself—in fact, if it did, it would immediately become possible to measure the effect and so arrange for true synchrony.

As the earth moves in its orbit, the value of u changes, so that its value in the spring, for instance, will be different from its value in the autumn. One pair of astronomers may attempt to synchronize a pair of clocks in the spring, but their synchronization will appear faulty to a second pair who repeat the determination in the autumn. There will, so to speak, be one synchrony for the spring and another for the autumn, and neither pair of astronomers will be able to claim that their results are more accurate than those of their colleagues. More generally we may say that different conceptions of synchrony will correspond to different velocities of translation.

These elementary considerations bring us to the heart of the problem which we illustrated diagrammatically in fig. 2. The observer at O in the diagram will have one conception of simultaneity, while the second observer who moves from O to P will, on account of his different velocity, have a different conception of simultaneity. The instants at which the wave front of the light signal from O reaches the points A, B, C in the diagram will be deemed to be simultaneous by the observer who remains at O, but the observer who moves fron O to P will quite unconsciously have different ideas as to simultaneity. At instants which he regards as simultaneous the wave front will have some form other than that of the sphere A B C surrounding O. If the hypothesis of relativity is to be true in its application to the transmission of light signals, this wave front must be a sphere having P as its centre.

Einstein examined mathematically the conditions that this should be possible. Unfortunately a precise statement of his conclusions can only be given in mathematical language.

The observer who is supposed to remain at O in fig. 2 may be supposed to make exact observations and to record these observations in mathematical terms. To fix the positions of points in space he will map out a " frame of reference " consisting of three orthogonal axes, and use Cartesian coördinates x, y, z, to specify the projections along these axes of the radius from the origin to any given point. He will also use a time coördinate t which may be supposed to specify the time which has lapsed since a given instant, as measured by a clock in his possession. Any observations he may make on the transmission of light signals can be recorded in the form of equations between the four coördinates x, y, z, t. For instance, the circumstance that light travels from the origin with the same velocity c in all directions will be expressed by the equation (of the wave front):—

$$x^2+y^2+z^2-c^2t^2=0. \quad . \quad . \quad . \quad (1)$$

The second observer who moves from O to P will also construct a frame of reference, and we can simplify the problem by supposing that his axes are parallel to those already selected by the first observer. His coördinates, to distinguish them from those used by the first observer, may be denoted by the accented letters x', y', z', t'. If his observations also are to show light always to travel with the same velocity c in all directions, the equation of the wave front, as observed by him, must be:—

$$x'^2+y'^2+z'^2-c^2t'^2=0. \quad . \quad . \quad . \quad (2)$$

A 19th-century mathematician would have insisted that x, y, z, t must be connected with x', y', z', t' by the simple relations:—

$$\left.\begin{aligned} x' &= x - ut \\ y' &= y \\ z' &= z \\ t' &= t \end{aligned}\right\} \quad . \quad . \quad . \quad (A)$$

but it is obvious that if these relations hold, then equation (1) cannot transform into equation (2). Einstein finds that equation (1) will transform into equation (2) provided the coördinates x, y, z, t of the first observer are connected with the coördinates x', y', z', t' of the second observer by the equations:—

$$\left.\begin{aligned} x' &= \beta\,(x-ut) \\ y' &= y \\ z' &= z \\ t' &= \beta\left(t-\frac{ux}{c^2}\right) \end{aligned}\right\} \quad . \quad . \quad . \quad (B)$$

where β stands for $\left(1-\frac{u^2}{c^2}\right)^{-\frac{1}{2}}$.

To form some idea of the physical meaning of these equations, it will be advantageous to consider the simple case in which the first observer is at rest in the aether while the second moves through the aether with velocity u. The points of difference between equations (B) and (A) then admit of simple explanation. The factor β in the first of equations (B) is simply, according to the suggestion of Fitzgerald and Lorentz already mentioned, the factor according to which all lengths parallel to the axis of x must be adjusted on account of motion through the aether with velocity u. The moving observer must correct his lengths by this factor, and he must correct his times by the same factor in order that the velocity of propagation of light along the axis of x may still have the same velocity c; this explains this presence of the multiplier β in the last of equations (B). The one remaining difference between the two sets of equations, namely the replacement of t in (A) by $t-\frac{ux}{c^2}$ in (B), represents exactly the want of synchrony which, as we have already seen, is to be expected in the observations of two observers whose velocity differs by a velocity u.

Although the equations admit of simple illustration by considering the case in which one observer is at rest in a supposed aether, it will be understood that the equations are more general than the illustration. They are in no way concerned with the possibility of an observer being at rest in an aether, or indeed with the existence of an aether at all. Their general interpretation is this: If one observer O, having any motion whatever, finds, as a matter of observation, that light for him travels uniformly in all directions with a constant velocity c, then a second observer P, moving relative to O with a constant velocity u along the axis of x, will find, as a matter of observation, that light, for him also, travels uniformly in all directions with the same constant velocity c, provided he uses, for his observations, coördinates which are connected with the coördinates of O by equations (B).

This is the meaning that was attached to the equations by Einstein in 1905, but the equations had been familiar to mathematicians before this date. They had in fact been discovered by Lorentz in 1895 as expressing the condition that all electromagnetic phenomena, including of course the propagation of light, should be the same for an observer moving through the aether with velocity u as for an observer at rest in the aether. For this reason the transformation of coördinates specified by these equations is universally spoken of as a " Lorentz transformation." What Einstein introduced in 1905 was not a new system of equations but a new interpretation of old equations. The two observers who used the coördinates x, y, z, t and x', y', z', t' had been regarded by Lorentz as being one at rest in an aether and one in motion with a velocity u; for Einstein they were observers moving with any velocities whatever subject to their relative velocity being u. Lorentz had regarded t as the true time and t' as an artificial time. If the observer could be persuaded to measure time in this artificial way, setting his clocks wrong to begin with and then making them gain or lose permanently, the effect of his supposed artificiality would just counterbalance the effects of his motion through the aether. With Einstein came the conception that both times, t and t', had precisely equal rights to be regarded as the true time. The measure t' is precisely that which would be adopted naturally by any set of observers, or race of men, who disregarded their steady motion through space; their adoption of it would be above criticism if, as Einstein suggested, their motion through space had no influence on material phenomena, and it represents, as we have seen, the usual practice of astronomers in comparing time at different places. From this point of view,

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neither measure of time is more accurate or more logical than the other. There are as many ways of measuring time as there are observers, and all are right.

The investigator who is trying to discover laws of nature will, in general, require to measure either directly or indirectly both time and space. If, to take a simple case, he is studying the motion of a single particle, he will measure out the position of the particle at definite instants as determined by his clock. He may specify the position of the particle at any instant by three measurements in space—for instance, he may say that two seconds after his particle started it was 6 ft. to the E. of the point from which it started, 9 ft. to the N. and 12 ft. vertically upward. The mathematician would express this by taking axes x, y, z to the E., to the N. and vertically upwards, and saying that at time $t=2$ the particle had coördinates $x=6$, $y=9$, $z=12$. Or he might, putting his time coördinate t on the same footing as the space coördinates x, y, z, simply say that $x=6$, $y=9$, $z=12$, $t=2$ represented one position of the particle. A complete set of readings of this type, each consisting of values of four coördinates, would give the complete history of the motion of the particle.

Such sets of simultaneous measurements form the common material of investigations in both pure and applied science. For instance, the engineer may measure the extension of a sample of steel corresponding to different loads; the electrician may measure the amount of light given by an electric filament corresponding to different amounts of current passed through it. In each of these cases there are only two quantities to be measured simultaneously, and an investigator can conveniently represent the result of the whole series of his measurements in graphical form; a single reading is represented by a point whose distances from two fixed perpendicular lines represent the quantities measured, and the curve obtained by joining these single points will give all the information contained in the whole set of readings.

We have seen that, in studying the motion of a particle in space, four sets of quantities must be measured, so that the results obtained cannot be plotted graphically on a piece of paper. Their proper representation demands a four-dimensional space, in which x, y, z and t are taken as coördinates. The practical importance of such graphical representation is *nil*, since it is impossible to construct a four-dimensional graph, but its theoretical importance to the theory of relativity is immense. For if the hypothesis of relativity is true, then the four-dimensional graphs of any natural event constructed by all observers, no matter what their relative motions, will be identical. The influence of their motion will be shown only in that the axes of x, y, z and t will be different for different observers, and the relations between these sets of axes will be those given by the foregoing equations (B).

The importance of this conception can hardly be overestimated, and it may be well to consider it further with the help of an illustrative example. Imagine a number of aeroplanes flying over England, and, in order to eliminate one of the three directions in space—the vertical—let us limit them to fly always at the same height, say 1,000 ft. above sea-level. Imagine a number of similar plates of glass prepared, each marked faintly with an outline map of England and with lines of latitude and longitude. Suppose that at 12 h. 0 m. G.M.T. a plate is taken and the position of each aeroplane marked by a thick black dot. At 12 h. 1 m. let a second plate be taken and similarly marked, and let this be done every minute for an hour. The 60 plates so marked will constitute a record of the motion of each aeroplane within this hour. If, now, we place the plates in order, one above the other, on a horizontal table, the mass of glass so formed will present a graphical representation, in three dimensions, of the motions of all the aeroplanes. In this graph the two horizontal coördinates represent motions in any two rectangular directions over England, say E. and N., while the third coördinate—the vertical—represents time. The individual black dots which represent the positions of any one aeroplane will form a dotted curve, and this curve gives a graphical representation of the motion of the particular aeroplane. Our rectangle of glass contains the history, for one hour, of all the aeroplanes in graphical form.

To represent the motion of particles in the whole world of space a four-dimensional graph is required. The four-dimensional space in which it is constructed may, following the usual terminology, be spoken of as a four-dimensional continuum. The history of any particle in the universe—just as that of any aeroplane flying over England—will be represented by a continuous line in the continuum, and this is called the "world line" of the particle. If the hypothesis of relativity is true the same continuum and the same world lines will represent the history of the particles of the universe equally well for all observers, the influence of their motions being shown only through their choosing different axes in the continuum for their axes of space and time. Thus the continuum must be thought of as something real and objective, but the choice of axes is subjective and will vary with the observer, the relation between different choices being expressed mathematically by our equations (B), the equations of the Lorentz transformation. An inspection of these equations shows that the sets of axes chosen by different observers have different orientations in the continuum, so that what one observer describes as a pure space interval will appear to another to be a mixture of time and space.

The instant of time and point in space at which any event occurs can be fixed by a single point in the continuum, so that the interval between two events will be represented by a finite line. The events and the interval between them are absolute, but the interval will be split up into time and space in different ways by different observers. The interval between any two events, such as the great fire of London and the outburst on the star Nova Persei, may be measured by one set of observers as so many years and so many millions of miles, but another set of observers may divide the interval quite differently. For instance a terrestrial astronomer may reckon that the outburst on Nova Persei occurred a century before the great fire of London, but an astronomer on the Nova may reckon with equal accuracy that the great fire occurred a century before the outburst on the Nova. A third astronomer may insist that the events were simultaneous. All will be equally right, although none will be right in an absolute sense. At this stage we may notice one respect in which our pile of glass plates failed to represent the true continuum. The mass of glass was stratified into different plates which represent different times for one particular observer. To obtain a section which would represent what an observer in motion relative to this first observer could regard as simultaneous positions of the aeroplanes, we should have to cut the mass of glass on the slant. The continuum is more closely represented by our plates of glass if they are annealed into a solid mass from which all trace of the original stratification is made to disappear. All observers, no matter what their motion, are then equally free to cut a section to represent their individual ideas of simultaneity.

Thus space and time fade into subjective conceptions, just as subjective as right hand or left hand, front and behind, are in ordinary life. The continuum alone is objective and may be thought of as containing an objective record of the motion of every particle of the universe. The curve in which this record is embodied is spoken of as the world line of the particle in question. To use the words of Minkowski: "Space in itself and time in itself sink to mere shadows, and only a kind of union of the two retains an independent existence."

Gravitation and Relativity.—Since all the phenomena of light and of electromagnetism are believed, on almost incontrovertible evidence, to be in accordance with the hypothesis of relativity, it is necessarily impossible to determine absolute velocity by optical or gravitational means. On the other hand, as we have already mentioned, the Newtonian law of gravitation is readily seen to be inconsistent with the hypothesis of relativity. Three alternatives are open:—

(i.) The Newtonian law may be true, in which case it must be possible to determine absolute velocity by gravitational means.

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(ii.) The Newtonian law may be untrue in its original form, but may become true when amended so as to conform to the relativity hypothesis.

(iii.) Neither of the foregoing possibilities may be true.

Alternative (i.) was explored by Sir Oliver Lodge, who, assuming the exact truth of the Newtonian law of gravitation, deduced that the observed motion of the perihelion of Mercury could be accounted for if the sun were moving through space with a velocity of about 70 km. a second in a certain direction. This investigation had to be abandoned when it was shown by Eddington that a similar discussion of the motions of the other planets would lead to vastly different values for the sun's velocity. Alternative (ii.) was explored by Einstein and others, but was found to lead to a motion of the perihelion of Mercury equal only to one-sixth part of that actually observed.

Alternative (iii.) remained with its innumerable possibilities. Einstein commenced his attack on the problem by eliminating all possibilities which did not conform to two general principles. The first of these was the principle of relativity. Inasmuch as all physical phenomena except gravitation were believed to conform to this principle, it was natural to try, as a working hypothesis, the effect of assuming gravitation also to conform. The second principle was the so-called principle of equivalence, and this demands a word of explanation.

To our children we explain that an apple falls to the ground because a force of gravitation inherent in the earth's mass impels the apple towards the centre of the earth. Most schoolboys know that this is not quite the whole story; the path of the apple is more accurately determined by supposing the apple to be acted on simultaneously by two forces—a gravitational force of attraction towards the earth's centre and the centrifugal force arising from the earth's rotation. It is only because the earth's rotation is comparatively slow that the conception of an attraction towards the earth's centre gives a tolerably plausible account of the fall of the apple. If the earth rotated at 17 times its present rate objects would not fall, even approximately, towards the earth's centre; they would fall always parallel to the earth's axis, and the inhabitants of the northern hemisphere might explain this as arising from a force of repulsion inherent in the pole star. If the earth rotated many times faster even than this, bodies would fall always perpendicularly away from the earth's axis, and this might be interpreted as arising from a gravitational repulsion residing in the earth's axis.

These illustrations will show that it is easy to confuse acceleration arising from the earth's rotation with gravitational attraction. We may go further and say that it is impossible to distinguish between the effects of gravitational attraction and the effects of acceleration of any kind whatever. Every aeroplanist knows this to his sorrow; it is inherently impossible to devise any instrument which shall show the direction of the vertical in an aeroplane, since an acceleration of the aeroplane produces on any instrument whatever, effects which are indistinguishable from those of gravity. From such considerations Einstein was led to his principle of equivalence, which may be enunciated as follows:—

"A gravitational field of force at any point of space is in every way equivalent to an artificial field of force resulting from acceleration, so that no experiment can possibly distinguish between them."

Guided by these two principles—relativity and equivalence—Einstein was led to the view that all gravitational "fields of force" must be illusions. The apparent "force" arises solely from acceleration and there is no other kind of gravitational force at all. In this statement, as in the statement of the principle of equivalence above, the word acceleration is used in its widest sense. Acceleration results not only from change in the amount of a velocity, but from a change in its direction also. For instance a motor-cyclist riding in a circle at a uniform speed of 60 miles an hour will be the subject of an acceleration towards the centre of the circle. He knows that the apparent force so produced is just as real in its effects as gravitation, and to save himself from falling as a result of its influence he must incline the direction of his machine to the vertical.

It is clear that the acceleration or curvature of path which figures as gravitation cannot be an acceleration or curvature in ordinary three-dimensional space. Before the apple starts to fall from the tree there is neither acceleration nor curvature, and yet the apple is undoubtedly acted on by gravitation. Moreover, this three-dimensional space is, as we have seen, different for different observers—it is a subjective and not an objective conception, and the gravitation resulting from such a curvature could not conform to the relativity condition. Einstein was accordingly led to suppose that gravitation arose from curvature in the four-dimensional space, or continuum, in which time formed the fourth dimension. This continuum, as has been seen, is objective and if the path of the particle can also be made objective, the resulting gravitation will conform to the relativity principle. The path of the particle in the continuum is, however, simply its "world line," which we have already had under discussion. This world line is determined by natural laws, and if these are to be objective the specification of the world line must also be objective. There is, however, only one specification of world lines in the continuum which is objective in the sense that the same specification will give the same world lines to observers moving with different velocities. It is that every world line must be so drawn as to represent the shortest path between any two points on it. Mathematically, lines which satisfy this condition are known as *geodesics*. Thus Einstein was led to suppose that world lines must be geodesics in the four-dimensional continuum.

Consider for a moment a page of this volume as presenting a two dimensional analogy of the continuum. The shortest distance between any two points is of course the straight line joining them, so that the geodesics are simply straight lines. These possess no curvature of path and if they formed a true analogy to the geodesics in the continuum there could clearly be no explanation of gravitation of the type we have been contemplating. There is, however, another type of two-dimensional surface. It is represented by the surface of a solid body such as a sphere—say the earth. On the earth's surface the geodesics are the great circles; every mariner or aeronaut who desires to sail the shortest course between two points sails along a great circle. To take a definite instance, the shortest course from Panama to Ceylon is not along the parallel of lat. (about 9° N.) which joins them—the aeronaut wishing to fly the shortest course between the two countries will fly N.E. from Panama, he will pass over England and finally reach Ceylon from the north-west. The reader may rapidly verify this by stretching a thread tightly over the surface of an ordinary geographical globe. Let him now trace out the course on an ordinary Mercator chart, and it will be found to appear very curved indeed—the course of the aeronaut will look surprisingly like that of a comet describing an orbit under the attraction of a sun situated somewhere near the middle of the Sahara.

The reader who performs these simple experiments will understand how Einstein was led to suppose that gravitation could be explained by a curvature inherent in the continuum. The world lines of particles are geodesics but the space itself, so to speak, provides the curvature. The curvature of path is thrust upon the particle by the nature of the continuum, but we, who until recently have been unaware even of the existence of the continuum, have been tempted to ascribe it to the action of a special agency which we have invented *ad hoc* and called "gravitation." According to Einstein, it is no more accurate to say that the earth attracts the moon than to say that the pockets of an uneven billiard table repel the balls.

This train of thought may seem artificial. If so, the reason is that we have not been able to explore the other possibilities which have branched off our main line of thought. In point of fact, Einstein found himself practically limited to the conclusion we have stated. Not only so, but the actual type and degree of curvature in the continuum prove to be uniquely fixed in terms of the masses of the gravitating bodies. Thus Einstein, knowing the mass of the sun, found himself in a position to predict absolutely what the motion of the perihelion of Mercury ought

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to be. It was found to be 42·9″ a century, a figure which agreed with observation to well within the limits of error of these observations. The motions of the other planets, as predicted by the theory of relativity, have also been found to agree with those observed to within the errors of observation. This latter test, however, is not a very stringent one, since the departures from the motion predicted by the Newtonian law are too small to admit of very precise measurement.

Einstein's theory requires us to suppose that the world line of a ray of light also shall be a geodesic in the continuum. In a gravitational field the curvature of the continuum will impose a twist on the path of a ray of light. Einstein found in particular that a ray of light which comes from a distant star and passes near the edge of the sun on its journey ought to be bent, in its passage past the sun, by an angle which should be 1·75″ if the ray just grazes the sun, and would be less in proportion to the inverse distance from the centre of the sun for other rays. The observatories of Greenwich and Cambridge dispatched expeditions to test this prediction at the eclipse of 1919. It was found that the stars which appeared near to the sun at the instant of eclipse showed an appreciable displacement, as compared with their normal positions, of the type required by Einstein's theory. Exact measurement confirmed that the displacement varied approximately as the inverse distance from the sun, and that the displacement at the limb was sensibly equal to Einstein's predicted value of 1·75″. The Cambridge observers, hampered by cloudy weather, obtained for this quantity the value 1·61″ ± 0·30″. The Greenwich observers obtained a value of 1·98″ ± 0·12″, but it has since been pointed out by Prof. H. N. Russell that their photographs indicate a horizontal and vertical scale difference of the order of 1 part in 12,000, almost certainly due to a distortion of the coelostat mirror under the sun's rays, and if the measures are corrected for this the result is brought much closer to the theoretical prediction.

The theory makes one further prediction which admits of experimental test. The atoms of any element, say calcium, may be supposed to be formed according to a definite specification, the terms of which depend neither on the velocity of a particular observer nor on his position relative to the gravitational fields of the universe. It can be deduced that the light received from a calcium atom situated in the intense gravitational field near the sun's surface ought to be of slower period, and therefore of redder colour, than the similar light emitted by terrestrial atoms. To be more precise, the Fraunhofer lines in the solar spectrum ought to show a displacement to the red; this displacement ought to be homologous, and should be of amount 0·008 A units at the cyanogen band λ 3883 at which observations have been chiefly made. Attempts to test this prediction led to strangely discordant results. All observers agreed in finding some effect of the kind predicted, but its amount was always less than the predicted amount, varying from almost *nil* (St. John, 1917) to nearly the full amount to be expected (Evershed, 1918; Grebe and Bachem, 1919). In 1921 the position with regard to this test still remained one of great uncertainty and confusion.

It will have been seen that the restricted physical theory of relativity introduced a revolution into the foundations of scientific thought by destroying the objectivity of time and space. The gravitational theory has effected a hardly less important revolution by destroying our belief in the reality of gravitation as a "force." The physicist has, however, to deal with other "forces" besides those of gravitation, and the question inevitably arises as to whether these too must be regarded as illusions, arising only from our faulty interpretation of the special metrical properties of the continuum. Prof. H. Weyl has pointed out that the continuum imagined by Einstein, and found to be adequate to explain gravitational phenomena, is not, in respect of its metrical properties, the most general type of continuum imaginable. A further generalization is possible and the new curvatures introduced must of necessity introduce new apparent forces other than gravitational. Weyl's investigation shows that these new forces would have exactly the properties of the electric and magnetic forces with which we are familiar. Indeed, the predicted forces coincide so completely with known electromagnetic forces that no experimental test of Weyl's theory is possible. Had there been the slightest divergence between the forces predicted by Weyl and those predicted by ordinary electromagnetic theory, experiment could have been asked to decide between the two, but no such divergence exists. It may, however, be said that Weyl's theory makes it highly probable that all forces reduce to nothing more than our subjective interpretations of special properties of the continuum in which we live our lives.

Finally a thought may be given to the position, under the new conceptions introduced by the theory of relativity, of the electromagnetic aether. At one stage in the history of science there was a tendency to fill space with aethers, to the extent almost of one aether for every set of phenomena requiring explanation. That stage passed, and by the end of the 19th century only one aether received serious consideration, the so-called electromagnetic aether of Faraday and Maxwell. This aether gave a plausible mechanical explanation of electrostatic phenomena, although it was more than doubtful whether it could account for the electromagnetic phenomena from which it took its name, and it was comparatively certain that it could not account for gravitation. It gave, however, a satisfactory explanation of the propagation of waves of light—they were simply waves in the aether and travelled with an absolute velocity c determined once and for all by the structure of the aether. On this view it was quite certain that an observer moving through the aether with a velocity u would measure the velocity of light travelling in the same direction as himself as $c-u$. Relativity teaches that this velocity is always precisely c, and this in itself disposes of the aether of Faraday and Maxwell. Whether any new aether will be devised to replace it remains to be seen, but none appears to be necessary. Any aether which can be imagined would appear to depend upon an objective separation of time and space. Relativity does not deny that such an objective separation may, in the last resort, really exist, but it shows that no material phenomena are concerned with such a separation. By a very slight turn of thought, the primary postulate of relativity may be expressed in the form that the material world goes on as though no aether existed.

To the relativist the essential background to the picture of the universe is not the varying agitation of a sea of aether in a three-dimensional space but a tangle of world lines in a four-dimensional space. Moreover, it is only the intersection of the world lines that are important. An intersection at a point in the continuum represents an event, while the part of a world line which is free from intersections represents the mere uneventful existence of a particle or a pulse of light. And so, since our whole knowledge of the universe is made up of events, it comes about that the tangle of world lines may be distorted and bent to any degree we please; so long as the order of the intersections is not altered, it will still represent the same universe. And so the last function of the aether, that of providing a scale of absolute measurements in space, becomes a superfluity. To the physicist who urges that space measurements without an underlying aether become meaningless, the relativist can reply that time-measurements without an underlying "time-aether" are equally meaningless. A "time-aether" has never been regarded as a necessity, and the relativist feels that the "space-aether" has no greater claim to retention. (J. H. Je.)

RENEVIER, EUGÈNE (1831–1906), Swiss geologist (*see* 23.98), died at Lausanne May 4 1906.

RENNENKAMPF, PAUL (1854–1918), Russian general, was born in 1854 and entered the army in 1873. On passing out of the Academy of the General Staff in 1882, he was appointed to the General Staff. From 1895 to 1899 he commanded a regiment and in 1900 he was promoted to the rank of general. In the war with China in 1900 he distinguished himself by his resolute action when commanding a column in Manchuria. In the war with Japan 1904–5 he commanded first a Cossack division, and later large forces of all arms, and again won distinction by his energy. From 1905 to 1913 he was a corps

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commander and in 1913 he was appointed to command the troops of the Vilna Military District. At the beginning of military operations in Aug. 1914 he commanded the I. Army which invaded Eastern Prussia. His inaction during the battle of Tannenberg, where the neighbouring army of Samsonov was destroyed Aug. 26–29, was a bitter disappointment, and, by the masses of the people, he was even accused of treachery. Personally brave, daring in small actions, Rennenkampf, as an army commander, showed himself in the strategic sphere alternately rash and timid, owing to his inability to grasp the situation as a whole. At the beginning of 1915 he was recalled from his duties of army commander, and later, under the pressure of public indignation, he was dismissed from the service. In 1918 he was killed by the Bolsheviks.

RENNER, KARL (1870–), Austrian politician, was born on Dec. 14 1870, the son of a peasant, at Unter-Tannowitz, Moravia. He studied law at the university of Vienna, occupying himself especially with questions of administration, and early attached himself to the Social Democratic party. He became an official in the library of the *Reichsrat*, and under the pseudonyms of "Synopticus" and "Rudolf Springer" showed a fertile literary activity, especially in connexion with the problems of the Austrian State, whose existence he justified on geographical, economic and political grounds. On the nationality question he upheld the so-called "personal autonomy," on the basis of which the super-national state should develop, and thereby influenced the programme and tactics of the Social Democratic party in dealing with it. As a theorist he was reckoned as one of the leaders of Neo-Marxism. He had been a deputy since 1907 and after the revolution of Oct. 1918 he became state chancellor of the republic of Austria, headed the Austrian peace delegation at St. Germain, and took over, after Otto Bauer's retirement, the Ministry of Foreign Affairs, which he conducted from the time of the retirement of the Coalition Cabinet in the summer of 1920 until the new elections in Oct. 1920. His principal works are:—*Grundlagen und Entwicklungsziele der oesterreichischen-ungarischen Monarchie* (1906); *Der Kampf der oesterreichischen Nationen um den Staat; Marxismus, Krieg und Internationale.*

RENOIR, AUGUSTE (1841–1919), French painter (*see* 23.101), died on the Riviera Dec. 3 1919.

REPARATION COMMISSION: *see* PEACE CONFERENCE; also 31.123 and 246.

REPIN, ILJA JEFIMOVICH (1844–1918), Russian painter (*see* 23.105), died at Knokkala, on the Finnish frontier, July 17 1918.

REPPLIER, AGNES (1858–), American writer, was born in Philadelphia April 1 1858. She was of French extraction and was educated at the Sacred Heart Convent at Torresdale, near Philadelphia. She was one of America's chief representatives of the discursive essay, displaying wide reading and apt quotation. Her writings contain much sound literary criticism as well as caustic comments on contemporary life. These characteristics were already apparent in the first essay which she contributed to the *Atlantic Monthly* (April 1886), entitled "Children, Past and Present." In 1902 the university of Pennsylvania conferred upon her the degree of Litt.D. She was the author of *Books and Men* (1888); *Essays in Miniature* (1892); *Essays in Idleness* (1893); *Philadelphia—the Place and the People* (1898); *Compromises* (1904); *In our Convent Days* (1905); *Americans and Others* (1912); *Counter-Currents* (1915).

RESZKE, EDOUARD DE (1855–1917), operatic singer (*see* 23.201), died at Garnek, Poland, May 29 1917.

RÉVILLE, ALBERT (1826–1906), French Protestant theologian (*see* 23.224), died in Paris Oct. 25 1906. His son, JEAN RÉVILLE (b. 1854), died in 1908.

REYER, ERNEST (1823–1909), French musical composer (*see* 23.225), died at Lavandou-sur-Huyères Jan. 15 1909.

REYNOLDS, OSBORNE (1842–1912), British engineer, was born at Belfast in 1842. He was educated at Dedham grammar school and at Cambridge, and in 1868 became professor of engineering at Owens College, Manchester, holding that post for nearly 40 years. He was elected F.R.S. in 1877. He was the author of over 70 papers on mechanics and physics published in the transactions of learned societies, notably *Sub-Mechanics of the Universe*, issued by the Royal Society, whose gold medal he won in 1888. (For his work *see* 3.581; 5.64; 8.783; 14.61; 22.806; 25.444; 28.428.) He died at Watchet, Som., Feb. 21 1912.

REYNOLDS, STEPHEN (1881–1919), English author, was born at Devizes May 16 1881. Educated at Manchester University and the École des Mines at Paris, he became sub-editor of an Anglo-French review in 1902 and the following year began an association with the Woolley brothers, fishermen of Sidmouth, which lasted for some years. He thus familiarized himself with fishing and the fisherman's point of view so far as to become a recognised authority on the subject and a medium of communication between fishermen and the Government. He was a member of the committee of inquiry into Devon and Cornwall Fisheries (1912), and of the departmental committee on Inshore Fisheries (1913), and in that year he was appointed adviser on Inshore Fisheries to the Development Commission. In 1914 he became also resident inspector of fisheries for the S.W. area. His publications included *A Poor Man's House* (1908); *Alongshore* (1910); *The Lower Deck, the Navy and the Nation* (1912); as well as a novel, *The Holy Mountain*, (1909) and a volume of tales. He died at Sidmouth Feb. 14 1919.

RHODE ISLAND (*see* 23.248).—The pop. of the state in 1920 was 604,397; in 1910, 542,610; an increase for the decade of 61,787, or 11·4 per cent. Rhode Island was still in 1920 the most densely populated state, having 566·4 inhabitants to the sq. m. (1910, 508·5). Every Federal census since 1790 has shown an increase in density, and at a rate faster than that of the United States as a whole.

The percentages of urban and rural pop. were in 1920: urban, 97·5%; rural, 2·5%; in 1910: urban, 96·7%; rural, 3·3%. The following are the cities of Rhode Island having a pop. of over 20,000 in 1920 and their percentage of increase in the decade 1910–20:—

	1920	1910	Increase per cent
Providence	237,595	224,326	5·9
Pawtucket	64,248	51,622	24·5
Woonsocket	43,496	38,125	14·1
Newport	30,255	27,149	11·4
Cranston	29,407	21,107	39·3
Central Falls	24,174	22,754	6·2
East Providence	21,793	15,808	37·9

The proportion of native-born in 1915 (state enumeration) was 68·8%; of foreign-born, 31·2%. The foreign-born whites numbered in 1920, 173,366, a decrease of 2·6% from 178,025 in 1910. During the 10 years there has been a steady change in the proportions of the various foreign elements in the population. Up to 1910 the largest foreign-born element was Irish. In 1920 the Irish were numerically inferior to the British and English-Canadian, the Italian, and the French-Canadian. There has been a remarkable increase in the number of Italian, Portuguese and Polish immigrants, and a noticeable influx of Armenians and Syrians. "Foreign stock," *i.e.* foreign-born and native-born of foreign parents, constituted, in 1915, 63·3% of the whole population.

Agriculture.—There has been a decline in farm acreage of 29·3% in 30 years to 331,600 ac. in 1920, and an even greater decline, 51·2%, in improved acreage to 132,855 ac. in 1920. The number of farms has fallen from 5,292 in 1910 to 4,083 in 1920. On the other hand there has been a rise in both the aggregate and the average value of farms, and in the value of crops (value of land and improvements, 1900, $26,989,189; 1920, $33,636,766; value of crops, 1909, $2,986,816; 1919, $5,340,378).

Fisheries.—Fishing has, on the whole, declined in relative importance. The shell-fish industry suffered severe loss, owing to the pollution of the Providence river and the upper waters of Narragansett Bay. From 1907 to 1920 the leased oyster grounds declined from 21,000 to 7,000 ac.; the state rentals, from $136,000 to $40,000; and the output during the oyster season from 10,000 gal. daily to 2,000 gallons. In 1920 the Commissioners of Shell Fisheries reported: "The Providence river has been practically destroyed as a suitable place for the production or growth of shell-fish as food," the result of contamination.

Manufactures.—Rhode Island is preëminently a manufacturing state. In 1914 it ranked 19th among the states in the value of its manufactures. The number of persons engaged in manufacturing and mechanical pursuits nearly doubled in 20 years (1900, 101,162; 1910, 156,898; 1920, 196,205). The number of factories increased from 1,678 in 1900 to 2,829 in 1919; the capital invested in manu-

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facturing from $183,784,587 in 1900 to $304,595,000 in 1914; and the value of all manufactured products from $184,074,378 in 1900 to $346,962,500 in 1916. Wages paid to factory employees in 1914 totalled $58,784,000; value added to products by manufacture, $116,030,000. Children under 16 years employed in factories numbered, in 1920, 7,243, of whom nearly 5,000 were in textile mills. The effect of the World War upon child labour in Rhode Island may be seen from the following statistics: in 1915 children under 16 years constituted 3·16% of all the factory operatives; in 1918, 4·44%; in 1919, 3·96%; in 1920, 3·69%. Textiles still held in 1920 the first place among the manufactures of the state, employing 83,204 persons. From 1910 to 1920, woollen and worsted mills increased in number from 88 to 103 (with 463,342 spindles and 9,304 looms); in employees, from 24,924 to 29,500; in value of products, from $74,600,000 to $90,000,000. Cotton mills increased in number from 106 to 130 (with 2,595,395 spindles); in employees, from 28,786 to 37,382; and in value of products, from $50,313,000 to $67,500,000. Over 7,000 were persons employed in bleaching and finishing, 6,000 in the manufacture of silk and silk goods, and nearly 3,000 in the manufacture of hosiery and knit goods. The combined value of the products of these factories exceeded $20,000,000. Webbing and braid were also produced in large quantities; and in recent years tire fabrics have become an increasingly important article of manufacture. Third among the industries of Rhode Island in 1920 were the machinery and metal trades, with 25,197 employees, and products valued at $45,000,000. In the manufacture of jewelry and silverware Rhode Island ranked first among the states. In 1914 the value of the jewelry produced was more than one-fourth of the total for the whole United States. The number of persons employed in making jewelry, silversmithing, reducing and refining gold and silver in 1920 was 14,052, in 322 establishments; and the value of the product was estimated at $37,500,000.

Transportation.—The railway mileage within the state in 1920 was 209·49 m., electric and street railways, 351·5 miles. The construction of a branch of the Grand Trunk Railway system from Palmer, Mass., to Providence was projected in 1910; but work was suspended in Nov. 1912, and has not been resumed. Considerable sums have been spent by the Federal Government for the deepening of the channel of Narragansett Bay, for harbour improvement at Providence, Newport, Westerly and Pawtucket, and for the construction of harbours of refuge at Block I. and Pt. Judith. The foreign imports of the customs district of Rhode Island amounted in 1920 to $8,252,046. Foreign and domestic commerce passing through Narragansett Bay in 1914 amounted to $320,195,277.

Finance.—The position of the state, Dec. 31 1920, was: assessed valuation, $988,061,741; rateable wealth, $1,745,715,365 (about $2,890 *per capita*); receipts, $6,909,172; expenditures, $6,187,173; bonded debt, $10,832,000; sinking fund, $1,631,917. June 30 1920 there were in Rhode Island three state banks, 17 national banks, 13 trust companies, 15 savings banks, and 10 other institutions for savings and loans; with total resources of $416,339,951. From June 30 1918 to June 30 1920 the assets of the state banks increased 47%; of the trust companies, 21%; of the savings banks, 20%; and of the national banks, 11%. Deposits in the savings banks, June 30 1920, were $113,200,366, an average of $630 per account. The average savings deposit in 1918 ($582.95) was the largest in any state.

Charitable and Penal Institutions.—In 1917 the Board of Control and Supply and the Board of Charities and Corrections were superseded by a State Penal and Charitable Commission. The number of the inmates in the institutions under the supervision of the Commission was, in 1919, 3,241 (468 less than in 1918); and the amount expended was $1,189,956. The budget for 1921 called for $1,562,394, to which should be added about $21,000 in aid of various private charitable organizations.

Education.—The total school population (age 5 to 15) in 1920 was 123,705, of whom 106,142, or 85·5%, were in school. There were 83,525 in public schools; 20,690 in parochial schools; and 1,927 in private schools. The total expenditure for education in 1920 was $4,493,772, of which $999,850 was contributed by the state, the remainder by the towns. In addition to its expenditure for primary and secondary instruction and for normal training, the state annually votes modest subsidies for the R.I. State College; the R.I. School of Design; the R.I. College of Pharmacy; the R.I. Historical Society; the Newport Historical Society; and about 70 public libraries, with over 700,000 volumes. In April 1920 the name of the State Normal school was changed to the R.I. College of Education. The enrolment of the institution in 1920–1 was 774 students and 57 instructors; state appropriation, $86,000. The state also maintains observation and training courses in various schools, and likewise makes an annual grant of $5,000 to Brown University in support of graduate courses in education. The R.I. State College at Kingston had, in 1920-1, 345 students and 55 instructors, an income of $168,000, and buildings valued at $500,000. The R.I. School of Design, Providence, has doubled in size since 1910; the number of students has increased from 923 to 1,856; instructors from 50 to 108; funds from $186,310 to $2,849,322; buildings from $220,000 to $650,000. Its museum is considered the most valuable in New England, outside of Boston. Providence College (Roman Catholic) was chartered in 1917, and opened for instruction in 1919, under the direction of the Dominican Order. In 1920, $200,000 was raised for buildings. The enrolment in 1920–1 (two classes) was 163 students; faculty, fourteen. Brown University, the oldest (founded 1764) and largest academic institution in the state, from 1911 to 1921 increased its faculty from 85 to 107; its students from 944 to 1,367 (plus 881 in extension courses); funds from $3,758,926 to $6,600,000, with about $1,750,000 of endowment subscriptions still to be paid in; volumes in the library from 180,000 to 270,000. The Arnold Biological Laboratory and Metcalf Hall have been added to the buildings; and a new Chemical Laboratory and a Hall of Modern Languages were in 1921 about to be erected. Providence is unusually rich in libraries. Among the most important collections are those of the Providence Public Library, 230,000 vol.; the Providence Athenaeum, 95,000; the R.I. Historical Society, 50,000; the Annmary Brown Memorial (founded by Gen. Rush C. Hawkins), containing a rare collection of incunabula; and the Shepley collection on R.I. history, 25,000 volumes.

History.—The political history of the state from 1910 to 1920 was comparatively uneventful. In 1911 an amendment to the constitution provided for biennial election of the state officers and Legislature. In 1909 the number of representatives in the Lower House was fixed at 100; but repeated attempts to reform the Senate and institute representation according to population have uniformly been defeated. The city of Providence, with 40% of the population of the state, has but one member in a Senate of thirty-nine. The property qualification for the full municipal franchise is still in force. In 1912 the number of Congressional districts was increased from two to three. But under a new apportionment on the basis of the census of 1920 the state would stand to lose a seat, unless the National House of Representatives is enlarged. The presidential vote of the state was cast in 1912 for Wilson, Democrat; in 1916 for Hughes, Republican (though at the same time a Democratic U.S. Senator was elected); in 1920 for Harding, Republican. Rhode Island ratified the Nineteenth (Woman Suffrage) Amendment to the Federal Constitution; but, with Connecticut and New Jersey, failed to ratify the Eighteenth (Prohibition) Amendment. In 1920 the state brought suit in the U.S. Supreme Court to test the validity of the Amendment and of the Volstead Act. The suit was dismissed. For the service in the World War Rhode Island furnished 28,817 men. The National Guard in 1918 numbered 4,625 officers and men. Subscriptions to Liberty and Victory loans amounted to $209,444,110.

The governors since 1910, all Republicans, were: Aram J. Pothier, 1909–14; R. Livingston Beeckman, 1915–20; Emery J. San Souci, 1921– .

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RHODES, JAMES FORD (1848–), American historian (*see* 23.257), was awarded in 1910 the gold medal of the National Institute of Arts and Letters. He published in 1913 *Lectures on the American Civil War* (delivered at Oxford in 1912); in 1917 *History of the Civil War;* and in 1919 *History of the United States from Hayes to McKinley*, being the eighth volume of his *History of the United States*, of which the first appeared in 1893 and the seventh in 1906.

RHODESIA (*see* 23.259).—The three divisions of which this territory had consisted were reduced in 1911 to two by the amalgamation of North-Eastern and North-Western Rhodesia, thenceforward known as Northern Rhodesia simply. The Zambezi is the line of division between Southern and Northern Rhodesia, and whereas geographically and in its political developments Southern Rhodesia is part of South Africa, Northern Rhodesia belongs geographically to Central Africa, it is not "a white man's country" and its political future is not necessarily the same as that of Southern Rhodesia. The administration of the two regions was kept distinct, and in the present article this distinction is preserved wherever necessary. In 1921 Rhodesia was still governed by the British South Africa (Chartered) Co., but measures were in progress to terminate its rule.

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Inhabitants.—At the census of May 3 1921 the white inhabitants of Southern Rhodesia numbered 33,621,[1] compared with 23,606 in 1911 and 12,596 in 1904. In 1921 males numbered 18,987 and females 14,634. The increase per cent. in the male pop. in the 10 years was 21·87, that of the female pop. 82·23. The natives in 1921 numbered 845,593, compared with 744,559 in 1911 and 591,493 in 1904. Asiatics in 1921 numbered 1,250 and the coloured pop. 1,997. Salisbury and Bulawayo, the chief towns, had in 1921 a white pop. of 5,654 and 6,830 respectively. Gwelo (white pop. 1,148) and Umtali (white pop. 1,874) were made municipalities in 1914, and Gatooma was made a municipality in 1917. All these places have most of the amenities of European towns.

In Northern Rhodesia the white in 1911 numbered about 1,500, and in May 1921 3,585, of whom 2,223 were males and 1,326 females. A considerable proportion of the white residents are officials and missionaries and their families. The native pop. in 1920 was estimated at 928,000.

Communication.—Little was done during 1910–21 to extend communication in Rhodesia itself, but from Sakania on the Rhodesian-Belgian Congo frontier the railway was continued through Katanga with the result that the valuable mineral output of that region was carried over the Rhodesian lines. The completion of the line from Zeerust (Transvaal) to Mafeking (Cape province) shortened the distance between Rhodesian stations and Johannesburg by 250 miles and enabled Durban to compete for the Rhodesian trade. On the completion in 1913 of the line through the northern Transvaal to the Limpopo at Messina, proposals were made to bridge the gap left—some 130 m.—between the Union railways and the West Nicholson branch of the Rhodesian system. As the bridging of the gap would place Lourenço Marques as closely in touch with Bulawayo as is Beira (its existing port), there was much opposition from interested parties to the building of the line and construction had not begun in 1921. Among other projects the most important was the so-called Sinoia-Kafue cut-off, to give Salisbury and Beira a much shorter line to Northern Rhodesia and Katanga. The line in 1921 had been built as far as Sinoia only. In south-eastern Rhodesia the branch line from Gwelo had been extended to Victoria.

There was a good deal of road-making, the largest piece of work being the cutting of a road—400 m. long—through the bush from Broken Hill to Lake Tanganyika. This was done for military reasons during the campaign in German East Africa. In 1919 aerodromes were made at Bulawayo and other stations on the Cairo-Cape route.

For the year ended Sept. 30 1919 the report of the Rhodesian Railways Ltd. showed that the gross revenue was £1,058,000; expenditure £568,000 and net earnings £490,000. For the year ended Sept. 30 1910 the corresponding figures were £789,990, £362,000 and £427,000 respectively. The gross revenue of the Beira-Salisbury and Kalomo-Broken Hill sections of the Mashonaland Railway Co. for 1918–9 was £647,000; expenditure £367,000 and net earnings £280,000, compared with £502,000, £184,000 and £317,000 respectively in the year ended Sept. 30 1910.

Agriculture.—At the end of 1919 the area under crops, excluding vegetable gardens and land cultivated by the natives for their own benefit, in Southern Rhodesia was 215,276 ac., of which 177,470 ac. were under maize. In 1911 the area under crops was 132,105 acres. The production of wheat increased in Mashonaland, the quantity produced in 1919 (13,432 bags) being double the amount of the output five years previously. Tobacco became one of the principal crops, the production of leaf in 1919–20 being about 2,500,000 pounds. Cotton-growing had not got beyond the experimental stage in 1921. The citrus industry made headway and considerable quantities of oranges, etc., are now exported. Over 6,000 boxes were shipped to the United Kingdom in 1920.

The Mazoe dam, which has an effective storage capacity in a normal season, after allowing for evaporation, of 4,000,000,000 gal., was completed in March 1920. This dam enables sufficient water to be stored for the irrigation of 6,000 ac. with 2½ ft. per annum.

Cattle-breeding in the decade 1911–21 became one of the leading industries of Rhodesia. By the importation of pedigree bulls the native breed was steadily improved. In 1919 29,510 head of cattle was exported by rail or on the hoof to the cold-storage works in the Union or to Portuguese East Africa and the Belgian Congo. By the end of 1919 the number of cattle owned by Europeans (673,431) exceeded the number belonging to the natives. In 1910 the total (European and native owned) was 371,000. The Liebig Co. acquired extensive ranching areas.

In Northern Rhodesia maize and tobacco are the principal crops; wheat was grown under irrigation. Experimental work in the cultivation of wheat and other cereals, fodder plants, fruit and forest trees, fibres and in the investigation of plant diseases was carried on at the Chilanga estate of the B. S. A. Company. Orange-growing was started and a small quantity of cotton grown in the Fort Jameson district adjoining Nyasaland. Large areas of wild rubber exist. Cattle ranching became popular, a good market being found in Katanga for slaughter beasts. Except for the settlement at Fort Jameson, the white residents are mostly concentrated along the railway line from the Victoria Falls to Katanga.

Mining.—Gold is now found in a large variety of formations, including quartz, schists, granite, sandstones, banded ironstones, conglomerates and dolorite.[2] The value of the output steadily increased from £2,566,000 in 1910 to £3,895,000 in 1916, when the yield in ounces was 930,356. The effects of the World War, increased working costs and labour difficulties then brought about a decline and the value of the output had fallen in 1919 to £2,499,000. In 1920 the value of the output went up to £3,056,000, though the yield measured by weight (552,497 oz.) was 40,725 oz. less than in 1919, the rise in value being due to the premiums obtained on sales of gold in 1920. The silver output reached its highest level (211,989 oz.) in 1917 and this was also the case with coal (584,954 tons) and copper (3,911 tons). The largest output of chrome iron ore (88,871 tons) was in 1916. After the end of the World War production was considerably reduced. Asbestos is becoming an important industry, the chief mines being in the Bulawayo and Victoria districts. The output rose from 55 tons in 1908 to 18,823 tons in 1920. Valuable mica deposits are being worked in the Sinoia district, the output in 1920 being 97 tons. Small shipments realized up to £600 per ton. Arsenic (1920, 437 tons) and tungsten (1920, 17 tons) are worked. The output and value of the principal minerals of Southern Rhodesia in 1920 were as follows:—Gold 552,497 oz. (£3,056,549); silver 158,982 oz. (£58,178); copper 3,109 tons (£333,111); chrome iron 60,269 tons (£245,378); coal 578,492 tons (£252,000); asbestos 18,823 tons (£459,572). The total value of mineral production in Southern Rhodesia up to the end of 1920 was £56,164,325.

Northern Rhodesia.—The chief mining centres in Northern Rhodesia are Broken Hill (lead and zinc) and Bwana Mkubwa, near the Congo border (copper). The mineral production in 1920 was as follows, the figures for 1916 being given in parentheses for purposes of comparison:—Gold 569 oz. (719 oz.), value £2,998 (£2,980); silver 5,583 oz. (8,777 oz.), value £706 (£877); copper 145 tons (1,298 tons), value £7,601 (£39,362); lead 16,345 tons (1,392 tons), value £335,000 (£25,121). Up to Dec. 31 1913 13,156 tons of zinc ore, valued at £84,577, had been produced. Mining for this ore then ceased. The total value of the mineral production of the northern territory to Dec. 31 1920 was £1,534,000.

Commerce.—Bacon-making, oil-crushing and soap-making, cheese-making and meat-canning, in addition to creameries and tobacco factories and flour-mills, are established. The following table shows the value of the imports and exports of Southern Rhodesia (exclusive of specie and goods reëxported) in 1910, 1915 and 1919.

	Imports	Exports
1910 . . .	£2,786,000	£2,812,000
1915 . . .	2,949,000	4,536,000
1919 . . .	4,500,000	4,432,000

In Northern Rhodesia the value of imports increased from £168,000 in 1911 to £424,000 in 1919. Exports in 1911 were valued at £107,000 and in 1919 at £452,000.

Revenue.—For the year ended March 31 1911 the revenue of Southern Rhodesia was £773,000 and expenditure £752,000. In 1918–9 the revenue amounted to £961,000 and the expenditure was £858,000. The chief items on the revenue side of the account were: customs duty £298,000; native tax £238,000; posts and telegraphs £100,000; stamps and licences £59,000; income-tax and excess-profits tax £60,000. For the year ending March 31 1920 the revenue was £1,031,000, the expenditure £1,061,000.

The revenue of Northern Rhodesia for the year ended March 31 1912 was £116,000, expenditure being £190,000. In 1919–20 the revenue was £169,000 and expenditure £260,000. Native tax produced (1918–9) £83,000 and customs duty £36,000.

Education.—In Southern Rhodesia in 1919 public expenditure on education was £125,000, the sum of £39,000 being received from fees. At the end of that year there were 77 public schools open, with 4,775 pupils. There are schools of domestic science at Bulawayo and Salisbury. There were 670 native schools, with 38,284 pupils, conducted by missionary bodies, receiving grants in aid.

In Northern Rhodesia in March 1920 European children attending Government schools numbered 222. The Administration established boarding-houses at three centres.

Native Affairs.—No radical change was made in the system of native administration in Southern Rhodesia during 1910–21. The office of Secretary of Native Affairs was filled by the administrator and in each district a commissioner was appointed to direct and protect the natives. The conduct of the white settlers and of the Chartered Co. towards the natives was the subject of strict scrutiny.

[1] The figures for 1921 are the unaudited return.

[2] The Geological Survey of Southern Rhodesia showed that the majority of the productive gold-mines do not lie in the "schist belt," as previously supposed, but occur in a peculiar granite mass, known as the Mont d'Or granite. Important chrome iron-ore deposits occur in a mass of serpentine and talc-schist, which is related to the Mont d'Or granite in structure and probably in origin. The two masses together, according to the Director of the Geological Survey, Mr. H. B. Maufe (formerly of the Geological Survey of the United Kingdom), constitute an important plutonic complex, which had remained unrecognized until then. The result of the mapping by the Survey was to give a view of the nature of the mineral field totally different from that generally held.

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Cases of grave injustice had occurred in the earlier history of the territory and in the period under review further charges were brought against the Company in connexion with the rearrangement of the reserves. Settlers complained that certain lands in native reserves were not being beneficially used by them; the natives made similar complaints. In 1914 a commission under the chairmanship of Mr. (afterward Sir) R. T. Coryndon, then resident commissioner of Swaziland, was appointed by the Colonial Office to inspect and report upon the reserves. The commission concluded its sittings at the end of 1915. It recommended that 5,610,595 ac. should be assigned as additional reserves or extensions to existing reserves, but that 6,673,055 ac. then included within the reserves were not required for that purpose. The total reserve area recommended was 19,428,691 ac., a net reduction of 1,062,460 acres. The Imperial Government decided to accept these recommendations in their entirety in 1917. There was, however, owing to war conditions, delay in adopting the commission's recommendations and attacks were made on the Company's native administration during the greater part of 1919. A Parliamentary White Paper issued in Feb. 1920 contained correspondence between the Aborigines' Protection Society and the Colonial Office on the subject. The charges against the Company were replied to by Lord Buxton (then high commissioner) at Salisbury in Aug. 1919, and by Col. Amery (Under Secretary for the Colonies) in the House of Commons in March 1920. Col. Amery said:—"I believe this House can with confidence endorse the very high testimony of Lord Buxton to the native administration of Rhodesia and the attitude of the civil population generally towards the natives. It is a model, not only in Africa, but for any part of the world where you have the very difficult problem of the white settler living side by side with the native." An Order in Council was passed giving sanction to the Coryndon commission's recommendations. The changes it recommended were gradually carried out and gave rise to little friction. Lord Milner (then Colonial Secretary) set forth in an official despatch that the settlement reached was regarded as final, not only as to the present, but also the future requirements of the natives. To ensure them security of tenure the reserves were vested in the high commissioner for South Africa and would be inalienable save for certain limited purposes and only in exchange for other land.

In Aug. 1921 Prince Arthur of Connaught (the new high commissioner) visited Rhodesia and received a deputation of Matabele. He told them that the decision as to the reserves must stand and that their desire to have a son of Lobenguela recognized as paramount chief could not be granted. "You cannot go back," said the Prince; "you must go forward."

The general condition of the natives of Southern Rhodesia had distinctly improved between 1910 and 1920, and their value as an asset of the country became generally recognized. They were not only producers on their own account, but considerable purchasers of European goods. They paid an annual poll-tax of £1—the only levy made upon them by the administration. In 1911 several ordinances designed to secure better housing, feeding and medical supervision of native labourers outside the reserves came into effect. Steps were also taken to provide agricultural and industrial training, and to cope with cattle disease in the native reserves.

Vaccination and medical examination of natives applying for domestic service was made compulsory and the Bulawayo municipality introduced by-laws providing for a standard of housing accommodation for native servants.

Sleeping sickness along the Congo border of Northern Rhodesia necessitated precautions being taken to prevent its southward extension. Some cases of the disease occurred in the Loangwa valley, but they appeared to be sporadic.

History.—The outstanding feature of the history of the territory in the period 1910–21 was the steady growth of political consciousness on the part of the white residents of Southern Rhodesia. The framers of the constitution of the Union of South Africa left open the door for the adhesion to it of Rhodesia. The ultimate joining of Rhodesia to the Union was taken for granted by most South Africans, but the actual formation of the Union in 1910 seemed to have a contrary effect. It appeared to give a distinct stimulus to the already nascent desire of the Southern Rhodesians for independent self-government. A distinct advance in that direction was made in May 1911, when, by Order in Council, the elected members were given a majority of the seats in the Legislative Council, provision being made for safeguarding the interests of the British South Africa Company.

The legal position at that time was that the British South Africa Co. exercised under its charter sovereign rights subject only to such control as was exercised by the Colonial Office through the high commissioner for South Africa and a Resident in Rhodesia. While the Company's administrative expenditure was by this time slightly exceeded by the revenue, there was no means of making good the heavy losses incurred in opening up the country save by the sale of unalienated lands. Of their ownership of the land and of their rights of disposal the Company entertained no doubt and this fact had much influence upon the attitude of the directors. Sir Starr Jameson, on resigning towards the close of 1912 his leadership of the Unionist party in the South African Parliament, became president of the Chartered Co. and retained that position until his death in Nov. 1917.[1] The administrator in Southern Rhodesia was Sir William H. Milton, a man of great experience and tact in his dealings both with the white residents and the natives. After over 16 years' service in the territory Sir W. H. Milton resigned in Oct. 1914 and was succeeded by Mr. (afterwards Sir) Drummond Chaplin. But while the administrator and his executive could do much to make the machinery of government work smoothly, there was no power, locally, to shape policy. Disputes arose between the Company and the settlers, who desired a still larger share in the administration. The controversy became acute in view of the fact that in Oct. 1914, under the terms upon which the charter was originally granted, the Crown would have the right to revise its terms with regard to administration. Sir Starr Jameson, Mr. Rochfort Maguire and other representatives of the Chartered Co. visited Rhodesia in 1913, when a further increase was announced in the numbers of elected members of the Legislative Council. As to the financial position the directors said that, as "the land and minerals belonged to the Company," no debt in respect to past deficits would be placed on the country when the Company relinquished its administration. Mr. Maguire described the Company's proposals as a means for bridging the period antecedent to self-government, the ideal towards which, he claimed, the Company was working. In accordance with the promise given, a redistribution ordinance was passed, the elected members being increased to 12, while the number nominated by the Company was fixed at six. At the general election in March 1914 11 of the 12 elected members returned were pledged to support the maintenance—for the time being—of the Company's administration, but, the Council declared, its continuance should not affect the right "at any time" thereafter to the institution of self-government.

The Council in April 1914 definitely challenged the right of the Chartered Co. to the ownership of unalienated lands. The question had been raised in 1908, but was then allowed to drop. It was now recognized as essential that the matter should be settled before the political status of Rhodesia was altered. On behalf of the Rhodesians (*i.e.* the white settlers) it was claimed that the Chartered Co.'s power to deal with the land was only a delegated right granted by the Crown, and secondly, that if the Company had acquired ownership rights such rights were vested in it "as an administrative and public asset only"; that as a trading body the Company had no title to the land or its revenues. Consequently it was contended that, on the Company ceasing to exercise administrative rights, all unalienated lands should go as public domain to the Government which succeeded it. In July 1914 the claim of the Legislative Council was referred to the judicial committee of the Privy Council for adjudication.

In the meantime it was decided that the Crown should not exercise its right to vary the terms of the charter, which therefore, in virtue of the original provisions, would legally continue unaltered for ten years from Oct. 29 1914. The directors of the Company intimated, however, that they would offer no objection to the earlier establishment of responsible (*i.e.* self) government should it be deemed necessary and had the concurrence of the British Government. A supplemental charter giving effect to this agreement was issued on March 13 1915.

Meanwhile the outbreak of the World War for a time forced the constitutional question into the background. But the war itself had an important bearing on the political question. The party which desired the indefinite continuance of Chartered Co. rule had nearly disappeared, but an influential party had advocated, as the alternative to self-government, joining the Union of South Africa. This party lost ground as Rhodesians

[1] After Sir Starr Jameson's death Mr. Philip Lyttelton Gell acted as chairman of the board of directors and in Oct. 1920 was appointed president of the Company.

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saw what was happening in the Union. The growth of separatist and republican sentiment among the Dutch population, evidenced by the increasing support gained by Gen. Hertzog and particularly the rebellion of 1914, inevitably influenced the political orientation of the almost solid British population of Rhodesia. Disinclination to be swallowed up in the Union and dislike of the introduction of bi-lingualism—a necessary result of Rhodesia becoming a province of the Union—were strongly reinforced by real if perhaps exaggerated fears as to the strength of the Dutch nationalist movement. It was possibly due in part to these developments that a proposal put forward by the Company in 1915 for the amalgamation of Northern and Southern Rhodesia secured (in 1917) a majority in the Legislative Council, though it was not proceeded with.

After an exhaustive inquiry the judicial committee of the Privy Council gave its decision as to the ownership of unalienated lands on July 29 1918. It had had before it not only the claims of the Crown and of the Chartered Co. but those of the natives, whose case was put forward without much evidence that it was being pressed by the natives themselves. The judicial committee reported in favour of the Crown. While, however, it decided that the Company could not claim ownership of unalienated land in Southern Rhodesia, it held that it was entitled to be reimbursed for expenses and outlays of administration in current or past years, and that while it continued to administer Southern Rhodesia it was entitled to apply the proceeds of any sale of land towards the reduction of such expenditure. The Company's exclusive rights to all minerals in the country were confirmed and grants or sales of land made by it were finally legalized.

The next step was to ascertain the amount which would be due to the Company in accordance with the judicial committee's report should the administration of Southern Rhodesia by the Company cease. At the request of the Chartered Co. a royal commission, of which Lord Cave was chairman, was appointed in July 1919 to ascertain the amount which would have been due to it for its administrative expenses if its governing powers had ceased on March 31 1918. The claim filed by the Company was in round figures for £8,000,000 plus interest on the accumulated deficits. The Cave commission took evidence in Rhodesia and its award was issued in Jan. 1920. The commission rejected the Company's claim for interest and fixed the amount due to the Company at £4,435,000, subject to deductions (1) in respect of the value of lands appropriated by the Company for commercial purposes, and (2) the proceeds or value of lands and rights alienated by the Company for considerations other than cash, but plus the value of the public works which might be taken over by its administrative successor, estimated at £830,000.

In the interval the campaign for the grant of self-government had been renewed vigorously in Southern Rhodesia.[1] In view of a coming general election the Legislative Council in May 1919 passed a resolution asking the Colonial office publicly to state what proof of fitness "financially and in other respects" would be considered sufficient to justify the grant of responsible government. Lord Milner (then Colonial Secretary) replied in Aug. that he could not regard the territory in its then stage of development as equal to the financial burden of responsible government, and as there appeared to be no great desire for the inclusion of the territory in the Union he advised that matters should be left as they were until the situation became clearer. This reply caused a good deal of dissatisfaction amongst the advocates of responsible government in Rhodesia. The strength of the movement was shown at the general election in May 1920, when the responsible government party secured 12 of the 13 elective seats in the Legislative Council. The 13th member advocated representative government, a half-measure which Lord Milner had considered impracticable.[1] Owing to the successes gained by the Dutch Nationalists at the general election in the Union a few months earlier, opinion in Rhodesia, which, in view of the discouraging attitude of the Colonial Office towards responsible government, had tended to consider more favourably entry into the Union, swung round completely.

The new Legislative Council, at its first meeting in May 1920, passed a resolution praying the Imperial Government to establish responsible government and affirming that—

"The record of the people of Southern Rhodesia establishes that they are capable of fulfilling in the interests of all the inhabitants thereof, irrespective of race, the duties of self-government, and are equally as able to bear the responsibility thereof as other peoples of the Empire to whom the rights of self-government have been granted in the past."

Lord Milner, in a despatch dated Dec. 22 1920, again urged delay. "In principle" he favoured the Rhodesian demand and the Chartered Co. was willing, he said, to be relieved of its responsibilities, but, chiefly on the ground of finance, he proposed that the Company's rule should continue till after the next general election, which in the ordinary course would be held early in 1923. If Rhodesia was then still in the same mind, responsible government could be brought into force not later than Oct. 1924. The elected members of the Legislative Council strongly traversed Lord Milner's arguments and in the end the Colonial Office sought the advice of still another committee.

This committee, of which Lord Buxton, lately governor-general of the Union and high commissioner, was chairman, was appointed on March 7 1921. It acted with promptitude and reported on April 12 following. The electors having so recently expressed their views in favour of the abstract principle of self-government, no advantage would be gained (the committee stated) by another vote on the principle. It recommended therefore that a scheme for responsible government should be drawn up in detail and that by means of a referendum the opinion of the electors on such a definite scheme should be ascertained. If the electors accepted the scheme a proclamation or Order in Council should issue annexing Southern Rhodesia to the dominions of the British Crown and that annexation should be followed by letters patent setting up responsible government. The draft of the constitution, it was suggested, should be drawn up by the Colonial Office in consultation with the elected members of the Legislative Council. Two special provisions were proposed:—

(1) That with regard to the natives the existing authority and control by the high commissioner should be retained; and (2) that control of unalienated land should be exercised through the high commissioner on the advice of a specially created land board. This unalienated land would be charged with the payment of the sums to which the Chartered Co. was entitled under the Cave award.

Many objections might be and were raised to the proposed manner of dealing with the land question, but the elected members of the Legislative Council, under the leadership of Sir Charles Coghlan, accepted the recommendations of the Buxton committee, and Rhodesian delegates were appointed to confer with the Colonial Office.

Meanwhile the general election in the Union in Feb. 1921 had resulted in the defeat of the Dutch Nationalists (though not in any diminution of their voting strength), and it was arranged that, before any irrevocable step was taken, the Rhodesian delegates should consult with Gen. Smuts, the Prime Minister of the Union, as to the alternative plan of Rhodesia becoming a province of the Union. The conference with Gen. Smuts was held at Cape Town in Sept. 1921, before the delegation left for England. It was made clear that if the Rhodesians had changed their minds and desired admission to the Union they would be welcomed, but that the Union would require the ownership of the unalienated lands.

The influenza epidemic of 1918 took a heavy toll of the natives of Rhodesia; the death-roll was estimated at fully 30,000.

A national tribute was paid to Sir Starr Jameson on May 22 1920, when his body, brought from England, where it had been temporarily interred, was given a last resting-place close to the grave of Cecil Rhodes at the World's View in the Matoppo Hills.

[1] The following is an analysis of the returns, one member being elected unopposed. Votes for responsible government 4,663; for representative government 420; for joining the Union of South Africa 814; for continuance of Chartered Co.'s rule 868; total poll (out of 11,098 electors) 6,765.

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Survivors of the pioneers Jameson had led into Mashonaland in 1890 were present, and Matabele and Mashona indunas.

Rhodesia's Part in the World War.—The Rhodesian frontiers in 1914 touched German protectorates both on the west and east. The Caprivi " Finger " of German S.W. Africa came up to the Zambezi, west of the Victoria Falls. It was occupied by the Rhodesian forces with little difficulty. On the east a more serious situation was presented, as the Germans, in comparatively strong force, entered Rhodesian territory between Lakes Tanganyika and Nyasa. Aided by and giving aid to the troops of the Belgian Congo, Rhodesian volunteers and the British South Africa police rendered excellent service and held their own against the Germans. Subsequently Rhodesians played a notable part in Gen. Northey's offensive. A small Matabele contingent took part in the fighting, and a combatant battalion was raised from the natives of Northern Rhodesia.

From the first the Rhodesians were not content with the defence of their own territory. A regiment (1st Rhodesian) was raised for service in the 1914 rebellion and in the campaign in S.W. Africa, and early in 1915 another regiment (2nd Rhodesian) was sent to British East Africa, where it gained a deservedly great reputation. Many Rhodesians also enlisted in the British army. Altogether 6,859 Rhodesians (Europeans) were on active service during the war, a number much more than half the adult male population. Rhodesian natives engaged as combatants in E. Africa numbered 2,721, and in addition there were 40,732 " first-line " carriers. Some 152,000 other carriers were engaged on war service in Northern Rhodesia alone.

In the last days of the war (Nov. 2 1918) Gen. von Lettow Vorbeck, with all that was left of the German forces, turning westwards from his pursuers, entered Northern Rhodesia and had reached the Chambezi near Kasama on the day the Armistice was signed in Europe. It was in Rhodesia, therefore, that the last act in the war was played, von Lettow surrendering to the magistrate at Kasama on Nov. 14.

Northern Rhodesia.—The amalgamation of North-Eastern and North-Western Rhodesia was carried into effect on Aug. 17 1911, when Mr. (afterwards Sir) Lawrence Wallace was appointed administrator, a post he held for nearly ten years.[1] The defence of the territory, which had been shared with Nyasaland, had been taken over entirely by the Rhodesian authorities a short time before the amalgamation was carried through. The number of British settlers gradually increased and missionaries did valuable work in training the natives and introducing higher standards among them. The proposal of the Chartered Co. to amalgamate Northern and Southern Rhodesia has already been referred to; the project was dropped. The war, which deeply affected Northern Rhodesia, at first caused marked depression, which was removed by the military expenditure in 1916–7, while the building of the Katanga railway and the mining activity in Katanga brought about a revival. An elective, but purely advisory, council was established in July 1913.

The Chartered Co. was faced with much the same difficulties in Northern as in Southern Rhodesia, nor in the north did revenue meet administrative expenditure. Up to March 31 1919 the deficit was placed at over £1,250,000. As in Southern Rhodesia, the Company claimed the land and minerals and the repayment of administrative deficits, and, equally, the white settlers claimed a greater share in the government, notably control of finance. The consideration of these questions was remitted to the Buxton committee, which in its second report, dated April 29 1921, advised that the legality or otherwise of the Company's claims should be settled by the Privy Council before the future status of Northern Rhodesia was decided. Meanwhile the immediate creation of a legislative council was recommended.

Barotseland (*see* 3.424).—Barotseland, the S.W. part of Northern Rhodesia, continued to be a native reserve in which Europeans, other than the officials of the Chartered Co. and missionaries and traders approved by the paramount chief, were not allowed to settle. The paramount chief in the exercise of his authority is aided by a *ngambella* (prime minister) and a *kotla* (council); he has no jurisdiction over Europeans. Relations between the Barotse and the Company were satisfactory and missionary enterprise prospered. Distinct interest in education was shown; in 1912 there were 413 scholars at the Barotse national school, 251 being boarders. Lewanika (*see* 16.519), who had placed his country under British protection and who won and retained the reputation of an enlightened ruler, died in 1916. He was succeeded by his eldest son Yeta III. (formerly known as Litia). Leahui, the native capital, and Mongu, the residence of the chief British officials, are both on the Zambezi and seven miles distant from one another.

A list of parliamentary papers relating to Rhodesia is given in the *Colonial Office List*, published annually in London, and annual reports are issued by the British South Africa Company. See also C. Gouldsbury and H. Sheane, *The Great Plateau of Northern Rhodesia* (1911); A. Darter, *The Pioneers of Mashonaland* (1914); the *Report of the Rhodesia Resources Committee* (1921); H. Rolin, *Les lois et l'administration de la Rhodésie* (1913); J. H. Harris, *The Chartered Millions* (1920); and A. S. and G. G. Brown, *The South and East African Year Book and Guide* (annually).

In the preparation of this article the writer is indebted to G. H. Lepper, of the *Trade Supplement* to *The Times*. (F. R. C.)

RHONDDA, DAVID ALFRED THOMAS, Viscount (1856–1918), British colliery owner and Food Controller in the World War, was a Welshman, born March 26 1856 in Aberdare, grandson of a Monmouthshire yeoman farmer, and son of a Merthyr grocer. His father had prospered in his trade, and in later life enriched himself by speculations in coal. Young Thomas was sent to Clifton College, and afterwards to Caius College, Cambridge, where he graduated as a *senior optime* in the mathematical tripos in 1880, and immediately joined his father in the coal business. He threw himself with great energy and ability both into that and into local Liberal politics; and was so successful in both spheres that he was returned to Parliament for Merthyr in 1888. His extraordinary commercial gifts, his insight, his foresight, and the sympathy which he brought to bear on the conditions of life in the mining industry, soon made him a prominent, and eventually the leading, figure in the industrial world of S. Wales. " D.A.," as he was always called, by his initials, in his own part of the country, endeared himself to the miners by becoming their champion in the 'nineties against the undercutting of prices by middlemen, and by the generous wages which he paid in the collieries under his control; and though in subsequent years he sometimes had differences with the men, he always retained their respect. His business combinations brought him great wealth and culminated in the Cambrian super-combine, which produced some six million tons of steam coal a year. Other important undertakings in which he took a leading share were the Ebbw Vale Steel, Iron and Coal Co., the Rhymney Iron Co., and the Taff Vale Railway Company. So extensive were the ramifications of his interests that, when he accepted office in 1916, the number of directorships from which he retired was no fewer than forty. He had much longer to wait for success in the political than in the commercial field. Though he sat in the House of Commons for Merthyr for 22 years and afterwards for some months for Cardiff, no use was made by the political chiefs of his party of his great capacities for public service, and he therefore retired from Parliament in 1910.

The outbreak of the World War gave him his opportunity. He rendered substantial help to Mr. Lloyd George both at the Exchequer and in the office of munitions, by organizing British industrial resources for war. He took a lead in " capturing German trade," carrying through, for instance, the acquisition of the Sanatogen business. He went to America to complete important war contracts for the Government, and on his return was saved, with his daughter, Lady Mackworth, from the sinking of the " Lusitania." He went back to America almost immediately, and spent seven months there at his own expense, expediting the output of munitions, and regulating and systematizing the prices charged. He was created a baron, as Lord Rhondda, for his services in Jan. 1916; and it was natural that, when Mr. Lloyd George, in forming his ministry in the following Dec., made up his mind to introduce captains of industry into office, he should turn at once to his old ally, who became president of the Local Government Board. His principal business in this post was to prepare for the establishment of the Ministry of Health. Before this was effected he accepted, in June 1917, at the Prime Minister's pressing request, the onerous burden of the Food Controllership, vacated by Lord Devonport. He was no respecter of persons, and immediately took strong steps to put an end to the speculation in the necessities of life which was becoming a public scandal. Then he

[1] On the retirement of Sir L. Wallace (1920), Sir D. Chaplin, the administrator of S. Rhodesia, took charge of N. Rhodesia also.

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gradually fixed prices and brought supplies under control, in regard to almost all articles of food except vegetables. Thus he eliminated profiteering in food-stuffs. He also carried through a great decentralization in the administration of his office. But he will be mainly remembered as the author of the system of compulsory food rationing, which was carried out with absolute fairness and impartiality, putting an end to the queues waiting at butchers' and bakers' shops that had rendered the housekeeper's life a burden. As Food Controller, Lord Rhondda ran the biggest trading organization that the world had ever seen. The turnover of his Ministry, apart from the work of the wheat and sugar commissions, amounted to 1,200 millions sterling; with them 2,733 millions sterling. Supplies never failed, and in spite of the German submarine menace there was no hunger in the United Kingdom. His strenuous labours affected his health, and in April 1918 he tendered his resignation; but his work was so invaluable that pressure was put upon him to remain, and he was created a viscount. But the strain was too great. He was attacked by pneumonia and died on July 3. Tributes to his work and to the public loss sustained by his death were paid in both Houses of Parliament.

He married Sybil Margaret Haig, a cousin of Lord Haig, who survived him. They had one child, a daughter, who married Sir Humphrey Mackworth, and who succeeded to the viscounty of Rhondda under a special remainder. (G. E. B.)

RHYS, SIR JOHN (1840–1915), British archaeologist and Celtic scholar, was born in Cardiganshire, the son of a yeoman farmer, and educated at the Bangor Normal College and Jesus College, Oxford. In 1877 he was elected professor of Celtic at Oxford, the first occupant of the newly created chair, and he held that post till his death. In 1895 he became principal of Jesus College. He was Hibbert lecturer in 1886, Rhind lecturer in archaeology at Edinburgh in 1899 and president of the anthropological section of the British Association in 1900. He also served on several royal commissions and was knighted in 1907. He died at Oxford Dec. 16 1915. His published works include *Lectures on Welsh Philology* (1877); *Celtic Britain* (1882, last ed. 1904); *Celtic Heathendom* (1886); *Studies in the Arthurian Legend* (1891); *Celtic Folk-lore* (1901); as well as editions of Welsh texts (with J. G. Evans); *The Welsh People* (with D. B. Jones, 1900), and numerous other papers and studies of Celtic inscriptions and literature. For his work on the Arthurian legend *see* 12.300, 321, 669.

RIAZ PASHA (*c.*1835–1911), Egyptian statesman (*see* 23.281), died June 18 1911.

RIBOT, ALEXANDRE FÉLIX JOSEPH (1842–), French statesman (*see* 23.285). On Jan. 3 1909 M. Ribot was elected a member of the French Senate, and in Feb. of the following year was offered, but refused, the Ministry for Foreign Affairs in the Monis Cabinet. After the formation of M. Poincaré's Government on Jan. 14 1912 he took the place of M. Léon Bourgeois as president of the committee appointed to deal with the Franco-German treaty, the necessity for the ratification of which he demonstrated. In 1913 he was an unsuccessful candidate for the presidency of the Republic, and on the fall of M. Barthou's Government was invited by President Poincaré to form a Cabinet, but refused. In 1914 he became, with M. Jean Dupuy, leader of the Left Republican group which refused to accept the decisions of the Radical Socialist congress at Pau in Oct. 1913. On June 9 1914 he became prime minister and Minister of Justice, but his Government was bitterly assailed by the Radical Socialists as well as other groups, and only lasted one day.

With the outbreak of the World War M. Ribot's great reputation as an expert in finance and foreign affairs brought him effectively into office. On Aug. 27 1914 he became Minister of Finance in M. Viviani's Ministry of National Defence, an office which he retained when, on Oct. 28 1915, M. Briand succeeded M. Viviani as prime minister. On Feb. 7 1916 he visited London and held a conference with the Chancellor of the Exchequer at the Treasury. When Briand reconstituted his Cabinet, in Dec. 1916, Ribot retained the portfolio of Finance. On the fall of the Briand Ministry (March 17 1917) President Poincaré again called upon M. Ribot to form a Government, and this time he consented, himself taking the portfolio of Foreign Affairs in addition to the premiership (March 19). In the statement of his policy made to the Chamber on March 21 he declared this to be "to recover the provinces torn from us in the past, to obtain the reparations and guarantees due to France, and to prepare a durable peace based on respect for the rights and liberty of peoples." On July 31, in a reply to the German Chancellor Michaelis, he admitted that in 1917 an agreement had been made with the Tsar to erect the German territories on the left bank of the Rhine into an autonomous state, but denied that there had been any question of their annexation to France. His Government resigned office on Sept. 7; but he accepted the Ministry of Foreign Affairs in the Painlevé Cabinet constituted six days later. He resigned office finally on Oct. 16, owing to the violent criticism of his refusal to fall into the "trap" of the German peace offers.

RIBOT, THÉODULE ARMAND (1839–1916), French psychologist (*see* 23.286), died in 1916.

RICHARDS, THEODORE WILLIAM (1868–), American chemist, son of the artist William Trost Richards (*see* 23.299), was born at Germantown, Pa., Jan. 31 1868. He was educated at home, at Haverford College (S.B. 1885), Harvard (A.B. 1886; Ph.D. 1888), Göttingen, Leipzig and the Dresden Technical School. After passing through the various grades of promotion he was appointed professor of chemistry at Harvard in 1901 and was made director of the Wolcott Gibbs Memorial Laboratory in 1912. He was best known for his researches on atomic weights, of which he revised over a score, including that of radioactive lead. The results were generally accepted and for his contributions he received the Nobel Prize in Chemistry in 1914. He also gave much time to physicochemical investigation, especially concerning electrochemistry and chemical thermodynamics, piezochemistry and surface tension. Of these his contributions to atomic compressibility, to the relation between the change of heat capacity and the change of free and total energy, and to the thermodynamics of amalgams have perhaps been the most noteworthy. In 1907 he was Harvard exchange professor at Berlin, and in 1908 Lowell lecturer. He was president of the American Chemical Society (1914), the American Association for the Advancement of Science (1917) and the American Academy of Arts and Sciences (1919). He was a member of the National Academy of Sciences and of most of the European academies. He received hon. degrees from Yale, Harvard, Haverford, Pittsburgh, Clark, Pennsylvania, Oxford, Manchester, Christiania, Prague and Berlin. He was awarded the Davy (1910), Faraday (1911), Willard Gibbs (1912), and Franklin (1916) medals. He was made a member of the National Research Council in 1916.

RICHBOROUGH, a port on the left bank of the mouth of the Stour river, Kent, England, 1¼ m. N. of Sandwich, created by the Government during the World War as a base for the expedition of *matériel* to the armies in France and Flanders. The port was planned in June 1916, primarily to relieve Dover of this class of transport. The site chosen consisted of an expanse of marshland through which the Stour flowed as an insignificant stream. The work of construction was under the control of the Inland Waterways and Docks Section of the Royal Engineers, and involved the reclamation of a large tract of swampy foreshore, the widening and deepening of the waterway, the construction of a wharf and jetty nearly a mile in length equipped with powerful cranes and of docks for the building and repair of certain kinds of craft, the erection of acres of hutments and store-sheds, and the laying of some 50 m. of railway sidings. The work was rapidly pushed forward, the workers at one time numbering 20,000; and eventually a self-contained cantonment arose, having its own postal, police, lighting and other services.

The base was operated in a comparatively small way at first but developed into an undertaking of gigantic proportions. At the outset, steamers and barges were used to convey the war material across, until the French ports became congested; then special barges were introduced to take goods direct into the

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French canals and thence as close to the firing line as possible. In 1917, speed of transport of material becoming extremely urgent, it was decided to establish a train-ferry service; it came into operation at the end of that year, and the hoisting of cargoes by cranes into barges was largely superseded. Three ferries plied incessantly between Richborough and Calais and Dunkirk, connecting railhead in England with railhead in France. In all, 4,000 barge loads of ammunition, 17,818 guns and limbers, and over 1½ million tons of other stores were sent across.

The ferries, specially designed and built at the works of Sir W. G. Armstrong, Whitworth & Co. of Elswick, were of 363 ft. overall length, 61 ft. beam and 3,654 tons displacement. Four lines of rails on deck gave accommodation for 54 ten-ton wagons carrying an average load of 900 tons. A lifting bridge at the wharf-end, which the ferry approached stern on, enabled accurate connection of rails at all states of the tide, the process of embarking a train requiring ordinarily not more than 15 minutes.

For the protection of the base, a monitor was stationed in Pegwell Bay, and searchlights and heavy and anti-aircraft guns were mounted at many points. Repeated air-raids took place in the vicinity and there were several bombardments from the sea, but Richborough itself was never seriously damaged, the low-lying, featureless character of the marshland probably affording its best protection, more especially at night.

For a year after the Armistice, Richborough continued to deal with vast quantities of material returned from the western front. After the sale and disposal of the surplus military stores and equipment, the port, with the remaining equipment and the fleet of ferries and barges, was sold by the Disposal Board for £1,407,000 (plus the cost up to £40,000 of acquiring the land by the Government) to the Queenborough Development Co., who thus acquired 1,500 ac. of land including 250 ac. that were reclaimed from the swampy foreshore. In 1921, the company proposed to work Richborough as a barge and train-ferry port, ancillary to Queenborough, both centres to serve the requirements of a comprehensive scheme of industrial development in the surrounding districts including the Kent coal-fields.

RICHMOND, SIR WILLIAM BLAKE (1842–1921), English painter (*see* 23.307), died at Hammersmith Feb. 11 1921.

RICHTER, HANS (1834–1916), Hungarian musical conductor (*see* 23.312), died at Bayreuth Dec. 5 1916.

RICKETTS, CHARLES (1866–), English artist, was born at Geneva Oct. 2 1866, and was educated in France. In 1889 he became joint editor with Charles Shannon of the *Dial*. In 1896 he founded the Vale press, the output of which was a series of beautifully designed and printed books. Of his pictures, "The Plague" (1911) is in the Luxembourg at Paris, and "Don Juan" (1916) in the National Gallery of British Art. He published *The Prado and its Masterpieces* (1903), *Titian* (1906) and *Pages on Art* (1913).

RICOTTI-MAGNANI, CESARE (1822–1917), Italian general (*see* 23.316), died at Novara Aug. 4 1917.

RIDDELL, GEORGE ALLARDICE RIDDELL, 1ST BARON (1865–), British newspaper proprietor, was born in London May 25 1865 and educated privately. He became a solicitor in 1888 and settled in practice at Cardiff. There he acquired an interest in the *Western Mail*, and he eventually turned his energies mainly to newspaper management. He went to London and obtained control over the Sunday paper, the *News of the World*, which he developed on popular lines, so that it obtained a huge circulation during the first decade of the 20th century and made its proprietor a very wealthy man. He gradually extended his newspaper connexions, becoming a director also of George Newnes Ltd., Country Life Ltd., and C. Arthur Pearson Ltd., etc. By the year 1909, when he received a knighthood, he had become one of the most influential personalities in the London press, and he took an active part in giving a more efficient organization to various forms of press work, by way of collective action between proprietors themselves and their organs. He was a prominent member of the Newspaper Proprietors' Association at the outbreak of the World War, and owing to his intimate relations with Mr. Lloyd George he gradually became the principal *liaison* between the Press and the Government so far as all matters of publicity were concerned. In this capacity he represented the British Press at the Peace Conference in 1919 and at all the important Allied conferences subsequently. He was created a baronet in 1918, and raised to the peerage as Baron Riddell of Walton Heath in 1920.

RIDGEWAY, SIR WILLIAM (1853–), British archaeologist, was born in Ireland Aug. 6 1853 and educated at Portarlington, Trinity College, Dublin, and at Caius College, Cambridge, where he was fifth in the classical tripos. In 1880 he was elected fellow of Caius College, Cambridge, and in 1883 became professor of Greek at Queen's College, Cork. In 1892 he returned to Cambridge as professor of archaeology and in 1907 became also Brereton reader in classics. He was made a fellow of the British Academy, and president of the Royal Anthropological Institute (1908–9). He was knighted in 1919. Amongst his publications are *The Origin of Metallic Currency and Weight Standards* (1892); *The Early Age of Greece* (1901); *The Origin and Influence of the Thoroughbred Horse* (1907); *Who were the Romans?* (1907); *The Oldest Irish Epic* (1907), etc. His views on early Greek civilization are described in 12.442; those on the origin of the Romans in 23.616, and those on the horse in 13.717.

RIFLES AND LIGHT MACHINE-GUNS (*see* 23.325 and 17.237).—Since 1910 there have been few important changes in the design of the military bolt-action rifle. The adoption by many countries of the pointed bullet in lieu of the round-nosed (*see* 23.328) has led to some strengthening of parts so as to withstand increased chamber pressures. Modifications in the patterns of sights used have also been made here and there.[1] The military rifle had practically reached its zenith before 1914, and the opening of the World War found all armies equipped with rifles of practically equal merit. With the exception that the French continued to use the tube-magazine Lebel rifle and the British and Americans had adopted a shorter barrel than the rest, it might be said that the military rifles of the world were not only equal in merit but similar in design.

This initial equivalence of the opposed rifles continued throughout the war period. Further changes of detail were made. Special rifles were sometimes brought into use for snipers, and fittings were added to the standard service rifle to adapt it as a grenade-thrower and as a sniper's weapon to be used from a deep trench. A heavy single-loader was designed in Germany as an anti-tank weapon, and many changes were made in the ammunition. But the rifle itself, the rifle of the average infantryman, was practically the same at the end of the war as it had been for the past 15 years, or, setting aside the change of bullet type, for twenty-five. The German army of 1918 carried the 1898 rifle, the French the Lebel model 1886–93, the Italians the Mannlicher-Carcano of 1891. The Russian three-line (·3-in.) rifle of 1900 was only a modification of the earlier Moussin and Nagant models. The most modern patterns were the British and the American, and these were characterized by having a relatively short barrel, experience in the S. African War having brought "snap shooting" and the consequent need of handiness into relief. Otherwise the elements and their functions were the same, and the dimensions of the same order, in all rifles except the French.

This standstill of progress, in a time when the design of every other kind of weapon was developing at an unprecedented rate, is very remarkable and indicates clearly enough that the military rifle of the conventional type had reached its zenith. As a type, it was not capable of much further development. Designers had already by 1914 produced the first practical models of automatic and semi-automatic arms. Governments were unwilling to re-arm their troops and re-stock their armouries with new models of an obsolescent class. Even the French, whose rifle was not only the oldest but also possessed a type of magazine long discarded by others, made no attempt to replace it by a weapon of the class of the British and American rifles. When war came, all Powers were waiting on events.

In the war itself the machine-gun proper very soon and decisively asserted itself, driving the simple rifle into the back-

[1] For further information *see* AMMUNITION and SIGHTS.

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ground. Further, trench warfare took unforeseen shapes. Grenades, trench mortars, bombs and man-to-man weapons, even clubs and daggers, became normal infantry arms in minor and subordinate combats, while in the battle proper it was the artillery and the machine-gun rather than the firing-line of rifle-armed infantry that governed the issue both in attack and in defence. Thus when, from the latter part of 1916 onwards, the "break-through," with its sequel of free infantry fighting in the background of the broken-through trench systems, became the ideal of tactics, the main infantry weapon was inevitably the machine-gun in some form. And thereupon the machine-gun of the pre-war and early war period began to develop on two distinct lines—the *heavy* machine-gun with its own rôle and characteristics (*see* MACHINE-GUN), and the light machine-gun or infantry machine-gun. When this evolution set in, the machine-rifle or automatic rifle (some forms of which were already in use as machine-guns, especially with aircraft) was more or less ready to take up the place allotted to it by tactics.

The light machine-gun or machine-rifle—"infantry machine-gun" is a better designation than either for the class as a whole—is differentiated from the heavy machine-gun, technically and tactically, by being: (*a*) portable by one man; (*b*) unprovided with a mounting in the proper sense; (*c*) as inconspicuous in action or movement as an ordinary rifle; and (*d*) limited for various reasons to short bursts of fire. On the other side, as against the rifle, it possesses: (*a*) fire power with which no hand-operated weapon can compete, which indeed is equivalent for some moments at a time to that of the machine-gun proper; (*b*) an accuracy that, while less than that of the heavy type, is greater than that of the rifle, owing to the absence of trigger jerk and disturbance of the firer by recoil and to the fact that a muzzle support is (usually) provided; (*c*) ease and certainty in the matter of fire control, a mechanical organ in the hands of one man being far more manageable in the confusion of battle than a squad of extended riflemen. These advantages it gains, of course, at the expense of being more cumbrous, more delicate in mechanism and more expensive than the rifle, and it requires a fuller ammunition supply, or may do so. Further, it lacks one of the characteristics of the old infantry firearm—it cannot serve as the haft of a bayonet, and thus the infantryman ceases, at least for the time being, to be self-sufficing, and infantry organization at its lowest level returns to the 17th-century form, in which a fire element and a shock element are combined in the tactical group rather than in the individual soldier.

The characteristics of automatic rifle and light machine-gun fire, which thus become the most important element of infantry tactics, are briefly as follows. (For convenience, the term "automatic rifle" will be applied to the lighter and that of "light machine-gun" to the heavier members of the class under consideration. The definition by weight adopted in the following article fixes the frontier between the automatic rifle and the light machine-gun at about 20 lb.)

The trajectory of an individual round, whether fired from a rifle, an automatic rifle, a light machine-gun or a heavy machine-gun, is the same for the same ammunition and barrel characteristics, though its relation to the object aimed at will vary to some extent according to steadiness of man or mounting, smoothness or shock of recoil and other factors. On the other hand, the cone or sheaf of fire formed by a group of rounds will be denser with the automatic rifle and denser still with the light machine-gun than it is with a number of rifles representing the same volume of fire per unit time. The grouping of shots is densest of all in the case of the heavy machine-gun fired from a steady mounting.

In proportion, therefore, as the steadiness in position, due to man, ground or mounting, enables an automatic rifle or light machine-gun to group its shots more and more closely, these weapons tend to acquire more and more of the peculiar tactical powers of the heavy machine-gun—the ability: (*a*) to support close-fighting infantry groups by overhead or acute flanking fire; (*b*) to pour a direct and intense fire into small but dangerous posts of the enemy, such as machine-gun nests; (*c*) to enfilade enemy trenches and harass bridge approaches, cross-roads, and other points of very small area by day or night. It may be admitted at once that no existing light machine-gun and, *a fortiori*, no automatic rifle, is fully capable of (*a*) and (*c*), and in particular of overhead fire or fire through intervals between moving or fighting bodies of friendly troops without endangering them. However, in (*b*) the light machine-gun is ballistically scarcely inferior to the heavy machine-gun. This is its true function, which it performs as a rule better than the heavy, because its mobility allows of a closer approach, easier observation and freer choice of position. The automatic rifle also possesses this power in some measure, but the light weapon of the future to be evolved from the two types must, before unity of type is acceptable, be made quite as capable of performing this tactical service as is the light machine-gun of to-day. At present the automatic rifle seems to be looked upon in some quarters as a weapon to be used normally as a semi-automatic, firing perhaps 50 or 60 rounds where the bolt-action rifle would deliver 10 and to that extent economizing men, reducing confusion, and minimizing casualties in the firing line, but in the last analysis always a rifle in the tactical sense. Its automatic power is reserved for special emergencies, just as, at the beginning of the evolution of the magazine rifle, the magazine was regarded as a reserve of fire power added to a single-loader.

Considering, next, volume of fire, we can safely say that for practical purposes all automatic rifles and light machine-guns have or can be made to have the same rapidity of fire as the heavy machine-gun. The rapidity is purely a function of the design. Whether recoil-operated or gas-operated, the cycle of operations is gone through as fast as the mechanism can take up the motive impulse. On the other hand, the possibility of maintaining the automatic rate for long without damaging the mechanism depends on (*a*) the solidity of the working parts; and (*b*) the capacity of the barrel to resist overheating. In both respects the light machine-gun and the automatic rifle are definitely inferior to the heavy. Solidity of working parts and the incorporation in the design of cooling devices both involve deadweight, and it is the designer's first object to eliminate deadweight. In the automatic rifle not only are weights of parts limited but cooling devices are omitted altogether.[1] The possibility of automatic continuous fire is therefore definitely sacrificed. In light machine-guns, on the other hand, the working parts are not greatly different in solidity from those of heavy machine-guns, and some form of cooling device—radiator, circulator or both—is invariably fitted. The extra weight translates itself into greater power of sustained fire. With a positive cooling system, such as the water-jacket of the German L.M.G.08/15, the volume of fire from a light machine-gun is practically equal to that of a heavy, if tactical conditions allow of equal ammunition supply to each. Even the air-cooled guns are capable of delivering many hundred rounds without a pause other than those for changing magazines or belts. It is true that the development of full fire power for several minutes continuously is exceptional and even very exceptional, and it is a matter of opinion how much importance should be attached to this factor relatively to others in the arm of the future. But it seems clear, in any event, that the infantry machine-gun which constitutes the backbone of the attack or the defence ought to possess, at least at the shorter ranges, that power of focussing a storm of bullets on the enemy's machine-gun group, nest, or other centre of effort as soon as it is located. Otherwise the attack or counter-attack must wait for the heavy machine-guns to come well up, or at least to wait till exact information as to the target and the situation has been communicated to them.

This line of reasoning would exclude the automatic rifle altogether but for certain other considerations. The blotting-out by destruction or neutralization of well or strongly posted enemy groups in key positions is not the only function of the infantry machine-gun. It prepares by its fire every local advance of the groups of its own side, whether against or past important hostile nuclei or against simple parties of infantry using fortuitous

[1] Except in the Chauchat, which is on the border line as to weight.

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cover, which constitute the rest of the hostile "line." It is the latter which is the average, though not the decisive, incident in mobile warfare, especially when, as in 1918, the principle is to "drive a nail where it will go." In these average incidents sustained fire is the rare exception—German light machine-gun squads in the spring offensive of 1918, for instance, seem to have found that 2,000 rounds daily per L.M.G. sufficed—and mobility is of supreme importance as the machine-guns must push along as fast as the rest of the infantry, and, indeed, get ahead of it in many cases. This is a strong, and indeed the principal, argument in favour of the automatic rifle of less than 20 lb. weight, as against the light machine-gun of 20–40.

In sum, therefore, the light machine-gun, by reason of its greater weight and steadiness, can deliver a fire of greater accuracy and more sustained intensity than the automatic rifle, and so can perform functions for which the heavy machine-gun would otherwise have to be called in. The automatic rifle, on the other hand, possesses a greater mobility than does the light machine-gun and can for a few moments at a time develop a fire power practically as heavy. In four-fifths of a day's work in battle, then, it is as useful as, or more useful than, the light machine-gun. But the last fifth, often more important than the rest put together, it cannot undertake with much hope of success. Both have the disadvantage that they must be fed with ammunition in very difficult conditions. They must, therefore, be squad weapons and not personal weapons, and there is a tendency for the squad to group itself about the gun and so to reveal itself for what it is. Both, on the other hand, have the advantage that very few of these squads are needed, as compared with rifle-armed infantry, to attack or defend a given front.

On the whole, it seems probable that a type of the future, evolved from both, will take the form, not of the lightened machine-gun, but of the automatic rifle provided with increased magazine capacity, a cooling device, and a mount sufficiently steady, with the weight of the gun, to give a bullet grouping at short ranges as close as that of the heavy machine-gun at longer.

The rise of the light machine-gun to importance as the main weapon of the infantry battle has been followed by another development of some interest, viz. a change of principle in what may be called the personal armament of the infantry soldier. Hitherto self-sufficing, but now become a member of a gun detachment, he has felt the need of possessing some handy weapon of his own which would give him intense fire power in emergencies. The same is the case with the artilleryman and, in the present day, with many specialists such as range-takers, observers and others, who have to work in the front line but are not armed with the normal battle weapon. For these, first an increase in the capacity of the pistol magazine was tried, and later an altogether new class of weapon was designed—the machine-pistol, which is a fully automatic arm of the carbine or long pistol kind, capable of firing pistol ammunition as fast as a heavy machine-gun fires rifle calibre ammunition. Such weapons may also usefully replace the light machine-gun itself in certain conditions, *e.g.* bush or mountain warfare. Some examples of this new class of arm are described below.

As to whether the semi-automatic rifle—that is, the military rifle fitted with self-loading mechanism but fired by the trigger shot for shot—will become a universal infantry weapon, opinions differ. On the whole, it seems unlikely that it will do so. On the one hand, for group action the light machine-gun or perfected automatic rifle is definitely superior in accuracy, volume, and control of fire to an equivalent number of semi-automatic rifles in individual hands, whatever the discipline and team work of the individuals. On the other hand, as a personal armament for fighting at close quarters the new machine-pistol is superior in intensity of fire and at least equal in handiness. The semi-automatic rifle may develop as a weapon for sniping and skirmishing, and as the soldier's personal armament in theatres of war where the country is very open and troops are required to do a good deal of individual patrolling and stalking. Of these services, however, all except sniping can be performed by the machine-pistol; and, in sum, the semi-automatic rifle seems likely as a military arm to become a sniper's rifle pure and simple—the military analogue of the sporting rifle, for which the semi-automatic principle is already well established.

Speculation as to the nature of the cavalry firearm of the future is now difficult, depending as it does on the tactical question of how far dispersion will be carried in the dismounted fire fight. (C. F. A.)

Practical Developments

The improvement of the rifle has been confined mainly to the development of auto-loading, or semi-automatic, rifles for both military and sporting purposes, and the development of the automatic or machine-rifle for military purposes.

The semi-automatic shoulder-rifle has become an efficient and reliable weapon for sporting purposes, but no military weapon of this type has been adopted by any of the leading powers to replace the bolt-action shoulder-rifle, although some fairly successful weapons have been produced. The principal difficulty in the way of perfection of an arm of this type is the weight limitation. The present bolt-action rifles are considered by many designers to be as light as is consistent with the pressures obtained with modern powders, and the automatic action can only be obtained through additional parts, and consequently additional weight. Successful automatic rifles of 12–20 lb. weight have indeed been produced. Such rifles are somewhat less heavy than the light machine-gun, the latter being defined as an automatic, rifle-calibre weapon, with a tripod as muzzle support weighing from 20 to 30 lb. complete, and it is possible that further developments in the type may lead to its superseding the light machine-gun as above defined.

Bolt-Action Military Rifles.—It has already been noted that no important progress was made in the design of the bolt-action rifle during the World War. Quite apart from the manufacturing difficulties attending upon an alteration of model in the midst of a great crisis, and setting aside also the changes in the tactical relations of rifle, gun and machine-gun in the war, the rifles used by the various belligerents were so nearly equivalent that no one possessed any advantage over the rest which could not be compensated for by slightly better training or slightly higher *moral* on the other side. And not only was the invention of necessity wanting, but also the conventional type of rifle had reached a point of development beyond which it was difficult to see possibilities of radical improvement.

Substantially, then, the rifles in use at the end of the war were the same as those in use at its beginning, and this is the less surprising as many peace-time criticisms levelled at one or another model proved to be useless, or practically unimportant, in war. Thus, rifles looked upon as obsolete revealed unsuspected good qualities in the severe test of war service, and modern rifles failed to show the superiority expected. The German Mauser had been popularly credited with being the best military shoulder arm; while the British short Lee-Enfield had been severely criticized on the score of its weak body and poorly designed bolt. Yet, under service conditions, the performance of the latter was excellent; the simple action, good balance, and rapidity with which it could be worked compensating for the superior ballistic qualities of the German arm. Similarly, the French Lebel, one of the oldest service rifles (1886–93), has been looked upon as being outclassed by modern arms, it being the only military rifle with a tubular magazine; yet this rifle with the "Balle D" cartridge has greater velocity and greater striking power at ranges in excess of 800 yd. than the American Springfield, which has 360 f.s. greater initial velocity. In only one instance, apparently, did a rifle prove so unsuitable that it was withdrawn from use. The Ross rifle, the original arm of the Canadian forces, while a good sporting and target rifle, proved unsatisfactory in the mud and dirt of trench fighting.

Another factor which tended to stabilize the rifle in its existing form was the interchangeability of rifle and machine-gun ammunition. Before the war there was a distinct tendency towards reducing the calibre of the rifle and employing a lighter bullet, in order to obtain flatness of trajectory at ranges within about 800 yards. But the modern light-weight high-velocity bullet

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loses its velocity very rapidly, which renders it less suitable than a heavier bullet for employment in machine-gun work, where effectiveness at long range is required. So long, therefore, as the ammunition of rifles and machine-guns remains interchangeable it is probable that no further reductions of calibre and bullet weight will take place. At the same time, the development of the heavy machine-gun itself may quite possibly call for not merely the retention of the present common calibre but an actual increase of calibre beyond what is admissible for the rifle. The principle of interchangeable ammunition has recently been questioned by some experts who would prefer that each class of weapon should be free to develop along its own lines; and already experiments have been carried out in the United States, not indeed with two calibre, but with two bullet weights, a bullet of 180 grains being designed for the machine-gun (and for occasional use for special purposes in the rifle) while the old bullet of 150 grains is retained for the shoulder weapon.

The only new model service bolt-action rifle produced by belligerents during the war on a large scale was the British rifle, ·303, pattern 1914, which was later adapted to ·30 U.S. ammunition and manufactured for the United States; about 2,500,000 rifles of this type being produced in that country during the eighteen months preceding the Armistice.

British Rifles of the War Period.—Before the war, the British service rifle, the short Lee-Enfield of ·303-in. calibre, had been subjected to a good deal of criticism, and the War Office, after much experimenting with various types of cartridges, found that it was not possible to obtain as high a velocity with this rifle as was desired. An improvement was effected, however, in the adoption of the Mark VII. ammunition, the pointed bullet of which weighs 174 grains instead of 215 grains as in the Mark VI., the muzzle velocity being 2,440 f.s., with a chamber pressure of 45,000 lb. This ammunition, however, did not give the ballistic qualities desired and the design of a new rifle was taken up. A rifle was finally evolved with a bore ·276 in. in diameter, and chambered for a rimless cartridge, giving a muzzle velocity of about 2,800 f.s., and a chamber pressure of 51,000 lb., and it is probable that this model would have been further perfected and adopted but for the beginning of the war. Military considerations then prevented its adoption in its original form, and it was modified to take the existing Mark VII. ·303 ammunition, and manufactured in the United States as the "British Rifle, Pattern 1914." The short magazine Lee-Enfield with Mark VII. ammunition, however, remained the standard British arm throughout the war; though the new rifle was also used.

Upon the entrance of the United States into the conflict, as a number of American factories were equipped to manufacture this rifle, it was again modified to accommodate the U.S. service ammunition and used as a substitute for the calibre ·30, model of 1903 (Springfield), under the name of the "U.S. Rifle Model of 1917." As chambered and bored for the U.S. ammunition, the rifle had approximately the same ballistic qualities as the Springfield. The British and American models of this rifle are the same in their essential features, except that the latter has not the long-range (dial and aperture) sights of British rifles. A remarkable feature common to both rifles is the position of the rear sight between two protecting lugs on the bridge of the receiver. This position of the rear sight gives a distance from back sight and fore sight of 31·76 in., that is, almost exactly over the trigger instead of in the customary position, a hand's breadth or more in front of the magazine. Further details will be found in the article SIGHTS. The length of the rifle overall is 46·3 inches. The weight without bayonet is 9 lb., 3 oz.; the sword bayonet is about 22 in. long (blade 17 in.) and weighs 15 oz. The magazine holds five cartridges which are loaded from a clip. The bore has five grooves, left-hand uniform twist, one turn in 10 inches.

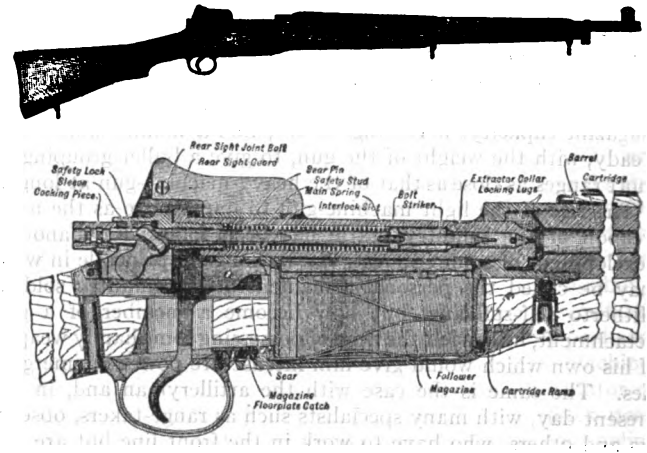
The action of this rifle is as follows (figs. 1 and 2). The cycle of operations is assumed to start with the extraction of a fired cartridge case. The bolt handle is raised and the cocking piece forced to the rear in the bolt by the half-cocking cam. This also withdraws the striker into the bolt. When the locking lugs on the bolt are clear the extracting cams on the bolt and receiver engage and the continued rotation of the bolt retracts the latter and loosens and partly withdraws the cartridge case (primary extraction), the extractor and sleeve being prevented from turning by the receiver. When the limit of the turning movement in the bolt is reached, it is drawn to the rear, withdrawing the empty cartridge case; during this movement the cocking piece rides over the sear nose and depresses it; the safety stud rises in the clearance cut in the bolt. When the cocking piece clears the sear nose, the sear spring returns the sear to normal position. The slotted locking lug (left hand) of the bolt now reaches the ejector, the latter protruding in the slot sufficiently to strike the rear of the empty case and eject it to the right. After a further slight backward movement the bolt lug comes in contact with the bolt stop, preventing further movement. If the magazine is now empty the follower rises and its rib prevents the closing of the bolt. If not, the magazine spring has pushed another cartridge up and into the path of the bolt, the forward movement of which forces it forward and up over the cartridge ramp.

During the early part of the closing movement of the bolt, the ejector is pushed outward by the bolt. Later, the sear notch in the cocking piece engages the sear nose, and is arrested. The bolt then slides forward over the striker, further compressing the main spring.

When the rotation of the bolt by the handle begins, the locking lugs engage the locking cams, and force the bolt home, seating the cartridge, and further compressing the main spring. The rotation of the bolt restores the half cocking cam, so that it is out of the path of fall of the cocking-piece lug.

The bolt is now locked, the mainspring is fully compressed, and the cocking piece is held by the sear nose.

When the trigger is squeezed, the bearing of the trigger first acts on the bearing of the receiver, slowly depressing the sear nose. Then the heel of the trigger engages the receiver, and completes the depression of the sear nose, which ends in the release of the cocking piece by the sear nose. The striker is then acted upon by the mainspring, and, striking the primer of the cartridge, detonates the same.



FIGS. 1 and 2.—British Rifle (Pattern '14) U.S. Model of 1917.

During the depression of the sear nose, the safety stud rises through the hole in the bottom of the well and enters the interlock slot in the bolt. If the bolt is not fully locked, the interlock slot will not register with the safety stud, and the trigger cannot be pulled.

United States.—When the United States entered the war its standard rifle was the "U.S. Rifle, Model of 1903" (Springfield). There were only about 600,000 of these on hand, and very limited possibilities of immediate expansion. To obviate delay, therefore, it was decided, as above mentioned, to adopt the British Pattern '14 rifle which had been manufactured in the United States in large quantities. This rifle, modified as previously noted, was used very successfully by a large portion of the U.S. troops; only the regular army and part of the National Guard continuing to use the Springfield. The Springfield, however, is still (1921) the official arm, the 1917 rifles having been withdrawn after the Armistice.

Other Nations.—The Lebel magazine rifle, calibre 8 mm., model of 1886–93, is still the standard arm of the *French* infantry. The magazine is tubular, lies under the barrel, and holds eight cartridges which are loaded singly. The carbine, model of 1890, and the rifle, model of 1907–15, were also used to a considerable extent. These are magazine rifles, having a one-piece stock and a bolt with a turning head. They are loaded with a charger containing three cartridges. A box magazine was later designed for these rifles, increasing the capacity to five cartridges. Several

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other types were used by the French, many of the old single-loading "Gras" rifles of the 1874 model being adapted.[1]

Mauser rifles in different calibres were used by *Germany*, *Turkey*, *China*, *Portugal*, *Serbia* and *Brazil*.[2] The *Japanese* "Arisaka," or "38th Year," also has a Mauser action. Many of these rifles were purchased from Japan by Russia early in the World War and also by Great Britain for training purposes. It was reported that since the Armistice Japan has increased the calibre both in new rifles and in the existing stock from 6·5 mm. (256) to 7 mm., the reason given for the change being that the 6·5-mm. bullet is too small to develop sufficient wounding power. This calibre is used by several other nations and is the smallest used in military rifles. The change is interesting, since the tendency had been towards reduction of calibre.

The standard arm of the Russian infantry is the "Three line" magazine rifle, 7·62-mm. (·3-in.) calibre. A new type of ammunition has been adopted for this rifle, having a pointed bullet weighing 148 grains and giving 2,820 f.s. velocity with 50,000 lb. pressure. The Russian Government also bought large quantities of Winchester, model of 1895, magazine rifles of the same calibre, the only lever-action magazine-rifle used in the war.

Austria-Hungary used the 8-mm. Mannlicher, "Straight Pull" rifle, model 1895, and carbine. Mannlicher type rifles were also used by *Italy*, *Bulgaria*, *Rumania* and *Greece*. The *Belgians* used the magazine rifle, calibre 7·65 mm., model of 1889, which has a Mauser action. The latest ammunition for this rifle has a pointed bullet weighing 154 grains with a velocity of about 2,740 f.s. The *Swiss* Schmidt-Rubin rifle has been redesigned to chamber a new rimless cartridge having a 170-grain streamline bullet with a velocity of 2,660 f.s.

Special Bolt-Action Rifles

Snipers' Rifles.—Several types of rifles have been developed by the various Powers for the use of "snipers," whose function it is to pick off with single shots individual scouts, officers, men of working parties, enemy snipers, etc. Snipers work as a rule in pairs wherever feasible, one acting as an observer, the other as a rifleman. The rifle used for this purpose is usually a very carefully selected specimen of the standard service rifle, fitted with telescopic sights of low power, or some other variety of optical sights, though plain sights are sometimes used. The British snipers used the short Lee-Enfield rifle with various forms of telescopic and other optical sights, and also the 1914 rifle with a special back sight. The U. S. rifle is fitted with a Warner and Swasey telescopic sight, 6-power, 4½° field, which is attached to the standard rifle by side brackets, but this combination is not entirely satisfactory and a new telescope and method of mounting are being developed. The German sniper's rifle was the standard Mauser with brackets fastened by screws to the top of the magazine to take a Goerz, Luxor, or Zeiss telescope, generally of 2½ or 3 power. The mounting of the telescope over the bolt and magazine makes it necessary to use the rifle as a single-loader and prevents the use of the regular sights while the telescope is attached. This method is, however, preferred by riflemen as aim may be taken with the cheek against the stock in the usual manner; the superior accuracy obtained offsetting these disadvantages. In the German sniper's rifle the telescope can be very quickly removed from its brackets and the rifle used the ordinary way.

Periscopic Rifle Holders or "Sniperscopes" have been designed and used with some success, although it cannot be said that these devices were ever popular or capable of very accurate or rapid fire. The tendency when using them is to shoot high and they are only reasonably accurate at ranges up to 200 yards. In the instrument developed by the Munition Invention Department of the British Government (fig. 3) the periscope (*aa*) and shoulder piece (*c*) are rigidly combined with each other and with a shoe (*d*) which takes the butt of the rifle. A trigger on the shoulder piece is connected to the rifle trigger by a cord (*eee*). Pivoted to the right side of the shoe is a system of levers (*bbb*) which enables the firer to open and close the bolt by means of a handle close to his right hand. The periscope itself is a simple mirror-periscope.

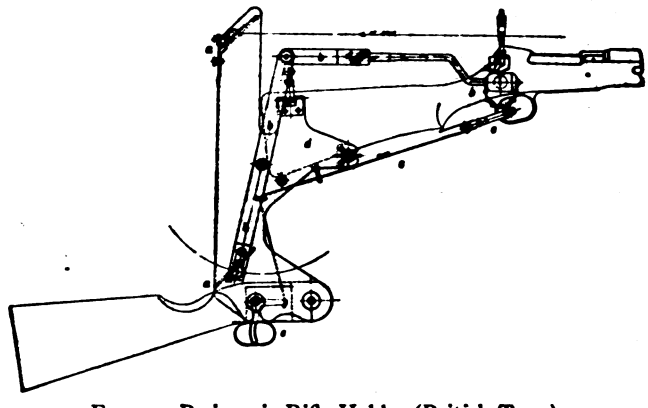

Fig. 3.—Periscopic Rifle Holder (British Type).

Anti-tank Rifle.—The German anti-tank rifle (fig. 4) is a single-shot calibre 13-mm. Mauser action rifle brought out as an emergency weapon[3] and intended to serve as a stop-gap pending the construction of a 13-mm. machine-gun. The weapon is intended for short-range work only, as the sights are graduated to only 500 metres. It is very heavy (37 lb.) and has a total length of nearly 66 in., the barrel being 39 in. long. It is provided with a bipod. The bullet, which weighs 801 grains, is pointed and armour-piercing, has an initial velocity of about 2,450 f.s., and a penetration of 20 millimetres in the best steel is claimed at a range of 500 yards. It is, however, very heavy for a portable arm, and, being a single-shot weapon, it has a very slow rate of fire. On account of the heating of the barrel and the heavy recoil, the fire cannot be sustained for more than 20 shots at a time. Each rifle was served by two men, carrying 124 cartridges as well as the rifle and accessories and their personal armament. The rifles were used in squads of three rifles, or singly, or in coöperation with heavy machine-guns using armour-piercing bullets, according to circumstances. The Germans had a high regard for this weapon.

Fig. 4.—German Anti-Tank Rifle.

High-power Rifles.—Sporting rifles with an initial velocity of 3,000 f.s., or slightly more, are now in use. These rifles have no particular feature except the additional strength necessary to withstand high pressures. The so-called "explosive" effect of high-velocity bullets upon striking make them extremely effective for sporting purposes.

Semi-Automatic Rifles

As already mentioned, efforts are being made to produce a semi-automatic shoulder-rifle to replace the bolt-action rifle. The successful sporting weapons of this type which have been devised are not considered suitable for military use, as the powder pressures and velocities obtained from their cartridges are much below those obtained with military ammunition. Sporting rifles are not subjected to the severe conditions that are usually encountered by the military

[1] The German infantry throughout the war carried the 1898 pattern Mauser (7·9 mm.). The cavalry carbine of the same pattern and calibre was also occasionally used by infantry as well as by cavalry serving dismounted in the trenches, and by the personnel of light machine-gun squads. During the trench-warfare period of the war, spare magazines holding 25 cartridges were designed for attachment to the underside of the ordinary magazine, in order to obtain an increased volume of fire for emergencies; these were, however, clumsy and unpopular with the troops, and were not generally used. The only important modification of the standard arm was the introduction in summer 1915 of a short rifle (43·5 in.) known as the Erfurt rifle. This has the same trench action, calibre, and magazine as the 1888 rifle, and, apart from the reduced length, differs from it only in having the sliding parts of the breech covered by a dustproof metal casing, the barrel cased in wood (as in the British and other short rifles) and the muzzle filled with a flash-reducing attachment. The bolt-handle is curved down close to the stock. This weapon was only issued for service in the last months of the war, but seems to have been retained as a standard weapon in the post-war army and police. Troops of older categories employed in garrison and line of communication duties had the old magazine rifle of 1888 (7·9-mm. calibre).

[2] The new Brazilian 7-mm. ammunition has the highest muzzle-velocity of any military small-arms ammunition, although several of the new cartridges closely approach it.

[3] The order for a design was given in Dec. 1917 and in spite of the manufacturing difficulties which naturally presented themselves with an arm of such unusual proportions, the Mauser works were able to begin quantity supply in April 1918 (Schwarte, *Technik im Weltkriege*, p. 21). (C. F. A.)

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arm; the sportsman seldom fires more than three or four shots in quick succession and is usually in a position to give the self-loading rifle the care which its more complicated mechanism requires.

The principal requirements in a semi-automatic rifle are that the rifle shall not weigh more than nine or ten pounds, and shall have a simple mechanism which will stand the shock of service ammunition and the wear and tear of campaigning. The weapon must be capable of being used either automatically or by hand as an ordinary rifle, and for the rest must possess all the qualities now demanded of a good bolt-action rifle. The automatic action, therefore, is not considered a substitute for any of the qualities of the present shoulder-rifle. No semi-automatic weapon so far designed has fulfilled these conditions to such a degree that it has been adopted in place of the bolt-action rifle. The Mondragon, a Mexican invention, has, however, been used by the Mexican Government to some extent, and in a modified form. A modification of this weapon was also used by Germany in the war, notably for the armament of aeroplanes. Two French models, the St. Étienne and the " Carabine Meunier," were brought out toward the close of the war, but not extensively used.

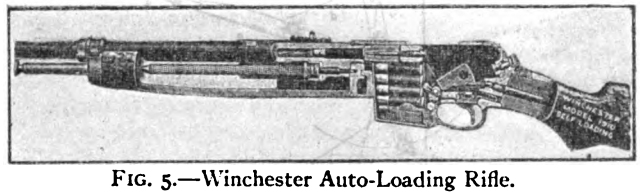

FIG. 5.—Winchester Auto-Loading Rifle.

The U.S. Ordnance Department recently (1920) held competitive tests, and further developments and tests have been made.

The principal advantages expected from the semi-automatic rifles are: increased rapidity of fire, less physical labour on the part of the soldier, and better *moral*, due to the knowledge that he can devote all his attention to the enemy and shoot without exertion or haste when necessary. On the other hand, the desirability of the semi-automatic rifle is not universally conceded. Some authorities consider the rate of fire of the present rifle to be quite as high as is consistent with accurate shooting and lay stress on the difficulties of ammunition supply.[1]

Semi-automatic Sporting Rifles.—The Winchester auto-loading system for rifles (fig. 5) utilizes the inertia of a heavily weighted bolt working against the compression of a coiled spring in the fore end to delay the rearward motion of the bolt at the moment of firing until the bullet has left the barrel. After this inertia is overcome, there still remains enough force to the recoil to move the bolt to the rear, eject the empty cartridge case, cock the hammer against the compression of the hammer spring, and finish the compression of the bolt

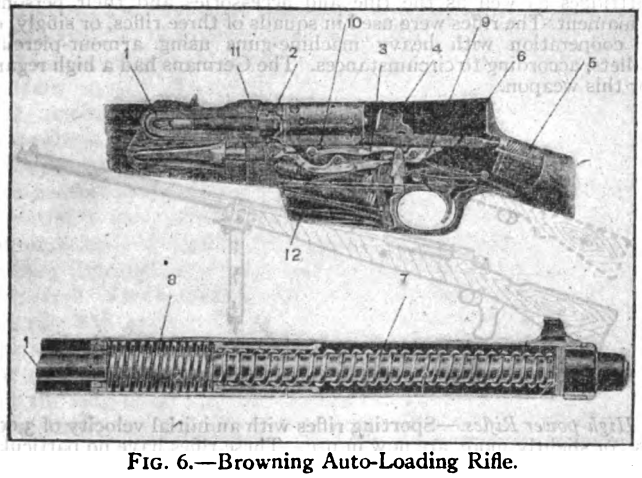

FIG. 6.—Browning Auto-Loading Rifle.

spring. When this has been accomplished, the bolt moves forward actuated by the bolt spring and feeds another cartridge into the chamber. A pull of the trigger now fires another shot. This rifle is made in various calibres, the most powerful being ·401 in. The 200-grain bullet in this size gives a muzzle-velocity of 2,132 f.s. and has a muzzle-energy of 2,020 foot pounds. The French Air Service used this type of rifle to a limited extent in the armament of aeroplanes.

The Browning auto-loading system (fig. 6), used by Remington (U.S.A.) and the Fabrique Nationale (Belgium), differs from the Winchester in that the barrel (1), breech bolt (2), and bolt carrier (3) are locked together at the moment of firing, these parts recoiling together against a powerful spring (7) in a casing surrounding the barrel and in which the barrel slides. The rearward motion pushes the hammer (4) backward, cocking the action and compressing the action spring (5) through the link (6) and the recoil spring (7). A buffer spring (8) also serves to retard the recoiling parts. At the completion of the backward motion the bolt-carrier latch (9) springs into a notch (10), locking the bolt in its rearmost position. The barrel and bolt carrier now start forward actuated by the recoil spring around the barrel; the bolt carrier after moving a short distance is held by the bolt-carrier latch; the barrel continues its forward movement, turning the bolt by means of a helical cam slot in its side and unlocking it. The empty cartridge case is held until the forward motion of the barrel withdraws it from the chamber, after which it is ejected. When the barrel has reached its forward position, the barrel extension (11) has forced the barrel lock down. This reacts against the bolt-carrier latch and allows the bolt carrier to be pushed forward by the action spring (5), carrying a fresh cartridge from the magazine (12) into the chamber and rotating the bolt so that the locking lugs are forced into their seats in the barrel extension, thus locking the bolt to the barrel.

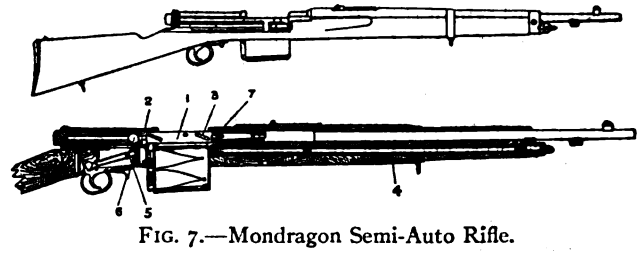

FIG. 7.—Mondragon Semi-Auto Rifle.

This rifle is made in ·25-in., ·30-in., ·32-in., and ·35-in. calibres. In the last-named the 200-grain bullet has a muzzle-velocity of 2,020 f.s. and an energy of 1,776 lb. The magazine is loaded with a clip of five cartridges similar to military rifles. Owing to the locked bolt and recoiling barrel, high pressures can be used in this arm. The cartridge is reduced in diameter or necked down for the bullet. The mechanism is, however, much more complicated than in a rifle where the breech only is blown back.

Semi-automatic Military Rifles.—The Mondragon semi-automatic military rifle (fig. 7) is the invention of Gen. Mondragon of the Mexican army. It was invented about 1891 and developed to its present state by Germany about 1915. The rifle is gas-operated, the gas being taken from a port in the barrel. It weighs about nine pounds, has the general appearance of the ordinary service rifle, is fitted for a bayonet, and is made in 7-mm. calibre. The characteristic feature of this rifle is the bolt mechanism, which permits the rifle to be used either as an auto-loading weapon or as a hand-operated shoulder rifle. The bolt (1) has three locking lugs on the forward end of the bolt and four on the rear end of the bolt, which are locked into locking recesses of the receiver (2). The bolt is made to rotate by two helical cam slots (3) in the side; two cam lugs, which are carried by the bolt handle, work these slots. The bolt handle is connected with the gas piston so that when the powder gases enter the gas chamber and drive the piston to the rear, the bolt handle is carried with it and causes the bolt to rotate and unlock, and move to the rear, extracts the empty case and compresses the recoil spring (4) which is coiled round the gas cylinder, and drives the mechanism forward after it has been arrested in the rear by the buffer spring. A gas adjustment is provided to regulate the amount of gas delivered to the gas cylinder, so that the rate of working can be to some extent regulated. The magazine has a capacity of 10 rounds. Another form of magazine, for aircraft purposes, is of the Luger "snail," or barrel type (*see* PISTOL), and holds 30 rounds. The rifle is provided with a separate hammer (5) which is linked up with the trigger mechanism as

FIG. 8.—St. Étienne Semi-Auto Rifle.

shown in the section. The change to hand-loading is done by means of a releasing catch on the bolt handle which disconnects this from the gas piston. The gas port in the barrel may also be closed by means of a valve. A safety device (6) is provided which disconnects the trigger if carried in a safe position.

The German pattern was officially known as the Aviator's Automatic Carbine (*Flieger-Selbstlader Karabiner*), model 1915, and was chiefly and successfully used for the purpose indicated by its name. It was also for a time tried as an artillery carbine, but for this purpose it proved unsuitable, in that it failed to stand the rough usage and careless handling of field warfare.

The *St. Étienne Semi-automatic Rifle* (a French " semi-automatic rifle, model 1918 ") is a gas-operated semi-automatic rifle which weighs about 11½ lb., is about 52 in. long, and has an ordinary rifle sight and bayonet fitting (fig. 8). It takes the French Lebel 8-mm. cartridge. The magazine which has a capacity of five cartridges is charged through the bottom of the magazine housing (8), which is hinged.

[1] The incorporation of the light machine-gun in the small fighting unit of infantry bears on this question. (C. F. A.)

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When the bolt handle, which is attached to the bolt (9), is pulled to the rear, the hammer (10) is forced to the rear against the action of the hammer and sear spring (11) until the sear (12) is engaged in the sear notch in the trigger (13). The rearward motion of the bolt compresses the recoil spring (15) which, when the bolt handle is released at the rear position goes forward and drives the next cartridge into the chamber, while the hammer is held in the rear position by the sear and trigger ready for firing. The trigger is pulled and released for each shot, but extraction and ejection of the fired cartridge case and the feeding of the new cartridge are automatic. When the trigger is pulled, the sear is released and allows the hammer to go forward and strike the firing pin which ignites the cartridge. When the cartridge is ignited a portion of the powder gases pass through the gas port (16) into the gas cylinder (17) which drives the gas piston to the rear. The gas piston is linked with the bolt mechanism through a slide which transmits the force of the gases to the bolt. This serves to unlock the bolt and drive it to the rear to extract and eject the empty case and to compress the action spring and cock the hammer for the next shot. The bolt body is forced to the rear by the slide which is attached to the gas piston, and also linked with the bolt head (18) through rotating cams which rotate the bolt head sufficiently to clear the bolt head locking lugs of the locking recesses in the receiver.

Automatic Rifles and Light Machine-Guns

As has been stated in an earlier part of this article the development of new tactical methods and conditions in the World War soon produced a demand for a light machine-gun or automatic rifle which could keep up with, and participate in, an

Fig. 9.—Browning Automatic Rifle.

infantry attack at every stage of its progress. Various types of weapons were adopted for this purpose and classified as light machine-guns or automatic rifles. There is no distinct separation of these types, the term "light machine-gun" being usually applied to machine-guns weighing 20 to 30 lb. fired from a bipod and used for fairly sustained direct fire. Practically all types are air-cooled by means of a heavy barrel with annular rings or a radiator. The automatic rifle, while it is sometimes supplied with a bipod, may be fired from the hip or shoulder and is capable of delivering limited sustained fire. Its weight varies from 14 to 20 pounds. The German "08/15" and "08/18" and the Bergmann, Lewis and Benet-Mercie are generally spoken of as light machine-guns. The Browning, Chauchat, light Hotchkiss and Madsen are examples of automatic rifles.

The *Browning Automatic Rifle* (figs. 9 and 10) is the standard automatic rifle of the United States army.[1]

The rifle is light and portable, weighing only 15½ lb. and being only an inch or two longer than the short military rifle. It can be handled by one man as a shoulder rifle. As it is heavier than the ordinary military rifle, the recoil is very slight, and a man can fire the gun continuously without distress.

By means of a change lever, the action of the gun is made either semi-automatic (the trigger being pulled for each shot), or automatic (being continuous as long as the trigger is kept pressed and cartridges are supplied).

As a semi-automatic rifle it is very effective. As the trigger pull is as light as that of an ordinary military rifle, it is possible with practice, to fire 100 shots a minute without unduly tiring the finger. Used in this manner every shot can be well directed, which makes the gun in some conditions as effective as the heavy machine-gun, with a considerable saving in the amount of ammunition expended.

The gun, firing automatically, has a rate of between 450 and 500 shots per minute. The speed can be regulated to a certain extent by adjustment of the gas regulator. The weapon can be used as freely when firing automatically as when firing single shots, the firer lying down, standing, or advancing at will.

When a magazine has been emptied it can be dropped out of the gun by pressing the magazine release in the trigger guard and a full magazine quickly pushed into place with one hand, so that very little time is lost in changing magazines.[2]

The mechanism is very simple and also extremely durable. Tests have been made where over 50,000 rounds have been fired out of the same rifle without any of the parts showing distress.

The rifle is gas-operated. A portion of the powder gases, while under pressure, are trapped near the muzzle of the gun and are caused to act upon a gas piston. The pressure of the gases forces the piston and slide to the rear against the action of the recoil spring, until stopped by the buffer, when the recoil spring returns the mechanism to its forward position.

The receiver (21) in which the barrel is firmly screwed contains the principal mechanism of the gun. The bolt-supports (23), upon which the bolt slides, are riveted in position. The bolt guide (25) fits in a slot cut in the receiver wall and is held in position by the bolt guide spring. The change lever stop (26) projects from a hole in the receiver wall in the path of the change lever and must be depressed before the change lever can be moved to the safe position. The buffer tube (28) behind the receiver contains an arrangement of friction cones, cups and springs. On the left-hand side of the receiver

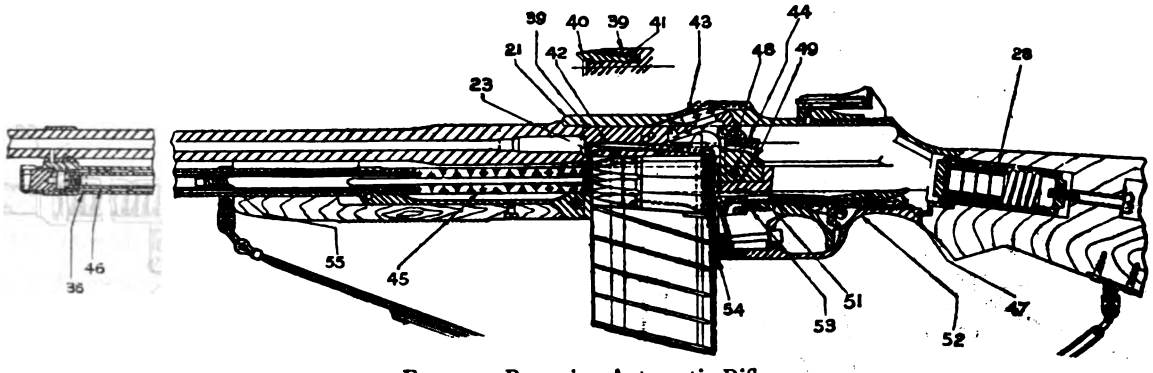

Fig. 10.—Browning Automatic Rifle.

are grooves in which the operating handle (34) slides. The forward end of the gas cylinder tube (36) is rigidly connected with the barrel.

The bolt (39) carries the extractor (40) which is held by the extractor spring (41). The firing pin (42) fits in the bolt, and has a cam lug which engages with a corresponding cam surface on the bolt lock (43). The downward motion of the bolt lock forces the firing pin back and prevents it from touching the cap of the cartridge until the arm is ready to fire. The bolt lock and link (44) are pivoted to the rear end of the bolt. The link connects the bolt lock and the slide (45), which moves horizontally in grooves in the receiver, the gas piston (46) being permanently attached to it. The slide is slotted to permit the magazine to pass through it, and has a notch on its lower rear end to engage with the sear (47). The link pin (48) passes through the link, hammer (49), and slide, pinning the three parts

[1] Brought out in 1917, just after America entered the war, and available in small numbers by Feb. 1918, it was not employed in battle till Sept., Gen. Pershing having become so convinced of its superiority over all other types in use that he preferred not to expose it to capture and copying by the enemy till the American army had been supplied with it on a large scale and had reaped the fruits of its superiority in a great battle. In effect, none was used before his offensive battles of Sept. but 4,608 were in action between that date and the Armistice. (C. F. A.)

[2] Magazines holding 20 cartridges are the standard size; they are also made to hold 30 and 40 cartridges. They are themselves filled by a device which presses in the cartridges, five at a time, from the usual clips.

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together in such a manner that the link may swing on the pin as a pivot. The link pin also protrudes through a slot in the receiver to engage the operating handle. The recoil spring (55) is encased in the gas piston, its front end pushing forward on the piston while its rear end rests against the head of the recoil spring guide.

The sear (47) is pivoted in the sear carrier (51) by the sear pin which also holds the sear carrier to the trigger guard (52). The holes through which the sear pin passes in the trigger guard are slotted, allowing a slight horizontal movement of the sear carrier. When the sear engages in the notch of the moving slide, the counter recoil spring (53) acts as a buffer, allowing the sear carrier and sear to move instead of suddenly stopping the movement of the slide.

The ejector (54) is a flat spring which yields slightly when struck by the empty cartridge case so that the latter is gradually ejected.

Action of the Mechanism.—With the gun in the ready-to-feed position and the change lever set for semi-automatic fire the cycle of operation when the trigger is pulled is as follows:—The connector which is pivoted in the trigger moves the sear (47) out of engagement with the notch in the slide and is cammed forward allowing the sear to spring into position to engage the slide on its return. The recoil spring (55) which has been compressed during the recoil of the mechanism, drives the piston (46) and slide (45), carrying the bolt (39), bolt lock (43), link (44) and hammer (49) forward. As they move forward the lower edge of the bolt strikes the upper edge of the top cartridge in the magazine and drives it forward into the chamber.

As the parts are nearing their forward position, the rear of the bolt lock (43) which curves downward, comes in contact with the rounded end of the bolt-supports (23) and the rear end of the bolt lock is started moving upward. As the slide moves further forward, the top end of the link, which is pivoted to the bolt lock, tends to move upwards as the lower end is swung forward with the slide, and the link forces the rear end of the bolt lock in front of the recoil shoulder in the receiver, thus positively locking the breech, as shown in the illustration. The motion of the bolt as the bolt lock swings upward, is gradually stopped so that the bolt is not stopped suddenly, but very gently as its forward horizontal motion is transformed into the vertical motion of the rear of the bolt lock.

The hammer strikes the firing pin and the cartridge is ignited. The forward shoulders of the slide then strike the heavy buttment of the gas-cylinder tube, and the motion is arrested.

After the bullet passes the gas port in the barrel near its muzzle, the expanding gases enter the gas cylinder and drive the piston and slide rearward. The rear of the bolt lock is brought down away from the recoil shoulder of the receiver, and is started back, gradually starting the bolt rearward with it, but by the time the bolt starts to move, the pressure of the gases has subsided, so that the empty cartridge is no longer expanded against the walls of the chamber, but comes out freely. Extraction troubles are thus avoided. The bolt is both stopped and started gradually and is not damaged with hammer-like blows. The empty case is drawn from the chamber by the extractor until its under edge strikes the ejector, when it is ejected to the right and forward; this avoids interference with a man immediately to the gunner's right.

The recoiling parts are arrested when the slide strikes the buffer, and the sear once more engages in the sear notch, which holds the slide and bolt mechanism to the rear with the breech open.

by an aluminum radiator with annular corrugations surrounding the barrel. The backward and forward motion of the barrel causes air to be driven into the holes in the radiator casing (*cf.* the Lewis gun, fig. 14) which also assists in the cooling. The locking of the bolt mechanism is positive and is done by two locking lugs on the bolt head which are rotated into locking recesses of the breech casing. Lugs are provided to guide the bolt head and bring it in contact with the cam cuts in the bolt body. The cartridges are fed from a semi-circular magazine holding 20 cartridges, when rim cartridges are used, and from a straight magazine when rimless cartridges are used. A regulator is provided, which adjusts the gun for safety, for automatic fire, or for semi-automatic fire.

The action of the mechanism is divided into two phases: the forward motion and the backward motion. The rifle is loaded by pulling the operating handle to the rear until the mechanism is arrested by the sear (57). A charged magazine is inserted into the magazine opening in the gun, the magazine being held in place by the magazine catch (58). When the trigger is pulled it causes the trigger bar (59) to rotate the hand sear (60) against the under side of the breech casing (61). This forces the sear lever (62) downward, depressing the sear and releasing it from the notch of the feed piece.

The bolt head (63), bolt body (64), firing pin, and feed piece move forward under the action of the mainspring, which is encased in the spring tube. The feed piece strikes the upper part of the head of the cartridge in the magazine and forces it forward out of the magazine. At this time the cartridge guide (65) is being held up by the roller working in the cartridge guide cam slot. The bullet is directed into the chamber, the magazine spring forcing the rear end of the cartridge up into the path of the bolt head just as the cartridge is freed from the lips of the magazine.

The cartridge guide cam causes the cartridge guide to drop, thus letting the feed piece pass forward and release the barrel catch (66).

The bolt-head stop (67) keeps the bolt head and bolt body at their extended positions so that the locking lugs in the bolt head are vertical, thereby permitting their entrance into the locking recesses. The bolt-head stop then comes out of the breech casing, the bolt head is released and rotates so that the locking lugs engage in the locking recesses in the breech casing to lock the mechanism. The bolt body and firing pin continue to move forward, and the extractor grips the rim of the cartridge as the bolt head turns. The firing pin primes the cartridge just as the feed piece releases the barrel catch.

Backward motion: The recoil from the explosion combined with the action of the gases on the barrel nut (68) carry the breech mechanism and casing in a locked position to the rear against the action of the recoil spring (69) and mainspring. The breech casing and barrel (70) being free to move, immediately start forward. The breech mechanism is held back, due to the sear engaging in the sear notch on the tail of the feed piece. As the barrel moves forward the empty cartridge case is drawn from the chamber by the extractor. As the barrel continues its forward motion the front end of the empty case clears the opening in the breech housing and it is thrown out through the ejection-opening by the pressure of the ejector upon its base. If the regulator is set for single fire the hand sear is immediately released by the trigger bar. This allows the sear to hold back the breech mechanism until the trigger is again pulled. If the regulator is set for automatic fire the hand sear is not released, but is held up

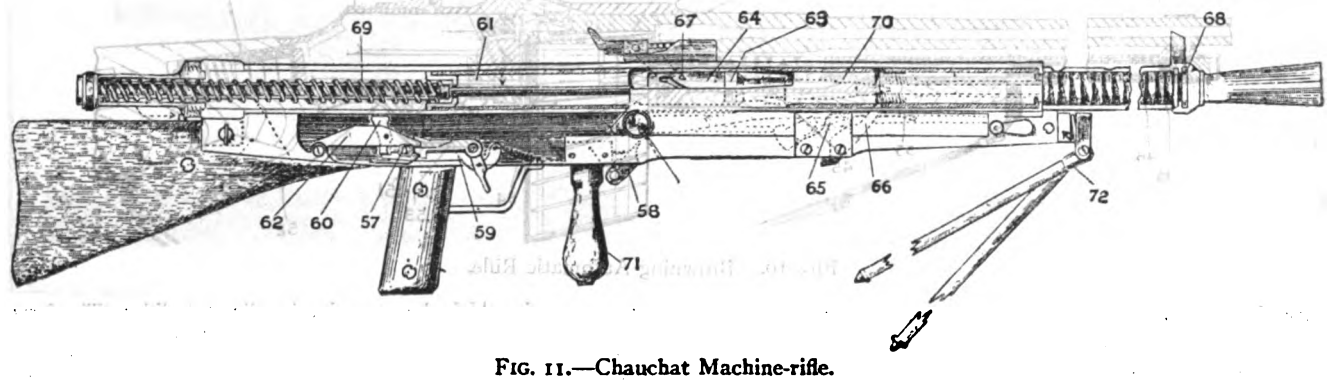

FIG. 11.—Chauchat Machine-rifle.

Chauchat Machine-rifle.—The Chauchat machine-rifle, model of 1915 (fig. 11), also known as Rifle C.S.R.G., was designed by a commission presided over by Col. Chauchat. It weighs about 19 lb. and is about 45 in. long. It takes the 8-mm. Lebel cartridge or, in the case of the guns taken over by the U.S. army,[1] the U.S. model of 1906 ammunition.

This rifle is recoil-operated; the recoil being assisted by deflecting part of the gases as they escape. The cooling of the barrel is assisted

by the trigger mechanism. The rear cam surface on the bottom of the breech casing strikes and depresses the hand sear just as the barrel reaches its forward position. The hand sear forces the sear lever down, which in turn depresses the sear, releasing it from the sear notch of the feed piece. This allows the breech mechanism to go forward and repeat the cycle.

This rifle is provided with a forward grip (71) for use in marching fire. A bipod (72) is provided for prone or fixed position firing.

Hotchkiss Light Machine-Rifle (fig. 12) weighs 18½ lb., is air-cooled and gas-operated, magazine-fed, and provided with a bipod (73), a hand grip (74) and a shoulder stock. The general mechanism is the same as in the Hotchkiss machine-gun. The speed regulator and buffer mechanism is especially interesting.

[1] As already mentioned, the Browning gun was reserved until a large supply could be put into line at one time. Pending this, the American forces in France were equipped with the Chauchat of which some 34,000 were adapted to U.S. ammunition.

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The regulation of the speed of the gun is controlled by an escapement mechanism, located in the tube (75), which arrests the recoil mechanism and releases it after the catch has been set free of escapement.

This weapon, like the German light machine-guns described later, and unlike those hitherto dealt with, is derived directly from the heavy machine-gun. It is the outcome, therefore, of an effort to increase the mobility of the machine-gun rather than an attempt to improve the fire power of the shoulder rifle. As a true automatic rifle was available in the form of the Chauchat, and as all facilities for the manufacture of typical machine-gun elements were absorbed by the demand for heavy machine-guns, this type was not manufactured on a service scale during the war. It is however interesting as an instance of the machine-gun approximating to the machine-rifle.

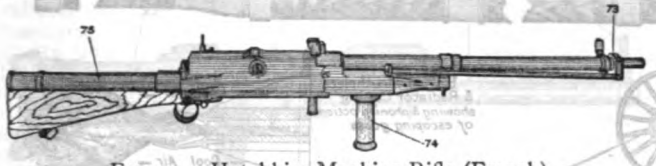

FIG. 12.—Hotchkiss Machine-Rifle (French).

Madsen Machine-Rifle (fig. 13) is a recoil-operated, air-cooled rifle weighing about 16 pounds. It may be fired either semi-automatically or automatically. The rate of fire when used as an automatic is about 500 shots per minute. The barrel is about 23 in. long, somewhat larger in diameter than the barrel of the ordinary shoulder rifle, and is provided with annular rings and a perforated barrel casing to facilitate cooling. A bipod and a rest attached to the butt steady the rifle when used by a firer lying down. The cartridges are fed from a detachable quadrant-shaped, 40-round magazine projecting above the gun. A detachable barrel is provided for the purpose of gaining a more sustained fire, the system being to replace the barrel, when it has been excessively heated, by another barrel, and continue the fire while the first barrel is being cooled. It is claimed that the barrel may be changed in from 12 to 20 seconds.

FIG. 13.—Madsen Machine-Rifle (Russian).

The action of the mechanism is as follows:—

When the gun is loaded, as shown in the figure, and the trigger (76) is pulled, the hammer (77) under the force of the hammer spring (78) strikes the link (79), which transmits the blow to the firing pin and so to the cap. On firing, the barrel (80) and bolt mechanism (81), locked as a unit, recoils, compressing the recoil spring (82) until the link disconnects the bolt from the barrel lock and allows the bolt to recoil sufficiently to cock the hammer, extract and eject the fired cartridge case. The accelerator (83) assists in driving the bolt to the rear as it engages on the accelerator lug (84) during the recoil and transmits the momentum of the barrel and mechanism to the bolt. The accelerator also drives the barrel home during the forward stroke of the bolt.

A safety device (85) controls the trigger. A change lever (86) enables the gun to be fired semi-automatically or automatically.

The Madsen light machine-rifle was designed some years before the war, and for a time all Russian cavalry divisions had automatic rifle sections armed with it. These were abolished before the outbreak of the World War and replaced by ordinary machine-gun sections as the lighter weapon was found to be too delicate for the field. The Madsen was, however, again taken into use by the Russians during the war, and under the name of the "Musket" it formed the armament of the German "Musket battalions" which were created in 1915. Some of these units with their guns were engaged in the battle of the Somme 1916 but apparently the result, in the trying conditions of the trench-warfare battle, was not very successful.[1] Tests have been made of the Madsen gun at different times in the British and United States armies.

The Lewis Machine-Gun (fig. 14) is a magazine-fed, gas-operated, and air-cooled machine-gun. The ground type, which is used as a light machine-gun, weighs 26½ lb., and is capable of firing at the rate of about 600 shots per minute. The ammunition is fed from a drum-type magazine placed over the receiver, and which holds 47 rounds for ground use, or 97 rounds for aircraft use. It was invented by Col. I. N. Lewis of the U.S. army shortly before the outbreak of the World War, and large numbers were purchased by the British Government to supplement the available Vickers (heavy) machine-guns. When the differentiation of light and heavy types began, therefore, the British army found itself already provided with a gun of what was judged to be sufficient mobility, handiness and firepower, and the Lewis gun became and remained the standard type of the light machine-gun for the fighting unit of infantry. In the United States, on the other hand, the military authorities determined to adopt the still lighter Browning, and pending the supply of this, the Chauchat as above mentioned. The Lewis gun, thus classed among the heavy machine-guns, was, however, used in large numbers for aircraft, and a few were employed for training purposes as well, some 39,000 of U.S. rifle calibre being ordered and produced. For aircraft, the gun was used by the French also, while in 1918 the Germans, who had a high opinion of it, armed some newly formed motor-cyclist units with captured weapons.

The principal feature is the cooling system, which consists of an aluminum radiator having deep longitudinal fins surrounded by a thin tubular casing which projects several inches beyond the barrel and is reduced in diameter at the front end. These parts with the barrel mouthpiece constitute the cooling system. The mouthpiece deflects the powder gases against the interior wall of the forward portion of the radiator casing in such a manner as to draw a current of cool air through the open rear end of the casing and along the thin fins from which it absorbs the heat. The heat conductivity and low specific gravity of aluminum combined with the construction described produce a light-weight cooling mechanism. The Lewis machine-gun is provided with a bipod mount. The over-all length is approximately 51 inches. The muzzle velocity and chamber pressure are approximately the same with a given ammunition as that of the shoulder rifles in which the ammunition is used.

Action: To operate the Lewis machine-gun, a loaded magazine (10–11) is placed in position on top of the gun, and the charging handle (8–4) is pulled to the rear until the sear nose (5–8) engages in the sear notch in the rack (8–1). The gun is then ready to be fired. When the trigger is pulled and held, the rack and piston (8–6) move forward under the action of the mainspring (9–9), which in unwinding rotates its gearwheel (9–7) and rack to carry the bolt (4–4) forward. As the operating rod moves forward, the front top edge of the bolt strikes the lower edge of the cartridge which is held in the magazine and feed-way, and drives the cartridge forward into the chamber. The locking lugs on the rear of the bolt move clear of the guide slots in the receiver so that the bolt is free to rotate. The locking of the bolt is then accomplished by the striker post coming in contact with the left side of a cam slot in the bolt, which forces the bolt and its lugs to turn one-eighth of a turn to the right. The extractor springs over the rim of the cartridge case (or the cannelure if rimless) as the bolt forces the cartridge in the chamber. The magazine is held by the rebound pawl (6–8) during the forward move of the bolt and piston. The feed operating arm (7–5) acted upon by the feed operating stud (4–1) on the rear of the bolt, returns to its normal position during the forward motion of the bolt ready to feed the next cartridge. When the bolt has been completely locked, the striker is free to drive forward and fire the cartridge. When the cartridge is fired the mechanism remains locked until immediately after the bullet has passed the gas port in the barrel (3–1). Thereupon a portion of the powder gases enters the gas regulator cup (3–8) and thence through a small aperture[2] reaches the front of the piston (8–6). The force of the expanding gases drives the piston to the rear and through the action of the rack, rewinds the mainspring (9–9). During the backward motion, the striker post, which is also carried on the rack, moves

[1] In 1918 the *Musketenbataillone* were reformed as ordinary heavy machine-gun units.

[2] The function of the gas regulator cup is to act as a well for any solid matter carried in the gas and to prevent fouling of the gas chamber. The size of the aperture can be adjusted as required.

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about one inch to the rear in a straight slot in the bolt, which, therefore, it does not affect while the bullet is traversing the final space between the gas port and the muzzle; but after the striker post has passed through the straightway of the bolt, it comes in contact with the right side in the cam slot in the bolt and unlocks the bolt and drives it to the rear. In unlocking the bolt is rotated and the locking lugs come into line with the guide slots in the receiver. Lastly the extractor (4–3) withdraws the empty cartridge case which is thrown out by the ejector (2–3), a flat lever pivoted in the centre and actuated by the feed operating stud (4–1) striking its rear end. This stud, which is carried by the bolt, also acts on the underside of the feed operating arm (7–5) and moves the arm to the left. By means of this arm and the feed pawl (7–2) that it carries, a cartridge from the magazine is brought under the cartridge guide (6–24) and into the feeding position in the feed-way in the top of the receiver and is partially turned so as to bring the next cartridge into position, being held in its new position by the stop pawl (6-7), and by the rebound pawl (6–8). The rearward motion of the mechanism is arrested when the bolt comes against the butt tang of the stock, and the bolt, rack, etc., then again move forward under the action of the mainspring, and the cycle of operation is repeated for each shot until the magazine is empty or the trigger is released. When the last cartridge is fired from the magazine, the bolt goes forward and locks with no cartridge in the barrel.

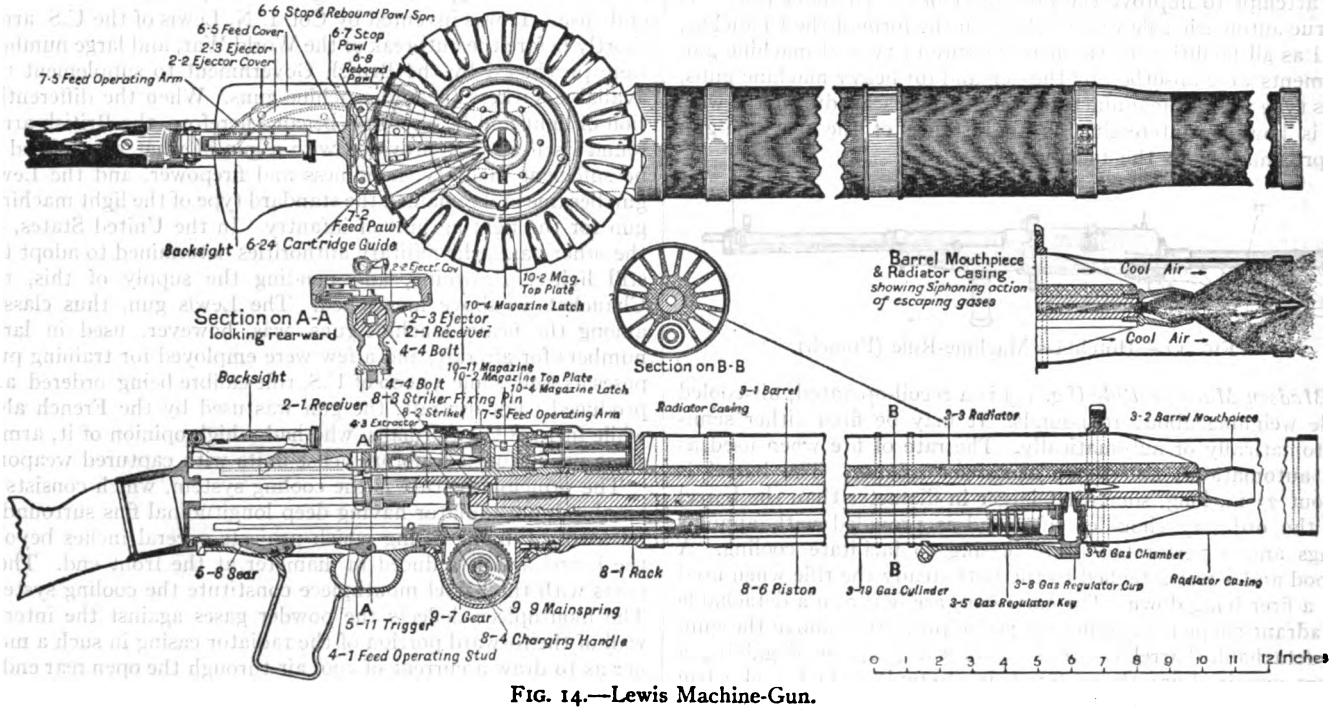

FIG. 14.—Lewis Machine-Gun.

The magazine is a round corrugated pan about 8 in. in diameter carrying 25 upright separator pins. This pan is mounted with an aluminum centre having annular grooves with a spiral step connecting each groove, into which the front end of the cartridge fits. The cartridge, being held from rotating by the separator pins, is fed along these grooves up the steps into the gun when the pan is revolved around the magazine centre. The pan is loaded by means of a special loading tool. The feeding of the cartridges being positive instead of depending on springs or gravity, the gun can be used when turned at any angle or upside down.

The Lewis machine-gun operates automatically, single shots being fired by quickly releasing the trigger after each shot.

In aircraft the Lewis gun is used as a "flexible gun," *i.e.*, a gun mounted (usually in the observer's pit) so as to fire in any direction in elevation or azimuth. The main differences between the ground type and the aircraft type gun are that the latter has no radiator or radiator casing, has a spade or stirrup-shaped hand-grip in lieu of the shoulder stock, and uses a 97-round magazine. A more efficient type of recoil check is also provided. This consists of a muzzle attachment which is arranged to deflect the powder gases so that they pass out practically at right angles to the axis of the bore. In this way a pressure against the muzzle piece tends to counteract recoil.

No cooling device is provided with the aircraft gun, inasmuch as the fire is in short bursts only and the speed of the aeroplane and the temperature at high elevations provide ample cooling. The aircraft gun fires at a rate of about 750 shots per minute, this higher speed being gained by increasing the gas pressure acting on the piston and the strength of the mainspring which returns the mechanism.

German Light Machine-Guns 08/15 and 08/18.—The German light machine-gun 08/15 is simply a modification of the standard heavy machine-gun (M.G. 08), which is of the Maxim type, without any change in the essentials of the system (for which *see* MACHINE-GUN, 17.237). A serviceable light machine-gun was made in large quantities and with the least possible delay, and the German authorities determined to lighten the existing material, for which manufacturing facilities were already available, rather than embark on the experiments and tool and gauge making that would have been necessary if a new type had been sought for. In consequence, the differences between the 08 and the 08/15 are very few. The diameter and contents of the water-jacket are considerably smaller in the light gun than in the 08. Instead of the tripod or sleigh mount, there is a shoulder stock and bipod, and a trigger release and handgrips replace the twin handles and firing gear. Ammunition is belt-fed as in the heavy gun, but the belt (100 rounds) is wound on a reel inside a drum attached to the right of the gun. The weight of the gun with water-jacket filled and bipod, is 40½ lb., or in action with drum and filled belt 51½. The Dreyse water-cooled light machine-gun was also used. Its weight was slightly less than that of the 08/15.

Guns of this weight, however, though they might be sufficiently mobile for trench warfare battles, were evidently too heavy for the more open warfare of 1917 and especially 1918, and a new and lighter model called the 08/18 was brought out. In this instead of the water-jacket there is a barrel casing with numerous holes to facilitate air circulation round the barrel. This abolition of positive cooling by water reduced the possibility of sustained fire almost to that of an automatic rifle, but independence of water supply greatly reduced freedom of manœuvre and the actual reduction in the weight of the gun was considerable (32 lb. as against 40½ in the 08/15).

This gun had been introduced only for cavalry and cyclists when the Armistice was signed. Had the war continued, it would no doubt have replaced the water-cooled weapons entirely.

The Bergmann Light Machine-Gun (fig. 15) in the German army, variously called L.M.G. and L.M.G. 15 n A, is a recoil-operated air-cooled, belt-fed machine-gun, weighing 30 lb. with bipod mount and sling, and fires about 600 shots a minute.

A barrel casing (91) is provided which carries the barrel and also serves as a housing in which the barrel recoils. The cooling of the barrel is assisted by rings which are formed on the barrel to increase the radiating surface. A handle (92) is provided to facilitate carrying the weapon short distances. The belt is fed through the feed-box opening (93) as in the Maxim and other heavy machine-guns.

The principal features of the Bergmann machine-gun are a small cylindrical service-rifle type of bolt and extractor, which may be

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operated by hand by means of a bolt handle (95); and an accelerator which is in the form of a cam lever, which acts against the bolt and barrel extension during the forward movement of the bolt, helping to push the barrel extension and barrel forward as the bolt advances under the action of the heavy recoil spring.

The gun is provided with a trigger and handgrip, a shoulder butt and a bipod, which is attached to the trunnion (96).

The front sight (97) is very high, owing to the low position of the barrel in the receiver and to the feed mechanism in cover. A tubular sight with a hole about one-fourth of an inch in diameter is attached by a bracket to the side of the gun for close-range shooting and for tank work. It will be noted that several features of this gun were adopted in the L.M.G. 08/18.

In the German army Bergmann guns formed the armament of the so-called "Light Machine Gun Detachments," mounted units created in 1916 for the Rumanian campaign. The use of this gun, however, seems to have been discontinued towards the end of the war, the weapons remaining serviceable being handed over to Turkey.

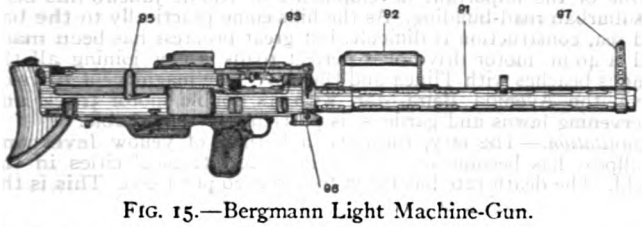

FIG. 15.—Bergmann Light Machine-Gun.

Machine Carbine-Pistols.—The idea of securing more accurate shooting from a pistol by fitting it with a shoulder stock and lengthening the barrel is an old one, and one well-known modern example is the Mauser pistol (for description *see* 21.657–8). But while in the pistol proper, from the nature of the arm and its uses, all modern development has been in the direction of perfecting the semi-automatic action (*see* PISTOL), there arose in the World War a need for some weapon lighter and handier than the rifle yet capable of developing an intensely rapid fire at short ranges. The outcome of this need was a class of firearm which at present has few representatives and no recognized generic title, but is very interesting. In the absence of an accepted designation, these may be called machine carbine-pistols.

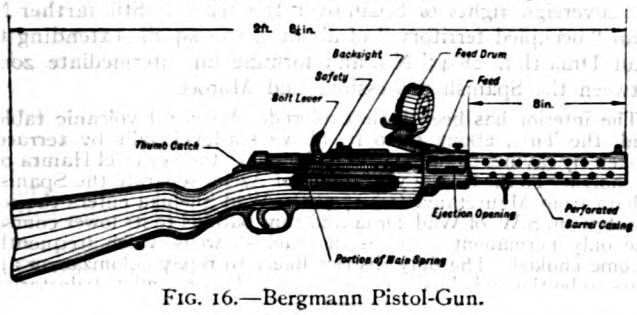

FIG. 16.—Bergmann Pistol-Gun.

In this field the precursors appear to have been the Italians. The *pistola migliatrice Fiat* (Fiat mitrailleuse pistol) was largely used by them as a substitute for the light machine-gun, no doubt because extreme lightness both in the gun and its ammunition was essential in an automatic arm for mountain warfare. The "machine pistol" is fitted with a small shield which also serves as a mounting, though the weapon can be used in the hands, if necessary. It is double-barrelled, each barrel having a separate box magazine of 25 rounds above the receiver. It is gas-operated and air-cooled. The bolt and its dependent parts are supported but not positively locked on firing. It weighs 14 lb. without shield, takes 9 mm. pistol ammunition, and is sighted to 500 metres. An outstanding feature is the very high rate of fire. Both magazines (50 rounds) are fired in two seconds, and with highly trained loaders and a full supply of magazines it is said that 1,000 rounds can be delivered in a minute. This extreme rate, in spite of certain advantages, militates against steadiness and accuracy, especially with so slight a mounting. Nevertheless, according to the Germans the weapon proved trustworthy and effective.

The Bergmann Pistol-Gun (fig. 16), on the other hand, was intended not to replace the light machine-gun but to provide artillerymen and machine-gunners with a handy personal weapon capable of intense fire power in emergencies. It originated in the pistol proper. The German service pistol 08 (Borchardt-Luger) used by specialists, who were not armed with the rifle, was fitted with a snail magazine (*see* PISTOL) allowing of 32 shots, the wooden holster being attached to the handgrip as a shoulder piece as in the Mauser pistol above alluded to, if accurate fire was required. The success of this arrangement led to the introduction of the Bergmann pistol-gun (officially, Machine-Pistol 18 I.), which in spite of its name is rather a carbine than a pistol, as an infantry weapon pure and simple.

This arm shoots 9 mm. pistol ammunition at the rate of about 540 shots per minute. The gun weighs 9 lb. 6 oz. without the magazine drum, which itself weighs 1 lb. 8 oz. empty. It is recoil-operated and air-cooled, and has an 8-in. barrel, protected by a casing perforated to allow circulation of air. The magazine (32 shots) is of the snail type (*see* PISTOL). The breech mechanism is of the "blow-back" class in which on firing the inertia of the bolt, the compressing of the mainspring, and friction of the cartridge in the chamber momentarily hold the action firm. The gun fires when the bolt reaches its forward position as the striker projects through the face of the bolt, and is cocked when the mainspring is compressed and the bolt drawn to the rear. This has the advantage that the chamber is always left empty, but the forward movement of the heavy bolt after pulling the trigger is liable to disturb the aim. The gun is sighted to 200 metres only. This gun was only brought into use just before the Armistice.

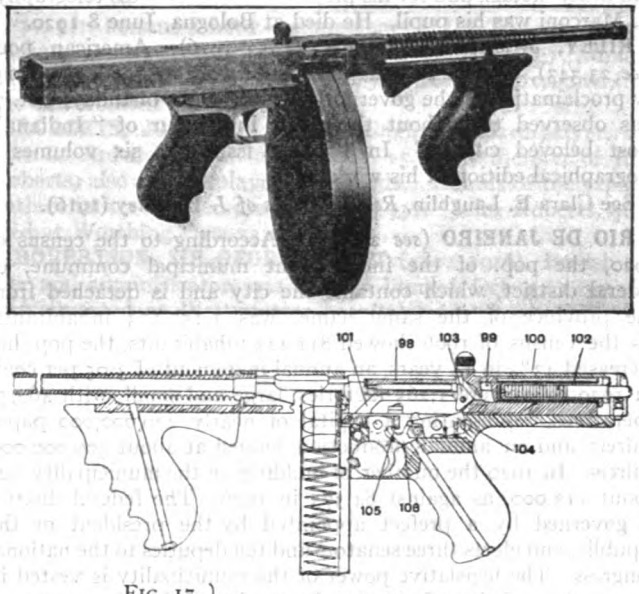

FIG. 17. FIG. 18. } Thompson Sub-Machine-Gun.

The Thompson Sub-Machine-Gun (figs. 17 and 18) is an interesting type of a very light portable automatic weapon which shoots a ·45-calibre pistol cartridge. The action is semi-automatic or automatic at will. The rate of fire when used as an automatic is 800 to 1,500 shots per minute. The weapon is about 23 in. in length, weighs 7·5 lb., and uses a straight magazine (fig. 18) holding 20 cartridges in staggered rows, or drum magazines holding 50 or 100 cartridges (fig. 17).

The novel feature of this weapon is the angular wedge breech closure which utilizes the force of adhesion developed by the heavy breech pressure to lock the breech. The principle, developed by Comm. Blish of the U.S. navy, has been briefly stated as follows:—

"In any breech closure consisting of a breech plug in a suitable housing and having two pressure-resisting surfaces, the forward surface disposed normally to the axis of the bore, and the rear surface inclined thereto and bearing upon a suitable surface of the housing, the force of adhesion will under heavy pressure immovably fix the breech block, but at a comparatively small pressure (whose value depends upon the inclination of the two surfaces) the force of adhesion ceases to act and the breech block is rendered free to move under the influence of the forces then existing."

The principle permits the use of a very simple breech-locking mechanism, the essential element being a bolt (98) having an angular slot cut in the under side, into which the lock (99) is free to slide, and a housing or receiver (100) having a slot (101) into which a projecting lug on the lock engages when the bolt is in its firing position. Under high pressure the lock firmly adheres to the receiver shoulder and

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prevents the bolt from being blown to the rear. When the pressure is reduced, the adhesion ceases, and the lock, actuated by the remaining pressure, automatically slides upward and clear of its retaining shoulder while the bolt moves rearward against the recoil spring (102) and cocks the firing pin.

When the weapon is cocked the entire bolt group is held by the sear (104) in a retracted position, as shown in fig. 17. On the trigger being pulled the bolt, driven forward by the recoil spring, pushes a cartridge into the chamber. During the forward motion of the bolt the hammer (103) strikes a shoulder of the receiver and rotates on the hammer pin, its top end strikes the firing pin and the cartridge is fired. Firing is discontinued by releasing the trigger; the sear (104) then engages the bolt in its retracted position, leaving the chamber empty. By means of the disconnector (105) the weapon can be made semi-automatic at will. When the magazine is emptied, the trip (106) allows the sear to engage the bolt in a rear position ready to feed and fire again when the trigger is pulled. Sights graduated to 600 yd. are provided.

The sub-machine-gun is intended as an auxiliary weapon for trench use and for close fighting generally. It has been adopted also by the police of several American cities for use as a riot weapon, both for shot and ball cartridges. (H. O'L.)

RIGHI, AUGUSTO (1850–1920), Italian physicist, was born at Bologna Aug. 27 1850. Details of his experimental work in magnetism and the problems of electricity and light are given in 17.389, 391 and 346, 6.859, 9.206, 21.936. He was specially noted for his discovery of the electrical conductivity of bismuth and other metals, and for his pioneer work in wireless telegraphy. G. Marconi was his pupil. He died at Bologna, June 8 1920.

RILEY, JAMES WHITCOMB (1853–1916), American poet (*see* 23.343), died at Indianapolis, Ind., July 22 1916. In 1915, by proclamation of the governor of Indiana, his birthday, Oct. 7, was observed throughout the state, in honour of "Indiana's most beloved citizen." In 1913 he issued in six volumes a biographical edition of his works.

See Clara E. Laughlin, *Reminiscences of J. W. Riley* (1916).

RIO DE JANEIRO (*see* 23.353).—According to the census of 1920, the pop. of the independent municipal commune, or federal district, which contains the city and is detached from the province of the same name, was 1,157,873 inhabitants. As the census of 1906 showed 811,443 inhabitants, the pop. has increased 43% in 14 years, an annual increment of 3·05 per cent. In 1920 there were 1,265 factories, large and small, with 46,953 operatives, representing a capital of nearly 270,000,000 paper milreis, and an annual production valued at about 500,000,000 milreis. In 1920 the number of buildings in the municipality was about 113,000, as against 84,375 in 1906. The federal district is governed by a prefect appointed by the president of the republic, and elects three senators and ten deputies to the national congress. The legislative power of the municipality is vested in a council consisting of 24 *intendentes* elected for three years.

The consolidated debt of the municipality in 1920 was computed at 227,089,200 paper milreis, of which 129,225,450 milreis was an external debt, and 97,863,750 milreis internal. The revenue had grown from 29,070,883 paper milreis in 1910 to 51,182,357 paper milreis in 1919.

Education.—Primary instruction is provided by the municipality, which in 1920 maintained 320 day-schools and 68 night-schools, with a matriculation of 74,111 pupils in the former and 8,662 in the latter. There are in addition 236 elementary private schools, with 19,825 pupils; over 80 receive a subvention from the Government on condition that they adopt the official curriculum and admit a certain number of children free. Secondary instruction is cared for in public lycées and in many private establishments. There is no university, but the capital possesses higher faculties of law, medicine and engineering, besides schools providing instruction in pharmacy, dentistry, commerce, music, dramatics and the fine arts. The national Government also maintains a naval academy, a military college and a preparatory school of tactics. The most important libraries are:—the National library, the best appointed in S. America; the Municipal; the Gabinete Portuguez da Leitura; that of the Lycée of Arts and Crafts; and the collections existing in the various ministries and departments.

Streets and Buildings.—During the decade 1910–20 the ambitious programme of municipal improvements inaugurated in 1903 was in large measure completed. The port works, including a sea-wall over 2 m. long, 8 ft. above mean high-tide, and lying almost entirely in deep-water, enclosing a broad reach of reclaimed land between it and the former shore-line, provide the city with the most modern facilities for loading and unloading ships. The Avenida Rio Branco (formerly Avenida Central), built through the heart of the city in 1904, is now one of the handsomest thoroughfares in the western hemisphere. Over a mile long from N. to S., it is lined with fine private and public buildings. The military, naval and jockey clubs are situated there, and also the offices of some of the principal newspapers, such as the *Jornal do Comercio* and *O Pais*, besides many fashionable shops, cafés and business places. At the southern end is a group of elegant State edifices, the Municipal theatre, the Monroe palace, and the National library and Academy of Fine Arts. It is adorned with three rows of trees, and with broad sidewalks of white and black stone set to form figures in mosaic, as in Lisbon. For this both material and workmen were imported from Portugal. The Municipal theatre, designed in 1904, cost over £2,000,000, although it seats but 1,700 people. The building which houses the National library, opened in 1910 in commemoration of the centenary of its founding (1808), is also a notable addition to the city. It is a fireproof structure of granite, marble and steel, equipped with every modern library appliance.

One of the important developments of Rio de Janeiro has been in suburban road-building. As the hills come practically to the bay and sea, construction is difficult, but great progress has been made and a 40-m. motor drive over perfect roads is now joining all the famous beaches with Tijuca and the city. The magnificent bayside drive, the Avenida Beira-Mar, with its double motor track and intervening lawns and gardens, is particularly remarkable.

Sanitation.—The city, formerly a hotbed of yellow fever and smallpox, has become one of the healthiest tropical cities in the world. The death-rate has fallen to about 20 per 1,000. This is the result of a campaign of scrupulous cleanliness, rigid enforcement of sanitary measures and scientific eradication of mosquitos and other germ-bearing insects, inaugurated under the direction of the celebrated Brazilian scientist, Dr. Oswaldo Cruz, in the first administration of President Rodrigues Alves (1903). In 1920 a law was passed by Congress creating a national department of public health, consisting of three divisions, one in charge of the federal capital.

(C. H. H.)

RIO DE ORO (*see* 23.357).—The area of the Spanish Sahara defined and extended by the Franco-Spanish Conventions of 1904 and 1912 is about 110,000 sq. miles. The frontiers have not been delimited. The colony proper (area, about 65,500 sq. m.) extends from lat. 21°20′ N. to 26° N. The 1904 Agreement recognized a Spanish Protectorate over an area on the N. of about 34,700 sq. m., extending to lat. 27°40′ N. and bounded E. by the meridian 8°40′ W.; and the 1912 Agreement acknowledged the sovereign rights of Spain over this region. Still farther N. is an "occupied territory" of about 9,800 sq. m., extending to Wad Draa (lat. 28°45′ N.), and forming an intermediate zone between the Spanish possessions and Morocco.

The interior has been little explored. A central volcanic tableland, the Tiris, about 1,000 ft. above sea-level, falls by terraces broken by ravines to the coastal plain and to the Segiet el Hamra on the north. To the S., the vast dunes of Azefal separate the Spanish Sahara from Mauretania (*see* 17.908). Wad Shebika enters the sea about 36 m. S.W. of Wad Draa and runs parallel to its lower course. The only permanent water is in brackish wells which frequently become choked. The only district likely to repay colonization appears to be the wide basin of the Segiet el Hamra and its tributaries, whose flood-waters suffice to fertilize pasture and arable land or date-groves, as at the oasis of Smara.

There are few main tracks and a network of smaller tracks, but no roads and but few villages. Smara, 160 km. inland from C. Juby, is the most important settlement and is the headquarters of the notorious religious agitators Ma el 'Ainin and his son El Hiba. Vil Cisneros, on the Dakhla peninsula, the residence of the governor (deputy for the governor-general of the Canaries), has a garrison and fish-curing industry; pop. (1918) 529 foreigners and 495 natives, with an adjoining village of 800 negroid half-castes (Imragen). The desert population, roughly estimated at 80,000, is nomadic, fluctuating between French and Spanish territory, and is split up into pro-French and pro-Spanish partisans. In 1912, there was a general rising under El Hiba. In 1916, a small Spanish expedition occupied C. Juby, but the fishermen, of whom the chief are the Aulad Delim Arabs and their allies the Regeibat (Arabized Berbers), remained practically uncontrolled. Camels and ostriches are reared.

In 1916 the total value of imports by sea was £4,820; of exports £4,910, chiefly fish and fish products. The fishing industry would be considerable if better methods were employed. There are open roadsteads at El Msit, at the mouth of the Segiet el Hamra, and Tarfaya, about 180 km. farther north. The climate is fairly equable on the coast, but intense heat and drought prevail inland, with diurnal variations of temperature in the shade of as much as 74°. At Villa Cisneros the mean maximum summer temperature is 86° F., and the mean minimum winter 48° F. (E. G. S.)

RISLEY, SIR HERBERT HOPE (1851–1911), English anthropologist, was born at Akeley, Bucks., Jan. 4 1851. Educated at

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Winchester and New College, Oxford, he entered the Indian civil service in 1873 and he had a distinguished career; but his principal work was done in connexion with Indian ethnography, the discussion of the caste system, etc., and he published under Government auspices some important volumes of anthropometric data. He had charge of the Indian census operations of 1901. In 1910 he was appointed secretary of the judicial department of the India Office. He was made K.C.I.E. in 1907, and he died at Wimbledon Sept. 30 1911.

RITCHIE, ANNE ISABELLA, LADY (1837–1919), English writer (*see* 26.716), eldest daughter of W. M. Thackeray, died at Freshwater, I. of Wight, Feb. 26 1919. She is best remembered perhaps as the author of *Old Kensington* (1873). Amongst her other novels were *The Story of Elizabeth* (1863) and *The Village on the Cliff* (1865). She also published various volumes of biographical essays (*Madame de Sévigné*, 1881, and *A Book of Sibyls*, 1883, etc.), and contributed a most interesting series of prefaces to the Library edition of her father's works, thus supplying a substitute for the regular biography of him that he had always deprecated. Her husband, SIR RICHMOND THACKERAY RITCHIE (b. 1854), became permanent Under-Secretary of State for India in 1910, and died Oct. 12 1912.

RIVIÈRE, BRITON (1840–1920), English painter (*see* 23.387), died in London April 20 1920. His later works include "Aphrodite" (1902) and "Hark! Hark! the Lark" (1909), also a portrait of Lord Tennyson (1909). His eldest son, HUGH GOLDWIN (b. 1869), became a well-known painter; and the second son, CLIVE (b. 1872), a prominent physician.

RIVINGTON, FRANCIS HANSARD (1834–1913), British publisher (*see* 23.387), died July 2 1913.

RIVOIRA, GIOVANNI TERESIO (1849–1919), Italian archaeologist, was born at La Manta di Saluzzo in Piedmont Sept. 22 1849. He came of an old Piedmontese family and on his mother's side was descended from the Riccati (*see* 23.288), a family of mathematicians and architects. He took his training as an architect and engineer at the university of Turin, entered Rome with the Italian army in 1870 and thenceforth resided there, devoting his life to travel and to the study of the architecture of the later Roman Empire. In 1884 he married Edith E. Johnson of Cheltenham. He published two monumental works, *Le Origini dell' Architettura Lombarda* (1901–7, Eng. trans. 1910) and *Architettura Musulmana* (1914, Eng. trans. 1919). At the time of his death in Rome March 3 1919 he was engaged upon a third, *Architettura Romana*, which was posthumously published in Rome (1920) by his widow.

ROBERT-FLEURY, TONY (1837–1911), French painter (*see* 23.403), died in 1911.

ROBERTS, FREDERICK SLEIGH ROBERTS, EARL (1832–1914), British field-marshal (*see* 23.403). Subsequently to 1905 Lord Roberts took an active and leading part, as head of the National Service League, in the movement in favour of compulsory military service for home defence. On the outbreak of the World War he was a frequent and welcome visitor at the War Office, and shortly after the arrival of the two Indian divisions in France he crossed the Channel to visit them when the weather was cold and inclement. He was attacked by pneumonia while at the front, and he died at St. Omer on Nov. 14 1914, the title going by special remainder to his elder daughter, Aileen Mary. He was buried in St. Paul's.

Lord Roberts was a tried and brilliant commander in the field. His self-reliance and willingness to accept risks when planning operations were demonstrated by the daring advance to Kabul after the massacre of the Cavagnari Mission, and by his swoop across the Orange Free State from the Modder to Bloemfontein in Feb. 1900, abandoning his communications. That instinctive grasp of a tactical situation which stamps the great captain was displayed by him on many occasions, notably when he attacked the Afghans on the Peiwar Kotal and at Kandahar, and on the occasion of his riding on to the field of Paardeberg. His attractive personality and his natural kindliness made him a most popular chief, and, even if he hardly ranked as a military administrator of the very foremost class, his stewardship in the high offices that he filled in India and at home was advantageous to the army and to the State. An eminently knightly figure, Lord Roberts was a fine horseman, a great gentleman, an ardent patriot and a devout Christian.

ROBERTS, GEORGE HENRY (1869–), English Labour politician, was born at Chedgrave, Norfolk, July 27 1869. His parents removed to Norwich where he attended an elementary school and evening classes. In 1883 he was apprenticed to the trade of printer and compositor. At the expiration of apprenticeship he went to London and joined the London Society of Compositors. After a year he returned to Norwich and identified himself with the movement to organize local printers in a branch of the Typographical Association, of which he became president and ultimately secretary. He also became president of the Norwich and District Trades and Labour Council. He was elected to the Norwich School Board in 1899, being the first candidate run by the local Labour party to win a seat on a public body. In 1904 he was elected to the post of national organizer of the Typographical Association and was chosen as its parliamentary representative. He was returned as one of the members for Norwich at the general election of 1906, and has held the seat since. He was whip of the parliamentary Labour party for about eight years and a member of the executive council of the party. When the Labour party joined the Coalition movement in 1915 he became a Lord Commissioner of the Treasury; he was parliamentary secretary to the Board of Trade 1916–7; Minister of Labour, 1917–8; Food Controller, Jan. 1919. He resigned from the Government Feb. 1920.

ROBERTS, JOHN (1847–1919), English billiard-player, was born at Ardwick, Manchester, Aug. 15 1847, the son of John Roberts, also a great player of billiards. Details of the exploits both of father and son are given in 3.937. John Roberts, jun., died at Worthing Dec. 23 1919.

ROBERTSON, SIR GEORGE SCOTT (1852–1916), British soldier and administrator, was born in London Oct. 22 1852. He was educated at Westminster hospital medical school, and in 1878 entered the Indian medical service. He served through the Afghan War of 1879–80, and in 1888 was attached to the Indian Foreign Office, being employed as agency surgeon in Gilgit, on the frontier of Kashmir. In 1890–1 he travelled in Kafiristan (*see* 15.630). In 1893 he went as political agent to Chitral, and in 1895 was besieged there by hostile tribesmen (*see* 6.252). For his services he was created K.C.S.I., and appointed British agent in Gilgit. He retired from the Indian service in 1899 and returned to England. He unsuccessfully contested Stirlingshire in the Liberal interest in 1900, but was elected for Central Bradford in 1906. He died Jan. 1 1916.

ROBERTSON, SIR WILLIAM ROBERT, BART. (1859–), British field-marshal, was born, of poor parentage, in Lincs. Sept. 14 1859. He enlisted as a private in the 16th Lancers in 1877 and served in the ranks of that regiment until 1888, when he won a commission in the 3rd Dragoon Guards, then in India. On joining he eagerly studied his profession in all its branches and he was very successful in learning the native languages. He was selected to be railway staff officer in the Miranzai and Black Mountain operations of 1891, and in the following year he joined the intelligence department at Simla; while on its staff he carried out a reconnaissance to the Pamirs, and in 1895 served with the Chitral Relief Force, being wounded and receiving the D.S.O. He passed through the Staff College in 1897–8—the first officer risen from the ranks to do so—and then, after a few months at the War Office, went out to S. Africa on the intelligence staff; he accompanied Lord Roberts on his advance from Cape Colony into the Transvaal and was promoted brevet lieutenant-colonel for his services. He spent the period from 1901 to 1907 at the War Office, being promoted colonel in 1903, and he then went to the staff at Aldershot, where he spent three years. In 1910 he was appointed commandant of the Staff College, was shortly afterwards promoted major-general, and in 1913 became director of military training at the War Office.

On mobilization of the army for the World War, Sir W. Robertson—he had been given the K.C.V.O. in 1913—was nominated

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quartermaster-general of the Expeditionary Force; he filled that appointment most successfully for five months and then, in Jan. 1915, he became chief of the general staff to Sir J. French. In the autumn of that year he was promoted lieutenant-general for distinguished service and in the following Dec. was brought back to the War Office to take up the post of chief of the imperial general staff. There he immediately introduced great improvements in the office organization, and during the first year and a half of his holding the appointment he was successful in keeping the general control of operations on sound lines. While convinced that the western front represented the decisive theatre of war, and fully aware how mischievous was dispersion of force in principle, he saw to it that, where circumstances unfortunately rendered operations in distant regions unavoidable, the commanders on the spot were furnished with what was deemed essential to achieve success—with the result that the position of affairs in Mesopotamia, on the Suez frontier and in E. Africa was completely transformed within a very few months of his taking up his task. His services were recognized by his being promoted general in 1916 and by his being given the G.C.B. in 1917. He had, however, always experienced some trouble in sufficiently impressing upon the Government that the war could only be won in the west, and in the later months of 1917 he found it more and more difficult, in view of the somewhat disappointing results obtained by Allied offensives in France and Flanders, to persuade the War Cabinet that diversion of fighting resources to Alexandretta, or to Palestine, or to Macedonia, or to the Austro-Italian frontier, endangered prospects of victory at the decisive point and might lead to disaster near home. His anxieties were increased by the manner in which the problem of man-power was treated. He moreover foresaw that the plan of having a supreme war council composed of military representatives of the Allies, such as was introduced towards the end of the year, was an unworkable one. Finally in Feb. 1918 he resigned—just one month before the success that attended the great German offensive of March proved how correct had been his appreciation of the situation. He was given charge of the eastern command, and three months later he succeeded Lord French as commander-in-chief in Great Britain. On the final distribution of honours for the war he was rewarded with a baronetcy and grant of £10,000, and he was nominated G.C.M.G. From April 1919 to March 1920 he commanded the British troops on the Rhine, and, after relinquishing that appointment on the force being reduced, he was promoted field-marshal.

See his autobiographical volume *From Private to Field-marshal* (1921).

ROBINS, ELIZABETH (1865–), Anglo-American novelist and actress, was born at Louisville, Ky., Aug. 6 1865, and educated at Zanesville, O. She had had her early training as an actress in America with the Boston Museum stock company, and afterwards with Edwin Booth. Coming to London she first appeared in *The Real Little Lord Fauntleroy* in 1889, and between 1890 and 1896 she played in most of Ibsen's plays, in which she established her position on the stage. In 1902 she was Lucrezia in Stephen Phillips's *Paolo and Francesca* at the St. James's theatre, London. Her first novels, *George Mandeville's Husband* (1894), *The New Moon* (1895) and *Below the Salt* (1896), appeared over the pseudonym of C. E. Raimond, but in 1898 the success of *The Open Question* led to her publishing in her own name, her reputation as a writer being maintained in *The Magnetic North* (1904); *A Dark Lantern* (1905); *Come and Find Me* (1908); *Camilla* (1918) and *The Messenger* (1920). She took an active part in the agitation for woman suffrage. Her play *Votes for Women* was acted at the Court theatre, London, in 1907.

ROBINSON, EDWIN ARLINGTON (1869–), American poet, was born at Head Tide, Me., Dec. 22 1869. From the public schools of Gardiner, Me., he proceeded in 1891 to Harvard, but withdrew after two years to take a business position in New York City. From 1905 to 1910 he was connected with the N.Y. Customs House, and then returned to Gardiner to devote his time to literature, and especially to poetry. He became a member of the National Institute of Arts and Letters. His works include *The Torrent and the Night After* (1896); *The Children of the Night* (1897); *Captain Craig* (1902); *The Town down the River* (1910); *Van Zorn* (1914, a play); *The Porcupine* (1915, a play); *The Man against the Sky* (1916); *Merlin* (1917); *Lancelot* (1920); *The Three Taverns* (1920); *Avon's Harvest* (1921); *Collected Poems* (1921).

ROBSON, WILLIAM SNOWDON ROBSON, BARON (1852–1918), English lawyer and lord of appeal, was born at Newcastle-upon-Tyne Sept. 10 1852. He was educated at Caius College, Cambridge, where he took his degree in 1877. In 1880 he was called to the bar and entered politics, sitting as Liberal member for Bow and Bromley from 1885 to 1886, and for South Shields from 1895 to 1910. He earned a reputation as a distinguished and energetic advocate, and became a Q.C. in 1892. In 1905 he was knighted, and became solicitor-general in Sir Henry Campbell-Bannerman's Government, being made Attorney-General in 1908. In 1910 he was made a privy councillor, and became a lord of appeal and life peer. He resigned his office in 1912, and died at Battle, Sussex, Sept. 11 1918.

ROBY, HENRY JOHN (1830–1915), English scholar (*see* 23.424), died at Grasmere Jan. 2 1915. He contributed a chapter on Roman law to the second volume of the *Cambridge Mediaeval History* in 1913.

ROCHEFORT, HENRI (1830–1913), French politician (*see* 23.426), died at Aix-les-Bains June 30 1913.

ROCKEFELLER, JOHN DAVISON (1839–), American capitalist (*see* 23.433), continued after 1910 to live a retired life, and to give great sums for charitable and educational purposes. In 1913 the Rockefeller Foundation was chartered under the laws of the state of New York (Congress having refused to enact the legislation necessary for a national charter) "to promote the well-being of mankind throughout the world." To this, the most extensive of his benefactions, Rockefeller had given in all $180,000,000 by 1921. The income and $10,000,000 of the original gifts were expended from time to time by its trustees. With increasing definiteness the Rockefeller Foundation focussed its efforts in the fields of medical education and public health. After 1913 it supported by appropriations the International Health Board, an independent organization engaged, in coöperation with governmental agencies, in demonstrations for the control of hookworm disease in 14 southern states of the United States and 22 foreign states or countries; of yellow fever in five South and Central American countries and of malaria in 10 southern states of the United States. In addition, the International Health Board, with funds provided by the Rockefeller Foundation, organized in 1917, partly as a war measure, the Commission for Prevention of Tuberculosis in France; this commission conducted in limited areas, as demonstrations, vigorous campaigns of popular education in hygiene, and provided for the training of French women as health visitors. By the end of 1920 arrangements were under way for the continuation of the work of the Commission by French authorities. In 1914 the Rockefeller Foundation established the China Medical Board to promote the development of scientific medicine and hygiene in China through medical schools, hospitals, and training schools for nurses. In 1919 the Peking Union Medical College, founded by it, was opened together with pre-medical and nurse-training schools. Gifts have been made also to other institutions in China offering pre-medical courses, and to hospitals. In 1920 the Foundation established a Division of Medical Education, through whose advice large pledges of money were made for the development of medical centres in London, and in various cities of Canada. As a part of its public health work, the Rockefeller Foundation also made grants for the support of schools of hygiene at Johns Hopkins University, Baltimore, and at the university of São Paulo, Brazil. A special feature of the work was provision for fellowships to persons from many different countries engaged in study in medical education and public health. During the year 1920, 71 fellows from 13 countries (including the United States) were supported. During the World War the Foundation contributed to war work agencies; and before crystallization of its general policy of limiting its work to

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medical education and public health, it made appropriations to a number of objects in other fields.

To the General Education Board, the next largest of his charities, Rockefeller had given up to Dec. 1920 over $115,000,000. By the close of the fiscal year 1920, this Board had contributed more than $32,000,000 towards the endowments of different colleges, excluding professional departments, the general practice being to make gifts contingent upon the raising of additional sums. Among medical schools which received help were Washington University, $2,345,000; Johns Hopkins, over $2,200,000; University of Chicago, $2,000,000 (joint fund with the Rockefeller Foundation, 1916); Vanderbilt, $4,000,000 (1919); Rochester, $5,000,000 (1920); Yale Medical School, $1,582,000; and the Meharry Medical College (for negroes), Nashville, Tenn., $150,000 (1920). The Board's facilities for aiding medical education were greatly increased in 1919 by a further gift from Rockefeller of $20,000,000, both principal and interest to be expended in the United States during the next 50 years. In 1919 it gave $500,000 towards the endowment of the Graduate School of Education at Harvard, opened the following year; and in 1920 appropriated $1,000,000 to the proposed building fund of Teachers' College, Columbia University, the largest gift yet made to any institution for training teachers. To the Rockefeller Institute for Medical Research, New York, Rockefeller gave in all upwards of $25,000,000. In Nov. 1920 announcement was made that he had given more than $63,000,000 to the Laura Spelman Rockefeller Memorial, New York, largely for the continuing of charities in which Mrs. Rockefeller, who died in 1915, had been interested. By that time more than $8,000,000 had already been appropriated, chiefly for the benefit of women and children.

It was estimated at the beginning of 1921 that the total amount given by Mr. Rockefeller for philanthropic and charitable purposes exceeded $500,000,000. Nearly four-fifths of this had gone to the four great charitable corporations which he created: The Rockefeller Foundation, General Education Board, The Laura Spelman Rockefeller Memorial and the Rockefeller Institute for Medical Research. Quite as significant as the magnitude of these gifts was the fact that they were free from all restrictions, having been given for the general purposes of the respective corporations, the trustees of which have power to dispose of the principal as well as the income. As the corporate purposes of these organizations are extremely broad, and the gifts are free from restrictions, they will always be adaptable to the changing needs of the future generations. While it was probably true that Mr. Rockefeller was the richest man in the world, it would appear, in view of the statements made by competent authorities, that his wealth in 1921 was less than $500,000,000, and that in making his gifts he had drawn very heavily upon capital as well as income.

RODIN, FRANÇOIS AUGUSTE (1840–1917), French sculptor (*see* 23.447), presented in Nov. 1914 20 examples of his work in bronze, including "L'Enfant prodigue," "La Muse," "France," "Cybèle," "L'ange déchu," "Balzac," and a bust of Mr. George Wyndham, to the Victoria and Albert museum, London, as a token of his admiration for the deeds of the British army. In 1916 Rodin presented all the works remaining in his possession to France, and in 1917 a replica of "The Burghers of Calais" was placed in the garden adjoining the House of Lords. He died at Meudon, near Paris, Nov. 17 1917.

RODZIANKO, MICHAEL VASSILIEVICH (1859–), Russian politician, was born in 1859 and belonged to a family of great landowners. At the age of 19 he joined the Horse Guards, but he soon resigned and retired to his large estates in the government of Novgorod. He took an active part in local life and was also a member of the conferences of Zemstova and Towns. In 1905 he was elected member of the First Duma and was re-elected at all subsequent elections. He joined the right wing of the Octobrist (Moderate Liberal) party, and with the support of the Conservatives was elected president of the Third Duma after the resignation of A. Guchkov in March 1911. Later he was reëlected president of the Fourth Duma, and took an important part in the struggle for constitutional changes in the Government of Russia. He strongly opposed the reactionary policy of the Imperial Government, and always defended the rights and privileges of the Duma. By the force of events Rodzianko was placed at the head of the national movement at the moment of the revolution, and, as president of the Provisional Committee of the State Duma, he sent a telegram to the Tsar pointing out the necessity of his abdication. But he had no real influence on the course of the revolution. He played for some time a purely decorative rôle, receiving telegrams of congratulation and delivering speeches, but he soon disappeared from the stage. After the Bolshevist revolution, he made his way to the south of Russia, where he took part in different anti-Bolshevist organizations and bodies. Later he emigrated to Germany.

ROGERS, BENJAMIN BICKLEY (1828–1919), English classical scholar, was born at Shepton Montagu, Som., Dec. 11 1828. Educated at Wadham College, Oxford, he was elected a fellow of the college in 1852 and was called to the bar in 1856. There he was on the high road to success, when increasing deafness obliged him to retire and devote himself exclusively to literature. He translated all the plays of Aristophanes, reproducing the Greek metres in the English version. He died at Twickenham Sept. 22 1919.

ROGERS, JAMES GUINNESS (1822–1911), British Nonconformist divine, was born at Enniskillen, Ireland, Dec. 29 1822. He was educated at Silcoates school, Wakefield, and Trinity College, Dublin. From 1865 to 1900 he was a minister of the Clapham Congregational church. He is best remembered for his close association with Dr. Dail in the Liberal-Nonconformist education and disestablishment campaigns of 1865–75, and for his friendship with Mr. Gladstone and Lord Rosebery, who consulted him as the foremost representative of Nonconformist statesmanship. He died at Clapham Aug. 20 1911.

ROLLAND, ROMAIN (1866–), French man of letters, was born at Clamecy, Nièvre, Jan. 29 1866. He was educated at Clamecy, and later in Paris, where he had a distinguished academic career. From 1889–91 he was a member of the French School in Rome, in 1892 went with an archaeological expedition to Italy, and in 1895 was appointed professor of the history of art at the École Normale Supérieure, later occupying the same position at the Sorbonne, where he introduced the study of the history of music. He produced many critical and historical works, among them *Histoire de l'Opéra en Europe avant Lulli et Scarlatti* (1895); *Des Causes de la Décadence de la Peinture italienne* (1895); and *Le Théâtre du Peuple* (1903); besides studies on *Millet* (1902); *Beethoven* (1903) and *Michel-Ange* (1906). His most famous work, however, is the romance of *Jean Christophe*, the biography of a German musician, one of the most remarkable productions of the present day. The work is in three series, *Jean Christophe*, *Jean Christophe à Paris* and *La Fin du Voyage*. It appeared in 10 volumes, the first, *L'Aube*, in 1904, and the last, *La Nouvelle Journée*, in 1912. A series of articles published by Romain Rolland in the *Journal de Genève* during Sept. and Oct. 1914 created an extremely bad impression in France owing to the "defeatist" attitude of the author. His later works include *Au-dessus de la Mêlée*, of which the ninth edition appeared in 1915; *Colas Brangnon*, a novel (1918); *Les Précurseurs* (1919) and *Voyage musical aux pays du passé* (1919).

See Jan Romein, *Romain Rolland* (1918); I. Debran, *M. R. Rolland, initiateur du défaitisme* (1918); W. Kuechler, *Romain Rolland* (1919).

ROMER, SIR ROBERT (1840–1918), English judge, was born in London Dec. 23 1840. He was educated privately and at Trinity Hall, Cambridge, where he was senior wrangler and Smith's prizeman in 1863. From 1865 to 1866 he was professor of mathematics at Queen's College, Cork, but in 1867 was called to the bar, becoming in 1881 a Q.C. and in 1884 a bencher of Lincoln's Inn. In 1890 he was raised to the bench of the Chancery division and knighted, and in 1899 became a lord justice of appeal. He presided over one of the inquiries made after the South African War, and was also a member of the royal commission on university education. He received the G.C.B. in 1901

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and retired in 1906. Romer, who married in 1864 the daughter of Mark Lemon, editor of *Punch*, died at Bath March 19 1918.

RONALD, SIR LANDON (1873–), English conductor and musical composer, born in London June 7 1873, was educated at St. Marylebone and All Souls grammar school, and the high school at Margate. His first appearance as a musician was in 1890, as solo pianist in the wordless musical play *L'Enfant Prodigue*, and in 1891 he was engaged by Sir Augustus Harris as conductor for a Covent Garden season. During the following years his reputation as a conductor steadily increased, and in 1908–9 he had a successful European tour. In 1908 he became conductor of the New Symphony Orchestra (now the Royal Albert Hall Orchestra), and in 1910 was appointed principal of the Guildhall school of music. His compositions include various orchestral works, and a large number of songs, many of which have attained wide popularity. He was knighted Jan. 1 1922.

ROOSEVELT, FRANKLIN DELANO (1882–), American politician, was born in Hyde Park, N.Y., Jan. 30 1882. He was a distant cousin of Theodore Roosevelt. He was educated at Groton, Harvard (A.B. 1904), and the Columbia Law School (LL.B. 1907). He was admitted to the bar in 1907 and began practice in New York City. He began his public career in 1910 when he was elected to the New York State Senate, being the first Democrat in 28 years to represent his district. He was an anti-Tammany man and was associated with the group that successfully opposed the Tammany candidate for the U.S. Senate in the session of 1911–2. In 1912 he was reëlected to the New York State Senate. The same year he strongly supported Woodrow Wilson for president and on the latter's election was appointed Assistant Secretary of the Navy in 1913. He then resigned from the New York Senate. In 1915 he was a member of the National Committee of the Panama-Pacific Exposition. After America's entrance into the World War he went to Europe in 1918 to attend conferences and to inspect the U.S. naval forces, and early in 1919 was in charge of their demobilization. He was a supporter of the League of Nations; he indorsed woman suffrage and was a strong advocate of civil-service reform for the post-office and consular appointments. At the Democratic National Convention in 1920 he was unanimously nominated for vice-president on the ticket with James M. Cox, but was defeated in the ensuing election.

ROOSEVELT, THEODORE (1858–1919), twenty-sixth President of the United States (*see* 23.707), completed his second term, March 4 1909, the most famous man in his country, with a wealth of personal friends, and a reputation as a master of men. Yet from the presidency, like most of his predecessors, he stepped down into a retirement which seemed to forbid a re-entry into public life or a recovery of the headship of his party. In the 10 remaining years of his life he displayed the same qualities of intense thought and action that had characterized him before; within a year after his withdrawal he again became a great force in American society and public life. A sense of fair play to his successor, President Taft, for whose choice he was indeed responsible, and that drawing-force of the unknown to which his nature was susceptible, led him to make plans for a hunting and exploring trip in Africa, some months before the end of his presidential term. He was also influenced by invitations to make addresses in England and France.

Accordingly he sailed from New York on March 23 1909 for Africa, where, in conjunction with his son Kermit and the well-known hunter Selous, he travelled a long distance, shot big game, and safely emerged at Khartum in March 1910. Here he plunged at once into politics by addresses at Khartum and Cairo, in which he stood for orderly and vigorous government for Egypt. In both instances the addresses were requested and approved by the local military authorities. From Egypt he proceeded to Europe, and, apparently to his own surprise, found himself an international celebrity. He was received in all the courts of central Europe except the Vatican, where an official interposed between him and the Pope by stipulating guarantees of his conduct in Rome. He left a most interesting account of the impressions made upon him by this journey, in a long and intimate letter written at the time to the English historian Sir George Trevelyan, and published in Bishop's *Theodore Roosevelt and His Time*. It was in vain for him to claim that he was only a "private citizen with no claim to precedence"; for everywhere he was received with the honours ordinarily paid only to sovereigns. He was warmly received in France where he made a public address at the Sorbonne. In England his Romanes lecture at Oxford, and particularly his Guildhall speech on the management of a great empire, were noteworthy; and he was designated by President Taft to represent the United States at the State funeral of Edward VII. His most striking experience was in Germany, where he was received with cordiality by the Emperor, but, as he said afterwards, it was the only country in Europe where he felt that "every man, woman and child was my natural enemy—that is, the enemy of my country."

Returning to the United States, June 18 1910, Roosevelt found that both his African and European experiences had been followed closely by the American people. President Taft had now had a year and a half of experience with the country, with Congress, and with reforms and policies which Roosevelt had initiated and expected would be carried out. There was a rift in the Republican party. Some of Roosevelt's friends were in opposition to the Taft administration. In the Ballinger controversy over western public lands, Roosevelt sided against the administration. A group of dissatisfied Republicans, the "insurgents," had arisen in Congress, and prepared to dispute the supremacy of the Conservatives in the party, on whom Taft seemed to be relying. To Roosevelt's mind, the "mossbacks" were in control; and a few hours after landing he agreed to throw his personal influence on behalf of Governor Hughes of New York, who was engaged in a struggle with the Republican Legislature over the direct primary. He made an address at Ossawatomie, Kan., Aug. 31, in which he laid down a radical programme of political and social reform to which he gave the name of the "New Nationalism." Plainly he was dissatisfied with Taft's administration. As early as Nov. 21 he discussed with an intimate friend the possibility of his accepting the nomination in 1912, to succeed Taft in the presidency. Through 1911 this quarrel grew. Soon after returning, Roosevelt became an editorial writer, bearing a free lance, in *The Outlook*, and alike in his editorials and in public addresses he took the side of the insurgent element. He regarded Taft as the representative of "the interests." Early in 1912, a group of seven Republican governors united in an appeal to Roosevelt to declare his willingness to be nominated. On Feb. 12, Taft made a bitter speech, in which, without mentioning Roosevelt, he spoke contemptuously of the extremists. This seems to have been the incident that decided Roosevelt's course; for on Feb. 26 he came out openly as a candidate for the nomination by the party convention in June.

Meanwhile the usual campaign for the choice of delegates to the Convention was going on, following the same lines as in 1908. In the southern states, where the Republicans were hopelessly in the minority, delegates were elected by the usual rump and machine-led state conventions. Roosevelt's friends made a campaign in the northern and western states, especially in those which had provided for a choice of delegates through a popular vote in party primaries. A majority of the Republican voters in those states favoured Roosevelt. When the Republican Convention met in Chicago, June 22, Taft was strong in the delegations chosen by state and local conventions; and Roosevelt in those representing a predominance of Republican voters. The organization of the Convention, however, was in the hands of the Taft men, because they had a large majority in the National Committee. Out of the numerous contested seats, only six were finally assigned by the Committee of Credentials to the Roosevelt column. On a test vote for the choice of temporary chairman, the Taft men showed a narrow margin. The turn of 15 votes—which might have been secured had Roosevelt come out a few weeks earlier—would probably have brought

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on a "landslide" for him. A speech by Roosevelt a few weeks earlier before the Ohio Constitutional Convention, advocating the "Recall" of judicial decisions, also gave alarm to some men who might otherwise have supported him. Once organized, the Taft forces were able to carry through the report of the Committee on Credentials, which assigned them a safe majority.

Roosevelt himself had come to Chicago a few days before the Convention, and was the centre of the hardest battle of his life. He rallied his supporters, and addressed an enormous public meeting, ending his speech with "We stand at Armageddon, and we battle for the Lord." Most of his followers stood by him; but they could not break down the walls of precedent and conservatism. The Roosevelt delegates, on their leader's request, remained in the Convention until the end, but refused to vote on the nomination; and Taft was duly nominated for a second term by the vote of about two-thirds of the Convention.

Roosevelt was a party man, who had stood by the party in 1884 when many of his friends bolted. His standpoint in 1912 was that he was trying to save the Republican party from a ruinous yielding to the forces of organized wealth and reaction. He was also a fighter, and felt himself deprived, by technicalities and personal hatreds, of an honour which the majority of his party was eager to bestow upon him. He unhesitatingly decided to "bolt," and on the evening of the adjournment of the Convention, at a meeting in Orchestra Hall, he advised the formation of a Progressive party. A later Convention of the Roosevelt men throughout the country, including a considerable number of Democrats, nominated Roosevelt, with Gov. Hiram W. Johnson of California for vice-president. Meanwhile the Democrats had nominated Woodrow Wilson, governor of New Jersey. The result was a three-cornered political contest, in which it was clear at the beginning that Taft could not be elected, but that Roosevelt probably could not win enough Democratic votes to prevent the choice of Wilson. Nevertheless, Roosevelt fought vigorously through the campaign, violently attacking Taft as a reactionary and tool of reactionaries. While on a speaking tour at Milwaukee he was shot by a fanatic, but was not seriously injured.

The result of the election was the choice of Wilson, who had 6,000,000 popular votes and 435 electoral votes; Roosevelt, 4,000,000 popular votes, and 88 electoral; Taft, 3,500,000 popular votes, and 8 electoral. On this showing the Progressives had more votes than their Republican adversaries, and therefore hoped to compel a reconstruction of the party. Their Republican opponents, however, kept tight hold of the name, organization and prestige. They had deliberately accepted defeat in advance in order to put Roosevelt out of the running.

This, the first serious defeat that Roosevelt had ever encountered, was to him a bitter humiliation. He felt that his public career was ended. His first movement was characteristic. He had cordial invitations to visit S. America and make addresses in the principal cities. As in his experiences of 1910, this dovetailed in with a plan of exploration. Accordingly, early in 1913, after visiting several S. American countries, including Brazil and Argentina, he returned to Brazil, made his way overland, and came down a river, whose uncharted course he followed for 600 miles. The hardships were severe, and he received an injury, serious for a time, and drew into his system the seeds of tropical malaria. The Brazilian Government named the stream Rio Teodoro.

On his return to the United States, out of office, a defeated candidate, an insurgent, the personal enemy of the Republican leaders, he seemed justified in his belief that his career was over. But as usual his enemies played into his hands. An obscure journalist ventured publicly to accuse him of drunkenness. In May 1913 he instituted a suit for defamation of character, with the result that the defendant broke down and acknowledged his error. A large section of the American people resented the affront, and rejoiced in the vindication. During this period Roosevelt was indefatigable as journalist and writer, first in *The Outlook*, then in the *Metropolitan* magazine, and finally through the columns of the *Kansas City Star*.

The outbreak of the World War gave him a new opportunity for his pen and voice. His instinct was against Germany as an oppressor of weak nations; but he stayed his desire for positive action for a time, from the feeling that he ought not to embarrass the President. It was at this time that a personal enemy gave Roosevelt the opportunity of again showing his character to his countrymen, through a publicity which both Roosevelt and the public enjoyed. William Barnes, one of the acknowledged leaders of the Republican party, brought a suit in April 1915 against Roosevelt because of an accusation of unfair and corrupt politics as a "boss" which Roosevelt had made against him. Roosevelt vigorously defended himself and won the suit. For 10 days he was on the witness-stand, and his testimony, which was spread broadcast throughout the land, revealed his undiminished force and appealed to the popular imagination.

The sinking of the "Lusitania" by a German submarine in May 1915 brought his bitterest denunciation, and from that time he foresaw first the possibility and then the likelihood of war between Germany and the United States. He made himself the leading spokesman for "preparedness," and presently drew down the wrath of President Wilson's administration for a speech at Plattsburg. From that time he did not spare sharp criticisms of President Wilson's policy as showing unwillingness to face the dangers of war. His utterances against Germany and in favour of the Allies had great influence.

As the election of 1916 drew near, the remaining Progressives, aided by some who had stayed in the Republican party, made an effort to force the Republican Convention to nominate Roosevelt. They called a Progressive Convention to meet at Chicago at the same time as the Republican, hoping to make a joint nomination with the Republicans. Roosevelt did his best to secure the prize, but again the party leaders would have none of him. Hughes was nominated, and this time Roosevelt accepted the situation as a loyal member of the Republican party, and supported the nominee.

As the World War went on, Roosevelt became the severest critic of the administration and the strongest advocate of preparedness. He formed a plan for raising a special division, in which he hoped to have a command, and which he would offer to the Government. Early in 1917, when the American breach with Germany came, he offered the services of himself and his sons, all four of whom subsequently enlisted. He requested that he might have a personal command, which was denied by the administration, although both Houses of Congress united in a bill making his plan possible. During the year he made some of the most notable addresses of his life, especially that before the "Order of Moose" Convention in Pittsburgh. By this time the Republican politicians were looking forward to the election of 1920 and began to group themselves about Roosevelt. His most persistent enemies, even William Barnes, accepted his nomination as a foregone conclusion. The year 1918, however, was a sad one for Roosevelt. His son Quentin was killed in the war. Ever since returning from Brazil, Roosevelt's constitution had shown weakness. He was several times in hospitals, and underwent a serious operation for abscess due to infection received during his Brazilian explorations. The hearing of his left ear was wholly destroyed. Still he continued his writing and speaking, and his direct personal influence upon his thousands of friends. Even in the first days of 1919, when he suffered from renewed disease, he looked forward to public service. On Jan. 6 1919 he died in his sleep.

A man who could do so much could not do everything perfectly, though few have ever done so many things so well. It was more true of him than of most men that his defects were inherent in his virtues. There were few half-tones in Roosevelt's moral perceptions and fewer in his vocabulary; he saw things as either black or white, and he forgot sometimes that he had not previously seen them as he saw them at the moment. He had enemies, and even former friends, who charged him with breaking promises, betraying political associates and setting his own wishes and interests above all others. The very intensity of his convictions sometimes blinded him to the sincer-

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ity and even to the justice of other points of view. Nevertheless this intensity, this moral fervour, gave his ideas a momentum and a success which they could never have acquired had they proceeded from a more judicial mind. He scorned "weasel words," and on occasion he did not hesitate to describe his enemies as thieves and liars. His remarkable energy reminded observers of some great elemental force which, like any natural phenomenon, is controlled by its own necessary laws. When Lord Morley was leaving the United States in 1904 he was asked by reporters what in America had impressed him most. "Two things," he replied, "Theodore Roosevelt and Niagara Rapids."

His fearlessness was as conspicuous as his energy. With a courage very rare in political life he attacked the iniquities that had crept into the conduct of American business. He asserted the importance of personal rights when these were being openly denied in the name of property rights. He rallied the patriotic elements of the country against the menace of a private "money power" which not only had frequently dictated the course of legislation but threatened to usurp the authority of the Government itself. He felt strongly that any position involving the exercise of power had its obligations as well as its privileges, and this feeling lent force to his denunciation of "predatory interests" and "malefactors of great wealth." On the other hand he had little patience with demagogic attacks on men or corporations merely because they were rich or successful, as was shown in his famous utterance in which he compared the authors of these journalistic attacks with the "muckrakers" in *Pilgrim's Progress*. It was said of him satirically that he had invented the Ten Commandments; but Roosevelt's earnestness in behalf of old truths was of the essence of his service to his countrymen, and more important at the juncture than the discovery of new ones.

His great personal power was used in the furtherance of honesty, fair dealing and patriotic service, when more than lip service to these virtues was vitally needed. He threw all his energy into the effort to bring about a reapplication of fundamental moral principles to American business and political life. While he was unquestionably an astute politician, the secret of his success lay in his imaginative understanding of the views and feelings of his countrymen: his enthusiasm was contagious because he vividly expressed what they already felt and believed to be the truest American ideals. When he spoke for the "square deal," the American people as a people always responded.

Born of a wealthy family, in an aristocratic society, enjoying all his days a literary and artistic atmosphere, he was still a natural democrat. He had a personal interest in every man or woman that he met, and a genuine affection literally for thousands of individual persons. He was a scientific man whose observations and deductions were valued by naturalists and investigators. He was a literary man, very widely read. He was an intellectual man, interested from youth to age in literature and philosophy. He was a politician without a rival in his time for boldness, foresight, and an innate knowledge of what his fellow countrymen were thinking about. He was a statesman of the most brilliant ability, who after a crushing defeat returned to power over the minds of the people and was on his way again to the presidency of the United States. His bitterest political enemies accepted his coming back to national leadership. To few men in history has it been given to wield such far-spreading and wholesome personal influence.

BIBLIOGRAPHY.—Between 1909 and 1919 Roosevelt published about 15 books, several of them consisting of articles and addresses. The more important are *African Game Trails* (1910); *Conservation of Womankind and Children* (1912); *Theodore Roosevelt, an Autobiography* (1913, contains little beyond 1909); *Life-Histories of African Game Animals* (2 vols. 1914); *A Hunter-Naturalist in the Brazilian Wilderness* (1914); *Through the Brazilian Wilderness* (1914); *A Book-lover's Holiday in the Open* (1916). His principal later books on public affairs and on the World War are *Realizable Ideals* (1912); *America and the World War* (1915 and 1919); *Fear God and Take Your Own Part* (1916); *National Strength and International Duty* (1917); *The Great Adventure* (1918). Numerous collections of extracts and speeches have been published, especially those of W. F. Johnson (1909); L. F. Abbott (African and European, 1910); W. Griffith (1919); J. B. Bishop, *Letters to his Children* (1919).

The most important biographies are those by J. B. Bishop (1920); H. Hagedorn, *Boy's Life of Theodore Roosevelt* (1919); W. D. Lewis (1919); W. R. Thayer (1919); Bradley Gilman (1921) and H. Hagedorn's *Roosevelt in the Bad Lands* (1921). A useful list of books by and about Roosevelt is J. H. Wheelock's, *Bibliography of Theodore Roosevelt* (1920). (A. B. H.)

ROOT, ELIHU (1845–), American lawyer and political leader (*see* 23.711), was elected president of the N.Y. State Bar Association in 1910, and chairman of the board of trustees of the Carnegie Institution of Washington in 1913. He was chairman of the N.Y. State Republican Convention in 1912, 1913, 1914, 1916, and permanent chairman of the Republican National Convention in 1912. In 1913 he favoured the repeal of the bill exempting American shipping from Panama Canal tolls. He also approved President Wilson's policy of non-interference in Mexico. He assailed as class legislation the exemption of labour unions and agricultural associations from the Sherman Anti-Trust Act. On Dec. 10 1910 he was awarded the Nobel peace prize because of his work in the pacification of the Philippines and Cuba as well as his part in the negotiations between the United States and Japan. The same day he became a member of the Court of Arbitration for settling the claims of British, French and Spanish subjects in connexion with property seized by the Portuguese Government when a republic had been proclaimed. In 1915 he opposed Secretary Bryan's treaty with Colombia, disapproving any apology for incidents attending the acquisition of the Canal Zone and regarding the proposed payment of $25,000,000 as too large. He attacked the Ship Purchase bill, pointing out dangers of international difficulties in case interned vessels were taken over. He also argued that for the Government to acquire shipping would discourage private enterprise and was socialistic in tendency. He was president of the State Constitutional Convention in 1915 and worked for many reforms, including the short ballot, means for remedying the law's delays and the excessive cost of securing justice, and the making of impeachments easier. When submitted to the voters, however, the new constitution was defeated. He was unanimously elected president of the American Bar Association in 1915. The same year he retired from the U.S. Senate, having refused to stand for a reëlection.

He had long advocated preparedness on the part of the United States and early in 1917 spoke in favour of war against Germany. After the United States entered the World War he urged full support of the President. In May 1917 he was appointed chairman of the special American mission sent to Russia and was given the rank of ambassador. Arriving at Petrograd in June he addressed the Russian Council of Ministers and in Moscow spoke at a special session of the Duma and at a meeting of the local Council of Workmen's and Soldiers' Delegates. Later he visited General Brussilov at staff headquarters. On his return to America he was elected honorary president of the National Security League, succeeding Joseph H. Choate. On Sept. 25 1917 he presided at the meeting of the National Association Opposed to Woman Suffrage and denounced suffrage agitation during the critical period of the war. He had never supported the movement and in 1914 had been blacklisted by the National American Suffrage Association. He approved in general the Covenant of the League of Nations but in 1919 suggested six amendments to protect American interests, including reservations concerning the Monroe Doctrine and immigration. He favoured separate consideration of the Peace Treaty and the League. He was strongly opposed to the Prohibition amendment to the Federal Constitution; was retained as counsel by several brewing interests and in 1920 argued before the U.S. Supreme Court against its constitutionality, but unsuccessfully. In 1920 the President reappointed him U.S. delegate to the Hague Tribunal and he went to Holland to assist in organizing the Permanent Court. In July 1920 he spoke at the unveiling of St. Gaudens' statue of Lincoln in London. In 1921 he was one of the four U.S. delegates at the Washington Conference on the Limitation of Armament.

He was the author of several volumes of lectures and addresses, including *Experiments in Government and the Essentials of the Con-*

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stitution (1913, lectures delivered at Princeton); *Addresses on International Subjects* (1916); *Addresses on Government and Citizenship* (1916); *The Military and Colonial Policy of the United States* (1916); *Latin America and the United States* (1917); *Miscellaneous Addresses* (1917); *North Atlantic Coast Fisheries at The Hague* (1917) and *The United States and the War* (1918).

ROSCOE, SIR HENRY ENFIELD (1833–1915), English chemist (*see* 23.725), died at Leatherhead, Surrey, Dec. 18 1915.

ROSEBERY, ARCHIBALD PHILIP PRIMROSE, 5TH EARL OF (1847–), British statesman (*see* 23.731), took an active part in the constitutional crisis in 1910 and 1911. He treated the Parliament bill as a revolutionary measure which in effect constituted single-chamber Government, and did his utmost to arouse the nation to a sense of its danger. But he disapproved of the bill which Lord Lansdowne introduced in May 1911 for the reconstitution of the House of Lords, holding that the Opposition ought to have contented themselves with reaffirming his own resolutions of the previous year. If the Parliament bill became law, Lord Lansdowne's bill mattered little; who would then be the acolytes and sycophants who would accept the degrading position of members of a second chamber? While, however, he bitterly condemned the conduct of ministers in going to "a young and inexperienced King" for contingent guarantees, he declined to follow the extreme course of rejecting the bill recommended by the "Die-hards." He shrank from the scandal of a great creation of peers. If the bill were allowed to pass, the House would be left with some vitality; if the creation of peers was forced, they would have none at all. He showed his own estimate of the impotence of the House after the passage of the bill by ceasing to attend its debates; and indeed he took no further part in public life till the outbreak of war in 1914 fired his patriotism. As lord-lieutenant of Midlothian and Linlithgowshire he promoted recruiting and other warlike activities in his own country; and helped to hearten the nation and to avert a premature peace by occasional speeches. His feeling was shown by a preface which he wrote in Oct. 1914 for the first volume of Col. John Buchan's *History of the War*. He spoke of "the incalculable blessing which the damnable invasion of Belgium has conferred incidentally upon ourselves. . . . It has revealed to the world the enthusiastic and weather-proof unity of the Empire. . . . Blood shed in common is the cement of nations, and we and our sons may look to see a beneficence of empire, not such as the Prussians dreamed of, not a war-lordship over other nations, not a nightmare of oppression, but a world-wide British influence which shall be a guarantee of liberty and peace, and which, hand-in-hand with our Allies in Europe and with our kindred in the United States, should go far to make such another war as this impossible."

The war cost Lord Rosebery his younger son, the Right Hon. NEIL PRIMROSE (1882–1917), whose political advance had been watched by his father with eager sympathy. He was under-secretary for the Foreign Office in 1915, parliamentary secretary for Munitions in 1916, and at the close of that year became Coalition Liberal Whip under Mr. Lloyd George. But these appointments were only held for short periods in the intervals of fighting as a captain in the Buckinghamshire Hussars, and he died of wounds received in action in Palestine in Nov. 1917. He had married Lord Derby's daughter in 1915. Lord Rosebery had a further domestic sorrow in the dissolution, in 1919, of the marriage (celebrated in 1909) of his elder son Lord Dalmeny with Dorothy A. M. A. Grosvenor. Lord Rosebery was created Earl of Midlothian in the peerage of the United Kingdom—the earldom of Rosebery being a Scottish earldom—at the coronation of King George in 1911, at which ceremony, as at the coronation of King Edward, he was one of the lords who bore the canopy. He became chancellor of Glasgow University in 1908 as he had long been chancellor of London University; and was chosen lord rector of St. Andrews University for the year of its quincentenary celebration in 1911.

ROSEGGER, PETER (1843–1918), Austrian poet and novelist (*see* 23.734), died in 1918. (*See* AUSTRIAN EMPIRE: *Literature.*)

ROSENTHAL, TOBY EDWARD (1848–1917), American painter (*see* 23.735), died in Berlin, Germany, Dec. 28 1917.

ROSENWALD, JULIUS (1862–), American merchant and philanthropist, was born at Springfield, Ill., Aug. 12 1862, and was educated in the public schools. From 1885 to 1906 he was president of Rosenwald & Weil, clothing manufacturers, Chicago. In 1895 he became vice-president and treasurer of the mail-order house of Sears, Roebuck & Co., Chicago, and in 1910 president. The gross sales of the company, which were $1,750,000 in 1896, increased under his management to $258,000,000 in 1919. He served during the World War under appointment by President Wilson as a member of the Advisory Commission of the Council of National Defense. In 1918 he was sent on a special mission of cheer by Secretary Baker, of the War Department, to the American troops in France. In 1919–20 he served in Washington as a member of the President's Industrial Conference. He devoted much time to work for philanthropic, educational and civic organizations. He gave $150,000 to Tuskegee (Ala.) Normal and Industrial Institute; $250,000 for a building to house Jewish philanthropic organizations of Chicago; and (with Mrs. Rosenwald) $750,000 for new buildings for the university of Chicago. Of the latter sum $250,000 was used to erect a building, Julius Rosenwald Hall, for the departments of geology and geography, and $500,000 for buildings for the medical department. He founded dental infirmaries in the Chicago public schools. During the World War he gave large sums to relief organizations, in 1917 alone $1,000,000 to aid sufferers in eastern Europe. He contributed generously to, and took a leading part in securing contributions for, the Hoover Children's Relief Fund in 1920–1. Beginning in 1914, he stimulated a programme for building rural schools for negroes in the southern states by agreeing to contribute toward their cost and toward the lengthening of the school terms, provided both the whites and the negroes of the neighbourhood contributed also and that public funds were appropriated. Up to 1920, 800 schools were thus constructed at a total cost of $1,500,000, of which Mr. Rosenwald gave $400,000. In 1920, 500 additional buildings were authorized for immediate construction at an approximate cost of $2,000,000, of which Mr. Rosenwald agreed to pay $500,000. At the close of 1920, 14 cities had Y.M.C.A. buildings for negroes, costing altogether $2,000,000, because of Mr. Rosenwald's offer to contribute $25,000 to each city under certain conditions. His share in the cost was $350,000. He was an official of several leading philanthropic, civic and educational organizations of Chicago, including the university of Chicago; also of the Rockefeller Foundation, Tuskegee Normal and Industrial Institute, the Baron de Hirsch Fund and the American Jewish Committee, and was identified with many other movements for public benefit throughout the country.

On Dec. 29 1921 it was announced that Mr. Rosenwald had pledged about $20,000,000 to safeguard the interests of Sears, Roebuck & Co. during the critical period of business readjustment after the World War. He increased the company's fluid assets by purchasing for $16,000,000 part of the real estate owned by the company in Chicago, and gave the company from his own holdings 50,000 shares of its common stock (par value $100). In 1920 and 1921 the company had paid no dividends on its common stock and it was apparent that its accounts at the end of 1921 must show a deficit. But Mr. Rosenwald by this action enabled the company to readjust its finances without impairing its capital stock, and protected its stockholders, many of them employees. It was recognized generally that he established a precedent which raised the standards of business when he thus faced heavy loss in order to protect those who had bought shares because of their confidence in his leadership, and also in order to foster the practice of employees' participative investment.

ROSS, SIR GEORGE WILLIAM (1841–1914), Canadian politician (*see* 23.739), was knighted in 1910. He published, amongst other works, *The Life and Times of the Hon. Alex. Mackenzie* and *Getting into Parliament and After*. He died March 8 1914.

ROSS, ROBERT BALDWIN (1869–1918), British art critic and writer, was born at Tours May 25 1869, the son of the

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Hon. John Ross, Q.C., attorney-general for Upper Canada, his mother being a daughter of the Hon. Robert Baldwin, premier of Upper Canada. He was educated privately, and later at King's College, Cambridge. After leaving the university he took to journalism. As a judge of pictures he was in very high repute, and from 1912 to 1914 he acted as adviser to the Board of Inland Revenue on picture valuations for estate duty. The most noteworthy feature of many years of his life, however, was his friendship with Oscar Wilde, whose literary executor he ultimately became. He was responsible for the publication of Wilde's *De Profundis* (1905), and subsequently for a complete edition of Wilde's works. Not long before his death Ross received from his admirers a presentation of plate, and also a sum of money which, at his request, was applied to the foundation of a scholarship at the Slade school of art. He died in London Oct. 5 1918.

ROSS, SIR RONALD (1857–), British physician and bacteriologist, was born at Almora, India, May 13 1857. He studied medicine at St. Bartholomew's hospital, and in 1881 entered the Indian medical service. About 1893 he commenced a series of special investigations on the subject of malaria, and by 1895 had arrived at his theory that the micro-organisms of this disease are spread by mosquitos (*see* 17.463, 20.786). In 1899 he retired from the Indian medical service, and devoted himself to research and teaching, joining the Liverpool school of tropical medicine as lecturer, and subsequently becoming professor of tropical medicine at Liverpool University. In 1913 he became physician for tropical diseases to King's College, London. During the World War Ross was appointed to the R.A.M.C. and became War Office consultant in malaria. In 1902 he received the Nobel prize for medicine, in 1911 a K.C.B., and in 1918 a K.C.M.G. He has also been the recipient of honours from many British and foreign universities. He published in 1910 *The Prevention of Malaria*, and also produced *Psychologies*, a volume of poems (1919), and a romance, *The Revels of Orsera* (1920).

ROSTAND, EDMOND (1869–1920), French dramatist (*see* 23.754), devoted himself during the World War chiefly to the writing of patriotic verse. Various comic versions of *Cyrano de Bergerac* were performed by the soldiers at the front, one of which, *Cyrano de Bergerac aux Tranchées* (1916), was prefaced by Rostand with some of his own verses. He died in Paris Dec. 2 1920. His two sons, Maurice and Jean, have produced various works, the former having published a volume of poems, *Le Page de la Vie* and *Le Cercueil de Cristal*, and the latter an important pamphlet on wealth.

ROSYTH (*see* 14.718).—The development of the German navy in the first years of the 20th century rendered it necessary to create a British naval base suitable for a fleet concentrated in the North Sea, and in 1903 it was decided to establish a first-class naval base at Rosyth on the Firth of Forth. Land was acquired and works were planned, but the development of possibilities of torpedo attack soon made it evident that the outer anchorage, as originally designed, would be insecure, and naval opinion became doubtful as to whether the base would be adequate. The plans of construction were, therefore, modified in 1908, but, up to the outbreak of war, Rosyth was regarded as the principal base and headquarters for the Grand Fleet, though it was decided that initial stations must be established at Cromarty (*see* CROMARTY) and Scapa Flow (*see* SCAPA FLOW). When the war began, Admiral Jellicoe preferred to establish his headquarters at Scapa Flow, but Rosyth was used as a secondary base, particularly for the battle cruisers.

The Firth of Forth had been selected, before the war, as the eastern terminus of a mid-Scotland canal which was to connect with the existing canal and follow its line for part of the way, and then crossing the low ground in the neighbourhood of Stirling, to enter Loch Lomond, and ultimately to reach the sea by a short canal from Balloch to a point near Dumbarton. The canal was projected not only for commercial purposes but also to enable warships to pass safely and rapidly from W. to E. and to make the great Clyde shipyards easily accessible from the naval base at Rosyth, and thus to avoid the necessity of constructing docks and repairing yards there. The project was again under consideration during the war, but it was obvious that it could not be accomplished in time, and Rosyth was developed as a great dock-yard.

The original scheme included a high-level main basin covering an area of 55 ac., with an entrance lock from the fairway, a dry or graving dock 750 ft. long and 110 ft. wide, a submarine tidal basin, the construction of an entrance channel, and the erection of workshops and offices, and work was begun in 1909. The whole site of the works has been reclaimed from the sea, and a great sea-wall was built to form the southern boundary of the docks, the number of which was increased from one to three. Great progress had been made by the outbreak of war, and it was anticipated that the works would be completed by the summer of 1916. Operations were pushed on vigorously during the war, and a special Act of Parliament was passed in 1915 to facilitate the provision of dwelling-houses for Admiralty employees. By the original Act for the construction of the base, the whole area between the town of Dunfermline and the land purchased by the Government was brought within the municipal area, which was thus extended from 2,016 to 7,730 acres. The erection of houses has involved the construction of new roads, and new water and sewerage schemes.

ROTHENSTEIN, WILLIAM (1872–), English artist, was born at Bradford, Yorks, Jan. 29 1872, and was educated at the Bradford grammar school. In 1888 he entered the Slade school, studying under Legros, and afterwards worked in Paris. In 1893 he began exhibiting at the New English Art Club. His paintings include "The Browning Readers" (1900), "The Doll's House" (1900), "Aliens at Prayer" (1904), "Jews Mourning" (1905), "Carrying the Law" (1910), "Morning at Benares" (1911), "Bourlon Church" (1919), and "The Last Phase: on the Rhine" (1919). Among his portraits may be mentioned those of Augustus John, Sir Francis Darwin (1905), Mr. Charles Booth (1908), Prof. Alfred Marshall (1908), Mr. Bernhard Berenson (1910), and Sir Rabindranath Tagore (1912); besides a portrait of himself (1900), now in the Metropolitan Museum, New York. His work is represented in many galleries, including the Dublin Gallery of Modern Art, the National Gallery, Melbourne, the National Portrait Gallery, Edinburgh, and the galleries of Bradford, Manchester and Johannesburg. He was in 1917 elected professor of civic art at the university of Sheffield. His published works include *Oxford Characters* (1896); *English Portraits* (1898); *The French Set, and Portraits of Verlaine* (1898); *Manchester Portraits* (1899); *Liber Juniorum* (1899); a *Life of Goya* (1900); *Plea for a Wider Use of Artists and Craftsmen* (1918); *Twenty-four Portraits* (1920).

His brother, ALBERT DANIEL RUTHERSTON (b. 1881), who took the name of Rutherston in place of that of Rothenstein in 1916, was born at Bradford Dec. 5 1881. He studied at the Slade school in 1898, and after 1901 exhibited regularly at the New English Art Club. He became well known as a theatrical designer of great taste and originality, his work including designs for *The Winter's Tale* (1912); G. B. Shaw's *Androcles and the Lion* (1913) and *Le Mariage Forcé* (1913). He also illustrated *The Children's Blue Bird* by Madame Maeterlinck (1913).

ROTHERMERE, HAROLD SIDNEY HARMSWORTH, 1ST VISCT. (1868–), British newspaper proprietor and financier, was the second son of Alfred Harmsworth, and brother of Visct. Northcliffe (*see* NORTHCLIFFE). He was born April 26 1868 at Hampstead, London, was created a baronet in 1910, Baron Rothermere in 1914, and Visct. Rothermere of Hemsted after his services as Air Minister, in 1918. He married in 1893 Mary Lilian, daughter of George Wade Share. At the age of 21 he entered the publishing firm in which his brother Alfred (afterwards Lord Northcliffe) was then the principal, soon after the date when *Answers* was launched. He assisted in developing the business on sound and economic lines, and for the next 20 years he was the close associate of his brother in all his great undertakings and shared in his triumphs. His administrative and financial skill admirably seconded Lord Northcliffe in working out his original schemes. He took an important part in the reorganization of the London *Evening News*, when his business talent helped to make that once insolvent newspaper a large profit-yielder. He was one of the three principals in the establishment of the *Daily Mail* (1896), for many years controlled the finance of that newspaper, and was largely responsible for developing its methods of distribution. He was equally active at the Amalgamated Press, the gigantic periodical publishing

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business which his brother had founded after the success of *Answers*. He founded the Glasgow *Daily Record*, bought the *Leeds Mercury*, and shared in the purchase of *The Times* (1908). He became known also as a most generous benefactor of charities. By the gift of a large sum he enabled the Union Jack Club to provide worthy accommodation for sailors and soldiers in London; and he gave £10,000 to the Territorial Force County of London Association. In 1910 he founded the King Edward chair of English literature at Cambridge, and in the same year he ceased his connexion with *The Times*, *Daily Mail*, and *Evening News*. In 1914 he acquired the *Daily Mirror* from Lord Northcliffe, and this henceforth became his special organ. In 1915 he founded the *Sunday Pictorial*, the first fully illustrated Sunday newspaper in London.

In the World War, Mr. Lloyd George, while Secretary for War, appointed Lord Rothermere in 1916 Director-General of the Royal Army Clothing Department. In the following year he accepted the office of Air Minister, under Mr. Lloyd George as Premier. He at once declared himself "whole-heartedly in favour of reprisals," which were the best means of carrying the war into Germany and protecting British towns against air attacks. Suffering from precarious health and his bereavements in the war, he resigned on April 25 1918, after he had carried out the fusion of the Royal Naval Air Force and Royal Flying Corps. "My second tragic loss in the war, ten weeks since," he wrote to the Prime Minister, "caused me great distress of mind and body . . . I was suffering from ill-health and insomnia." Immediately after the war he began a most energetic campaign against extravagance in national and local finance, himself contributing numerous articles to his newspapers.

The tragic losses to which he referred were those of his two sons, Capt. Harold Alfred Vyvyan St. George Harmsworth, M.C. (b. Aug. 2 1894) and Lieut. Vere Sidney Tudor Harmsworth (b. Sept. 25 1895), both of whom, after showing exceptional promise in civil fields, served with extreme gallantry in battle and fell in the national cause. Harold, in the Irish Guards, was twice severely wounded in 1915, and was then given a staff appointment in England. This he insisted on resigning and returned to his battalion at the front. There in Bourlon Wood, on Nov. 27 1917, he received mortal wounds of which he died on Feb. 12 1918. In recording the grant of the M.C. for his conduct on that occasion the *London Gazette* stated: "He led his company forward under heavy fire and himself put out of action two enemy machine-guns. It was entirely due to his splendid example that his company reached their objective." In his memory Lord Rothermere founded and endowed the Harold Vyvyan chair of American history at Oxford University in June 1920. Vere, educated for the navy which he had to leave owing to gun-deafness, joined the Royal Naval Division immediately after the outbreak of war, took part in the expedition to Antwerp, and, when his battalion was driven across the frontier into Holland, made his escape from Dutch internment. He was in the terrific fighting at Gallipoli and in the battle of the Somme, having refused a staff appointment, like his brother, because he was determined to share the fortunes of his men. Twice wounded in the storming of Beaucourt on Nov. 13 1916, but still advancing and setting an example which, as his commander wrote, "thrilled with pride the men of his battalion," he was struck a third time by a shell and killed. In memory of him Lord Rothermere in 1919 established and endowed the chair of naval history at Cambridge which bears his name.

Lord Rothermere's third and only surviving son, Esmond Cecil (b. May 26 1898), who had served during the last part of the war in the Royal Marine Artillery, was in 1919 elected "anti-waste" M.P. for Thanet, and was then the youngest member of the House of Commons and the fifth of his family in Parliament. (H. W. W.)

ROTHSCHILD, NATHANIEL MAYER, 1ST BARON (1840–1915), Jewish financier, was born in London Nov. 8 1840, the son of Lionel Nathan de Rothschild, Austrian baron, head of the English branch of the famous financial family (*see* 23.758). He was educated at Trinity College, Cambridge, and in 1879 succeeded his father as Austrian baron. He sat in the House of Commons from 1865 to 1885 when he was created a peer by Mr. Gladstone, the first of his race and religion to be raised to the House of Lords. He was well known as an agriculturist as well as a financier, and he was renowned for his charities. He died in London March 31 1915.

His brother, LEOPOLD DE ROTHSCHILD (1845–1917), who had been throughout associated with him in the management of the financial house, succeeded him as its head and also took over most of his public offices, besides interesting himself especially in the Jewish community and becoming president of the United Synagogue. He was an art collector and owner of race-horses. He died at Ascott, Leighton Buzzard, May 29 1917.

ROUND, JOHN HORACE (1854–), English historian, only son of John Round, lord of the manor of West Bergholt in Essex, and through his mother grandson of Horace Smith, author of *Rejected Addresses*, was born at Brighton on Feb. 22 1854. He was educated privately, afterwards going to Balliol College, Oxford, where he took a first-class in modern history. The teaching of Dr. Stubbs, then Regius Professor of History, greatly stimulated the young student, whose independent and critical genius had already begun to revolt against the superficial methods of historical study traditional in the English schools, and after a few years he devoted himself to historical research. His own aim as a historian, as stated by himself, was "to add to or correct our knowledge of facts" (preface to *Feudal England*), and from the first he insisted that students of mediaeval history must go to the records in order to find evidence to supplement and check the chroniclers on whom historians of the type of Freeman had too exclusively relied. In 1883 he published in the *Antiquary* a criticism of Brewer's introduction to the *Book of Howth* (Rolls Series), in which he proved that the author was "strangely at fault" in his views on its authorship, its origin and its contents; and three years later, in his *Early Life of Anne Boleyn*, he again pointed out errors "on the simplest matters of fact" made by the same eminent scholar. In 1884–5 he published in a magazine articles on "The Origins of the House of Lords" (reprinted in *Peerage and Pedigree*, 1910), in which he argued for "that feudal origin of the House which, in view of the teaching of Freeman and Stubbs, it was, at that time, heresy to assert." In 1888 appeared his edition of *Ancient Charters, Royal and Private, prior to 1200* (Pipe Roll Soc. vol. x.), in the preface to which he pointed out their use for genealogy, topography, legal and ecclesiastical antiquities, etc. In 1891 appeared his *Introduction of Knight-service into England* (privately printed, reprinted in *Feudal England*, 1895), in which he proved the entirely Norman and feudal origin of this institution (*see* the article by Round in the *E.B.* 15.867).

In 1892 he published in the *Quarterly Review* (vol. 175, No. 349) his famous attack on Freeman's historical method. He accused him of working as a historian "not from manuscripts, but from printed books," and pointed out "the danger to our national school of history in the wide-spread and almost superstitious belief in his unimpeachable authority." This authority he proceeded to assail, centring his attack on that "palisade" of solid timber which, in his *Norman Conquest*, Freeman had imaginatively built round the English host at "Senlac," and proving that this palisade had as little existence as "Senlac" itself (*see E.B.* 13.59 note). Round had begun openly to attack Freeman as early as 1882, but the fact that the *Quarterly* article, though written before Freeman's death, did not appear till afterwards excited unjust comment, and blinded the dead historian's friends to the convincing force of the criticism itself. The long and bitter controversy that followed was summed up by Round in "Mr. Freeman and the Battle of Hastings" in *Feudal England*. In 1892 also appeared *Geoffrey de Mandeville*, a study of the anarchy under Stephen, which established the author's reputation as a constructive historian. In *Feudal England*, which appeared in 1895, Round published in collected form some of the results of his researches into the history of the 11th and 12th centuries, the first part of the book setting forth views as revolutionary on the Domesday side and the whole system of land

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assessment as on the actual introduction of the feudal system into England. In 1899 was published his *Calendar of Documents preserved in France illustrative of the history of Great Britain and Ireland*, vol. i., pp. 918–1206, and also another collected series of studies under the title of *The Commune of London*. In the following year he published his *Studies in Peerage and Family History*, and at the Congress of Archaeological Studies he read a paper (subsequently published) on "the systematic study of our English place-names," in which he again pointed out the impossibility of accomplishing any scientific work in the department of research until the place-names of England had been classified and traced to their origins.

Round's vast and detailed knowledge of the periods which he had made his own led to his opinion being sought by successive law officers of the Crown charged with the conduct of peerage cases brought before the House of Lords. His attention was thus drawn to peerage law, and he soon discovered that there "was room for its treatment on fresh and historical lines." In 1910 he published *Peerage and Pedigree*, containing studies on peerage law and its problems, in which incidentally he attacked "the muddle of the law," pointing out that the lawyer, whose vision is bounded by his "books," is still in the Middle Ages, while the historian is a man of science. Although the labour involved in these peerage cases was immense, Round refused to accept any remuneration; in 1912, however, his services were publicly recognized by the creation in his favour of the new office of Honorary Adviser to the Crown in Peerage Cases. His passion for historic truth led him to wage ruthless war on the "pedigree-mongers," whom he attacked with mordant wit (see, *e.g.* in *Peerage and Pedigree*, "Some 'Saxon' Houses," "The Great Carington Imposture"), and on those who were attempting to give a false value to the possession of coats-of-arms (*ibid.* "Heraldry and the Gent"). Occasionally he extended the range of his attacks, falling, for instance, upon those who, consciously or unconsciously, falsified history in the interests of particular political or religious opinions (*e.g.* "The Elizabethan Religion, in correction of Mr. George Russell," *Nineteenth Century*, vol. xli., p. 191).

History on a large scale Round never attempted. His books are all collections of particular studies, and they represent but a tithe of his published work. He edited, with prefaces, a whole series of the Pipe Rolls; he was a frequent contributor to the *English Historical Review;* he helped to edit the *Ancestor*, for which he also wrote; and innumerable papers by him are scattered in various historical and archaeological journals and reviews. In 1913 he had begun to prepare a catalogue of these scattered works, but in 1921 this had not yet been published. Round's historical method—reaching conclusions by induction from isolated facts whose connexion he had in turn to prove—prevented his becoming a popular writer; but his style is always luminously clear, and the articles contributed by him to this Encyclopaedia (DOMESDAY, KNIGHT SERVICE, BARON, BARONET, EARL, BAYEUX TAPESTRY, SCUTAGE, the families of FITZGERALD and NEVILLE, etc.) are excellent examples of his capacity for concise statement. (W. A. P.)

ROUVIER, MAURICE (1842–1911), French statesman (*see* 23.781), died at Reuilly-sur-Seine June 7 1911.

ROVNO, BATTLE OF.—The Rovno operations played an important part in the Russian campaign of 1915 on the eastern front (*see* EASTERN EUROPEAN FRONT CAMPAIGNS).

In consideration of Austro-Hungarian troops having been set free by the rally of Mackensen's group of armies in their victorious march on Brest Litovsk, and of the connexion between the Russian N.W. and S.W. fronts having been broken by the withdrawal of the former N. of the Polyesie, the Austro-Hungarian army Higher Command decided, on Aug. 27 1915, to take the offensive with the army front which had been inactive on the Zlota Lipa and the Bug. The objects in view were Rovno (Rowne) and the liberation of the east portion of East Galicia.

The S. wing of the II. Army under Böhm-Ermolli, and the N. wing of the Southern Army under Bothmer, made a successful attempt to break through Shtcherbachev's XI. Army in the battle at Gologory and on the Zlota Lipa. Bothmer's S. wing and the N. wing of the VII. Army engaged Lechitski's IX. Army; Puhallo advanced with the main body of the I. Army towards the bent back N. wing of Brussilov's VIII. Army to throw it back on Dubno; and Field-Marshal Roth-Limanowa pushed forward on the Kovel (Kowel)–Luck road in order to capture from the Russians the command of the northern flank. Puhallo's advance decided Ivanov to break off the battles and to withdraw Brussilov during the night, and Shtcherbachev and Lechitski's N. wing on the 28th and 29th to a position behind the Sierna, on the watershed between the Bug and the Styr, on the Zloczów heights and behind the Strypa. The S. wing and centre of the Austro-Hungarian front followed immediately in pursuit, and in consequence two battles developed, after the occupation of the Russian position: one, on the 30th on the Strypa, from whose bridgeheads Shtcherbachev and Lechitski delivered mighty blows against Bothmer's S. wing and Pflanzer-Baltin's N. wing; the other, on the 29th at Zloczów, where Böhm-Ermolli attempted to break through.

Puhallo only arrived before Brussilov's front on the 29th and had to put off attacking until the 31st. Roth, having encountered opposition at Rozyszcze on the 29th, had advanced with the main body across the Styr at Sokul, and that day began a forced march towards Luck. The XXXIX. Corps, brought up by train, flung itself upon him but was defeated on the 30th.

Ivanov made Brussilov withdraw in the night behind the Putilowka and go into position at Olyka, Mlynow, Kozin and the source of the Ikwa. Luck was surrendered. Shtcherbachev held the Zloczów heights until the morning of Sept. 1, although he was surrounded on the N. and his front was broken through in places. He then retired to the position Radziwillow–Podkamien–Zalozce.

Lechitski was still holding out on the 1st, in spite of the failure of his counter-assaults, and Pflanzer-Baltin therefore delivered an assault with his group, established N. of the Dniester close to the mouth of the Sereth. During the night the Russians fell back on to the strongly fortified Sereth position, which was provided with several bridgeheads.

Ivanov hoped that his N. wing, which had been bent back a long way and was difficult to envelop owing to the adjacent marsh area, and had, further, been reinforced by fortress artillery from Rovno, would be able with the aid of flank attacks from the region of dense forests and impassable swamps known as Polyesie ("the Woods") to hold out until the S. wing, opposed by far weaker forces, should have lifted the whole front off its hinges by a victorious assault.

The Austro-Hungarian army Higher Command arranged for the N. wing, now divided into two armies under Archduke Joseph Ferdinand, to deliver a decisive blow by means of assaults on Rovno and Dubno; for Böhm-Ermolli to break through in the centre of the Russian front; and for Bothmer and Pflanzer-Baltin to contain the Russian forces by an attack on the Sereth position. Lechitski wanted to employ the time until his N. and Shtcherbachev's S. wing should be ready, by removing the threat to his flank offered by Pflanzer-Baltin's troops, who had advanced on both sides of the Lower Sereth. These battles on the 4th and 5th, combined with a simultaneous attack on the Bukovina, failed in their object.

While Bothmer was grouping his army for a break-through S. of Tarnopol, and Pflanzer-Baltin's N. wing was waiting to attack simultaneously with him on the 7th, the Russians, on the afternoon of the 6th, opened the battle of the Sereth (the battle of Tarnopol) with a great mass assault from the Trembowla area. On the same day Böhm-Ermolli finished the battle at Podkamien, begun on the 2nd, with a victory that resulted in Shtcherbachev's N. wing retiring as far as Butyn on the Goryn, while Brussilov's S. wing, abandoning Dubno, fell back behind the Middle Ikwa.

Archduke Joseph Ferdinand's I. and IV. Armies, which had come up in front of the Russian positions on the 2nd, defended themselves against numerous counter-assaults, by which Brussilov was trying to prevent the diversion of troops to the N.

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wing. The pressure on the flank from Polyesie grew, and it became imperative to bring up all cavalry divisions within reach. These became entangled in difficult minor combats in the midst of forest and marsh. On Sept. 8 Archduke Joseph Ferdinand delivered at Cuman the blow which decided the battle of Olyka. Brussilov escaped by retreating behind the Stubla.

These successes barred the advance of the Sereth front, which by 7 P.M. had forced back Bothmer's and Pflanzer-Baltin's inner wings as far as the Strypa. Böhm-Ermolli's S. wing executed a relief attack E. of the Sereth towards Zbaraz. Ivanov, in his anxiety for his N. wing, ordered the S. wing reserve to be diverted and sent to its relief. This wing was for the moment endeavouring to cover the flanks of the attack-group which had advanced a great distance, but could overpower neither Bothmer's N. wing in the direction of Tarnopol nor the troops in the foreground of the Zalesszyki bridgehead. On the 10th the Archduke Joseph Ferdinand began the battle of the Stubla, which he hoped to bring to a decision by sending the N. wing to cross the Goryn below the mouth of the Stubla, and then make an advance on Rovno simultaneously with that of Puhallo's army coming from Dubno. By the 12th the road to the Goryn had been made clear, one division brought across the river, and the groups which threatened the N. wing driven back a considerable distance.

The arrival of Russian reinforcements opposite to Böhm-Ermolli's sparsely occupied front, as well as the arming for a continuation of the Sereth front's advance, showed that Ivanov was planning a great offensive on both sides of the Tarnopol-Lemberg line. The Austro-Hungarian army Higher Command stopped Puhallo's advance, drew back Bothmer's N. wing to the level of the Strypa front and dispatched thither the VI. Corps which had been intended for use against Serbia.

On the 13th the counter-offensive set in with the battle of Krzemieniec-Gontowa, and won some initial successes. The N. wing's attack was now also stopped. On the 14th the Russians broke through the Strypa front and reached the W. bank. The VI. Corp's attack, together with an advance by Bothmer's N. wing and a group of Böhm-Ermolli's posted W. of the Sereth on the N. flank, caused the Russians to retire again in the night of the 16th-17th to their Sereth position. During this time Böhm-Ermolli had repulsed the assault, and used the reënforcements sent by the Archduke for an attack. But a calamity had overtaken the N. wing. Keeping the attention of the weakened group of armies on the Stubla cleverly riveted, Brussilov with the XXX. Corps on the 15th threw back the N. wing behind the Putilowka and forced the Archduke, by continuous envelopment, to retreat behind the Styr and the Ikwa on the evening of the 17th. The bridgehead at Luck could not hold out, and on the 23rd the Russians stood on the E. bank of the river. On the same day Shtcherbachev and Brussilov's S. wing advanced to the attack on the II. Army and Puhallo's I. Army, now under command of Böhm-Ermolli, from the Upper Sereth to the mouth of the Ikwa. This second battle of Krzemieniec ended on the 25th with the failure of the Russians. At the same time Brussilov received the news that German troops had taken part in the storming of the bridgehead at Kolki on the Styr. Recognizing the intentions of the allies, he at once ordered a retreat to the Putilowka position, while concentrating a powerful group to the N. of the Kormin brook to fall on the enemy's flank.

Linsingen, the new commander of the IV. Army and of the troops in Polyesie, was in fact planning a blow on the Russian flank and rear by way of Kolki-Sokul, using for this purpose the German XXIV. Reserve Corps (brought up from the German front through Polyesie after Gyllenschmidt's forced retreat behind the Wiesiolucha and the Styr) and the Austro-Hungarian XVII. Corps which was to have been sent against Serbia. Gerok's group, the XXIV. Reserve and the XVII. Corps, had now to do with nothing but rearguards, who by the 27th had been overthrown. On the 28th, when Shtcherbachev at the battle of Nowo Aleksiniec again attacked Böhm-Ermolli in order to keep his forces engaged, the main body of the N. wing arrived at the Putilowka. Linsingen guessed Brussilov's scheme, made Gerok wheel to the N.E., and intercepted the Russian blow. The allies' decision to grant the much-exhausted troops some rest in a permanent position brought the battle of the Putilowka to an end on the evening of the 30th.

The Russian command refused to be satisfied with this close to a campaign which had not brought them much gratification. On Oct. 3 Gyllenschmidt delivered a flank blow from Rafalowka, W. of the Styr, but was driven completely back by the 6th. The attack against Serbia was a spur to renewed exertions. On the 6th a fresh battle set in on the Putilowka, which on the 7th spread over the whole front up to the Rumanian frontier, lasting until the 10th—until the 13th on the Strypa—without a change in the situation. On the 15th Ivanov once more delivered a blow on the N. flank in the bend of the Styr at Czartorysk, which at first made great progress. But Linsingen's clever concentric placing of the hurriedly brought-up reinforcements drove the Russians back with heavy fighting behind the Styr by Nov. 14. During the crisis Shtcherbachev had attacked the II. Army in vain from Oct. 21 to 23 in the second battle of Nowo Aleksiniec. More dangerous still were the Russian attempts to break through on the Strypa from Oct. 30 to Nov. 8, which culminated in the struggle for the village of Siemikowce. Finally, in the middle of Nov. a prolonged lull fell upon this theatre of war. (M. H.)

ROWELL, NEWTON WESLEY (1867–), Canadian politician, was born Nov. 1 1867 in Middlesex county, Ontario. He was called to the bar in 1891, and became head of the law firm of Rowell, Reid, Wood & Wright, Toronto; ultimately being made bencher of the Law Society of Upper Canada in 1911. He stood unsuccessfully as a Liberal for the Dominion Parliament at the general election of 1900, but in 1911 was elected to the Ontario Legislative Assembly for N. Oxford. From 1911–7 he was leader of the Liberal Opposition in the Ontario Legislature. On Oct. 1917 he entered the Federal Unionist Government as president of the council and vice-chairman of the War Committee of the Cabinet, and was elected to the Dominion House of Commons for Durham county, Ontario, Dec. 1917. He was a member of the Imperial War Cabinet and Imperial War Conference, 1918; Canadian Government representative at the International Labour Conference at Washington, 1919; and a Canadian delegate to the first assembly of the League of Nations at Geneva, 1920. He resigned his seat in Parliament in May 1921.

ROWING: *see* SPORTS AND GAMES.

ROYCE, JOSIAH (1855–1916), American philosopher, was born at Grass Valley, Cal., Nov. 20 1855. He graduated from the university of California in 1875 and the following year went to the newly established Johns Hopkins University, being one of the extraordinary first group of fellows elected there. After receiving his Ph.D. in 1878 he was instructor in English literature and logic for four years at the university of California. In 1881 he prepared *A Primer of Logical Analysis* for students of English composition. In 1882 he was called to Harvard where he taught as instructor in philosophy, assistant professor (1885–92), professor of the history of philosophy (1892–1914) and Alford professor of religion, moral philosophy, and civil polity (after 1914). He was the leading American exponent of idealism (*see* 14.284) and his works were distinguished for their literary qualities. He was made a member of the National Institute of Arts and Letters, and received hon. degrees from Harvard, Yale, Johns Hopkins, Aberdeen, St. Andrews and Oxford. After the outbreak of the World War he was a staunch supporter of the Allies, and on Jan. 30 1916, in a notable address delivered in Tremont Temple, Boston, advocated a breach with Germany. He died in Cambridge, Mass., Sept. 14 1916.

He was the author of *The Religious Aspects of Philosophy* (1885); *California* (1886, in the American Commonwealth Series); *The Feud of Oakfield Creek* (1887, a novel); *The Spirit of Modern Philosophy* (1892); *The Conception of God* (1895); *Studies of Good and Evil* (1898); *The World and the Individual* (2 vols., 1900–1, Gifford Lectures at the university of Aberdeen); *The Conception of Immortality* (1900); *Outlines of Psychology* (1903); *Herbert Spencer: An Estimate and Review* (1904); *The Philosophy of Loyalty* (1908); *Race Questions, Provincialism and Other American Problems* (1908);

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William James and Other Essays on the Philosophy of Life (1911); *Bross Lectures on the Sources of Religious Insight* (1912); *The Problem of Christianity* (2 vols., 1913, lectures before Manchester College, Oxford); *War and Insurance* (1914); *The Hope of the Great Community* (1916, war addresses) and the posthumously published *Lectures on Modern Idealism* (1919).

ROYDEN, AGNES MAUDE (1876–), English social worker and preacher, was born at Mossley Hill, Liverpool, Nov. 23 1876, the daughter of Sir Thomas Royden, 1st Bart., of Frankby Hall, Birkenhead. She was educated at Cheltenham Ladies' College and Lady Margaret Hall, Oxford, and afterwards for some years did settlement work in Liverpool. She also lectured on English literature for the university extension movement, and in 1909 was elected to the executive committee of the N.U.W.S.S. From 1912 to 1914 she edited the *Common Cause*, the organ of the union. Miss Royden became well known as a speaker on social and religious subjects, and in 1917 became assistant preacher at the City Temple, being thus the first woman to occupy this office.

RUBBER (*see* 23.795*).—Since 1910 the rubber industry has developed very largely and taken increased importance in the commercial world. The word rubber is applied to three different substances: (*a*) an elastic solid, the chief constituent of the coagulated latex or milk of a great variety of trees, shrubs, vines, and plants, as Pará rubber; (*b*) an elastic solid found in solution in the tissues of a few shrubs and vines, as Guayule rubber; (*c*) a chemical product from isoprene or homologous hydrocarbons, as synthetic rubber. In all commercial rubber caoutchouc exists in two forms, one fibrous or hard, the other viscous and soft. In the best trades the fibrous form preponderates. The soft form can be dissolved by benzol and many other substances of that class; the fibrous form swells but does not dissolve. Vulcanization (the chemical union of caoutchouc and sulphur) hardens the viscous portion. As the result of this process the rubber becomes less sensitive to heat and cold and to the effect of acids and alkalies and becomes more durable. A small amount of sulphur in rubber produces soft rubber. By using more sulphur and greater heat a very hard black substance called hard rubber is obtained. Moulding India rubber consists of softening by heat the stiff rubber dough until it is plastic, pressing it into a mould and vulcanizing it at a heat much less than that required to melt it; not in melting, pouring and casting according to popular misconception. Rubber once melted remains a sticky, worthless semi-fluid.

Wild Rubber.—At first there were but three types of rubber to be found in the world's markets: India rubber, the product of the *Ficus elastica* from Assam, Burma and Java; gum elastic, the product of the *Hevea brasiliensis* from S. America, and "virgin gum" from the *Castilloa elastica* of Central America. In 1921 all grades from whatever source were termed India rubber, and there were some 200 sorts. They were divided generally as follows: (1) S. American rubber, from the *Hevea brasiliensis* and kindred species which comprised Pará rubber in 3 general grades and 20 sub-grades; Caerá rubber (Maniçoba) from the *Manihot glaziovii* and kindred species, 6 grades; Mangabeira from the *Hancornia speciosa*, 2 grades; and Caucho rubber from the *Castilloa ulei*, 3 grades. (2) Central American rubber, known as "centrals," the product of *Castilloa elastica* and kindred species, some 25 grades; virgin rubber, the product of the *Sapium tolimense* and kindred species, 3 grades; Guayule rubber, from the *Parthenium argentatum*, 12 grades. (3) African rubber, a lower grade of wild rubber, produced by a great variety of vines of the *Landolphia* genus and to a degree from trees, as the *Ficus vogelii* and the *Funtumia elastica*. The number of grades was 120. (4) E. Indian rubber, the product chiefly of the *Ficus elastica* from Rangoon, Penang and Java, 9 grades; together with Borneo rubber from the *Willoughbia firma*, 3 grades; Pontianak (Jelutong), from the *Dyera costulata*, 4 grades. (5) Plantation rubber. From 1860 attempts to cultivate rubber-bearing trees and vines have been undertaken in various parts of the tropical world. The most persistent and finally the most successful were carried on in the British experiment stations and Royal botanic gardens, especially in Ceylon and the Straits Settlements. A measure of success was attained in cultivating the *Manihot glaziovii*, the *Castilloa elastica*, the *Ficus elastica* and the *Funtumia elastica*. All of them proved to be good rubber-producers but could be tapped only at intervals of several months. The product found ready sale, and considerable plantations of *Manihot* in Ceylon, and *Ficus* and *Castilloa* in the Federated Malay States were installed. American interests also planted thousands of acres of *Castilloa* in Mexico, Nicaragua and Guatemala. Experiments with another tree, however, the *Hevea brasiliensis*, developed the fact that through what was termed "wound response" it could be tapped daily without injury. This process in brief was the opening of the tapping cut by the removal daily of a thin shaving of the bark. The amount from each tapping was small, but the year's product far exceeded that of the planted trees of any other sort. The result was that most of the others were abandoned or destroyed and the *Hevea brasiliensis* put in wherever it could possibly thrive. Thus the *Hevea* plantation product, which in 1900 was four tons, increased to 8,400 tons in 1910, and from then on the increase was very large, as shown in the table below.

Hevea Plantation Acreage and Production.

	Plantation Acreage	Plantation Production (tons)	Total Wild Rubber Production (tons)	Total World's Production (tons)
1910	1,122,550	8,200	62,300	70,500
1911	1,505,350	14,419	60,730	75,149
1912	1,817,350	28,518	70,410	98,928
1913	2,021,750	47,618	60,822	108,440
1914	2,181,050	71,000	49,000	120,380
1915	2,293,750	107,867	50,835	158,702
1916	2,458,950	152,650	48,948	201,598
1917	2,611,350	213,070	52,628	265,698
1918	2,759,950	255,950	40,629	296,579
1919	2,900,000	285,225	41,775	327,000
1920[1]	3,200,000	320,000	40,000	360,000

[1] Estimated.

Distribution of the World's Rubber Production (Gross Tons).

Country	1912	1913	1914	1915	1916	1917	1918	1919	1920
United States	45,928	46,400	61,240	96,792	116,495	177,088	142,772	236,977	235,000
Great Britain	14,500	18,640	18,000	15,072	26,760	25,983	30,104	42,520	56,572
France	10,000	6,500	5,000	10,770	14,000	17,000	18,000	22,000	14,500
Italy	1,000	2,000	4,000	6,500	9,000	9,000	9,800	14,000	7,000
Russia	9,000	9,000	11,610	10,000	7,500	7,500	2,000	1,500	300
Canada	1,500	1,600	1,700	4,500	4,000	6,281	8,300	9,500	11,000
Scandinavia	—	1,500	2,400	6,568	4,525	5,323	5,000	7,000	7,700
Japan and Australia	1,000	1,300	2,400	2,500	4,500	4,500	7,400	12,000	6,000
Germany and Austria	16,000	18,500	13,400	6,000	3,000	3,000	1,000	4,000	9,300
Belgium	—	3,000	630	—	—	—	—	5,000	3,500
Total	98,928	108,440	120,380	158,702	189,780	255,675	224,376	354,497	350,872

** These figures indicate the volume and page number of the previous article.*

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Approximate World Consumption of Rubber, 1920.

United States	260,000 tons
Great Britain and Colonies	50,000 "
France	20,000 "
Italy	10,000 "
Japan	8,000 "
Other Countries	16,000 "
Total	364,000 tons

Synthetic Rubber.—From the time when India rubber began to be important in the arts, its synthetic production was the dream of the inventor. Analysis of rubber with a view to ultimate synthesis was made between 1835 and 1840 by Dalton, Liebig, Himly, A. Bouchardat and Gregory. A more systematic attempt to isolate and examine the products in crude caoutchouc distillate was made in 1860 by Greville Williams, the English chemist. He obtained isoprene, C_5H_8, a hemiterpene, a fluid boiling at 37° C., and a hydrocarbon now known as dipentine, boiling at 170 to 173° C., which he named "heveene." An important step towards the production of artificial rubber was that taken by Gustave Bouchardat of the Paris School of Pharmacy in 1879, when, in studying the action of hydrochloric acid on isoprene, he noted the formation of a substance having the same percentage composition as isoprene, lacking chlorine, possessing elasticity, insoluble in alcohol but soluble in ether and carbon bisulphide like natural rubber, and yielding on distillation the same hydrocarbon as caoutchouc. Sir William Tilden, the English chemist, in 1882 observed the polymerization of isoprene and that it could be converted into true caoutchouc with certain chemical reagents. In 1884 he obtained isoprene by passing the vapours of turpentine through a hot tube. In 1887 Prof. Otto Wallach of the university of Göttingen noted that isoprene undergoes polymerization on exposure to light with the production of a rubber-like mass, and Tilden in 1892 showed that such material could be vulcanized with sulphur. The synthesis of isoprene and, as a consequence, that of caoutchouc, was accomplished in 1897 by Prof. Euler-Chelpin of the university of Stockholm. In 1909, due to the rapidly mounting cost of natural rubber, greater efforts were made to produce the artificial kind on a commercial scale, the problem being attacked in England by W. H. Perkin, his assistant Weizmann, and Francis Matthews; by August Fernbach in France; and in Germany by the Bayer and Badische companies. In 1884 Tilden suggested that not only isoprene but its homologues should be capable of similar polymerization. Now these bodies, chief among them butadiene, form the basis of methods for obtaining synthetic caoutchoucs. Dr. Fritz Hofmann and Dr. Carl Coutelle, chemists in Germany, in 1909 devised a process for making absolutely pure isoprene, converted it into rubber by heating it in a closed tube or in the presence of other substances, and sent the sample to Prof. C. D. Harries, of Kiel University, who pronounced it true rubber. In 1910 Prof. Harries showed that isoprene could be converted into rubber by heating it in a closed tube with glacial acetic acid. He had in 1905 determined the chemical constitution of natural rubber. The German scientists did not confine themselves to isoprene but experimented successfully with the homologous hydrocarbons suggested by Tilden. Harries and the English investigators, Matthews and E. Halford Strange, noted independently that polymerization proceeds at great velocity in the presence of metallic sodium and the resulting rubber differs much in its properties from that produced by mere heating. German chemists observed different results when polymerization by sodium was carried on in an atmosphere of carbonic acid. A later process in Germany was based on the use of ozonizers on sodium hydrogen peroxide as catalysers. Some of the synthetic rubbers are soluble, elastic, and may be readily vulcanized; others possess only some of these qualities. They are obtained from butanes, dimethylbutanes, and from isoprene, and in each of the three classes are to be found standard ozonide, carbonic acid and sodium rubbers.

Despite this wide range of materials with their possible use in the arts, the making of synthetic rubber is still a minor industry as compared with the production of natural rubber and the manufacture of goods therefrom. In the manufacture of the hydrocarbons of the isoprene series for synthetic rubber there are such large quantities of by-products that their removal or utilization presents a problem more difficult than the production of the artificial rubber; hence competition with natural rubber is very unlikely. Synthetic rubbers lack the durability of natural rubber, possibly because they lack the resins, albumen, etc., which act as protective colloids to lessen the vulnerability of the natural article. Then, too, for a wide range of needs, synthetic rubbers cannot be substituted for natural rubber because the latter product is a uniform vegetable substance, not a mixture like the artificial product. While synthetic rubber must be greeted as a chemical triumph, it is not an industrial success, and must still be classed commercially with the more or less haphazard production of alleged rubber substitutes prepared, often by honest inventors and manufacturers, from oils, gums, cellulose, or in fact anything that will produce a waterproof plastic.

Reclaimed Rubber.—In few other industries is conservation such an important factor as in rubber manufacture. Nearly all kinds of worn-out vulcanized goods are collected and the basic material recovered to be compounded, manufactured and vulcanized again into new articles that compare favourably with those made from new gum. To so many uses is devulcanized or reclaimed rubber now put, that its annual consumption fully equals that of new crude gum. Experiments early demonstrated the value of "reclaim," and while the more conservative long looked askance at the utilization of "refuse rubber," buyers of goods made wholly or in part from the regenerated material found that for most purposes the goods were practically as serviceable as those made directly from fresh gum. The element of cost, too, played an important part in popularizing reclaimed rubber, as articles made of it could be produced and sold for much less than those made with new gum only, and to a considerable degree the price of the crude gum has been kept from rising too high by the ample supply of the reclaimed. As the advantages of reclaimed rubber became better appreciated, and as through the activities of rubber chemists and manufacturers the quality of the product was improved, it became an important factor in the industry. To meet more satisfactorily the fast-growing demand, large companies with world-wide connexions and specialized equipment soon supplanted the small reclaimers. Such concerns employ not only the most modern machinery but also maintain research and analytic laboratories for control of the processes, for standardizing the products, and for the study of reclaiming and compounding problems.

The first attempt to reclaim rubber commercially was that made in the early 'fifties when Hiram L. Hall, the pioneer manufacturer in Massachusetts, boiled powdered vulcanized rubber in water and then sheeted it. Francis Baschnagel, an early American experimenter, next patented a method for devulcanizing rubber, finely ground, by exposing it to live steam. An important later development was the destruction of fibre in the ground material by means of acids, chiefly sulphuric, for which processes over 50 patents were granted, which incidentally became the subject of much litigation. The acid process was of use chiefly in the reclaiming of worn-out footwear or "dry heat" goods, but was not of great value in recovering other waste. The alkali process, patented by Arthur Hudson Marks, an American manufacturer, solved the latter problem. In this, caustic soda was used to destroy the fabric and incidentally it proved to be the most effective agent in desulphurizing the mass. The entire removal of not only the free sulphur from vulcanized rubber (which modern reclaiming accomplishes) but also of the sulphur which during curing unites chemically with the crude rubber, is the goal towards which experimenters were striving in 1921. Notable progress in this direction had been made in England by Dr. David Spence, who used an accelerator, aniline-potassium, but in solution in excess of aniline. He claimed not only the dissolution of the waste rubber but the liberation in soft rubber of from 78% to 90% of the combined sulphur, and the changing of the latter into an insoluble alkaline sulphide. In hard rubber 73% of the combined sulphur was said to be similarly reduced.

Vulcanization, or curing, is effected generally by either the heat cure or the cold cure. In the first-named method either steam or heated air is employed. A wide range of rubber goods, either in moulds wrapped with strips of cloth, or imbedded in pans of French talc to preserve their shape, is very efficiently cured with live steam in various types of vulcanizers. For many other needs the dry-heat cure, in which the goods are placed in a hot compartment without either wrapping or mould protection, has

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been found serviceable. Still another heat cure, now but little used, is that of solarization, whereby the fabrics, coated with a thin skin of rubber, are exposed to the sun's rays for vulcanization. In very exacting work, such as the vulcanizing of hard-rubber sheets, curing is effected by immersion of the material in hot water. In the cold cure either the acid or the vapour process is employed. In the former, goods are dipped in solution of chloride of sulphur dissolved in bisulphide of carbon, after which they are given an alkali wash. For the vapour cure, rubber goods are suspended in a heated compartment in which the fumes of chloride of sulphur pass freely over the surfaces to be vulcanized. Over-curing is checked by the admission of ammonia fumes.

Since Charles Goodyear (*see* 12.240) in 1839 discovered, and in 1844 patented, his process for vulcanizing rubber with sulphur by means of heat, numerous attempts have been made radically to improve on his method and material; but the bulk of the rubber goods produced is still cured by the sulphur and heat method. In the long train of experiments, many of which have led to important results, the curing of rubber has been effected by the use of sulphates, sulphides, chlorides, nitrates, fluorides, bromides, iodides and phosphorets of nearly all the common earths and metals, as well as chlorine, sulphurous acid and various gases. The Russian chemist Ivan Ostromislensky, in later experiments, succeeded in vulcanizing rubber with trinitrobenzene and other nitro-compounds so as to impart all the qualities given it by sulphur, effecting the curing more rapidly than with sulphur, and with but one-twelfth of the material, while a lower temperature was maintained during the cure. Victor Henry, a French chemist, also reported in 1909–10 that he had effected the vulcanization of thin layers of rubber solutions by means of the ultra-violet rays, and others have made similar researches along the same line that have much scientific if not practical interest. The period of vulcanizing ranges from a few minutes to many hours, depending on the degree of heat employed, the nature of the compound, the thickness of the goods, etc. Factors which affect the rate of cure, as shown in England by Dr. Philip Schidrowitz, are the amount of protein or nitrogen in the crude gum, its stay in storage, its density, the amount of smoke, formalin or other preservatives used, quantity of acid used in coagulating the latex, time in drying, age of latex-yielding tree, etc. An important vulcanization development is the chemical process of vulcanization described by S. J. Peachey, the English chemist, in 1918, after an investigation of the behaviour of rubber towards the various allotropic forms of sulphur. Unlike the Parkes process, which yields an addition-product of both sulphur and chlorine, this leads to the formation without the aid of heat of a sulphur addition equal to that produced by the hot-curing process. By it rubber, alone or compounded with fillers and pigments, is exposed successively to the action of two gases, sulphur dioxide and hydrogen sulphide. Diffusing through the rubber and interacting, the gases produce an especially active form of sulphur capable of combining with and vulcanizing the rubber at the ordinary temperature, and more thoroughly than by either the hot process or the sulphur-chloride cure. A density is acquired, it is said, unattainable by the older methods. The dual gas treatment can be used either for rubber in its original solid form or liquefied with a solvent. In the latter case the gases effect a complete pectization of the solution, forming a jelly which, on evaporating the solvent, is found to be fully vulcanized rubber. One of the advantages claimed is that fabrics, as well as organic fillers such as leather waste, sawdust, woodmeal, etc., that would be more or less decomposed by the hot cure or the sulphur-chloride cure, could be used with rubber for a wide variety of new and useful purposes, as in the making of fine or heavy reformed leathers, linoleums, etc. It may also effect a considerable improvement in the waterproofing of cloth. Rubber footwear, it is said, may be produced by the new process without either the heat or pressure hitherto deemed essential, and without special machines for stitching and riveting, thus greatly cheapening the product. An additional advantage pointed out is that this process makes it possible to use both natural and coal-tar colouring-matter in rubber, so as to obtain both deep shades and delicate tints impossible with the old methods of vulcanizing.

Organic Accelerators in Vulcanization.—The recent discoveries of Dr. Spence and others that certain organic substances, termed accelerators or catalysers, mixed with rubber, notably hastened the process of vulcanization, have caused a revolution in compounding and vulcanizing. Mineral or inorganic catalysers, such as litharge and magnesia, had been in use since the discovery of vulcanization. The organic type was, however, unknown until in attempts to vulcanize synthetic rubber it was found necessary to add organic accelerators to effect the union of sulphur and the rubber-like substance. It was but a short step to their use in connexion with natural rubber, and the results were surprising. In fact, the time required in vulcanization was reduced by one-half, thus doubling the vulcanizing output without extra heat or pressure. The theory of catalytic action, according to M. André Dubosc, an eminent French chemist, is explained as follows. He found that when a typical organic accelerator derived from an amine, such as hexamethylene tetramine, was mixed with sulphur, placed in a sealed tube, and heated to 135°–145° C., not only carbon sulphide or hydrosulphuric acid but also sulphocyanic acid was evolved. At the vulcanization temperature, sulphocyanic acid separated, yielding hexavalent sulphur and cyanhydric acid. While the same temperature was maintained, this acid combined in the presence of ordinary divalent sulphur, producing unstable sulphocyanic acid which by dissociation again furnished hexavalent sulphur. M. Dubosc holds that cyanhydric acid is the true active agent in such catalysis, the practical effect of which is the transformation of ordinary divalent sulphur into hexavalent sulphur. Assuming that vulcanization is the saturation by sulphur of a double bond in the rubber molecule, then by saturation of two such bonds the speed of the reaction between sulphur and rubber should be doubled, and by saturation of three bonds the speed would be tripled. Saturation is accomplished with hexavalent sulphur generated during vulcanization through catalysing action of cyanhydric acid, evidently the true accelerator, and corresponding to Dr. Spence's "active principle." While a single molecule of rubber reacting with ordinary divalent sulphur will saturate only one double bond, hexavalent sulphur in vulcanizing may saturate three double bonds belonging to rubber with which it is in contact and during its polymerization, which M. Dubosc explains thus: (1) In the case of an aggregate of rubber molecules, the end molecules, which have a double bond, will be broken and give a molecule of rubber of which the four valences will be saturated. The aggregate will have its polymerization increased by one molecule and its resistance to break will be modified in a slight degree only. (2) In the case of vulcanization with hexavalent sulphur, saturation of the terminal free valences of three physical aggregates of rubber will take place. Polymerization will therefore be three times as great as that produced with ordinary vulcanizations, because it acts on three aggregates instead of one. Resistance to break, dependent on polymerization, will therefore be much increased and its theoretical tripling has been demonstrated experimentally. This theory would appear to apply not only to the amino (NH_2) or imino (NH) groups, but also to the nitroso compounds discovered by Peachey. Nitroso bodies decompose during vulcanization and generate cyanic acid. The latter, influenced by sulphur, yields sulphurous anhydride and sulphocyanic acid. The acid dissociates and leaves hexavalent sulphur, and the liberated cyanhydric acid again functions as a catalyser.

The most important organic catalysers are: (1) Aniline, extensively employed to quicken the combining of rubber and sulphur in vulcanization, particularly in the manufacture of tires and tubes, and obtained through a series of chemical transformations from coal-tar. It is an oily liquid boiling at 184·8° C. Special precautions are taken to carry off its noxious fumes and prevent contact of the oil with the skin of the workers. (2) Carbon bisulphide with aniline, diphenylthiourea or thiocarbanilide, melting at 154° C., used for quick-curing stocks. (3) Carbon bisulphide with dimethylamine; effects vulcanization within 15 minutes at 135° C. (4) Carbon bisulphide with either dimethylaniline, tetrahydropyrrole or dimethyl X methyl trimethylene amine. (5) Ammonium borate; effective but not practicable. (6) Aldehyde ammonia; melts between 70 and 80° C.; a very useful catalyser. (7) Quarternary ammonium bases; patented, rapid accelerators with aldehyde ammonia, para-phenylene-diamine, sodium amide, bencylamine and naphthylenediamine. (8) Accelerene; widely used and powerful English catalyser. Used in one-third to one-half of 1% reduces vulcanizing period to one-third of normal, and with quick repair compounds to one-eighth. It owes its activity to the presence of the nitroso group and adds notably to tensile strength of goods. (9) Para-phenylene-diamine; a very poisonous catalyser melting at 140° C., and subliming at 267° C., used with synthetic rubber. (10) Tetramethylenediamine; a substance formed from decomposing animal matter such as fish; called also putrescin. (11) Hexamethylene-tetramine; known also as hexamethylenemine and formin; an accelerator largely used; caution is required in its use as it is not only very soluble in water but vaporizes freely, irritating the exposed skin of the workmen. (12) Piperidine or aminopentane; a liquid easily miscible in water, boiling

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at 105·7° C. and smelling like pepper and ammonia. A prototype of the more recently discovered organic catalysers, it was brought out in 1912 for use in making synthetic rubber, but was soon found to be of remarkable value for vulcanizing hard and soft natural rubber, cutting down the curing time three-fourths. (13) Methyl piperidine; an active catalyser boiling at 107° C. (14) Quinoline; a good accelerator, boiling at 240° C. and with a strong, disagreeable odour; little used. (15) Quinoline sulphate; a catalyser yielding good-looking, well-vulcanized rubber. (16) Hydroxy-quinoline; regarded as a valuable accelerator. It melts at 76° C., boils at 266·6° C., and is soluble in alcohol and volatile with steam. (17) Quinosol; a catalyser of special value to users of litharge, such as rubber-footwear manufacturers. It cuts the vulcanizing period one-half. (18) Oxiquinoline and oxiquinoline sulphonic acid; the latter gives good acceleration but porous rubber. (19) Oxiquinoline sulphide; a catalyser that can be used in practically every kind of vulcanizing; regarded by some as too rapid. (20) Anthraquinone; a catalyser used in batches containing rubber substitutes and cutting curing-time three-fourths. (21) Antipyrine and (22) naphthylamine; act like anthraquinone. (23) Urea formanilide, (24) thioformanilide and (25) guanidine are useful catalysers.

The Manufacture of Rubber Goods.—The manufacture of rubber goods begins with the tearing of the rubber into shreds, passing it between corrugated rolls and washing out the impurities. A stream of water flowing over the rolls carries off a large part of the dirt, while the rolls flatten the rubber into a thin sheet. The sheets require drying, after which they are ready for mixing with sulphur and other substances into what are called compounds. Compounding is done either on a machine called a masticator or in a mixing mill which kneads the mass until it is homogeneous. The rubber is next run into sheets, cut into various shapes, built up over forms and lastly baked or vulcanized. Hard rubber is handled in much the same manner except that after vulcanization it may be turned, shaped, buffed and polished. A list of the uses to which rubber is put would, if complete to-day, be only partial to-morrow. The main lines of its use may be briefly indicated as follows:—mechanical rubber goods; pneumatic and solid tires (*see* TIRES); moulded work; druggists' and stationers' sundries; dental and stamp rubbers; surface clothing; carriage cloth; mackintoshes and proofing; boots and shoes; insulated wire; hard rubber; cements; notions; plasters. Such a list, not of articles manufactured but of special lines, some of which include hundreds and even thousands of different articles, is sufficient to indicate the great variety of uses to which rubber is put.

In the period 1910–20 not only was progress shown in such chemical discoveries as catalysers but the mechanics of rubber manufacture was revolutionized. For example, for many years rubber, after being cleaned by washing, was dried in airy lofts, often hanging for a year to "age." With the growth of the business came hot dryers, bringing the drying-period down to weeks and sometimes days. Eventually the vacuum dryer came into use and a few hours sufficed to extract the moisture. More than 250 fillers and compounding materials are used in rubber manufacture. Their purpose is chiefly to enhance or supplement certain qualities in which rubber may be lacking. For example, powdered asbestos in quantity makes a compound that is heat-resisting, as in packings and brake linings. Most of the above materials have been known for years. The successful use of organic plastics such as glue is of recent accomplishment, as is the preparation of elaterite in plastic form, known as mineral rubber and largely used.

The Pressure Cure.—From the time of Goodyear, rubber footwear was vulcanized by the dry heat cure, that is, in closed rooms filled with hot air. This was very slow, entailing some seven hours of heating. Furthermore, only rubber containing a considerable amount of litharge could be used for this type of cure. The colour was always black, and variety in compounding and stocks was impossible. The discovery of the pressure cure by Augustus O. Bourn, of Providence, R.I., in 1901, however, practically revolutionized the business. In this process the goods were confined in large boiler-shaped shells. These were filled with hot air under pressure and the air from the inner surfaces removed by a vacuum process, the result being that vulcanization was hastened and a great variety of tough compounds, as for example those used in tire treads, were at once available. Rubber and fibre soles are coming in again, with a far better product. This is a compound of rubber and finely shredded cotton fibre. It is superior to leather in waterproof qualities and in wear. It finds a large market in medium-grade footwear but has not been accepted by makers of the best grades of leather shoes. To a large degree the rubber heel has also displaced leather in medium-grade footwear.

Balloon Compounds.—With the interest in pilot and dirigible balloons stimulated by the World War, came marked progress in rubber compounds used in their manufacture. Of these the most notable were cements of vastly increased tenacity; ingredients and surface coatings that remained unaffected by the sun's rays, and compounds practically impermeable to gases and inflation. As a successful application of the last-named may be cited the gas-proof masks evolved by rubber chemists, that effectually protect the wearer from poison gas and have a wide field of use in many of the perilous industries of peace. Bathing suits and bathing caps of rubber, beautiful in texture, colours and ornamentation, are recent accomplishments. This is due to the production by chemists of colours unaffected by heat and sulphur. Rubber fills a large place in sports, but most of the goods supplied have been familiar for decades. An exceptional and novel use is rubber thread in golf-ball manufacture. The standard ball was for years made of solid gutta. In 1898 Coburn Haskell of Cleveland, O., invented a golf ball with a small ball of rubber as a core around which was wound rubber thread under tension. Outside of this was moulded a thin cover of gutta percha. The ball because of its long flight soon took the place of the "gutty" and helped enormously to popularize golf.

Hard Rubber.—Electric batteries employed in motor cars for lighting and starting and for a host of commercial uses resulted in a great demand for hard-rubber battery jars. Formerly made by a slow hand process, the invention of building and moulding machines greatly added to the quality of the product and the ability to meet the trade demands. The production of hard-rubber bowling balls, better than the lignum vitae, and of aeroplane propellers, better than laminated wood, points the way to the use of hard-rubber lumber, as nearly all the fine hardwoods are successfully imitated.

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RÜCKER, SIR ARTHUR (1848–1915), English physicist, was born at Clapham Oct. 23 1848. Educated at Clapham grammar school and Brasenose College, Oxford, he became professor of mathematics and physics at the Yorkshire College, Leeds, in 1874 and professor of physics at the Royal College of Science in 1886. This post he held until 1901, when he became principal of the university of London. He received the Royal medal of the Royal Society in 1891, was one of its secretaries from 1896 to 1901, and was knighted in 1902. He died at Newbury, Berks, Nov. 1 1915.

RUFFEY, PIERRE XAVIER EMMANUEL (1851–), French general, was born at Dijon (Côte d'Or) on March 19 1851. He entered the École Polytechnique in 1871 and two years later was appointed *sous-lieutenant* in the artillery. He became a lieutenant in 1875 and a captain in 1878. In 1879 he went through the staff course at the École de Guerre, to which he later returned as professor of artillery. He was promoted major in 1891, lieutenant-colonel in 1897 and colonel in 1901. He served with the expedition to Madagascar, and in 1905 was made a general of brigade. In 1910 he was promoted general of division and in 1913 he was made a commander in the Legion of Honour. On the outbreak of war in Aug. 1914 he commanded the III. Army, but a month later, after the Longwy battles, he was removed from the command of his army, being succeeded by Sarrail. Thereafter he was not employed in an active command at the front, and in Jan. 1917, having already attained the age of retirement, he ceased to hold any appointment. General Ruffey, during the last years before the World War, had persistently advocated the increased employment of heavy artillery with the field army, and it was perhaps due to him more than to any other leading personality that the French Army was able to adapt itself so readily to the use of the new arm.

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RUMANIA (*see* 23.825).—Before 1913 Rumania had an area of about 50,702 sq. m.; and by the treaty of Bucharest (Aug. 7 1913) it received from Bulgaria an addition of 2,969 sq. m. in the Dobrudja, which formed the departments of Durostor and Caliacra. By the treaties following the World War, this area was more than doubled, the additions consisting of the Banat (11,009 sq. m.), Bessarabia (17,146 sq. m.), Bukovina (4,030 sq. m.), Crisana (8,038 sq. m.), Maramuresh (6,258 sq. m.) and Transylvania (22,312 sq. m.), making the total area of the kingdom 122,282 sq. miles. Thus during the period 1910–21 Rumania, from being slightly smaller than England, became somewhat larger than the whole British Isles. In shape Rumania is nearly circular, with a perimeter of about 1,850 miles. The Carpathians and Transylvanian Alps, which formerly separated Rumania from Austria-Hungary, run in a sickle-shaped curve from near Mt. Pietros to the Iron Gates, and almost down the centre of the country, which takes in the Transylvanian plateau and extends westwards into the Hungarian plain. Bessarabia forms a continuation of the plain of old Rumania. The territory corresponds roughly to the ancient Dacia, and the new Rumania constitutes a satisfactory ethnological unit, while its physical boundaries are, except in some parts, more defined by natural features than would appear from small-scale maps.

Population.—The Rumanian people form the great majority of the population, which was estimated in 1920 at 17½ millions, males being about 100,000 in excess. Apart from the alien elements of mediaeval or earlier origin many foreign stocks are represented in the territories which form new Rumania, and throughout the 19th century Jews driven from Poland penetrated far into the country, particularly into Moldavian towns. But no one of these heterogeneous elements numbers one-tenth of the population, and the very high rate of natural increase among the Rumanians, the common use of the Rumanian language and the wide toleration which prevails in matters of religion, all tend to unification.

The National Orthodox Church had in 1918 a membership of over 9½ millions, and the Greek Catholic, Roman Catholic and Protestant churches each nearly 1½ million. Jews numbered about 830,000, Mahommedans 44,000 and Armenians 17,000.

The chief towns are Bucharest, the capital (estimated pop. in 1919 400,000), Jassy (80,000), Galatz (60,000), Braila (60,000), Kolozsvar (60,000), Ploesci (50,000), Craiova (46,000). Kishinev, the capital of Bessarabia, has a pop. estimated at 125,000.

Government and Administration.—The Senate consisted in 1920 of 170 members, of whom 82 represented the old kingdom, 45 Transylvania, 24 Bessarabia and 19 Bukovina. The Chamber of Deputies had 347 members; old kingdom 168, Transylvania 112, Bessarabia 51 and Bukovina 16. The Constituent Assembly elected in May 1920 was charged with the adjustment of the constitutions of the old kingdom, Transylvania, Bessarabia and Bukovina. In the elections of June 1920 the returns of parties were:—People's party 215, Federal Democrats 34, Bessarabian Peasants 25, Transylvanian Nationalists 21, Socialists 19, Independent Democrats 6, others 12.

For administrative purposes Rumania is divided into 735 districts and 129 urban and 5,735 rural communes.

Education.—Education continued to make progress although a large proportion of the population was still illiterate and compulsory school attendance was difficult to enforce. There were in 1920 19,374 schools with 1,612,763 pupils. Universities were founded at Cluj (Kolozsvar) in 1919 and at Cernaŭti (Czernowitz) in 1920.

Finance.—The national debt of Rumania at the outbreak of the World War amounted to 2,086,008,329 lei. This increased during the war by 2,910,012,500 lei and subsequent increases brought the total to 11,148,408,330 lei as on April 1 1920, of which 3,986,008,330 was funded and 7,162,400,000 lei unfunded debt. To this was to be added about 10,000 million lei as Rumania's share in the national debts of the states added to her territory by the various treaties of peace, and at least 5,000 million lei required for the withdrawal of Austrian kronen and Russian rubles. The deficits of the war years were largely covered by a "National" loan (1916), a "Unirea" loan (1919) and Banque Nationale loans, and a loan against Treasury Bonds. The revenue and expenditure for the financial year 1919–20 were respectively 1,140 million lei and 4,127 million lei. About one-third of the revenue is obtained from indirect taxes and one-third from State monopolies and public services.

There were in 1919 notes of the National Bank of Rumania amounting to about 4,431 million lei, notes of the General Bank of Rumania (issued by the Germans) 2,172 million lei, more than 8,000 million Austrian kronen and about 1,000 million Russian rubles. When the krone and ruble are replaced by Rumanian notes the equivalent paper circulation may be taken at 11,500 million lei. The National Bank had in gold 315 million lei in Moscow, 80 million in Berlin and 98 million in the Bank of England: adding to this drafts and other interest-bearing resources abroad, the guarantee of the notes was nearly 34%, a high percentage compared with the notes of most banks of issue in other countries.

Agriculture.—Four-fifths of the population of Rumania are engaged in agriculture. About 40% of the land under cultivation consists of holdings under 25 ac. and 50% of farms of 250 ac. or more. Far-reaching measures of agrarian reform were begun in 1917, and large areas had in 1921 been expropriated and transferred to the peasants. Of the 34 million acres which made up Rumania after the Peace of Bucharest in 1913 (2 millions of which consisted of rivers or lakes) about 12½ million acres were under cereals; 500,000 under pulse, vegetables and various industrial plants; 400,000 were vineyards and orchards; pastures covered nearly 3 million acres and nearly 1½ million acres were meadowland. Wheat and maize are the principal crops, the former being produced chiefly for export and the latter for home consumption. Maize is the characteristic crop of the small holder in the hill regions, while most of the wheat is produced in the larger farms in the plains. The methods of agriculture are in many parts still very backward; by the development of irrigation in the plains and the abandonment of the fallow system, production could be largely increased. Table 1 shows the area under cultivation and the production (in tons) of the principal crops in the years 1914, 1915, 1919 and 1920.

TABLE 1.

Area and Production of the Principal Crops.

	1914		1915		1919		1920	
	Acres (thousand).	Tons (thousand).	Acres (thousand).	Tons (thousand).	Acres (thousand).	Tons (thousand).	Acres (thousand).	Tons (thousand).
Wheat . .	5,216	1,248	4,703	2,408	2,949	1,320	2,096	630
Maize . .	5,092	2,701	5,205	2,743	4,838	2,597	4,051	1,773
Oats . .	1,056	367	1,064	373	594	207	971	425
Barley . .	1,404	644	1,371	758	584	257	1,054	460
Rye . .	208	49	188	75	218	87	184	52

The cultivation of industrial plants is little developed. The vineyards produce in good years as much as 66 million gallons of wine. Plum trees take the place of the fig tree in Mediterranean countries. The tobacco and beetroot produced barely suffice for local needs.

The number of domestic animals was greatly reduced during the war: in 1920 it was estimated that in the new Rumania there were less than 5 million cattle and 11 million sheep. The breeding of horses was again becoming important, particularly in the Banat and the Nistru (Dniester) valley.

Forests.—Rumania has nearly 19 million acres of forest, of which 6¾ millions are in old Rumania, 5½ millions in Transylvania, 1¼ millions in Maramuresh and 1½ millions in the Banat. A great deal of timber is required locally for building and there is a considerable export from Piatra and Galatz, but the development of the immense timber reserves had only made a beginning before the war.

Minerals.—The useful minerals occur chiefly in the hill districts; petroleum is by far the most important. The production of petroleum amounted in 1914 to over 1¾ million tons, placing Rumania fourth in the list of the world's oil-fields. Oil has been chiefly obtained in the region between the Ialomitza and the Bistritza, the main wells being in the districts of Prahova, Dambovitsa, Buzeu and Bacau and especially in Prahova; but there are strong indications that the fields are much more extensive. A line of three pipes from the oil-fields to Constantza, carried over the Danube by the Cernavoda bridge, was completed shortly before the war. The wells and oil refineries were wrecked by a British mission in Oct. and Nov. 1916 to prevent their falling into enemy hands, but during the occupation they were largely restored and a new pipe-line was laid through Bucharest to Giurgevo on the Danube. The production was 517,500 tons in 1917, 1,214,000 tons in 1918, and 920,000 tons in 1919. Considerable importance is attached to discoveries of natural gas, of which it was estimated in 1920 that the annual available supply is 2,500 million cubic feet.

Salt, which is a Government monopoly, is mined at Targu Ocna, Ocnele Mari and Slanic.

About 4 million tons of lignite are produced annually, chiefly in the region between the Danbovitsa and the Ialomitsa. Small quantities of coal (less than 400,000 tons in all annually) are mined near Oravitza in the Banat. The exploitation of iron (400,000 tons annually), copper, lead and manganese has been begun. The gold mines in the Aranyos valley are the most productive in Europe.

Manufactures.—The development of manufactures in Rumania scarcely began before the 20th century. The chief industries are

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petroleum refining, sugar manufacture, flour milling and saw milling. Bucharest, Braila and Galatz are the most important centres. In 1915 there were 1,149 industrial establishments employing 58,871 workmen and having invested capital of 805,472,618 lei. It has been estimated that water-power amounting to 150,000 H.P. is available, but in 1912 less than 9,000 H.P. had been brought into use.

Imports and Exports.—The total imports and exports for the years 1911–5 and 1919 are given in Table 2.

TABLE 2.

	Imports and Exports (000's omitted).					
	1911	1912	1913	1914	1915	1919
	£	£	£	£	£	£
Imports . .	22,790	25,516	23,601	19,970	13,186	143,318
Exports . .	27,669	25,684	26,828	17,897	22,581	4,116

Before the war exports were chiefly to Belgium and Holland, and cereals formed the most important articles. In 1919 more than half the value of exports was made up by petroleum. Of imports in 1911 29% in quantity and 15% in value came from the United Kingdom, 25% and 24% respectively from Austria and 19% and 32% from Germany. The chief imports in 1919 were cereals and cereal by-products (220,149 tons; value 362 million lei) and manufactured articles. Exports to the United Kingdom were valued at £2,742,000 in 1919 and £3,227,000 in 1920, imports from the United Kingdom £5,585,085 in 1919 and £7,121,555 in 1920.

Communications.—Rumania had in 1913 2,586 m. of national roads, 3,066 m. of departmental roads, 22,000 m. of communal and village roads and about 7,000 m. of unmetalled tracks. The main roads are well constructed and maintained, but the communal and village roads are not well adapted for traffic and are often impassable at certain seasons.

By the Treaty of Versailles the Commission of the Danube is composed of representatives of France, Great Britain, Italy and Rumania alone. The Pruth, the only important waterway in Rumania besides the Danube, is navigable for ships of about 600 tons as far as Jassy. In 1919 Rumania had 158 merchant vessels aggregating 71,158 tons, including 17 steamers of 29,441 tons. The number of vessels entered at Rumanian ports in 1919 was 10,546, total tonnage 2,991,095 tons.

The railway system is inadequate. Four main lines of standard gauge radiate from Bucharest and a number of transverse lines cross the plains. The Carpathians are crossed at three points. There were 2,200 m. of line open in 1914 and 7,240 m. in 1920. The gauge of the Bessarabian railways differs from the others. Many new lines were in course of construction or were projected in 1921.

HISTORY, 1910–21

The Balkan War.—The war which broke out in the Balkan peninsula in 1911 as a consequence of the Italo-Turkish conflict and the Albanian risings demanded the anxious attention of the Rumanian government, now headed by J. Brătianu in place of Sturdza, whom ill-health had compelled to withdraw finally from political life. Rumania's official attitude towards the conflict of 1911 was strictly neutral, public sympathy being manifestly on the side of attacked Turkey. Towards the end of the year the Liberal ministry was obliged to resign. Rather surreptitious methods had been employed to pass a measure providing the church with a new constitution, which established a Supreme Consistory of the Protestant type, representatives of the priesthood sitting side by side with the bishops—this being the result of recent episcopal scandals of a private nature. The new convention with Austria-Hungary had sacrificed the vital interests of the Rumanian herdsmen of Transylvania, accustomed to feed their flocks and herds on the Rumanian slopes of the Carpathians and on the Wallachian plain. An endeavour had been made to regulate the internal distribution of petrol; and at the last moment the Minister of Finance, Costinescu, introduced a scheme for a progressive income tax, which was not adopted by the succeeding Liberal administration.

There were two candidates for the succession: on the one hand M. Take Jonescu, who, having left the Conservative party in consequence of a long-standing feud with the leader of its younger members, the rich landowner Nicolas Filipescu, had then formed a Conservative-Democratic party, which the longing of all classes for a new era had rendered remarkably successful at by-elections; on the other P. P. Carp, whom the death of G. Cantacuzène had placed at the head of the Conservative party. Promising a long programme of reforms, including an administrative transformation (the districts to be merged in "regions" of greater size administered by captains), it was the latter who obtained the King's call to office. Among his colleagues were T. Maiorescu, N. Filipescu, and one of the country's foremost writers and orators, the lawyer B. St. Delavorancea.

The new Government far from satisfied the hopes of the public. The Minister of the Interior, Alexander Marghiloman, long regarded by Carp as his future successor, was chiefly preoccupied with assuring his party, despite its unpopularity, of a majority at the polls. To this end no pains were spared. Directly Parliament met, a virulent campaign was opened against the Liberals, beginning with an attack on their new economic policy (inspired chiefly by Vintilă Brătianu, brother of the leader of the party), which aimed at combining the interests of private capital with those of communal and state capital in such great transport concerns as the electric tramways of Bucharest. The Liberal opposition, numerically small, left the Chamber, and combined with Take Jonescu in a furious campaign for the overthrow of the Government. At the same time J. J. Brătianu, influenced by the Socialists, and by a Bessarabian "Poporanist" (peasant party) who had gained a high position in the party, raised the long-abandoned question of universal suffrage, and definitely pledged himself to the considerably milder policy of a single electoral college, with, moreover, only literate electors—the intention seeming rather to be that of weakening the spirit of independence of the first and second electoral colleges, whose sympathies were tending towards new formations like the National Democrats. Efforts were made at the same time to retain the votes of the rural school-teachers.

The Carp Government did something to ameliorate conditions of life for the peasantry; and N. Filipescu strove to improve the army, which had received scant attention of late years. In the matter of the Rumanian ecclesiastical schism—a quarrel between the Bishop of Roman and the Metropolitan Primate Athanasius—both protagonists were persuaded to resign and quit the field.

It was at this moment that the Balkan Confederation went to war with Turkey, whose European possessions they intended to share among themselves. Not only had no support been sought from Rumania, but certain clauses provided for the event of war with both that country and Austria-Hungary. At the outset, in Nov. the Rumanian Government professed complete unconcern with what was happening beyond the Danube. The rapid successes of the allies, however, and above all the Bulgarian victories of Kirk Kilissé and Lule Burgas, opened the eyes of neutral spectators to the danger of a new imperialism in the Balkans. From Austria-Hungary came formal proposals of military collaboration, in order to prevent the victors from realizing the expected profits of their astounding success, and General Conrad von Hoetzendorff arrived at Bucharest, charged with this express mission.

But already the minds of a new generation, educated in the consciousness of a Rumanian moral unity which should necessarily produce practical results at the first great European upheaval, were totally opposed to the continuance of the policy inaugurated in 1884. After a visit from Francis Joseph himself to Bucharest in 1909, the Crown Prince Francis Ferdinand made his appearance at Sinaia, hoping to strengthen ties that were daily growing looser. The Hungarian Government, of which the Crown Prince pretended to disapprove, none the less pursued its denationalizing policy, imposing, with the full rigour of the Apponyi law, which monopolized nearly the whole of primary education with the study of Magyar, an examination in that official state language even on pupils belonging to Oriental religions or to the Greek church. The Emperor-King rejected the representations of the church of Sibiu on this subject. Political prosecutions, even of women, roused public feeling among the Rumanians of Transylvania. Efforts were made, under cover of seemingly democratic intentions, to turn against the Rumanians a project of Hungarian electoral reform then in preparation; and the electoral contests of June 1910 were of unusual brutality (*cf.* the present writer's pamphlets: *Les Hongrois et la nationalité roumaine en 1909* and *Les dernières élections en Hongrie et les Roumains*, Vălenii-de-Munte, 1909–10). The idea of Rumanians marching shoulder to shoulder with the soldiers of

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Hungary was received with almost general indignation (*cf.* the writer's pamphlet: *Les Roumains et le nouvel état de choses en Orient*, Vălenii-de-Munte, 1912). The necessity for a policy based on the existence of 13 million Rumanians, even though they inhabited three different countries, impressed public opinion more and more; and whatever may have been the Government's first intention, it began to realize its difficulties.

In the autumn the Bulgarian minister Danev, all-powerful at that moment, visited Rumania and offered to procure Bulgarian renunciation for ever of all claims to the Dobrudja—where, indeed, Bulgarians formed but a minority of the population—and also the modification of the frontier by flattening salient angles to the advantage of Rumania. His proposals were not accepted. "Compensation" was demanded for the huge territorial gains realized by the neighbouring state; and a formidable agitation for this broke out all over the country. M. Take Jonescu, with whom after the Court of Cassation's verdict in favour of the Tramway Co. an alliance had been made in a new ministerial grouping, with Maiorescu as president of Council, went to London to promote an arrangement, but was unsuccessful. The case was submitted to the Conference of St. Petersburg, which assigned Silistra to Rumania (April).

The mere delimitation of this territory raised many difficulties; and soon after the discussions between the Bulgarians and their allies, the question presented itself anew in different conditions. At that moment Carp, supported by Filipescu, was conducting a violent campaign against the Government, which had "lowered the dignity of Rumania," of which Silistra would even be "the tomb." The Government was called upon either to resign or to declare war on Bulgaria. Maiorescu obtained a parliamentary victory in the debate on the convention of St. Petersburg. But when the Serbians were treacherously attacked by the Bulgarians, and Bulgarian schemes for a Balkan hegemony became obvious, the idea of military intervention beyond the Danube had to be accepted. Russia, whose representative at Bucharest, Chehekov, manifested Rumanian sympathies, advised in that sense, Serbia just then enjoying the support of the Russian Cabinet. In June the Rumanian army, 500,000 strong, crossed the frontier, occupying on one side the Southern Dobrudja as far as Kavarna; and on the other side advancing in an irresistible rush upon Sofia by Vrasta and Orhanie. The exhausted Bulgarian soldiers deserted *en masse* and the Rumanians sent them back to their homes.

As the Rumanian troops, commanded by the Crown Prince, drew near the Bulgarian capital, the Tsar Ferdinand despatched a telegram to King Charles asking for peace. Negotiations were immediately begun at Bucharest between Rumanians, Serbians, Greeks and Bulgarians. Peace was concluded in August: as regards Rumania, she obtained the territory which she had already occupied in the Dobrudja; and, furthermore, her rights of protection over the Rumanians in Macedonia were recognized.

Question of Rumanians in Macedonia.—In that region, isolated from the national soil, all through the Middle Ages sturdy local Rumanian communities had persisted, with forms of autonomy respected by the Turkish Government. Besides the shepherds, whose flocks covered the plateaux of the Pindus (see Wace and Thomson, *The Nomads of the Balkans*, London, 1913), there was an industrious urban population of artizans and traders, who spread, moreover, into towns in other parts of the Balkan peninsula. Later the activity of these "Koutzovlaks" turned towards Austria, and their colonies advanced from Budapest, Vienna, and Trieste to London and even to Philadelphia. Meeting with the Rumanian intellectuals of Hungary they initiated a new national programme, and in 1830 revived the ancient relations with Bucharest. The Rumania of Charles I. not only welcomed them as brothers, but created, chiefly through the wise agency of their leader, the Apostal Mărgărit, a complete system of Rumanian education in Macedonia, including a *lycée* at Monastir, and a commercial school at Salonika. The Porte was persuaded to differentiate the Rumanian communities of that region from the Greeks of the patriarchal organization, and from the Bulgarians of the Exarchy residing at Constantinople. There lacked but one element, absolutely essential (granted the local conditions), namely the national bishop. He had been promised to the Rumanian faithful by the Treaty of Bucharest; but the clause had never been applied, as much through the Rumanian Government's own negligence as through the ill-will of the new Serbian and Greek masters of the situation.

Germany hailed Rumania's success as a means of retrieving through her ally that influence which the defeat of her *protégés* the Turks had caused her to lose in the East. As to Austria-Hungary, the imperial and royal minister at Bucharest, Prince Fürstenberg, presented a note from Count Berchtold in which the recently concluded treaty was referred to as a simple "preliminary arrangement." This conception was energetically rejected, and the scheme for a European congress to arrange Oriental affairs "definitely" was wrecked. But it did not prevent the Tsar Ferdinand from issuing to his army an order of the day in which, speaking of "spoliation," he indicated "better days of glory" as yet to come.

Rumania during the World War.—The World War was now brewing. In the month of June 1914, under the form of a pilgrimage to universities, Turkish intellectuals came to Rumania to make soundings with a view to reconcilation with Bulgaria. One month later Austria-Hungary declared war with Serbia, on the pretext of avenging the murder of the Crown Prince and his wife at Serajevo by a Serbian. The treaty with the Triple Alliance had only just been confirmed by the minister Maiorescu. His successor, the head of the Liberal party, who had come to power with a long programme of reforms—foremost among them an agrarian law based on the expropriation of the large landowners, and an electoral law establishing universal suffrage with the exclusion of illiterates—had never shown any intention of abandoning the foreign policy identified with King Charles' views and sympathies. Vienna felt assured that the Rumanian army, long prepared to that end, would march at her orders. The King's interview with the Tsar of Russia at Constantza, though it had caused a profound sensation in the country, raising hopes of a change of orientation, had produced no diplomatic results.

Public opinion was violently hostile to the Austrian adventure. During the Bulgarian campaign the soldiers had clamoured to be led to Transylvania; the King himself had witnessed their manifestations. In face of Italy's disclaimer of her obligations under the treaty, and England's declaration of war against the Central Powers, Charles I. and his advisers were forced to adopt the compromise of an armed neutrality, which the king hoped to break on the first opportunity.

When the German march on Paris failed, Rumanian politicians had to reconsider their position. M. Take Jonescu passed from the first idea of "loyal neutrality" to that of intervention on the side of the Allies, and in this he was supported especially by the combative energy of Filipescu. The latter did not shrink from dividing his own party, opposing Marghiloman, whose traditional Junimism favoured the Central Powers; and joining hands with his former rival, he effected a fusion with Take Jonescu. Meanwhile, popular demonstrations continued against Austria-Hungary and Germany, who by means of conventions were exploiting Rumania to feed the population of the German Empire, and whose subventioned Rumanian press was generally despised, despite the assistance given it by Carp and a few of his personal friends. At the "Lemberg moment" (the invasion of Galicia by the Russians), Filipescu had vehemently demanded rupture with Austria-Hungary.

In Sept. J. J. Brătianu succeeded in obtaining a declaration from the Allies (including the much-feared Russia) that in exchange for a benevolent neutrality Rumania should have the right to occupy those Austro-Hungarian territories which belonged to her by virtue of nationality. The sudden death on Oct. 10 of King Charles, to the last irreconcilable to a change of policy, facilitated the task of those who desired it. The sufferings of the Rumanians of Transylvania, induced to serve in the army of the Emperor-King by the lie that Rumania herself had embraced the same cause, and that her soldiers were fighting in

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Galicia, together with the humiliations imposed on their religious and political leaders, increased the indignation provoked from the first by the conduct of the Germans in Belgium and invaded France. Soon after the Russian retreat from the Bukovina, moreover, rumours began to spread about the man-hunts organized by Austrian gendarmes against Rumanian "traitors."

The head of the Government, knowing the inadequacy of the military preparation and the difficulty of completing it, thought best to delay yet longer. Meanwhile Count Czernin, Austro-Hungarian representative at Bucharest, spoke to the Crown Prince Ferdinand (married to Princess Marie of Edinburgh, whose sympathies were well known, and whose political attitude and charitable activities were equally admirable) about the "miserable treachery" of Rumania if she abandoned her allies (*Diplomatische Aktenstücke betreffend die Beziehungen Oesterreich-Ungarns zu Rumänien in der Zeit von 22 Juli 1914 bis 27 August 1916*, Vienna, 1916). The irresistible trend of public opinion was pointed out to him in reply. In Parliament discussion was forbidden on the burning question of relations with the belligerent powers. Troops concentrated in view of possible events were now partially demobilized. And on the side of Austria all that was done was to offer the Rumanians of Transylvania, through the Orthodox Archbishop, "a certain consideration for the wishes of our non-Magyar fellow-citizens relative to the church-schools," and "the admission of the maternal language in direct communication with the authorities," and "modifications of certain dispositions of the electoral law."

As Rumania refused to allow the passage of munitions for Turkey, whose capital was now menaced by the attack in the Bosporus, war on Serbia began anew in 1915. The Brătianu Government, which continued negotiations about the frontiers of the Bukovina, claiming to receive back the province precisely as Austria had taken it in 1775, and also about the frontiers of the Banat, where owing to Serbian colonization in the western districts there was no decisive preponderance of Germans and Rumanians, once more managed to hold public impatience in check. Henceforward, all the Central Powers could exact from Rumania was the passing of measures necessary for provisioning their populations. Italy's declaration of war in May 1915 served to raise still higher the popular excitement, which was now clamouring for a prompt decision in the only possible sense.

But when the offensive of General Brussilov once more reached Galicia and the Bukovina, further delay was impossible, especially as now, in the month of July, the treaty assuring Rumania of the desired territorial limits had just been signed. Russia became urgent: the Rumanian Cabinet was warned that delay would cause the cancelling of the territorial engagements. Certain illusions had been cherished with regard to Bulgaria, whose Prime Minister Radoslavov had formerly declared in Nov. 1894 that his country was "ready to give all the guarantees which should eventually be desired that she would not attack Rumania if the latter should take part in the general war." Now, however, Russia, who undertook to unite with the Rumanian forces when they entered Transylvania, and to march in concert upon Budapest, was asked to send into the Dobrudja troops sufficient to supervise the somewhat mistrusted neighbour who had participated with such zest in the annihilation of Serbia. Without having ever made one serious proposal, the German and Austrian ministers prepared to depart the moment Rumania's declaration of war arrived at Vienna (Aug. 28 1916).

As regards the internal political situation, the Liberal Government, which had achieved the entry into war unassociated with any of the opposition parties (for Maiorescu, summoned to the palace on the eve of the declaration, had fancied he was going to be called to power in order to prevent the rupture), did not even call the Chambers together to obtain their approval of the step. The armies were swiftly crossing the mountains by all the passes, to unite and form one single front upon a diagonal line in the middle of Transylvania. The enemy's feeble forces were everywhere retreating; but Germany had soon moved in her ally's interests, and had declared war. Bulgarians armed and led by German officers now surprised at Turtucaia a badly organized Rumanian army, forced it to capitulate, and advanced through unresisting Silistra into the Dobrudja, which despite General Averescu's sturdy defensive was soon the prey of Marshal Mackensen; while in Transylvania itself General Falkenhayn was striking a decisive blow near Sibiu-Hermannstadt.

For the Rumanians nothing was left but the tragic duty of defending, with utterly inadequate technical preparation, their Carpathian frontier. This defensive they succeeded in prolonging until the end of Nov., when, served by the spies of the Austro-Hungarian companies for the exploitation of the forests, and favoured by exceptionally mild weather, they penetrated the valley of the Jiu, and occupying Craiova proceeded towards Bucharest, whose fortifications, constructed against the Russians in 1880 by the Belgian General Brialmont, had no longer any military value. After brilliant initial success a stand was made on the Argesh by advice of the French General Berthelot, but ended in defeat. The army retreated in disorder towards Moldavia to reorganize there, sheltered behind Russian troops who had at last arrived on this new theatre of war; king, ministers, and parliament were already in the ancient Moldavian capital of Jassy, where they had to remain until the end of 1918.

A counter-offensive, carefully prepared during 1917, had already begun, and in July had opened the path through Wallachia, when the Russian defection in Galicia and the subsequent push by Mackensen, who threw all the forces at his disposal upon the Sereth for an advance upon Odessa, brought upon the new Rumanian army the great disaster of Marasesti —a battle lasting ten days and ending in complete inability for further resistance. As the disintegration of the Russian army proceeded, yesterday's allies turning into pillaging bands dangerous to the whole life of the country, hostilities were perforce suspended; and eventually it became necessary to submit to the armistice imposed by the Germans on General Shtcherbachev, who had assumed the chief command on the Rumanian front, passing over King Ferdinand's right to the supreme command. Rumania, nevertheless, parleyed yet another two months before entering into negotiations that could only mean the abandonment of her rights, the diminution of her pre-war territorial possessions, and the loss of her economic independence.

Agrarian and Electoral Reforms.—Ever since in Dec. 1916 the Parliament had met at Jassy and enthusiastically approved the prosecution of the war to a finish, Brătianu had shared the burden of power with Take Jonescu and his section of the Conservative party. (Filipescu had died at Bucharest before the *débâcle*.) The activities of the Coalition Ministry had naturally been limited to ordinary current affairs. But in April the agrarian question once more became urgent, owing in part to the reactions on the public mind of the triumph of the social revolution in Russia. (The chief of the Rumanian socialists, a Bulgarian named Rakovski, after having been kept for some time under arrest at Jassy, had managed to escape, and was now agitating with his followers against the king and the *bourgeoisie*.) Influenced by the Crown, the Conservatives at last accepted the radical policy of expropriation, to be applied to an area fixed at 2,000,000 hectares.

Parliament debated the project for two months, the result being a law promulgated in July 1917, which left the original proprietors 500 hectares at most for each separate estate (absentees being completely expropriated), and assigned them a compensation in State bonds, the amount not to exceed twenty times the annual value of the property. A scheme for the communal holding by village associations of the land thus obtained was rejected in favour of the traditional individual tenure. Details of the distribution were to be fixed by law; but now, under the menace of a German occupation even in Moldavia, members of parliament were dispersing. When the triumph of the Central Powers seemed certain, and the armistice foreshadowed an early peace, the leaders of the war-party were practically forced to flee the country. A number of them took refuge in Paris, where they formed a national Committee of Claims.

Reunion of Bessarabia; Peace of Bucharest; Expulsion of Occupying Forces.—Already, however, the depredation of the

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Russian Bolsheviks had obliged the Rumanians of Bessarabia to form a Moldavian Republic; the ancient Rumanian spirit had quickly awakened, thanks in part to a group of young writers who had never ceased to cultivate spiritual relations with free Rumania. An attempt to form a local army having failed, appeal was made to the Rumanian troops, who had moreover an interest in defending the stores of food in Bessarabia. The union of the Principalities was celebrated in Feb. 1919 at Chishinau, capital of the province, as well as at Jassy; and on April 9 the *Sfatul Țării* (Council of the country), formed on the model of all the other revolutionary assemblies of the former empire of the Tsars, was to proclaim the union of Bessarabia with the kingdom of Rumania. J. J. Brătianu had already resigned (Jan. 1918) in face of the equal impossibility of either organizing resistance or signing a treaty of abdication. General Averescu, charged with the negotiations because of his military prestige, went for this purpose to Buftea near Bucharest, and found in the capital a party of violent opponents of the war led by the Germanophils Carp and Stere. Count Czernin, irreconcilable in his attitude towards the Rumanians, rejected Germany's advice, brought him by von Kuhlmann, to concentrate solely on placing Rumania in a state of economic servitude, and proceeded to carve up in fantastic fashion the mountainous frontier of the kingdom; cutting off, moreover, the Dobrudja, whose future was to be settled between the Germans and the Bulgarians, Rumania being only left access to the sea under terms to be subsequently fixed. The Danube would become an artery for Austrian and German commerce, Vienna taking foothold at Severin, and Berlin at Giurgevo by means of "purchases" of wharves and sites on long leases. The entire export of the chief products of the country was assured to the Central Powers. Their army of occupation would have to remain for years to enforce the fulfillment of provisions, unexampled in severity, imposed on the country as expiation for its "crime."

This treaty was signed by the new Marghiloman Ministry, installed in office just after the arrival of a secret mission from the Emperor Charles acquiescing in the maintenance of the Rumanian dynasty. The king had been subjected to the extreme humiliation of having to go to a Moldavian railway station to meet Count Czernin, who had come there expressly to afford himself the satisfaction of that revenge.

The Marghiloman Ministry, whose chief certainly possessed statesmanlike qualities, struggled against insurmountable difficulties through months of unexampled suffering for the exploited and humiliated country. In the occupied territory everyone was snatching greedily at the remnants of national prosperity now in process of dispersal; the unlimited issue of paper money imposed on the country by the Austro-Germans through the Banque Générale presaged financial ruin; while economic ruin was ensured by the exportation of sheep and cattle, by the cutting down of forests, and by the dismantling of factories. The population, meanwhile, was starving, reduced to famine rations, and the morals of its working-class were being perverted by revolutionary propaganda. A Parliament elected under the pressure of enemy armies—a Parliament, moreover, composed of the worst elements of political life—often succeeded in disgusting even those who had desired to have it.

This state of things lasted until the battle-front of the Central Powers had been penetrated both on the Rhine and in the Balkans. The king then called to power General Coandă, an old soldier who had already had experience in diplomacy, together with General Grigorescu, to whom was due the chief credit for the victory of Marashti, as Minister of War. This Cabinet, without reference to Parliament, decreed a law for the expropriation of landowners, in accord with liberal ideas, and on the basis of the new constitutional text (the acts had been passed by the dissolved Marghiloman Parliament, the decisions of which had been declared null and void). But no sooner had the French troops commanded by General Berthelot arrived on the Danube, than the head of the Liberal party claimed, as initiator of a war due chiefly to pressure of public opinion, a change of Government in his favour. In a few days he entered Bucharest at the side of the king, to inaugurate an administration which only lasted one year.

Reunion of the Bukovina and of Transylvania.—The new Liberal Government had the extraordinarily difficult task of reuniting, in one political whole, provinces which had been under the domination of different alien states. Bessarabia was already incorporated in the ancient kingdom, having completely abandoned the idea of autonomy, which had at first been supported by her leaders, Inculetz, Pelivan, and Halipa. Before the King's departure from Jassy he had received a deputation which came to offer him the Bukovina with the delimitation of 1775. Menaced by a Bolshevist agitation begun at Czernowitz by demobilized soldiers, this province had in Nov. proclaimed its reunion with the mother-country, under the inspiration of the historian, Prof. Jean Nistor, and of Jean Flandon, formerly head of the National party and of the Rumanian Political Union (his rival, Aurèle, chief of the Democrats, had compromised himself by projects for a great Austria, to include Rumania). The German immigrants, the few Poles, and the Jews had given their assent; only the Ruthenians held aloof, planted out as they had been by Austria and sedulously represented by statistical artifices as being the principal nationality in the Bukovina.

In Transylvania during the war the Magyar administration had spared no pains to reduce the number and importance of the Rumanians, over 3,000,000 in numbers, and predominant especially in the rural districts. The prisons were filled with suspects; judicial murders were the order of the day; a measure was framed to expropriate in favour of alien immigrants the widows and children of soldiers killed in action. At Bucharest the Bessarabian C. Stere performed the deplorable rôle of editing a journal which advocated the candidature of the new Emperor-King Charles to the throne of Rumania (Prince Joachim of Prussia had also been suggested). Directly Vienna and Budapest repudiated the Habsburgs and their followers, as being responsible for the defeat, a great Rumanian assembly at Alba Iulia declared (Dec. 1918) that Transylvania henceforth formed part of the kingdom of the united Rumanians, but that they promised absolute national liberty to their Saxon and Magyar fellow-citizens. The Saxons gave their adhesion immediately; but the Magyar bishops, Catholic, Calvinist, and Unitarian, did not take the oath of allegiance to King Ferdinand till 1921. A Council of Direction, presided over by Jules Maniu, took the reins, established order, and gave new national forms to Transylvanian life. The greater number of non-Rumanian officials were retained; communes kept their accustomed privileges; Magyar and Saxon schools worked unmolested side by side with Rumanian institutions both old and new.

Latest Events: The Agrarian Question.—During the few months of Liberal Government the reunited country awaited in vain its definitive constitution. The reconstruction of the devastated districts had to be attended to, and difficult diplomatic negotiations had to be conducted that should result in the recognition by the Allies of the new frontiers. Those fixed by the treaty of 1916 were drawn back in places to give the Hungarians a part of the hinterland of Oradea-Mare (Nagy-Várad, Gross-Wardein), and the Serbians a good half of the Banat—they had pressed to be given also the town of Temesvar (Temişoara).

After the end of 1918 a Bolshevist Government had been in power at Budapest, Count Karolyi having resigned rather than acquiesce in the military convention which deprived Hungary of the provinces which she had conquered and held since the Middle Ages. This Government showed from the first its intention of serving the party of revenge, and of trying to restore the mediaeval kingdom. An armed attack on Rumanian territory by the greater part of the Red army led, in Aug. 1919, to a Rumanian counter-offensive, which—despite the interdiction of the Allies—arrived at Budapest in a few days; and there the Rumanians remained until the appointment of Admiral Horthy as regent. This was expected to promote the same policy of revenge by preparing the return of Charles of Habsburg.

The treaties of Versailles and of St. Germain recognized as Rumanian the territories which had belonged to the Dual Mon-

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archy. Austria quickly signed what regarded her; but Hungary resisted till 1921, and then expressed her ratification in terms which left no doubt as to the sentiments animating a large part of the nation. Nevertheless, Rumania now considered it right and safe to demobilize (April 1921).

The Brătianu Government had resigned in order to avoid signing a treaty which imposed on the kingdom a system of minority rights that they would have preferred to establish by their own legislation. As a matter of fact, by two successive measures full political rights had already been granted to the Jewish population, without distinction between old inhabitants and recent immigrants; so that this "question" had finally ceased to exist.

For the first time the elections were free, under supervision of the "Ministry of Generals" presided over by Arthur Vaitoianu. They resulted in a large majority for the Peasant party (whose chief was the rural school-teacher Jean Mihalachi) and the National Democrats; the Liberals now formed but a fifth part of the total number of deputies; the National party of Transylvania, the Peasant party of Bessarabia, and the National party of the Union of Bukovinians were united in their representation; a certain number of Socialists made their appearance in this first Parliament of united Rumania. The majority parties coalesced as a "*bloc parlementaire*," and in Nov. 1919 formed a democratic Government of advanced tendencies under presidency of the Transylvanian Alexander Vaida Voévod, who at once visited Paris and London and obtained the formal recognition of a Rumanian Bessarabia (this was confirmed by his successor at the Ministry of Foreign Affairs, Take Jonescu). Measures were elaborated for a definitive solution of the agrarian question (the Mihalachi scheme, leaving landowners only 100 hectares for each estate, but granting concessions to those who had farms and agricultural installations); for the reorganization of education and administration; and for remedying the shortage of housing accommodation (scheme of Dr. Lupu, Minister of the Interior). General Averescu, who in April 1917 had founded a "League of the People," demanding penalties against the abuses of the Liberals during the war, and who had developed this organization—which contained many Conservatives and some "new men"—into a party under his leadership, now came into power, thanks to the alarm aroused at Court and in society by the Bolshevist agitations. The Socialists had promised their support to the man of the moment; and soon after his advent to power (March 1920) General Averescu concluded a pact with Take Jonescu, though without admitting that statesman's "Democratic" party (entirely Conservative but for Marghiloman's "Progressists") to a share in the administration of the country.

There ensued a régime of relentless repression. The threat of a general strike provided an opportunity to try and to condemn by court-martial the leaders of the Communists, from whom the Social-Democrats had detached themselves under the leadership of the Bukovinian Grigorovici. During the elections opponents were roughly treated. Few attempts were made to check the growing corruption of the towns. Important projects of law were hung up: that concerning the distribution of land was modified until it resembled the Mihalachi scheme in regard to the quota to be expropriated (and for the remainder, simple decrees at once put in force had, as in other cases, anticipated parliamentary decision). In March 1921 the Finance Minister, Nicolas Titulescu, having reduced to order the chaos of the Treasury Bonds, introduced a bill heavily taxing new fortunes and capital in general, while relieving the peasants and the small urban proprietors. It was hoped by this means to stabilize the national finances, and to restore the Rumanian exchange, which had fallen as low as 18 centimes in Paris. (N. J.)

LITERATURE.—The revival of Rumanian literature dates back to about the middle of the 19th century, when, owing chiefly to the awakened interest in Percy's *Reliques*, the poet Alexandri published his collection of *Folk Poems*. This, together with the *Old Chronicles*, edited by Kogalniceanu, constituted a living monument of the vernacular. Their importance as an inspiring and stimulating power to the new writers was fully appreciated by Titu Maiorescu, who became the leading critical spirit in Rumanian letters. Under Maiorescu's influence a group of national writers gathered round the newly founded periodical *Convorbiri Literare*. Among them were J. Creangă, who in the *Recollections of Childhood* and other tales embodied the spirit of the Moldavian peasantry; Caragiale, who, besides a realistic drama and two volumes of short stories and sketches of unsurpassed craftsmanship, showed in his comedies *The Lost Letter* and *Stormy Night* the grotesque effect resulting from a hasty introduction of Western manners into a society still stamped with an Oriental character; and above all the poet Eminescu. The last-named, who has been compared with Leopardi, was dominated by a note of profound, penetrating, overwhelming sadness, which affected all his successors, not excepting Al. Vlahutza, a poet with a strong individuality of his own. But there is another side to Eminescu, his broad conception of the Rumanian race. It was this that impressed writers of the later generation such as Prof. Jorga, who, in his *History of Rumanian Literature*, arrived at a clearer understanding of what a national literature may be. In his own weekly, *Sămănătorul*, as well as in such other periodicals as *Convorbiri Literare* under the editorship of Prof. Mehedintzi, *Luceăfarul* and *Viata Românească*, was first published almost all the modern writing which reflects artistically the deeper characteristics of the Rumanian people. A corner of the humble life of Banat is described in Popovici-Banatzeanu's short story, *Out in the World;* the romantic Vlach population scattered throughout the mountainous parts of Macedonia, Epirus and Thessaly is represented in Marcu Beza's volume of short stories *On the Roads* and his novel *A Life;* Transylvania has produced the poets G. Cosbuc, Octavian Goga, and Stephen Josif. To the last-named, a Transylvanian of Vlach paternity, are due the best renderings into Rumanian of Shakespeare's *Midsummer Night's Dream* and Shelley's *To a Skylark*. Barbu Delavrancea has given to the theatre an historical trilogy. Victor Eftimiu's poetic excursion into fairyland, *String ye pearls!* is founded on a popular Rumanian folk tale. And among story-writers must be mentioned Bratescu-Voineshti, Duiliu Zamfirescu, and Michael Sadoveanu. A great loss to Rumanian literature was the untimely death of the poet Cerna, who in profundity ranked next to Eminescu. (M. B.*)

RUNCIMAN, WALTER (1870–), British politician, was born at South Shields Nov. 19 1870, the son of Sir Walter Runciman, 1st Bart., a Newcastle ship-owner. He was educated at Trinity College, Cambridge, and afterwards joined his father in his shipping business, being from 1896 to 1905 managing director of the Moor line of cargo steamers. In 1898 he unsuccessfully contested Gravesend in the Liberal interest, but was elected for Oldham in 1899, although he only held the seat for a year. In 1902 he stood successfully for Dewsbury, and retained this seat until 1916. In 1905 he entered Sir Henry Campbell-Bannerman's Government as parliamentary secretary to the Local Government Board. He became financial secretary to the Treasury in 1907, president of the Board of Education in 1908, and was president of the Board of Agriculture from 1911 to 1914. From 1912 to 1914 he was also Commissioner of Woods and Forests, and from 1914 to 1916 president of the Board of Trade. On the formation of Mr. Lloyd George's Ministry in 1916 he retired from the Government.

RUPPRECHT, Crown Prince of Bavaria (1869–), eldest son of King Louis III., was born May 18 1869 at Munich. In 1899 he visited India and in 1902–3 undertook a journey round the world, of which he gave some account in his *Reiseerinnerungen aus Ostasien* (1905). In 1906 he was appointed to the command of the I. Bavarian Army Corps. At the outbreak of the World War he was commander of the Bavarian troops (the VI. German Army) and led them to victory in the great battles fought in Lorraine (Aug. 20–22 1914). In the following Oct. he was placed in command on the German front in Artois and southern Flanders, and, after having been advanced to the rank of field-marshal, was entrusted in the spring of 1917 with the chief command of the Northern Group of Armies on the

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western front. Prince Rupprecht's first wife, a daughter of Duke Karl Theodor of Bavaria and sister of the Queen of the Belgians, died in 1912. In 1918 he was betrothed to Princess Charlotte, afterwards Grand Duchess of Luxemburg, but at the end of the war the betrothal was annulled. Prince Rupprecht renounced his claims to the Bavarian throne at the time of his father's abdication (Nov. 1918), and in 1919 he offered to stand his trial before a Court of Justice for State Affairs, if such a court, as had been contemplated, were instituted. In a letter written in 1917, but published only in 1921 in the press, Prince Rupprecht declared his disapproval of the foreign and military policy of Germany during the World War, and expressed the well-founded opinion that it was doubtful whether the Hohenzollern dynasty would survive the war.

It may be noted that through his mother, the Archduchess Maria-Thérèse of Austria-Este, Prince Rupprecht is the descendant of the Stuarts and might, therefore, pose as the "legitimist" claimant of the British Throne.

RUSSELL, BERTRAND ARTHUR WILLIAM (1872–), English mathematician and philosopher, second son of Viscount Amberley and grandson of the 1st Earl Russell, was born at Chepstow May 18 1872. Educated at Trinity College, Cambridge, where he took a first-class both in the mathematical tripos and in the 2nd part of the moral sciences tripos, he remained at Cambridge as a lecturer, and became well known as a student of mathematical philosophy and a leading exponent of the views of the newer school of Realists. In June 1916, Mr. Russell, who had taken a strong line against the Government, and was a "conscientious objector," throughout the World War, was fined £100 and £10 costs for making statements calculated to prejudice recruiting, and, in consequence, Trinity College, Cambridge, deprived him of his lectureship. His chief published works, on which his philosophical reputation was based up to the outbreak of the World War, were *German Social Democracy* (1896); *Essay on the Foundations of Geometry* (1897); *Principles of Mathematics* (1903); *Principia Mathematica* (with A. N. Whitehead, 1910) and *Our Knowledge of the External World* (1914). Later he published *Principles of Social Reconstruction* (1917); *Mysticism and Logic* (1918); *The Analysis of Mind* (1920) and (after a visit to Russia) *The Theory and Practice of Bolshevism* (1920).

RUSSELL, GEORGE WILLIAM (1867–), Irish writer and painter (best known under his sobriquet of "Æ"), was born in Lurgan, co. Armagh, Ireland, April 10 1867, the second son of Thomas Elias Russell. He went to Dublin with his parents in 1874, and was educated at Rathmines school. After some years spent in an accountant's office in Dublin he joined the Irish Agricultural Organization Society in 1897 and became an organizer of agricultural societies. In 1904 he became editor of the *Irish Homestead*, the organ of the agricultural coöperative movement in Ireland, a position he still held in 1921. He published his first book of verse, *Homeward: Songs by the Way*, in 1894. His second, *The Earth Breath*, was published in 1897. *Literary Ideals in Ireland*, some essays in collaboration with W. B. Yeats, W. Larminie and John Eglinton, appeared in 1899; and *Ideals in Ireland*, essays in collaboration with W. B. Yeats, Douglas Hyde, Standish O'Grady, D. P. Moran and Lady Gregory, appeared in 1901. *The Nuts of Knowledge*, a book of selections of his lyrics, was hand-printed in 1903. *The Divine Vision*, his third book of verse, appeared in 1904; *The Mask of Apollo*, a book of mystical tales, appeared in the same year; *New Poems* (edited, 1904); a hand-printed selection of his verse *By Still Waters* (1906); some *Irish Essays* (1906). *Deirdre*, a play in three acts, was published in 1907. *The Hero in Man*, an imaginative musing on the character of the soul, appeared in 1909; *The Renewal of Youth*, a similar meditation, in 1911. *Coöperation and Nationality* and *The Rural Community*, two pamphlets embodying coöperative ideals, were published respectively in 1912 and 1913. *Collected Poems* appeared in 1913, and *Gods of War* and other poems, privately printed, in 1915. *Imaginations and Reveries*, a book of prose essays, was published in 1915; *The National Being: Some Thoughts on an Irish Polity* in 1917; *The Candle of Vision*, prose, in 1919. He was a member of the Irish Convention called in 1917, and his *Thoughts for a Convention*, now embodied in the 1921 edition of *Imaginations and Reveries*, appeared that year. As well as those mentioned, he published from time to time pamphlets on various social and political subjects.

As a poet he ranks among the mystics, in the sense that his verse is dominated by a spiritual conception of the universe. Of the two great poets brought to light by the Irish literary revival, W. B. Yeats and "Æ," it might be said of Yeats that he coined for the world the treasure recovered by the renewed access to Gaelic sources into what was virtually a new language in poetry, and of "Æ" that he brought into Irish literature the ancient spiritual thought of the world. His gifts as a poet are reinforced by the vision of an artist, and though in verse he attained his highest expression, his paintings convey a vision of nature as intimate and delicate as in his verse.

He embodied his ideals for the coöperative movement and his thoughts for an Irish polity in *The National Being*. In this book coöperative ideals are used, in a fashion entirely novel, for the creation of a society which would be easily malleable to human impulse and yet stable. The foundations of his state do not begin in a legislature but in the parishes of the country, the social order taking precedence of the political order. He exhibits a general dread of the highly organized state, a dread which may be to some extent an Irish characteristic, and would make the pillars of his nation innumerable coöperative societies, each with the largest freedom for economic and social development, but federated together for enterprises which are too extensive for operation by a small community alone. He would like these communities to do many things which in other countries State departments are asked by socialists to undertake. His ideas on these matters had considerable effect upon the younger generation of Irishmen as well as upon the coöperative agricultural movement in Ireland, founded by Sir Horace Plunkett, and in which "Æ" had worked so many years. His *Candle of Vision* is a record of a personal psychological experience expressed in a luminous and distinguished prose. His economic writings in *The Irish Homestead* and elsewhere, his imaginative prose writings, his verse and his painting, exhibit a unity and harmony rare in one whose modes of expression are so diverse. This probably arises because all are inspired by a conception of God and man and Nature as one single yet multitudinous being, and out of this philosophical root comes the harmony of character maintained throughout in work in such varied spheres as painting, poetry, psychology, economics and politics. (S. L. M.)

RUSSELL, ISRAEL COOK (1852–1906), American geologist (*see* 23.862), died at Ann Arbor, Mich., May 1 1906.

RUSSELL, SIR THOMAS WALLACE, 1ST BART. (1841–1920), Irish politician, was born at Cupar, Fife, Feb. 28 1841. At the age of eighteen he went to Ireland and settled at Donaghmore, co. Tyrone, working as an assistant in a drapery shop. In 1864 he became secretary and parliamentary agent of the Irish temperance movement, and became well known as a speaker for that cause; it was largely due to his energy that the Irish Sunday Closing Act was passed in 1878. In 1885 he unsuccessfully contested Preston as a Liberal, but in the following year was elected to Parliament for S. Tyrone. The Home Rule controversy was then at its height, and Russell was one of the most determined opponents of Gladstone's measure. His valuable work for the Unionist cause led in 1895 to his appointment as parliamentary secretary to the Local Government Board, a post he held until the general election of 1900. About 1899, however, Russell's views underwent a change, and from this time he not only gave up his advocacy of the Unionist policy in Ireland, but became its unceasing and rather bitter critic. His book *Ireland and the Empire* (1901) was largely an attack on the Irish agrarian system, and he also expressed in it his distaste for the Ulster point of view in no measured terms. He became in 1902–3 a member of the Dublin Land Conference, presided over by Lord Dunraven, which ultimately led to the passing of Mr. George Wyndham's Land Purchase Act (1903). In 1907

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Russell succeeded Sir Horace Plunkett as vice-president of the Irish Department of Agriculture and Technical Instruction. In 1910 he withdrew from the representation of S. Tyrone, but in the following year was elected for N. Tyrone as a Liberal and Home Ruler. He received a baronetcy in 1917 and retired from public life in 1918. He died at Terenure, co. Dublin, May 3 1920.

RUSSELL, WILLIAM CLARK (1844–1911), English author (*see* 23.865), died at Bath Nov. 8 1911.

RUSSIA (*see* 23.869).—The history of Russia in the years 1910–21 was dominated by the revolution. The connexion between the World War of 1914–8 and that crisis is evident, but even the years preceding the outbreak of the war, both at home and abroad, must be considered chiefly as leading up to the catastrophe. The decay of the bureaucratic system of government, the entanglements of the foreign policy of the empire, the spread of extreme theories among the educated classes, the misery and discontent of the common people, were manifested by striking symptoms both on great occasions and in everyday life.

The Last Years of Tsardom.—The transition from an autocratic to a constitutional régime is a difficult problem to solve under any circumstances, and it was rendered especially difficult in Russia by the lack of political education among the people, the doctrinaire fanaticism of the intellectual leaders and the short-sighted egotism of the Government. Instead of realizing the necessity of working together and supporting one another in order to avoid a revolutionary catastrophe, the traditional rulers and the reformers were intent on destroying each other. The First Duma had ended its days in a vain attempt to appeal to the country against the Imperial Government. In the face of terroristic attacks bureaucratic circles invited the support of enlightened public opinion, but they did it in a characteristic fashion. General Trepov conducted negotiations with a view to forming a Cadet Ministry, but competent observers were convinced that his ultimate object in applying to the advanced doctrinaires was to effect an unworkable coalition which would have to be given up after a short interval in favour of a military dictatorship (Isvolsky, *Memoirs*, 201F).

The Stolypin Ministry, which was actually formed in 1906, started also with a programme of coöperation between the Government and "leaders of public opinion," and it sought an agreement with the more moderate sections of Liberals, especially with the Octobrists, the supporters of a policy aiming at putting into practice the Manifesto of Oct. 30. The failure of this attempt is a fact of historical importance in so far as it showed conclusively how irreconcilable the tendencies of the Imperial bureaucracy were with the programme of Moderate Liberalism. Our survey of the period must start with a brief account of Stolypin's policy, as its failure led directly to the events of the revolution which put an end to the monarchy of the Romanovs.

Stolypin's Policy.—The protagonist of the drama in 1906–10, P. A. Stolypin, was as fine a representative of Old Russia as the governing class of the time could muster—not a great statesman nor an original thinker, but a high-minded, patriotic country gentleman endowed with the traditional courage of his class, with practical experience in Zemstvo work and provincial administration, accessible to ideas of reform, but constitutionally adverse to radical theories. When Minister of the Interior in Goremykin's Ministry he had taken part in negotiations with the "leaders of public opinion," even with Cadets like Muromtsev and Milyukov; on assuming the premiership he tried to introduce into his Cabinet Liberals like Count Heyden, A. Guchkov, N. Lvov, but he did not insist on this combination and eventually formed his Ministry on bureaucratic lines, while relying on the support of the Moderates in the Duma.

The sanguinary repression of revolutionary attempts and of agrarian revolts was taken in hand with ruthless energy, and it succeeded in driving discontent underground and in reëstablishing external order, but it cast its shadow on the constructive work of Stolypin's statesmanship. After the clash with the intractable Second Duma the electoral system was altered by the Manifesto of June 3 1907.

This *coup d'état* secured to the Government a numerical majority in the Third and in the Fourth Dumas, while at the same time it weakened the moral authority of these Assemblies and made the Moderates more susceptible to the appeals of the Lefts.

Some of the points of the complicated electoral system introduced by the Manifesto of June 3 1907 may be mentioned. The deputies were chosen by provincial electoral colleges, only the principal landowners and capitalists had the right to vote personally in these colleges, while other citizens had to exercise their right through representatives chosen at preliminary meetings. The direct franchise was conceded to persons holding land in varying quantities in the different provinces, roughly from 150 dessiatines (about 400 ac.) to 600 dess. (about 1,600 ac.), or town property of the value of 15,000 rubles (about £1,500). The preliminary assemblies were constituted separately for smaller landowners, smaller householders in the towns, the clergy, factory and workshop workmen and peasants. Electors belonging to different nationalities could be divided into separate electoral groups by ministerial decree. The elections in Petrograd, Moscow, Kiev and Odessa were to be carried out by direct suffrage.

Stolypin's counter-offensive against the revolutionary movement could not be restricted to measures of police and emergency legislation: it made itself felt in the intellectual domain.

In spite of the outward pacification of the country there was no real settlement, and the flames of political passion burst out occasionally with ominous violence. The close of 1910 was marked by an increased agitation among the students—the most sensitive and audacious element of Russian society. Harrowing tales of flogging and tortures practised on political convicts in the prisons of the North and of Siberia had reached the educational centres, and a series of strikes and indignation meetings began in all the various high schools of the empire. The professors and academic authorities did all they could to put an end to these disturbances and to ensure the continuation of teaching, and the majority of the undergraduates supported them in this respect. The reactionary bureaucrats, however, with M. Kasso, the Minister of Public Instruction, at their head, decided to use these sad occurrences in order to overthrow the self-government of the universities, conceded to these institutions by the Imperial *ukaz* of Aug. 27 1905, and to curb the rebellious spirit of the students by stern centralization. Towards the end of the Christmas vacation M. Kasso and the Council of Ministers issued decrees ordering the establishment of a strict régime of official inspection, the closing of students' unions and societies with the exception of the scientific ones, and, eventually, the direct interference of the police for the maintenance of order within the universities and high schools. As a protest against these measures, strikes and obstructions broke out again in all the establishments for higher education; lectures had to be delivered in the presence of police officers, armed constables occupied the halls and corridors of academic buildings, and wholesale arrests and deportations of undergraduates took place. In Moscow the Rector (Prof. Maniulov) and his assistants declared that they could not assume responsibility for the carrying into effect of the ministerial measures, and resigned their offices, when thereupon they were deprived of their chairs; 63 professors and lecturers tendered their resignations as a mark of sympathy with their dismissed comrades. This did not disturb the minister in the least, and he promptly accepted most of the resignations, although this involved the intellectual ruin of the oldest and most famous university of Russia. The "Pride's Purge" in Moscow was followed by a number of dismissals in other educational establishments; it was obvious that some of these repressive measures had been prompted by feelings of jealousy and revenge on the part of the minister.

The unsparing scourging of the academic corporations produced the desired effect of outward submission, but it brought the feelings of hatred and humiliation among the intellectuals to the highest pitch, and the outcasts and convicts of the university "Stories" afterwards formed the principal contingent among the embittered intellectual leaders of the revolution.

Another sign of the times may be discerned in Stolypin's legislation in respect of the Zemstvos of the western provinces (Kiev, Volhynia, Podolia, Mogilev, Minsk and Vitebsk). The introduction of a measure of local self-government would have

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been in itself a boon to the population of these provinces, but Stolypin made it an occasion for a renewed humiliation of the non-Russian nationalities, strongly represented in these districts. The project of the Government disfranchised the numerous Jewish population, and drove the Poles into a position of inferiority by dividing the electorate according to national colleges and establishing beforehand the preponderance of the Russian colleges by means of an artificial scheme of repartition. The unfairness and political short-sightedness of these restrictions provoked a strong opposition even in the docile Third Duma.

In the Council of the Empire a coalition between the Rights and the Lefts led to the rejection of the bill. Stolypin did not submit in the face of such an assertion of independence. He prorogued the Duma for three days (May 14–17), and in the interval obtained an Imperial decree promulgating the law as an emergency measure on the strength of Art. 87 of the Organic Laws. In consequence of this snub administered to the Legislative Assemblies, the Octobrist Centre could no longer support the Government; the leader of the Octobrists, A. Guchkov, resigned the presidentship of the Duma, and votes of censure on the Government were passed in both Houses on the resumption of their sittings. Stolypin's position was made untenable by these events. His victories meant in truth the breakdown of his programme. The Premier had again to rely exclusively on the goodwill of the autocratic Tsar as against independent public opinion, and he had to strive for that goodwill in the enervating and treacherous surroundings of Court intrigue, in which obsequious chamberlains were more expert than himself. The consciousness of failure was clearly expressed in Stolypin's behaviour after the smashing of the universities and the snubbing of the Legislative Assemblies. He looked worn in July 1911, and alluded repeatedly to his approaching resignation (Prof. Pares, in the *Russian Review*, 1912).

The *coup de grâce* came from the midst of the secret police, that had become the mainstay of the Imperial system in its struggle against rebellion. One of the agents of this organization, Bogrov, inflicted a mortal wound on Stolypin at a gala performance in the Kiev Opera House on Sept. 14 1911. The hatred of oppressed nationalities and of the humiliated intellectual class had armed the hand of the assassin, a well-educated Jew.

One part of Stolypin's activity calls for special examination, his land reform, which may be considered as the immediate introduction to the social revolution of 1917.

Defects of the Emancipation.—The agrarian revolts of 1905 attracted the attention of the Government and of society to the deplorable condition of the most numerous and important social class, the peasantry. The causes of the growing impoverishment of the peasantry are to be sought primarily in the manner in which the emancipation of 1861 had been carried out. The Emancipation Act of Feb. 19 1861, liberating the peasants from personal serfdom and giving them part of the land on certain conditions, was meant at the same time to achieve two other purposes: it tried to secure the necessary number of workmen for the landowners, who had lost the gratuitous labour of their serfs, and to ensure the collection of taxes and redemption payments. Each peasant received at the emancipation a certain quantity of land from the landowner; he had to pay for it a redemption price, the amount of which was fixed by the Government: the payments had to be completed in 45 years. The plot of land which the peasants got as their share on the transaction was called the holding (*nadël*): its size varied greatly in different provinces. "Large" holdings ranged between $2\frac{3}{4}$ (about 8 ac.) and 12 dess. (33 ac.), while minimum holdings corresponded to one-half of the maximum ones. The landowner's share comprised, besides his domain land, from one-third to one-half of the land formerly occupied by the peasants, on the condition that the latter should receive no less than the minimum holding. Besides these two principal types of holdings the Emancipation Act of 1861 established also the "beggarly" or "gratuitous" holding, which was to be no less than one-quarter of the maximum one. The gratuitous holding was established by free agreement between the peasants and the landowner; in this case the peasants had to pay no redemption, while the landowner kept all the rest of his land. On the whole the quantity of land held by the peasants had been much reduced.

The following figures for the province of Saratoff may serve as an illustration:—

Peasants who held	before 1861	after the emancipation
More than the "large" holding .	48·1	5·8 per cent
From $\frac{1}{4}$ to 1 of " " " .	35·8	4·8 " "
Less than $\frac{1}{4}$ of " " " .	16·1	52·2 " "

In 1861 688,826 peasants received beggarly holdings; they held 502,383 dessiatines. In 35 provinces 921,826 souls[1] were assigned one-half of the large holding each and held 1,530,000, or less than 2 dessiatines per soul.

The peasants' landholdings, which were already whittled down at the time of the Emancipation, were further reduced after it by the increase of the population. A Commission for the investigation of the conditions and needs of the peasantry described the diminution of the peasants' holdings in the following manner: in 1860, 4·8% decrease on the average; in 1880, 3·5 decrease and in 1900 2·6 decrease. Besides a portion of the arable land, the peasant lost at the Emancipation the right of using the landowner's pasturage, of cutting wood in his forest, and some other subsidiary rights important in peasant farming.

The redemption payments were a heavy charge on the peasant's budget. The Agricultural Commission of 1872 found that squires had to spend on taxes less than 14·5 kopeks per dess., while the peasants paid more than 95·5 k. per dess. In addition the peasants had to pay the poll-tax, the amount of which was about 4r. 45k. per soul. The same Commission states that in 37 provinces the taxes and redemption payments of the former state and appanage peasants comprised 92·75% of their net income from land, the payments of former unfree peasants 198·25 per cent. Professor Yanson calculated that in the province of Novgorod the taxation of peasants who got small holdings was, in relation to the net income of their land, 275% in the case of the peasants who owned their land, and 565% in the case of those who had to pay the land redemption. This means that the peasants had to find other sources of revenue in order to satisfy the collectors of the land tax. The Government made some attempts to relieve the peasants' tax load. The salt tax was abolished in 1880, the poll-tax in 1882. But these measures could certainly not solve the financial difficulties of the peasantry. Arrears grew rapidly to enormous proportions.

The following figures show the growth of arrears from redemption payments in the province of Tambov:—

1871–5	3%
1876–80	5%
1881–5	16%
1886–90	35%
1891–5	124%
1896	151%
1897	205%
1898	244%

Driven by land hunger, the peasants farmed on lease a large part of the State's appanages and of squires' land, but this expedient cannot be considered as an effective help in the solution of the land problem. The rent paid by the peasants to the landowners was usually very high. It is important to notice that certain plots of land, the use and possession of which was an essential necessity for the whole community, for example strips bordering on watercourses, remained usually after the Emancipation in the hand of the landowner. This gave him the power to require exorbitant rent for such land and keep the peasants in permanent fear of losing these grounds, without which village life was practically impossible. This led to continual collisions. Under such conditions the backward and extensive methods of peasant cultivation proved very difficult to reform.

One of the most important defects of the peasant's landholding before the land settlement of Stolypin was the intermixture of strips in the open fields. The land of a community lay only seldom in a compact block. It was usually divided into a number

[1] Persons doing the normal work of a villager.

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of smaller "shots" sometimes mixed up with lands of other villages and landowners. The blocks of land belonging to the same community were again subdivided into strips, which were sometimes 2 to 3 yd. broad and some hundred yards long. Each household held a certain number of strips 20–30–50, sometimes even 100–150. The strips were scattered at a great distance from the farmyard, and the driving to them entailed a considerable waste of time and work: this hampered greatly the farming arrangements of the villagers. A peasant of the province of Novgorod calculated that he and his horse had to make about 1,548 versts (a verst is about ¾ mile) every summer merely to go to and from his field situated at a distance of 3 versts from his farmyard. But some strips lay at a distance of 15–20 v. and even more. The intermixture of strips separated from each other only by narrow balks obliged the whole community to follow the same system of cultivation, which was usually the three-fields one. The very large extent of fallow land, the poor manure produced by weak, badly fed cattle, the carelessness of the holders who were not sure of keeping their land permanently—all this had the most ruinous effect on the peasants' farming. Under such conditions, hampering individual energy and initiative, the production on the peasants' holdings was very low indeed. The average value of the gross produce in 27 provinces[1] of one dessiatine of peasants' land was 8r. 99k., while the average cost of production per dess. was 5r. 22k.; so that the net produce per dess. amounted only to 3r. 77k. The productiveness of the squires' estate was 12–18% higher than that of the peasants, but if we take into consideration that a large area of landowners' land was taken on lease by the peasants, the difference in the results of cultivation would be much greater. Mr. Yermolov puts it at about 50%.

Decay of the Peasantry.—The growing impoverishment of the peasantry during the whole period which followed the Emancipation of 1861 is reflected in the following description of peasants' life under normal conditions, taken from a memoir of the Zemstvo of Tula:—

The peasant's life is hard and unsightly even in periods of comparative welfare. Generally he lives in a cottage of 8–9 yd. width and no more than 3 yd. in height. Cottages without chimneys are still very common, the smoke being let out through a hole in the roof. The roof is almost always thatched. In many provinces the walls are covered with dung for the sake of warmth. A peasant's family, sometimes a numerous one, is huddled together in a space of 20–30 sq. yards. The floor of the cottage is almost always bare soil, because lambs, calves, pigs and even cows are put in during the cold weather. Skin diseases are very common among the population. Meat, bacon, oil, butter appear on the peasant's table only on exceptional occasions, perhaps two or three times a year; his usual fare is composed of bread, porridge, kvass, cabbage and onions.

A very characteristic symptom of the decay of the peasants' farming is the reduction of the number of horses and the increase in the numbers of horseless households. A comparison of the figures of the horse statistics in 1888 and 1893–4 proves that in 31 provinces the number of horses had fallen by 10·88 per cent. The number of horseless households had increased during the same period in 23 provinces of central Russia from 21·56% to 26·85 per cent. More than 25% of the households have no horses at all; another 25% have only one horse each.

Let us now examine a peasant's normal budget as it is presented in the remarkable work of Mr. F. A. Shcherbina (edited by Prof. A. J. Chuprov). A medium budget of a peasant was balanced at 54r. 92k. The budget of a medium peasant householder consisted of the following items:—

Income from:—	
Corn on his land	16 r. 20 k.
Corn on household land	1 r. 92 k.
Straw and hay	8 r. 16 k.
Gardening	2 r. 63 k.
Cattle-breeding	9 r. 99 k.
Trade or craft	8 r. 47 k.
Sundries	7 r. 26 k.
Total	55 r. 63 k.

Expenses:—	
Corn	18 r. 10 k.
Food for cattle	8 r. 45 k.
Vegetables and fruit	1 r. 30 k.
Meat	3 r. 90 k.
Rent	1 r. 2 k.
Taxes	2 r. 65 k.
Sundries	20 r. 10 k.
Total	55 r. 54 k.

Assuming that 19 puds of corn per head are the minimum necessary during one year and that 7·5 puds are sufficient for fodder, Mr. Maress calculated that 70·7% of the peasant population had less than 19 puds per head, 20·4% had between 19 and 26·5 puds per head, and only 8·9% had more than 26·5 puds per head. This means that 70·7% of the farming population could not live on the income from their land and would be reduced to semi-starvation if they could not find any supplementary means of existence. No wonder the standard of living of the great mass of the people stood exceedingly low. The following figures[2] enable us to form a judgment as to the comparative consumption of corn in various countries; in studying them one must remember that corn was the staple food in Russia and that meat played a negligible part in the bill of fare of the people.

Average Corn Consumption and Production, per head (in kilograms): 1909–14.

	Production	Consumption
Canada	1,696	1,326
United States	1,151	1,108
Hungary	651	552
Argentine	1,322	509
Germany	417	497
France	421	480
Rumania	875	420
Russia	445	381

The state of mind produced by this situation among the peasantry may be gathered from the opinions expressed by peasant deputies in the Second Duma in the course of the debates on agrarian reform. One of the members of the Right, Prince Sviatopolk Mirski, had said that the ignorant and inexperienced mass of the Russian people had to be guided by the landlords as a flock is guided by shepherds. Kisselev, a peasant belonging to the group of toil, replied:—

"I should like the whole of peasant Russia, the whole of the Russian land, to remember well these words of the noble descendant of Rurik. . . . We have had enough of that kind of thing! What we want are not shepherds, but leaders, and we know how to find them without your help. With them we shall find our way to light, to truth, to the promised land!"

Afanassiev, a non-party deputy, an ex-soldier, said, among other things:—

"In the Japanese war I led a number of mobilized soldiers through estates (of the squires). It took us forty-eight hours to reach the meeting place. The soldiers asked me: 'Where do you lead us?'—'To Japan.' 'What for?'—'To defend our country.' They replied: 'What is that country? We have been through the estates of the Lissetskys, the Besulovs, the Padkopailovs. . . . Where is our land? Nothing here belongs to us.'"

The same deputy said on another occasion:—

"Work, sweat and use the land! But if you do not wish to live on the land, to till it, to work on it, you have no right to own it!"

The great majority distrusted projects of expropriation based on the idea of compensating the former landowners, as likely to lead to unfair adjudications to the advantage of the squires. Some of the leaders were calculating how much should be taken outright, without any compensation; a few demanded the whole. Pianych, a socialist, exclaimed: "Throw them all off!"

Government Policy.—In order to meet this disastrous situation the Government made attempts in three directions—the increase of the size of peasants' holdings, emigration and the improvement of agricultural methods. It would be erroneous to think that the deficiency in land could be entirely removed by new distributions from the estates of the squires and the domains of the Crown. In 1906 the distribution of land among different classes of land-

[1] Statistics of the Taxation Department 1903.

[2] Nordman, *Peace Problems: Russian Economics*, p. 36.

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owners was as follows (*La Réforme agraire en Russie*, Ministère de l'agriculture, 1912):—

Crown land	133,038,883 dess.
Peasants' holdings	119,067,754 dess.
Land bought by communities and associations of peasants	11,142,560 dess.
Land bought by individual peasants	12,944,154 dess.
Land of the gentry	49,287,886 dess.
Land owned by other classes	22,664,493 dess.
Land owned by various institutions	6,985,893 dess.

The enormous area of the Crown lands was mainly covered by forests or situated in the northern and eastern provinces, so that it could not be used for agricultural purposes; the surface of convenient land in the hands of the Crown was only about 3,700,000 dess. The arable land owned by the Church and different ecclesiastical institutions amounted to 1,672,000 dess. (Statistics of the Holy Synod, 1890); the appanages comprised arable land of 2,000,000 dess. If we take into consideration that a large part of the landowners' land was covered also by forests, we come to estimate the surface of the arable land owned by squires at about 35,000,000 dess. (Yermolov). The sum total that could be disposed of would thus amount to 45,000,000 dess., or about 30% of the area of the peasants' holdings; divided among the villagers it would make less than one additional dessiatine per soul. The insufficiency of the land reserve becomes even more evident if we keep in mind that about 85% of the Crown's arable land, 90% of the appanage arable land, and a considerable part of the squires' land were already leased by the peasantry. Of the 7,449,228 dess. which were sold by a newly instituted Peasant Bank to the peasants from 1882 to Jan. 1 1906, village communities acquired 25·6%; peasants' associations 72%; individual householders only 2·4 per cent.

The peasants' revolt of 1905 and the new schemes of Stolypin gave an entirely new direction to the agrarian policy of the State. The Manifesto of Nov. 3 1905 suspended all redeeming payments after Jan. 1 1906. Of the surface of 2,846,620 dess., which the bank sold directly from Jan. 1 1906 to June 1 1913, peasants' communities got 5·5%, peasants' associations 14·8%, individual owners 79·7 per cent. The peasants also acquired from the landowners, with some assistance of the bank, 4,375,163 dess. It is estimated by Oganovsky that the result of the bank activity until July 1 1910 was the creation of 45 to 50 thousand separate farms and of 130–140 thousand small compact plots, the owners of which live in hamlets.

Let us turn now to the policy of the Government concerning emigration. The law of 1889 had subjected emigration to official supervision. Those were allowed to emigrate who were able to pay the expenses of the journey and of the installation of a new household, provided their departure did not harm the remaining members of the community. No Government assistance was given to the emigrants. Permission to emigrate was refused if the local authorities considered that the emigrants could find work in the old district. Those who emigrated without an official permission had to be sent back. These regulations resulted in a great reduction of the emigration movement, which was practically closed to the poorest peasants.

The events of 1905 and the new orientation of the Government brought a great change in the emigration policy. Greater facilities were granted, and Government assistance was promised by the Provisional Rules of June 6 1906. But the growth of emigration which followed the new regulations was obstructed by a complete lack of organization. The following figures give us some insight into the working of the new laws:—

	Emigrants to Asia (in thousands)	Emigrants returning from Asia (in thousands)
1906	139·1	13·7
1907	427·3	27·2
1908	664·8	45·1
1909	619·3	82·3
1910	316·2	114·9
1911	166·5	84·4

These figures prove that the emigration policy of the Government was far from successful.

We have now to consider the third branch of the Government activity, directed towards the solution of the agrarian question. The scheme for improving agricultural methods was based on a reform of the distribution of the land. In 1861 a legal confirmation of the peasants' customary commune was considered the best means to secure the return of the money advanced by the State for redemption. The statistics of landownership in 1905 showed that 23·2% of the households and 17% of the land owned by the peasants were held by private tenure; 76·8% of the farms and 82·7% of the peasants' land were in communal tenure. The right of property was attributed not to separate householders but to the whole village community, as a juridical person. In the case of communal land tenure only the farmyard belonged to households in permanent tenure; other land belonged to the whole community, and was subject to occasional redivisions. Unfree domestic servants were assigned to peasants' communities, but did not obtain holdings: they formed in this way a village proletariat.

In the reign of the Emperor Alexander III. the communal tenure, which was regulated by the Liberation Act of 1861, came to be regarded as a political safeguard, and its decay was considered to be a national danger. The law of Dec. 14 1893 made practically impossible the transition from communal to household tenure. But the growing impoverishment of the peasantry gave evidence that the existing land system ceased to be beneficial. The special conference established by an Imperial Order on Jan. 22 1902 recognized for the first time the necessity of a fundamental change in the existing land settlement of the peasants. The majority of the Conference were of the opinion that the communal tenure and the intermixture of strips were the chief causes of the alarming condition of the peasantry.

Stolypin's Land Settlement.—The agrarian disorders of 1906 gave increased importance to the problem, and proved that the settlement of it could not be postponed any longer. In the years 1906–7 the problem of land reform excited the strongest interest in governmental circles, and played a most prominent part in the programmes of different parties and in the debates of the First and the Second Dumas. Stolypin took the initiative on the part of the Government and eventually obtained the support of the Third Duma. His scheme was directed towards a political purpose, the creation of a conservative class of small peasant owners who could be counted upon to defend the existing régime. This class had to be strong and progressive from the economic point of view, as it was clear that the improvement of the peasants' condition could be attained only by more intensive farming. As was said above, some measures had been taken to enlarge the area of the peasants' holdings without violating the interests of the squires. But the greatest part of the Government activity was directed to a complete reconstruction of relations inside the village, to the creation of separate farms and to the spread of individual ownership. The Imperial *ukaz* of Nov. 9 1906, the Land law of June 14 1910, and the Agricultural law of May 29 1911 were enacted for this purpose. The leading features of Stolypin's scheme were as follow. Each householder possessed of land in a village community can demand that his land shall be constituted a plot in individual property. A simple majority of the village assembly may convert the holdings into the land owned privately. The land has to be assigned to the claimant, if possible, in a single block. The conversion of the land of the entire community can be decreed by a resolution of the village meeting passed by a simple majority of the members. All the communities where there had not been any redivision of land since 1861 were declared to have passed from communal tenure to individual or household ownership. The formation of compact plots could not be refused if it was asked for by not less than one-fifth of the householders. The Land Commissions created by the *ukaz* of March 4 1906 were entrusted with the redistribution of land under the new land settlement.

In the Duma the Right clung to the opinion which had been predominant in the time of Alexander III.; the Left entertained

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the hope that the communal land tenure was to form the cradle of future collectivism. The Cadets mostly agreed with the principles of the Government scheme, but they objected to the coercive character of its methods. The majority of the House supported the Government and carried its bill through the Duma. The motives that influenced the deputies of the Duma were well expressed by the chairman of the Land Committee, S. Shidlovsky, in his speech on Oct. 23 1908:—

"Our attitude as regards the decree of Nov. 9 is in substance a favourable one, because this decree aims at the development of individual land tenure and individual land tenure is certainly the necessary condition of improved cultivation, and the latter means the solution of the agrarian problem . . . . The foundation of a State ruled by law consists in a free, independent and energetic personality. Such a personality cannot exist unless you allow the common right of ownership, and no one who wishes the State to be ruled by law should oppose the spread of private property in land. Land is, after all, only a basis for the application of labour and capital, and labour is most productive when the labourer is placed in favourable conditions. In the forefront in this respect we have to place an open door for personal enterprise, free play for creative energy, security against outside interference, personal interest. . . . The avenue towards a permanent improvement in the existence of our peasants is to be found in an immediate increase of production and income from land, and this cannot be achieved without the help of outside capital. . . . A law which opens the way to personal property enables the agricultural worker to display his creative force."

It seemed as if the reform had achieved an immediate and striking success. Before Jan. 1 1913 the Commission had arranged farms on an area of 7,413,064 dess., held by 738,980 households; strips had been concentrated into blocks on an area of 4,359,537 dess., held by 585,571 households.

The following figures illustrate the first part of the Commission's work from 1907 to 1911.

Up to April 1 1911 the number of peasants who wanted to leave the commune amounted to 2,116,600, or 23% of the whole number (9·2 millions). The movement towards enclosures was not equally popular in all the parts of the Empire. To make the process clearer we may divide the country into 5 areas: (1) South-East, (2) Agricultural Centre, (3) two Industrial Centres, round Petrograd and round Moscow, (4) South-West and West, (5) North and North-East (Oganovsky).

The following figures show the proportions of demand for compact plots in each of these provinces in proportion to 1,000 households:—

	S.E.	Agr. Cent.	Ind. Cent.	S.W and W.	N. and N. E.	The whole country
Till Nov. 1907	2·8	0·9	0·5	5·2	0·4	1·4
Nov. 1907— Nov. 1919	7·9	7·2	3·7	14·6	2·7	6·7
Nov. 1908— May 1909	15·8	9·1	6·6	15·6	1·7	8·9
May 1909— Jan. 1910	6·1	5·0	4·8	7·3	2·1	4·9
Jan. 1910— July 1910	5·2	4·6	4·8	8·6	1·4	4·7
Aug. 1910— April 1911	2·5	3·1	1·8	6·1	1·0	2·8

The number of demands for separate farms before April 1911 for each 1,000 households who held their land in communal tenure were:—S.E. 320·6; Agr. Cent. 236·9; Ind. Cent. 172·5; S.W. 427·3; N. and N.E. 77·9; whole country 234·9.

These figures show that the greatest number of demands for separate farms were made in the South and South-East provinces, where the most extensive agricultural methods prevailed. It appears also that after May 1909 the number of householders applying for farms diminished in a marked proportion. The area of the compact plots was generally very small: and the percentage of poor peasants who asked for enclosure was growing. Their intention in getting rid of communal ties was to sell their land.

To judge by these data, the Government scheme of creating a class of small independent farmers was not in a fair way to success. As was shown above, most of those who asked for separation held only a small plot, and belonged to the poorer peasantry. Even with Government assistance they were unable to start separate farms, as this undertaking involves in the beginning a considerable outlay of capital. Besides, the natural conditions in some parts of Russia were not favourable to separate farms or homesteads. One of the chief difficulties was the lack of water, which cannot be found at all, except in connexion with considerable rivers, in very large tracts of the "black soil" area. This fact, together with the traditional leaning of the peasantry to village life, obliged the Land Commission to keep up on many occasions the village system even after the concentration of the fields.

A memoir drawn up by the conference of Old Ritualists held at Moscow on Feb. 22–25 1906 discloses the view taken by the peasantry on the question of communal land tenure. The opponents of the commune suggested that it made impossible any improvements in agricultural methods and diminished the productive power of the soil; its supporters stated that communal tenure was the only system based on justice; this consideration is characteristic of the traditional feeling among the Russian people. The Government scheme sacrificed justice for the sake of expected increased production. Stolypin himself described the new land settlement as "a stake on the strong."

The small area of the holdings of the new farmers and their economic helplessness had, however, a very unfavourable influence on the expected increase of production. A farmer who held only 8–10 dess. of land could not introduce any extensive improvements in his household in the absence of cheap credit. Stolypin recognized that "primitive methods were used by the peasantry as before." On the other hand, the rapid growth of emigration was one of the results of the new settlement.

The land settlement of 1906–10 was carried out with uncommon energy, but the social needs of the population were not satisfied. The Government was accused of having destroyed by a stroke of the pen an institution formed by centuries. The sudden change affected not only the economic conditions of the peasants' life, but the juridical relations between the members of the family were also shaken. Before the new settlement the life of the peasants was based on the participation in the common holding of all the members of the household. The new law substituted for this family tenure the individual ownership of the chief householder. All the other members of the family suddenly lost their rights in the land.

Other important inconveniences were also pointed out: the compulsory introduction of the reform, the danger of the increased competition, the buying up of the peasants' land for speculative purposes, the increased difficulties of existence in the case of the small households. The great end of the settlement—the creation of a strong, wealthy and conservative class of small landowners, was not attained. The necessity of extensive Government assistance and credit for the improvement of agriculture was felt more and more, but the financial estimates under this heading for 1911 amounted only to 4,000,000 rubles.

Altogether it may be said that Stolypin's agrarian measures could take effect only if they were accompanied by a steady policy making for agricultural education and backed by extensive credit. Even in such a case a long time would have been necessary to enable them to strike root. Their immediate consequence was rather to increase the fermentation in the villages and to excite and embitter the feelings of the villagers, who were losing faith in the village community without acquiring any other standard of economic organization. Thus the legislation of 1906–11 helped the agrarian upheaval instead of preventing it.

The Third and Fourth Dumas.—The death of Stolypin left a wide gap in the ranks of the Government, and the appointment of M. Kokovtsov, the Minister of Finance, to the premiership did not result in a rejuvenation of the bureaucratic system. The new Premier was in favour of continuity in policy; this meant that he would keep on the lines traced by Stolypin's initiative and avoid new departures as far as possible. He was a trained administrator, placed by chance at the head of the country in a time when caution and routine were certainly insufficient to meet the requirements of a critical situation. The principal achievement of the three years of Kokovtsov's rule was apparent success in the management of financial operations. The budget grew every year and reached in 1914 the enormous sum of 3 milliard rubles, and yet not only was a deficit avoided, but some 1,500 millions in gold were accumulated as a reserve fund to sustain the currency and meet possible emergency calls.

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The instability of the vast structure buttressed on the chronic alcoholism of the people was duly perceived by public opinion, and a campaign was started in the Duma to put an end to this shameful and perilous situation. One of the Duma members, Chelyshiv, was the soul of this active agitation in the Legislative Assemblies and in Government circles. He succeeded in obtaining the formation of a commission to examine and report on the subject, but his abolitionist plans were obstructed by the opposition of the Finance Ministry, which did not see its way to balance the budget without the resources supplied by the monopoly of the sale of spirits.

Yet signs were not wanting that the welfare of the country was seriously threatened, in spite of the deceptive appearances of an enormous and duly balanced budget. The harvest of 1911 was so poor that in 1912 Russia was visited by a severe famine. Yet the Government refused to let voluntary organizations assist in fighting the disaster; only associations affiliated to the Red Cross or to the Zemstvos were allowed to send agents into the provinces, to collect and to distribute funds. The public works organized by bureaucratic boards were conducted in a very unsatisfactory manner: the peasants got hardly any help from them, as support was systematically directed to assist householders who owned horses and were altogether better off. Public opinion was incensed but powerless. As regards workmen in factories and workshops some progress was made in connexion with insurance against ill-health, but in other respects the employers were left very much to their own way, with the result that strikes, which had decreased considerably in number and intensity after the collapse of the revolutionary movement in 1907, began to multiply again. In 1912 2,032 cases of strikes were registered, in 1913 4,098. On many occasions the unrest was quelled by the intervention of Cossacks and soldiers. The most terrible case of the kind occurred in the gold-fields of a company largely supported by British and other foreign capital—the Lena Company: a dispute as to wages and maintenance was terminated by a fusillade in which 162 workmen were killed.

It is difficult to estimate the exact effect of this kind of administration on the peasants and workmen subjected to it, although there can be no doubt that bitter resentment was increased by the fact that it was driven underground. But indirectly the disappointment and disaffection of society left its mark in the growth of political opposition in spite of all the efforts of the Government to suppress it and to obtain outward compliance by means of artificial restrictions of the franchise and downright pressure on the electors.

The dissolution of the Third Duma on the completion of its period of five years presented an opportunity for an attempt of this kind on a large scale. The Third Duma had been led by the Octobrist party in conjunction with the moderate Right. This policy had suffered shipwreck through the absolutist bent of Stolypin's administration and the colourless leadership of Kokovtsov. In the last sessions before its dissolution the Duma assumed a frankly hostile attitude towards the Ministry and the leader of the Octobrists, A. Guchkov, pronounced thundering indictments against the "irresponsible influences" which shaped the course of politics from behind the scenes: the egregious mismanagement of the Artillery Department, presided over by the Grand Duke Serge Mikhailovich, and the scandalous influence of the Empress's protégé Rasputin, gave good grounds for these attacks. The decree of June 3 1907, which had introduced an intricate and restricted franchise, provided convenient handles for the gerrymandering of elections, and Kokovtsov's Government made full use of them in order to secure a Government majority in the Fourth Duma. Especially conspicuous was the mobilization of the parish priests by command of the Procurator of the Holy Synod, Sabler: the clergy were enjoined to exert all their influence on the peasants in order to ensure the election of deputies of the Right. The bureaucracy was so far successful in this campaign that, thanks to its pressure and to the evident breakdown of the plan of a coalition with the Government, the Octobrists were defeated in a number of districts and their leader, Guchkov, succumbed at the polls.

The party grouping may be tabulated as follows:—(1) The Right, 67; (2) Moderate Right, 38; (3) Nationalists, 55; (4) Centre (Krupensky's group), 28; (5) Octobrists, 87; (6) Progressists, 37; (7) Constitutional Democrats, 60; (8) Social Democrats, 14; (9) Polish circle, 13; (10) Mahommedans, 6; (11) No party, 20; (12) Group of Toil, 7; (13) Of unknown party allegiance, 17.

The new Duma was thus apparently more reactionary than the one which had preceded it. But public discontent and the inability of the Government to frame any effective policy of reform produced the unexpected result that a combination was brought about between the groups of the Left, the Octobrists, and even, in some cases, the Right Centre. In a general way the Duma assumed an attitude of opposition as regards the Government and the reactionary Council of the Empire. This line of policy was especially conspicuous in a long series of interpellations and resolutions of want of confidence carried against arbitrary acts of the authorities. The following interpellations may be mentioned among many: on the illegal acts of the police during a search in the house of the deputy Petrovsky; on the acquisition of the Kiev–Voronezh railway line by the State; on naphtha trusts; on the secret dealings of the Government with Baron Günsburg, the principal director of the Lena gold-field; on an illegal ordinance of the Petrograd prefect concerning the suppression of hooliganism; on a reform of the Medico-Surgical Academy of Petrograd by an illegal order of its principal; on the spending of money without warrant from the Legislature and failures in carrying out the conditions as to grants and credits, etc. And yet when a bill was passed by the Duma to establish rules as to the responsibility of civil servants, the Council of the Empire refused to sanction the most modest requirements in this respect, although even the Minister of Justice had expressed his agreement. On the other hand, the Government did not scruple to prosecute a deputy (Kusnetsov) for a speech he had made in the Duma, and the administrative department of the Council of the Empire laid down the principle that members of the Legislature were liable to prosecution in such cases.

All measures of home policy, even the most urgent ones, were regarded from the point of view of political strife. The Education Committee of the Duma, in conjunction with the Zemstvos, had worked out a plan for the provision and equipment of a sufficient number of elementary schools in order to secure universal instruction throughout the country. It was calculated that some ten million children had to be accommodated in the schools, in addition to about five million who were already enrolled for a course of three years in the schools of the towns and the Zemstvos (provinces). In order to achieve the result by 1924, the Duma proposed to develop gradually a network of schools by means of appropriations successively increased by 10,000,000 rubles a year in the course of 10 to 12 years. This scheme could not be carried out in its entirety and in a systematic form on account of obstruction from the Board of Education and from the Council of the Empire. Besides the distrust of these reactionary bodies as regards all kinds of enlightenment, they were opposed to any policy which gave precedence to secular schools over Church schools, although it could not be contested that the former were much more advanced and perfect in teaching and organization. The comprehensive law of consolidation which would have ensured a steady progress towards systematic instruction in the country was wrecked by the Council of the Empire: the "enlightened bureaucrat" Count Witte did not scruple to oppose the bill in alliance with the stalwarts of reaction, because, as he expressed it himself, it was an attempt to obtain paradise by means of child-murder, the murdered child being the Clerical school organization. Thwarted in its comprehensive policy, the Duma nevertheless proceeded on its course by occasional increase of credits for elementary education.

These constant conflicts produced a perceptible sliding towards the Left in the ranks of the Duma legislators. One of the symptoms of this process consisted in the disruption of the Octobrist party. It broke up into three small groups—the Left, hardly distinguishable from the Cadets; the Centre, which professed to devote its activity mainly to the strengthening of the Zemstvos; and the Right, which still clung to the idea of a possible alliance

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with a reformed Government. The dismemberment of the Duma into a number of small party groups gave additional influence to the Cadet nucleus, which, though it counted few members in the Duma, acted under strong discipline and had a powerful press.

In one direction only the majority of the Duma was fairly in agreement with the Government, namely as regards foreign affairs and in questions concerning the interests of the dominant nationality of the Empire. In spite of certain minor disagreements between the parties of the Left and the Centre and Right, the Duma as a whole was decidedly Nationalistic. The Third Duma had bequeathed to the Fourth a definite line of policy concerning the Finland conflict: the Legislature backed the Government in its endeavours to subordinate the autonomy of the Finnish State to the superior claims of the Empire. The view that the union between the Grand Duchy and Russia was a *real* and not a *personal* one led to the assertion of the supreme jurisdiction of the Imperial Senate and of the St. Petersburg Court of Appeal over Finnish tribunals; to the passing of laws commuting the obligation of personal military service for money payments; and to the recognition of Russians dwelling in Finland as citizens of the Grand Duchy on equal terms with native Finns. Even the Cadets did not contest the general principle from which such demands were derived, although they disapproved of the raising of issues which embittered the intercourse between nationalities and led to unpleasant consequences in the shape of passive resistance and the incarceration of Finnish officials who refused to recognize the legality of the interference of Russian institutions in Finnish affairs, apart from the traditional channel of the governor-general and Senate as representing the authority of the Grand Duke.

The creation of the new province of Chelm (Kholm), separated from the provinces of Lublin and Sedlitz, envenomed another national conflict of long standing—that between Russians and Poles. The new Government was formed out of districts in which the dominant ethnographic element of the population was Little Russian and not Polish, although this population had been included for centuries within the boundaries of the Polish State and had been recognized as part of Congress Poland annexed to Russia by the Treaty of Vienna (1815). The Duma passed the law of separation without taking heed of the violent protests of Polish public opinion.

The Conflict with the Central Empires.—The Nationalistic orientation of the Third and Fourth Dumas was put to the test by the growing entanglements of foreign policy in the course of the years 1911–4. Russia had definitely joined the combination of Western Powers against the predominance of Germany, and opinion in the country fully supported this momentous change of front. The annexation of Bosnia and Herzegovina by Austria under the protection of Germany "in shining armour" was strongly resented, not only by Stolypin and Isvolsky as the official exponents of Imperial policy, but by the nation at large, the more bitterly as it was felt that Russia was not in a position to give free vent to her dissatisfaction. No wonder that in 1911, during the Agadir affair, Russia was found on the side of Kaiser William's opponents. But matters became especially serious when the Macedonian hostilities, which had been smouldering for decades, burst out into flames in 1912. The coalition between Bulgarians, Serbians and Greeks against Turkey had been rendered possible and effective by the support on which they reckoned from Russia; and O. Hartwig, the Minister Resident at Belgrade, was one of the principal agents in bringing it about. M. Sazonov, the successor of M. Isvolsky at the Foreign Office, cautious, but devoted to the great tradition of Russia's protectorate over the Balkan Christians, was intent on using to the full the favourable situation created by the union between the three Balkan States, the sympathy of Western Liberals and the temporary indecision of the Central Powers. In this he was supported by the Tsar Nicholas, who, however, made it clear to his agents that Russia would not risk an actual war.

The crushing defeat inflicted on the Turks by the Balkan allies seemed to justify completely the combination engineered by Hartwig. But the harvesting of the fruits of victory proved a more difficult task than the actual fighting. The Central Powers had realized the menace of a permanent Balkan League to their ascendancy in the Near East. Austria vetoed any extension of Serbia towards the Adriatic. With the support of Germany she succeeded in depriving the Serbs and Montenegrins of the position they had won in Albania. Russia did not dare to back the latter's claims to the finish at the London Conference, and the Western Powers were disinclined to proceed without Russia. The eviction of the Serbs from the west proved fatal to the peace of Europe. They tried to recoup themselves in the east by demanding districts of western Macedonia which had been previously conceded to the Bulgarians. M. Sazonov tried to stop the growing animosity between the Balkan allies by offering the mediation of Russia, and Nicholas II. attempted rather late in the day to exert his personal influence on the wily Ferdinand of Bulgaria as well as on the Serbians. These attempts at conciliation proved unavailing: the Bulgarians broke away first, but were soon checkmated by a coalition between Serbia, Greece and Rumania. The Peace of Bucharest, which gave the Dobrudja to Rumania, western Macedonia to Serbia and important districts of Thrace and Macedonia to Greece, shattered all hopes of an effective Balkan League, and laid Bulgaria open to the insidious intrigues of Austria and Germany. M. Sazonov manifested clearly the ill-humour of Russia; but this powerless discontent made her diplomatic defeat still more humiliating.

All these events were watched by Russian public opinion with keen interest and warm sympathy for the cause of the Slavs. It was realized more and more clearly that the struggle did not concern merely the small States of the Balkans, but also their big neighbours; in the Duma and in the press the attitude of the Government was applauded or criticized from the point of view of national self-consciousness and imperialistic aspirations. M. Sazonov found unexpected support from M. Milyukov, the leader of the Cadets. B. Maklakov and V. Bobrinsky came forward as the spokesmen of Slavonic solidarity. No one knew exactly how much was involved in the risk of a breach with Germany, but the public at large sought a kind of compensation for the disappointments of home politics in a bold attitude in foreign affairs. In this way, when the climax in the antagonism between Austria and Serbia was reached in the assassination of the Archduke Franz Ferdinand, the Russian public was prepared to back the Government against any hostile acts of the Central Powers. The outrageous treatment of Serbia by Austria-Hungary was rightly interpreted as a provocation to the Entente, and especially to Russia. It is well known that everything was done to preserve peace, short of surrendering Serbia to an Austrian inquisition and waiting patiently till Germany should complete the mobilization which was proceeding under the guise of "precautionary measures." The only person of any weight who advised submission at any price was Count Witte. Everybody else, from the Emperor to the most humble citizen, understood that no choice was left but to fight for existence. The dynasty was granted a unique opportunity to retrieve its misdeeds and blunders by placing itself wholeheartedly at the head of a great popular movement. The Duma, usually so critical, expressed by the voice of its various leaders the unanimous resolve of the nation to withstand the common enemy with patriotic unanimity.

Russia in the World War.—In the light of subsequent events the declarations made on the outbreak of the World War assume a particular significance. The representatives of alien nationalities expressed emphatically their resolve to stand by Russia in the struggle. Goldman, a Lett, said: "Neither our nationality nor our speech nor our creed prevent the Letts and the Esthonians from harbouring warm patriotic feelings towards Russia and from standing shoulder to shoulder with the great Russian people for the defence of the fatherland." Friedman, a Jew, spoke in the same strain: "We have lived and we live in particularly oppressive conditions. Nevertheless, we have always felt ourselves citizens of Russia and faithful sons of the fatherland. No power will ever be able to tear us from our mother-country Russia, from a land to which we have been tied for centuries. We come forward to the defence of this country not only to perform

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a duty, but because we are attached to it." Even the Poles chimed in. Iaronsky pointed on their behalf to the tragic situation of Poland:—

"The Polish nation torn into three parts sees its sons in mutually hostile camps. In spite of that our feelings of sympathy for the Slavs weld us into one whole. This is suggested to us not only by the justice of the cause taken up by Russia, but also by political reflection. God help the Slavs led by Russia to repulse the Teutons in the same way as they were repulsed five hundred years ago by Poland and Lithuania in the battle of Grünwald. Let us hope that the blood shed by us and the terrors of a fratricidal war may lead to the reunion of the three fragments of the Polish people."

If the alien nationalities spoke in this way no wonder the Russian groups expressed their resolve to spare no effort in the struggle, and to support the Government to the utmost in the task of defending the country. Even the Group of Toil declared by Kerensky's voice that they were persuaded of the righteousness of Russia's cause and ready to sacrifice everything for the country's defence. Only from the little group of Social Democrats came threatening notes. Their spokesman dwelt on the solidarity of the proletariat all the world round, on the common guilt of all the Governments in provoking the war, on the resolve of the proletariat to bring about a speedy peace, on the hope that the present terrible catastrophe would result in the abolition of all wars. These discordant notes were lost, however, in the general display of enthusiasm.

The Tsar's Government was on the crest of a mighty popular wave; it might have steered a course towards victory and national regeneration if it had possessed the moral strength to rise to the occasion, to throw away the tawdry equipment of despotism and to concentrate the forces of the people for the momentous struggle. Events soon proved that it was not only incapable of such an effort, but that its leadership was in itself a hindrance to success at home and in the war.

At the start, however, two steps in the right direction were taken by the Government: the abrogation of the State monopoly of the sale of spirits, and the promise of autonomy to the Poles. The Gordian knot of the temperance problem was cut by Imperial decree in spite of the difficulties raised by finance experts. The beneficial influence of the measure on the morals and health of the people and of the army cannot be doubted.

The results for the Imperial Treasury were not so appalling as was predicted by timorous specialists. They can be gathered from a comparison between the budgets of two consecutive years—1914 and 1915.

	1915 Estimates	1914 Estimates and Assignments	Increase or Decrease
	Rubles	Rubles	Rubles
Ordinary revenue . .	3,080,108,314	3,572,169,473	−492,061,159
Ordinary expenditure .	3,078,814,461	3,309,523,517	−230,709,056
Surplus of ordinary revenue . .	1,293,853	262,645,956	−261,352,103
Extraordinary revenue . .	9,500,000	13,400,000	−3,900,000
Extraordinary expenditure .	155,493,953	304,045,881	−148,551,928
From free balance of Treasury .	—	27,999,925	−27,999,925
Deficit to be met by loan . . .	144,700,000	—	144,700,000

The proposed budget for 1915 included 502,642,000 rubles of ordinary revenue from new taxes and increases of existing taxation. The necessity for this increase of taxation arose from the reduction in the Government spirit monopoly operations and the influence of war upon revenue. In the 1914 budget the revenue from the spirit monopoly totalled 936,217,500 r. or 26·2% of the total ordinary revenue. For 1915 the estimated revenue from this source was only 144,360,000 r. or 4·7% of the total ordinary revenue, a decrease equal to 22·1% of the ordinary revenue of 1914. On the other hand account must be taken of the saving that would be effected in expenditure on the spirit monopoly. This expenditure totalled 246,787,567 r. in the 1914 estimates, but was reduced by 140,374,401 r. in the 1915 estimates. So the expected decrease in the net revenue from the spirit monopoly was about 651,000,000 rubles.

The appeal to the Poles was made in a proclamation of the commander-in-chief, Grand Duke Nicholas. The grant of autonomy was held out as a reward of coöperation against the common enemy, the Germans. It would have been better if the promise had come directly from the Tsar, and if instead of vague words something tangible had been conceded at once. As a matter of fact the high bureaucracy began at once to put obstacles in the way of any reform, and the matter never reached a further stage than that of discussions in a Government committee. The damage done by these vacillations was incalculable. Instead of enlisting the wholehearted support of Polish patriots Imperial bureaucracy drove them into a position of distrust and hostility, which became especially keen in view of the tactless and offensive behaviour of Russian authorities in Galicia, and could not be placated by occasional concession in details. This episode may serve as an example of the stupid policy followed by the Government in regard to all minor nationalities of the Empire: their enthusiastic rally was discouraged in every way, and old enmities were revived and increased at the most critical time. The case of the Jews was especially flagrant: numbers of them continued to perform their military duties faithfully and zealously, but many others took advantage of opportunities to spy and to betray their persecutors, and the round of executions and pogroms set in again with increasing force.

The Effects of Misgovernment.—In the field the old cancers of corruption and favouritism were again producing disappointment and disaster. The army did not lack excellent leaders—the chief-of-staff of the Southern command, Alexeiev, the corps commanders Ruzsky, Brusilov, Radko Dmitriev, were generals of the first rank. The officers and the common soldiers fought with the traditional tenacity and valour; no sacrifices were spared and brilliant victories were won. And yet on decisive occasions incredible things had happened. Samsonov's army was destroyed, thanks to a slackness in coöperation on the side of Samsonov's colleague, Rennenkampf, who was believed to play for his own hand. The suspicion was confirmed by a similar lapse on the part of the same commander later on at the battle of Lodz, when he failed to close the noose in which two corps of Mackensen's army had been caught. In Jan. 1915 an intelligence officer, Miassoyedov, actually sold the plans of the northern concentration to the Germans, and brought about a crushing defeat of Sivers' army. Worst of all it became clear towards the spring of 1915 that the army was insufficiently provided with munitions, aircraft, artillery and other appliances of war. The onslaught of Mackensen's and Hindenburg's Germans had to be met by soldiers many of whom had to man the trenches with sticks, in expectation that the death of comrades might give the chance of picking up rifles; batteries were forbidden to fire more than a couple of times an hour; the armies were surrounded by multitudes of "Kids"—marauders and deserters. Even in these terrible circumstances the Russians fought stubbornly, retreated step by step, and eventually, with the help of Alexeiev's strategy, succeeded in arresting the stream of the invasion on the lines of the Dvina and the Dniester. But the psychological effect of this desperate campaign was a lasting one. The common men had learned that their blood was shed without stint by a Government which had been criminally careless and inefficient. The way was opened to the insidious propaganda of revolutionary defeatists and traitors. The revolution of 1917 was prepared on the battlefields of Gorlice and Krasnostav.

The progressive elements of Russian society attempted to save the situation by a great effort. The Zemstvo and Town Unions, which had been doing wonders in hospital work and equipment, offered their services for the preparation of munitions:—

Towards the end of May 1915, at a congress of representatives of trade and industry, the discussion of technical questions was interrupted by an impassioned speech delivered by one of the leading Moscow millionaires, V. Riabushinsky, just back from the front and full of the impressions of the life and death struggle against the invaders. "The whole of Russia forms the rear of the army," he said. "We cannot busy ourselves with our everyday affairs at the present moment: every workshop, every factory must be used to break the enemy's force." It was not a question of forming this or that committee, but of sinking all differences and appealing to the

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assistance of every able man, without distinction of parties, as people had done in the West in France and in England. Prince Lvov spoke in the same strain on June 5 at a meeting of delegates of the Zemstvo Union. "At this great historical juncture," he said, "what is needed is not criticism, but energetic work. We do not want to produce irritation, but a bold spirit and combined efforts. We must strive to concentrate all the forces of the land and to inspire Government and society with mutual confidence." (Vinogradoff, *Self-Government in Russia*, 116, 117).

Technical committees were created with the participation of leaders of industry, Zemstvo workers, representatives of the working class: they displayed fervid energy and achieved good results. But the main condition demanded by Riabushinsky and Lvov—mutual confidence between the people and the Government—was conspicuously absent. Subordinate officials joined in the efforts of the unions, but the central Government continued to flounder in the morass of Court intrigues and supine reaction. The worthless Minister of War, Sukhomlinov, was indeed dismissed and put on his trial; the ancient bureaucrat Goremykin had to resign the premiership; but the appointment of his successor, Stürmer, provoked a general outburst of indignation. He was known for his reactionary opinions, and had shown his mettle in helping to coerce the progressive Zemstvo of Tver. His great merit was his subserviency and affected devotion to the Imperial family, especially to the Empress Alexandra Feodorovna. This obstinate and hysterical lady meddled more and more with affairs of State, particularly after the assumption of the supreme command by the Emperor. And behind her stood various favourites, chief among whom was the astute peasant Gregory Rasputin, whose exploits had made the Petrograd Court a place of scandal for the whole world. No wonder that the opening of the Duma in Feb. 1916 gave rise to manifestations very different from those which had occurred in that assembly in July 1914. The ally of Stolypin, Shidlovsky, speaking on behalf of the bloc of progressive parties, said: "The general longing of the entire country towards a situation in which the country could entertain confidence in its Government, and feel in union with it, has been traduced as an incitement to seize power. . . . The forces of the nation, bereft of unity, aim and guidance, have been spent in vain, and the great national effort has weakened under the dissolving influence of discontent and indifference." The leader of the Progressives, Efremov, addressed the ministers in the following words: "You must understand that your duty as patriots is to go, and to clear the place for a national Ministry."

The discord between the Government and the Duma found expression on many occasions in connexion with important questions of internal policy. The Duma rejected a bill as to the organization of coöperative societies because it placed them at the mercy of the administration. A strike at the Putilov works, suppressed by military force, gave rise to a heated discussion in which the Duma, while condemning the strike as "a stab in the back," expressed the desire that the legal activity of trade unions should be given free scope and that chambers of arbitration should be founded for the settlement of trade disputes. Perhaps the most significant pronouncement was made in the course of the debates on the budget of the Holy Synod. The Duma voted a resolution to the effect that it considered necessary a reform of the Church administration on the principle of the supremacy of Councils and of a wide application of local self-government. For this purpose a national Council should be convoked without delay. The reform should extend to central and to local administration, to ecclesiastical courts, especially in the matter of divorce procedure, and to the ecclesiastical schools; the parish should be developed as much as possible; bishops should not be transferred from one See to another, more particularly if the consent of the Church had not been obtained. The State should cease to look upon the clergy as a political instrument, and all circulars and orders in this sense should be revoked.

The Government seemed to take delight in ignoring and thwarting all these resolutions. Stürmer was called to one ministerial post after the other. In Feb. he was appointed Home Secretary in succession to N. Khvostov, in July Foreign Secretary in succession to S. Sazonov, who was dismissed because he had urged the necessity of settling the Polish question in the sense of definite and real autonomy. Altogether ministerial portfolios were shuffled like cards at the bidding of the Empress. According to the winged word of Eugene Trubetskoy, ministers were following each other like "fleeting shadows." It may be sufficient to notice the advent of M. Protopopov, a convert from the ranks of the Liberal bloc to the Ministry of the Interior (Sept. 16). The dismay and indignation of the country found expression in a series of resolutions demanding the appointment of a Cabinet supported by the confidence of the people. Even conservative institutions like the Council of the Empire and the Association of the United Gentry joined in the chorus.

The Popular Leaders.—Before proceeding with the narrative of events which led up to the actual revolution, let us consider the various currents of thought and party organization of the intellectuals who were preparing for the coming conflict.

It is not necessary to dwell at any length on the Octobrists and the Cadets. The former drew their main strength from the provincial gentry and the Zemstvo institutions, the latter from the urban middle class and the liberal professions. The Octobrists pleaded for gradual development from local self-government, while the Cadets placed their hopes on the introduction of a constitutional democracy in which actual leadership would fall to the representatives of Western culture. The importance of far-reaching social and economic reforms was fully realized by the Cadets, and they were prepared to place them in the forefront of their political activity, but in spite of a recognition of the "four-tails" formula (*i.e.* universal, equal, direct and secret suffrage), the Cadets had no hold on the mass of the people, and relied on the selection of the educated by the uneducated.

Socially and psychologically, the leading groups of the years of upheaval were bound to come from the midst of the extreme revolutionary intellectuals, and it is to them that we have to turn our attention. Three leading currents may be distinguished in the history of revolutionary thought in Russia: militant idealism born of bitter resentment at the backward state of Russia in comparison with the West; the tendency to seek regeneration in a closer contact with the folklore of the common people; the economic materialism proclaimed by Marx and transplanted by various Russian thinkers. In theory, the views of the first group were most vividly expressed by writers like P. Lavrov and N. Mikhailovsky. The stress was laid by them on the propaganda of progressive ideas of European civilization among the intellectuals, especially among the youth, in order to form the minds of irreconcilable fighters for emancipation in all fields of human activity. Lavrov had initiated a philosophical theory (anthropologism) somewhat akin to the humanism of the modern pragmatic school; Mikhailovsky had preached "subjective" ideals with great effect as a journalist and literary critic. His violent radicalism was directed not only against the "powers that be," but also against agitation among the masses without corresponding enlightenment. He repudiated "class struggle" as a "school of bestiality," from which men issued as "live corpses with faces distorted by rage." In contrast to these "Westerners" appeared a group of writers who clung to the conception of a special aptitude of the Russian people for social brotherhood and communal economics (Zlatovratsky, Korolenko, Oganovsky, Kacharovsky): their antecedents must be sought in the romantic teaching of the Slavophils as well as in emotional motives in sympathy with the toil and struggle of the peasantry.

In the case of active revolutionaries like Chernov, the radicalism of the Westerners was allied with the romanticism of the Populists, and in various combinations both tendencies helped to shape the views and the policy of the Social Revolutionary party. In the beginning of the 20th century one could distinguish some five groups representative of this party. The struggle with the Government in the first revolution (1905–6) welded these sets into a more compact body, the principal organ of which (the *Messenger of Revolutionary Russia*) proclaimed the necessity of a close alliance between revolutionary intellectuals,

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conspiring proletarians and the struggling peasantry. As the programme of the Social Revolutionaries aimed at union between the classes in common opposition to the Government, it laid chief stress on political rights, democratic organization and the raising of the status and consciousness of the individual. Their methods of terrorism and insurrection were themselves the outcome of the heightened sense of personality and of the importance attached to energetic action and self-sacrifice.

The ways of the Social Democrats were different; they adopted Marx's teaching as a gospel and tried to develop and to apply it in every direction. Their chief exponent was for a time G. Plekhanov, a philosopher and economist who had taken up his residence abroad, in Switzerland and in Italy. He held strictly to the evolutionary construction laid down by Marx, according to which Capitalism appears as a necessary stage in the development of production and gives way to Collectivism only when the majority of the workers have been turned into wage-earning proletarians. Marx's principal disciple, Engels, had added that it would be the greatest misfortune for the working-class if it seized power before it had fully reached the stage of complete consciousness and Western organization. As a consequence of this, Plekhanov and his followers did not consider the Russian people ready for class war against the bourgeoisie, and insisted, on the contrary, on combined action with the social groups possessed of better education and greater political experience. Some Marxians went even further in the direction of compromise with the middle class and with the Government. For a time an "economic" orientation was very much the fashion; it discarded political action as untimely and hopeless, and insisted on "business" efforts for the improvement of the standard of living, increase in wages, industrial organization, better protection for the working-class, etc. The "Revisionist" movement, initiated in Germany by Brentano and Bernstein, found a wide field for application (Struve, Bulgakov, Prokopovich). Struve declared the formula of a class war to be a "myth," although he conceded it a certain value inasmuch as it helped to rouse the self-consciousness of the proletarians. Bulgakov analyzed the situation in regard to the distribution and cultivation of land, and came to the conclusion that the process of economic evolution consisted substantially in the gradual disappearance of brutal exploitation of human beings by fellow men; in industry this was effected by the concentration of production and increasing control, in agriculture by the breaking up of large estates and the strengthening of a class of prosperous husbandmen. Both movements converge in swelling the current of rising democracy.

The realities of Russian life did not prove favourable to a growth of these tendencies towards social peace. The burden of increasing taxation, the disastrous conduct of the Japanese war, the reactionary stupidity of the Government,—all contributed to revive the revolutionary spirit in the ranks of the Social Democratic party. The history of this revival may be traced from the appearance in Dec. 1900 of the *Iskra* (*The Spark*), a newspaper conducted by Lenin and Martov, supplemented by a monthly review *Zaria* (*The Dawn*) for more detailed exposition and argument. Lenin's pamphlets, *What is to be done?* (1902) and *Letter to a Comrade* (1903), express one of the leading ideas of his later activity. He pleads in them for centralized direction and decentralized responsibility, that is, for an oligarchy of leaders and strict discipline as regards the execution of their decisions by subordinate units. Democratic watchwords are set aside and efficiency of organization is demanded at all costs. This led to the disruption of the party. At the London Congress of 1903 the fateful division between "Bolsheviks" and "Mensheviks" was inaugurated, as a consequence of disagreement concerning the problem of leadership and discipline. The Bolshevik (meaning "Majority") group carried its proposals by a very narrow majority, and captured the Central Council of the party, from which they excluded entirely their opponents. The latter, who had a majority on the staff of the *Iskra*, proclaimed a boycott against Lenin and his adherents. The insignificance of the immediate cause of the split was only apparent: in truth the division arose from fundamental opposition between the democratic orientation of Plekhanov and the oligarchical spirit represented by Lenin. The struggle was not suggested by a deep cleavage of principle among the rank and file of the party, but by disputes among its intellectual leaders.

Questions of principle arose, however, in the course of the Japanese war and the first revolution. While Plekhanov and the Mensheviks were for coöperation with the Liberals in the fight for political freedom and for a gradual introduction of social reforms, Lenin set his hopes on the hatred of the peasantry for the landlords, and preached a ruthless *Jacquerie*. In his pamphlet, *The Agrarian Programmes of Social Democracy*, he contended that orthodox Marxians had failed to grasp the peculiarities of the Russian situation inasmuch as they were still talking about a coalition of the bourgeoisie of the towns, while in Russia the moving power was to be sought in the rising of the peasant bourgeoisie against the squires. He contrasted the abstract views of the town proletariat with the intense revolutionary temper of the peasants who were "ready to fly at the throat of the landlords and to strangle them." In his view the proletariat had to supply leaders and instructors when the revolution had been set going, but he looked to the exasperated peasantry for bringing down the existing order.

It is hardly needful to point out the close connection between these literary disputes and the Zimmerwald agitation[1] of 1915–16, as well as with the eventual overthrow of the old regime in 1917. Let us note that the Congress of the Social Democratic party in 1917 sided definitely with Lenin and the Bolsheviks.

The Revolution.—The situation in the beginning of 1917 was extremely tense and abnormal. The Emperor had left the capital and taken up his residence at the army headquarters in order to see as little as possible of the ministries, the Duma, or the Court, and to lead a "simple life" among the selected retainers of the Stavka; the Empress continued to look for hypnotizing inspiration to monks and priests and interfered constantly in affairs of State in favour of reaction. Even the staunchest conservatives, like Trepov, found it impossible to remain in office under such conditions, and the field was left clear for half-insane subjects like Protopopov and bigoted courtiers like Prince N. Galitsin. The army at the front held on sullenly to its positions, but was war-weary and distrustful of its leaders;

[1] The Zimmerwald Manifesto of 1915 is full of momentous declarations. The following are some of them:—

"The war that has produced this chaos is the outcome of Imperialism, of the endeavours of capitalist classes of every nation to satisfy their greed for profit by the exploitation of human labour and the treasures of Nature. . . .

"To raise welfare to a high level was the aim announced at the beginning of the war: misery and privation, unemployment and death, underfeeding and disease are the real outcome. For decades and decades to come the cost of the war will devour the strength of the peoples, imperil the achievements of social reform, and hamper every step on the path of progress. Intellectual and moral desolation, economic disaster, political reaction—such are the blessings of this horrible struggle of nations. . . .

"In this intolerable situation we have met together, we representatives of Socialist parties, of trade unions, or of minorities of them, we Germans, French, Italians, Russians, Poles, Letts, Rumanians, Bulgarians, Swedes, Norwegians, Dutch and Swiss, we who are standing on the ground, not of national solidarity, with the exploiting class, but of the international solidarity of the workers and the class struggle. . . .

"The struggle is also the struggle for liberty, for brotherhood of nations, for Socialism. The task is to take up this fight for peace—for peace without annexations or war indemnities. Such peace is only possible when every thought of violating the rights and liberties of the nations is condemned. There must be no violent incorporation, either of wholly or partly occupied countries. No annexations, either open or masked, likewise no forced economic union, that is made still more intolerable by the suppression of political rights. The right of nations to dispose of themselves must be the immovable fundamental principle of international relations.

"Since the outbreak of the war you have put your energies, your courage, your steadfastness at the service of the ruling classes. Now, the task is to enter the lists for your own cause, for the sacred aims of Socialism, for the salvation of the oppressed nations and the enslaved classes, by means of the irreconcilable class struggle."

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the enormous levies in the rear provided crowds of conscripts, who resented the separation from their households and their land, chafed under the drudgery of stupefying training and swallowed eagerly the germs of insidious propaganda. The factory workmen in the towns were deeply affected by internationalistic and socialistic ideas, while the peasants were groaning under the heavy toll of conscription and the economic demands arising from a war which they had ceased to understand. Among the intellectuals there was a widespread feeling of uneasiness as regards the coming catastrophe: some were afraid of "cutting off the branch on which they were sitting," and many realized the madness of plunging into revolution in the midst of a war for existence. But the prevailing sentiment was despair as to any improvement under the reactionary Government. Even in Court circles the notion of a revolutionary movement was spreading rapidly, although, of course, officers of the Guards did not look further than to the elimination of Nicholas II. and of his spouse by a conspiracy similar to those which had put an end to the vagaries of Peter III. and of Paul. Such facts as Milyukov's scathing denunciation of the Empress Alexandra's protégé Stürmer (Nov. 1–14 1916), and the assassination of Rasputin by some aristocrats among whom there was a Grand Duke, Dmitri Pavlovich, showed that the indignation of upper circles of society had reached a revolutionary pitch. The Allied mission, in which Lord Milner represented Great Britain, left Petrograd just in time not to witness the explosion which everybody was expecting. But the decision came from below, and not from the stormy currents on the surface.

The principal centres of political agitation were the factories of Petrograd and the queues of householders and servants lined up for hours in sleet and snow at the doors of the bakers. It seems almost ludicrous now to consider the quest of food as one of the principal causes of unrest, but people did not realize then what might result in this respect from a disruption of orderly intercourse, and ascribed the scarcity of bread and the high prices to the inefficiency of the hated Government. Already in Nov. 1916 there had been talk in Petrograd of the imminence of a general protest strike. On March 8 1917, bread riots actually broke out, and on the next day (Friday) the streets were full of a surging mob which protested against everything. On the Saturday the police fired on the mob, and on Sunday troops used their weapons. Already on that day it was clear that part of the garrison could not be depended on. The Pavlovsky regiment of Grenadier Guards, after an encounter with rioters, in which it fired on the crowd, came back to barracks in a very ugly mood; the men declared to their officers that they would not help to murder their brothers in the streets. On Monday (March 12) the military revolt broke loose. The Volhynsky and Litovsky Guards marched against the Arsenal in the Liteynaya. They were opposed by some other troops, but before long one regiment after the other joined in the revolt, and by March 14 the principal positions in the town had been occupied by the rebels. The premier regiment of the army, the Preobrazhensky Guards, marched to the Taurida Palace where the Duma was sitting and placed itself at the disposition of its president, M. Rodzianko. An Executive Committee of the Duma was formed and subsequently a Provisional Government of members of all parties except the extreme Right (Prince Lvov, Milyukov, Guchkov, Shingarev, Tereshtchenko, Nekrasov, Godnev, V. Lvov, Manuilov, and Kerensky). At the same time another centre of authority was set up at the Smolny Institute, where a Council of Workmen's delegates appeared. It represented the factory workmen, artisans and various nondescript elements which had taken part in the Revolution and claimed a share in the reorganization of the country, and it was joined by representatives of the soldiers.

On March 15 Nicholas II. abdicated in favour of his brother Michael, who, however, declined to ascend the throne unless invited to do so by the will of the nation. In less than a week the mighty Imperial power of the Romanovs had been overthrown almost without bloodshed. All the commanders of the armies in the field and the governors of provinces, including the Grand Duke Nicholas, Viceroy of the Caucasus, hastened to promise loyal support to the new Government.

Discordant Tendencies.—People were elated in those days. Even statesmen and historians were carried away by the general rejoicings over the newly acquired freedom of Russia. Nothing seemed impossible to the great nation which had come to its own after centuries of bondage. And yet it was evident that a task of superhuman magnitude had to be faced. The story of the "Zauberlehrling" was repeating itself: the pupil of the magician had succeeded in calling up the waters of the deep, but did not possess the word capable of arresting them, and they rose and flooded the place, and drowned the unfortunate amateur in witchcraft. The party leaders thought that the Revolution could be directed by programmes and compromises. In reality the Revolution meant the overthrow of all accepted creeds, morals and habits of the people, a confusion of their entire nature in which, for a time, nothing could be relied upon —neither duty, nor humanity, nor affection. A people renowned for its Christian spirit and stubborn patience gave vent to outbursts of bestial lust and cruelty, to hysterical moods of blind selfishness. Even those of the leaders, who had apprehensions as to the effect, consoled themselves by comparisons with the French Revolution, as if the French Revolution had to deal with cultural problems of such complexity as the Russian one, or had challenged the existence of the educated class.

The history of the Russian Revolution starts with the gradual dissolution of all fundamental institutions and notions. The first to go was the army, as it was the most tangible and irksome form of State organization. The first act of the Soviet of Workmen was to issue an order to all army units enjoining the formation of Soldiers' Committees to watch over the behaviour of officers, to take over arms, etc. It is to be imagined what effect this order exercised on the discipline of the army. The patriotic Minister of War in the Provisional Government, A. Guchkov, strove might and main to stop the disintegration of discipline, the fraternization with the enemy, and the cowardly desertions. He called up a legendary hero of the war, Kornilov, and placed him at the head of the Petrograd garrison. But all these efforts were of no avail in the face of the disorganization of the soldiery; the adulation of the demagogues, the propaganda of German and native Defeatists, and the regime of Soldiers' Committees was substituted for hierarchical command. In April Kornilov left for the front in disgust, and in May Guchkov resigned in despair.

Next came the turn of foreign policy. The mob, led by the Council of Workmen and Soldiers, was repeating the magic formula of "peace without annexation and indemnities." How could fidelity to the Alliance concluded in the fateful months of August 1914, how could the aspirations towards a command of the Straits or any other aims of Russian national policy be made to square with this abstract, colourless formula, devised at Zimmerwald by the enemies of European civilization?

The extremists in Russia took a perverse delight in ignoring completely the menace of German domination, and dreamed, or pretended to dream, of a rising of the German Socialists that would substitute class war for the struggle of empires. The Minister of Foreign Affairs, Milyukov, was not willing to dissociate himself from the Allies and to disregard the German danger, nor was he prepared to tear up as a scrap of paper the agreement concluded with much difficulty by Sazonov, in which the Western Powers had acknowledged the justice of Russia's claim to Constantinople and the Straits. He had to retire, because the mob did not want to go on with the war and cared nothing about the Allies or about Imperial interests of Russia, while those who pulled the strings behind the scenes kept in touch with the Germans and were bent on the destruction of historical empires in accordance with Zimmerwald policy. After stormy demonstrations Milyukov resigned.

Even worse than these ministerial changes was the displacement of the centre of gravity in the political world. The Duma was set aside by the appointment of the Provisional Government. As the Duma had been elected on a narrow and artificial

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franchise, it carried no weight with the people. Its Executive Council could not find its right place by the side of the Provisional Government, and looked helplessly on the latter's efforts to assume authority. An attempt was made to summon the members of all the four Dumas to a kind of political conference, but this only led to a good many speeches without any practical results. The four Dumas in conjunction looked even more like ghosts than the fourth one by itself. This meant that a number of influential public men—Rodzianko, Shidlovsky, Shulgin, Maklakov, N. Lvov, Karaulov—vanished into oblivion, some for ever, others at the most critical moments of the incipient Revolution. The Provisional Government was left in isolation in the face of a seething mass of half-educated people, who had lost all sense of duty and all respect for authority. This would have been bad enough in itself, but the Provisional Government had to reckon not only with these heaving throngs but with a rival and energetic organization—the Soviet Workmen and Soldiers.

The resignations of Guchkov and Milyukov rendered necessary a reconstruction of the Provisional Government, and it was effected in the direction of the Left. The outstanding facts in this reconstruction were the appointments of Kerensky as Minister of War and Marine, the Social Revolutionary Chernov as Minister of Agriculture, the Social Revolutionary Skobelev as Minister of Labour. Prince Lvov was kept president of the Council, but he was not much more than a figure-head: the principal personage in the new combination was A. F. Kerensky, while the appearance of Chernov and Skobelev as members of the Government showed that the country was to be subjected to socialistic experiments of the most extreme kind. The dykes had burst and torrents of disorderly agitation were let loose on the land. The composition of the new Ministry was intended to bring some harmony in the action of the two rival centres, the Ministry and the Council of Workmen and Soldiers, to which a third element, delegated from the peasants, had been added. In practice the Government was made amenable to the direct influence of the council, whose aggressive Socialism was not tempered by any sense of responsibility. At its head stood a characteristic figure Cheidze, a Georgian Social Democrat, who hated everything that savoured of Russian national tradition. He had nothing to recommend him as a political leader except his stubborn opposition under the old regime. His election to be chairman of the Soviet, showed that the men, who were ready to discard all bonds of national honour and self-preservation for the sake of peace at any price, had the masses behind them.

The most terrible symptoms of the advancing disease was the arrival from abroad of Bolshevik leaders—Lenin coming through Germany, under the benevolent protection of the Kaiser, and Trotsky arriving from America. These men were resolved to preach the doctrine of Zimmerwald and Kienthal. Their zeal did not cool down in Russian surroundings. Riazanov demanded that deserters should be free from punishment for the sake of individual freedom. Steklov incited soldiers and citizens to kill generals suspected of counter-revolutionary designs without further inquiry. The weak spot in the armour of Russia had been discovered. A hysterical stampede began which spread rapidly from the rear to the front, and it is not a paradox to say that the Government was powerless against this organized disorganization: the Soldiers' Committees at the front acted systematically against the officers, fraternization with the enemy was encouraged by many of them, and when it came to a fight, they debated for hours whether they should obey orders or leave the line. In case of serious onslaughts on the part of the Germans and the Austrians, whole regiments gave way. The state of the army was depicted in the most mournful colours by no less a man than that great citizen-soldier of Russia General Alexeiev:—

"Let us be frank; the fighting spirit of the Russian army is exhausted. But yesterday stern and powerful, it now faces the enemy in a trance of fatal inaction. A longing for peace and quiet has replaced the old traditional loyalty to the country. Base instincts of self-preservation are reawakened. Where is the powerful authority at home for which the whole State is yearning? We are told it will come soon. But we do not see it yet. What has become of our love for the Mother country? Where is our patriotism? The sublime word of brotherhood is inscribed upon our banners, but it is not written in our hearts. Class antagonism is raging in our midst; whole classes who had honourably fulfilled their duty to their country are placed under suspicion. As a result a deep abyss has yawned between soldiers and officers."

In front of this disruption of moral ties the reproaches and warnings of progressive leaders who had not lost the sense of their allegiance to the Motherland did not avail, and yet among these patriots there were many who had passed their lives in prison and exile for the sake of their opinions—Plekhanov, Krapotkine, Breshkovskaya, Herman Lopotin.

Kerensky's Rule.—The most conspicuous, although by far not the most worthy representative of the "Defencists," was the favourite of the Revolution, the new Minister of War and Marine, A. F. Kerensky. None had thundered with more effect against the oppressive measures of the old regime, none could speak with such enthusiasm, of freedom, the sanctity of revolution, popular inspiration, the right of the masses, and the dawn of a new era. Unfortunately, impassioned feelings and eloquent words do not serve as substitutes for statesmanlike foresight, clearness of purpose, and strength of will. After attaining to a unique position at the head of revolutionary Russia Kerensky entangled himself in a net of contradictory measures, of ill-judged assertions of authority, and of weak-minded compromises and renunciations. With incredible levity and conceit he assumed that he could, by his personal magnetism, repair the harm which was being done to the army by the propaganda of Defeatists. He rushed from corps to corps, harangued soldiers' meetings, revelled in their applause, and believed that he had achieved wonders by his appearance at the front. Witnesses of these meetings did not fail to notice that the soldiers, after listening with some interest to the new kind of theatrical performances, did not conceal their incredulity as to results. These results were disclosed in a manner which did not admit of any doubts when the time came for testing the effects of this oratorical campaign in a struggle with the enemy.

Towards the beginning of July 1917 a general offensive movement was attempted, in the hope that the gallantry of specially formed shock battalions would kindle the fighting spirit of other troops, and that the whole line would advance and break at least the thoroughly shaken Austrian army. The first onslaught in the south-west was successful; Kornilov's shock troops pushed as far as Stanislau (Stanisławów) in Galicia. But it was the last flickering flame in the case of an army disintegrated by defeatist propaganda. In the north the ordinary troops refused to support their comrades and looked on with irony at their desperate efforts against heavy odds. In the midst of the fighting a general *débâcle* began: the Russian regiments rolled back in disorderly retreat, and the only fact which prevented an immediate collapse was the extreme weakness of the enemy on the Austrian front.

The Russian nation, as represented by its army, had definitely succumbed in the great struggle. Even more terrible perhaps than the defeats at the front was the corresponding chaos in the country. A Separatist disaffection in the Ukraine seized the opportunity presented by the great catastrophe to assert claims as to an independent Government, based on the fact that the provinces on both shores of the Dnieper had for some centuries formed part of a Cossack republic and of the Polish-Lithuanian State. The fundamental unity of the Russian people, as well as the immense benefits brought by the reunion in the 17th century and the common progress in the 18th and 19th centuries, were set at nought by these people. The bulk of the Ukrainian population would not have followed them, in spite of many grievances against Petrograd rule, if it had not been for the hysterical stampede of the Revolution. As it was, people dreamt of a new heaven and a new earth in Kiev and in Poltava, as well as in Petrograd and in Moscow, only with the difference that their visions were reminiscences of Cossack prowess and licence. The representatives of the Provisional Government—the romantic socialist Tseretelli, the wealthy amateur Tereshtchenko, the shifty intriguer Nekrasov—were not able to make any stand

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against such treasonable pretensions, and conceded an autonomy bordering on complete separation. Some of the Cadet members of the Provisional Government—Prince Lvov, and Shingarev—protested and resigned, but their withdrawal was hardly noticed. Kerensky was placed definitely at the head of the Government and continued his campaign of eloquent appeals.

In the general confusion the group of relentless realists, the Bolsheviks—thought the moment opportune to show their hand. On July 14 a military revolt broke out in Petrograd: regiments converted by the extremists—the first machine-gun regiment at their head—seized strategic points in the capital; cruisers and destroyers flying the black and red flag of terroristic Revolution came into the Neva from Kronstadt. For three days it seemed doubtful whether the Provisional Government would be able to hold its own. The attempt was, however, somewhat premature. Part of the Petrograd garrison remained passive, and this made it possible for some loyal troops to suppress the rebellion. The Government was afraid, however, to strike hard: Trotsky, Lunacharsky and Kamenev were let out after a brief arrest; Lenin had disappeared as soon as it became evident that the outbreak had miscarried. Apart from the usual irresolution of ministers who had not learnt to govern during their long apprenticeship in the ranks of a critical Opposition, the hands of the Executive power were tied by the pressure from the Soviet of Workmen, Peasants and Soldiers. The Social Revolutionaries and Social Democrats, although disagreeing with the Bolsheviks and afraid of them, worshipped the word "Revolution," and were loth to adopt coercive measures against their comrades of the extreme Left. Stern measures against the extremists might have seemed a return to the oppression of the Tsarist regime, and the Socialists preferred risking their own safety to the danger of being accused of the crime of "*lèse-Révolution.*"

So the see-saw of contradictory decrees and measures continued for some time. While the military chiefs addressed passionate appeals to the Government for a restoration of discipline, for stern punishment of deserters, for abolition of the political authority of the Army Committee, Socialists, even moderate ones, defended the "new discipline" of the noble revolutionary army, minimized its defeats and demoralization, and consoled themselves with the prospect of a rebirth of the nation under the mighty influence of the revolutionary spirit. In the meantime, the peasants were grabbing the estates and the live stock of the squires, burning houses, and killing some of the unpopular owners. The Minister of Agriculture, Chernov, looked upon this lawlessness of self-help as a perfectly natural outbreak of the policy of expropriation. The factory workers and workshop artisans in the towns were not less insistent in the assertion of their rights; wages went up by leaps and bounds, while the work done became more and more careless and casual. Owners and engineers were sometimes thrown out of their establishments, seized by the proletarians. It happened, indeed, that after trying their hand at management for some time the workmen requested or compelled their former employers to return as managers, but such isolated cases did not counterbalance the general effect of disorder and slackness. The decay of Russian industries was proceeding fast. The efforts of military chiefs and responsible leaders to arrest the spread of treason, disorganization, and demoralization were denounced by the Socialists of the Soviet and their representatives in the Provisional Government as counter-revolutionary attempts.

The Second Revolution.—Prince Lvov recognized that it was no longer possible for Liberals to work with Chernov and his companions. He resigned from the premiership, and the Cadets in the Ministry followed him. Kerensky became prime minister. Although he retained the portfolio of War and Marine, he set himself the task of constructing a "strong revolutionary" Government. In order to find a basis for a national coalition he called a conference in Moscow, in which all classes, groups and principal institutions of the Russian State were to be represented. The Bolsheviks refused to take part and ridiculed the idea of a congregation of that kind. On Aug. 26 about 2,000 delegates met in the Grand Theatre, representatives of the various parties, of Zemstvos and municipalities, of universities, of army, of factory workmen, of peasant communities, etc. The meeting might have been a first step towards the regeneration of Russia, if the leaders had clearly realized that the danger did not lie in counter-revolution but in disorganization. But Kerensky opened the discussion by a speech in which warnings as to the danger to the country were intermixed with the usual revolutionary catchwords, and no lead was given in the direction of any practical reform. Kornilov, as commander-in-chief, delegates of the officers, and many of the former political leaders, spoke strongly of the necessity of reëstablishing discipline, of a strong executive, of national work to be carried on by all parties and classes. But the delegates of the Left, who were in the majority, not only turned a deaf ear to all such exhortations, but manifested openly their contempt and dislike for the old ideals of patriotism. Among the worst were the soldiers delegated by various army committees. The whole attempt was a failure; instead of bracing up the political consciousness of the nation it revealed a state of complete paralysis on the part of the so-called rulers of the country.

At the beginning of September Riga fell, after a half-hearted and disconnected defence by the XI. Army. In the Soviet, Tseretelli tried to bring through the reintroduction of capital punishment for treason and desertion, and although he succeeded in collecting a narrow majority, this measure, insisted upon by the officers, was nullified by motions in the opposite direction—for example, by a demand that the arrested Bolsheviks should be liberated. It was evident that no serious effort to arrest anarchistic effervescence could be expected either from the Provisional Government or from the Soviet: they felt spellbound as soon as the sacred word "Revolution" was pronounced by the enemies of the State. The commander-in-chief, Kornilov, was not the man to submit meekly and without a struggle to the fatal policy of drift. He threw his authority into the scales against social disorder, and tried to force the Provisional Government to side with him. With this object in view he ordered some cavalry divisions on which he could rely to march toward Petrograd. He began negotiations with Kerensky through the medium of Boris Savinkov, a Social Revolutionary and active terrorist, who was acting as Assistant Minister of War at the time. This is how Savinkov related the main occurrences of this momentous crisis:—

"When, on the 5th–6th of September, at Headquarters I again told him that in the near future the Provisional Government would examine the bill which was being prepared by the order of the Prime Minister, for the measures to be taken at the base, he believed that the Government was no longer hesitating, and when bidding me farewell on the 6th of September at Headquarters he declared that he would give full support to the Prime Minister, for the good of the country. On my return to Petrograd I reported my conversations with General Kornilov to the Prime Minister, and on the evening of the 8th of Sept. the bill for legalizing measures at the base (*i.e.* severe penalties for breaches of discipline) was to have been examined by the Provisional Government. But on the 8th of Sept. I was summoned to the Winter Palace, and the Prime Minister told me something that was a complete surprise to me. He told me that V. N. Lvov had come to him with an ultimatum from Gen. Kornilov, who demanded that the supreme authority should be given over to the Commander-in-Chief, with all military and civil power over the country, and that he, the Commander-in-Chief, was to form a Cabinet in which I was to be Minister of War and the Prime Minister was to be Minister of Justice. The ultimatum was in writing, but was signed, not by Gen. Kornilov, but by V. N. Lvov himself. Then the Premier called Kornilov up on the Hughes apparatus, and asked him without reading out to him the text of the declaration signed by V. N. Lvov—whether he was ready to sign the ultimatum presented by V. N. Lvov. Gen. Kornilov replied, 'Yes, I am ready to sign.' On the same day (8th of Sept.), the Prime Minister sent a telegram to Gen. Kornilov at Headquarters, demanding that Kornilov should immediately give up his post and leave the army." (Tyzkova–Williams, 214, 215.)

Kornilov's attempt to assume power was obviously conducted in a very clumsy manner: he was not a statesman, but a soldier, and the people around him were in no way able to make up for his deficiencies in political training. It is almost inconceivable how he could have chosen as his messenger the half-witted

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V. Lvov. But, apart from that blunder, the chief advisers of Kornilov, were Zavoiko, a minor bureaucrat of the old regime, crafty and plausible, but devoid of insight and authority, and Aladine, a noisy half-educated demagogue, a member of the First Duma, who had turned Nationalist and had nothing to recommend him but his posing as the mouthpiece of the secret diplomacy of the Entente. However this may be, the intended *coup d'état* miscarried completely and made the situation only worse. Kerensky assumed the part of a heroic defender of the Revolution against a military conspiracy, all the various Socialistic groups joined him in the outcry against the would-be dictator, the army did not rise to support the general, who wanted to reëstablish discipline and unity of command, the leader of the cavalry corps, which had advanced to the outskirts of Petrograd, shot himself, and Kornilov and his principal supporters —Danikine and Lukomsky—were arrested and charged with treason. The outcome of the whole affair was a recrudescence of revolutionary zeal, and a violent rush to the Left. In the country the panic produced by Kornilov's attempt expressed itself in wholesale massacres.

The victorious Kerensky did not realize that he had thrown away the last chance of salvation from the rising tide of anarchy and terrorism. He appointed himself commander-in-chief and imagined that he was strong enough to defeat the onslaught from the Left as well as from the Right. Yet he received warning after warning of the crumbling away of political organization. The central executive of the Soviet had been effected by the landslide towards the Left. They called a Democratic Conference in Petrograd from which all bourgeois elements were excluded: the membership was restricted to delegations from Soviets, trade unions, coöperative societies and peasants' communes. This Assembly, in which the various Socialist groups had entirely their own way, could not even agree on a resolution calling for a Coalition Government capable of defending Russia in the hour of supreme danger. A motion in the sense was first passed and then rejected in consequence of the reluctance to admit Cadets and adherents of Kornilov to any share in the Government.

In contrast with this confusion of ideas and lack of resolution the extremists were quite clear in their minds, and the snake of Bolshevism was lifting its head again. Trotsky, who had been let out of prison, was more popular than ever, when he discoursed on the necessity of forming a Government of the Soviets and appealing for peace to the proletarian masses of the world. At the new elections to the Executive of the Soviets of Workmen, Peasants and Soldiers, he was elected President against Cheidze. This meant that the dualistic system was recognized to be obsolete, and the Provisional Government with Kerensky at its head was to be discarded in favour of a concentration of power in the hands of the Extremists. A motion condemning Kerensky and his Government was passed by the Soviet Executive.

Kerensky tried to parry the blows by supplementing a tottering Coalition Ministry with a Council of the Republic composed of representatives of all the political parties, principal associations and institutions. This body met at Petrograd on Oct. 20. It gave a measure of its capacity for political action by starting a long discussion on the question of the active or passive defence of Russia against the ever-increasing German menace. Although the Bolsheviks ostentatiously left the Council as a protest against the presence of " bourgeois " elements and the " counter-revolutionary " policy of the Council, the remaining parties were unable to agree on any definite and patriotic motion. The Internationalist delusions of many Socialists were strong enough to prevent any firm declaration directed against the Germans. Five motions were made, and all five were rejected one after the other. Defencists like Plekhanov were powerless against the Internationalists led by Martov.

The Bolshevist Usurpation.—The time of the Bolshevists had come. In the first days of Nov. 1917 the Soviet under Trotsky's leadership formed a military Revolutionary Committee, and on the 3rd, the authority of that Committee was recognized by the Petrograd garrison. Then steps were openly taken to form an armed force dependent on the Soviet and independent of the Provisional Government. By the side of this force, which was considered not to be entirely trustworthy, the sailors of the Baltic fleet could be counted upon implicity: they had long ago thrown in their lot with the advocates of civil war and terrorism. Kerensky assured his ministers, and proclaimed loudly to the population that he had taken the necessary measures to suppress any attempt at a revolt. In reality he had no troops at his disposal except a couple of battalions of military cadets and one company of women. The commander-in-chief of the Russian army relied on speeches against machine-guns, as the Chinese generals of 1860 had relied on painted dragons against the rifles of the English and French expeditionary force. The result was a similar one. On Nov. 7, Bolshevik sailors surrounded the Winter Palace, and after a brief scrap with the women arrested the ministers, the premier and commander-in-chief having disappeared in good time. A lieutenant with some soldiers drove out the Council of the Republic. The Cadet battalions were overpowered, and their remnants massacred by the soldiery and the mob. A small force of Cossacks under Gen. Krasnov skirmished for a few days against the sailors and armed workmen on the outskirts of Petrograd, but eventually concluded an armistice and withdrew. In Moscow the struggle was fierce, and Cadets held out for some time in the Kremlin together with a few loyal battalions. But there, too, defenders of the Government submitted to superior gun-power, lack of supplies and the discouraging influence of discussions and treachery. All along the front the demoralized soldiery rose against their officers and massacred them in the name of the Revolution. The commander-in-chief at headquarters, Dukhonin, was dragged out by a mob of soldiers and murdered.

The first act of the Bolshevik dictators was to satisfy the craving of the masses corrupted by them: private property was abolished, with the reservation that the land of the peasants and Cossacks was not to be confiscated. At the same time the new Soviet Government addressed to all the belligerent States the proposal to conclude peace. The Entente Powers were invited to join in direct negotiations with the Central Empires; failing this, Soviet Russia would conclude a separate peace. The advanced Socialists had no scruples as to the " letting down " of Allies who had been struggling for three years against the German Junkers: what they were chiefly afraid of was an Allied victory.

The same contempt for truth, duty and justice, was displayed in the domain of home politics. The *coup d'état* had left one institution still standing—the Constituent Assembly in process of formation. The Bolsheviks had clamoured for its immediate convocation, and accused all the parties with the criminal design of delaying or preventing its meeting. They were now at the head and could not forthwith stop the elections. These had been prepared laboriously by idealistic doctrinaires—by staunch believers in universal, equal, direct, and secret suffrage. All citizens of both sexes who had attained the age of 20 were to take part in it. To make the arrangements absolutely perfect, the principle of proportionate representation had also been introduced in a somewhat peculiar form. The various parties were to present lists containing as many names as there were seats allotted to the electoral district. The attribution of these seats to the parties was to be made in proportion to the number of votes cast in support of each list, the candidates taking places in the order of their seniority in the parties nomination. The absurdity of these mechanical devices had been already demonstrated by the municipal and rural elections, but the defects of the latter were greatly intensified in the case of the Constituent Assembly. Ignorant peasants were led off to record their votes for long lists of men whom they did not know and in support of platforms they did not understand. The extreme parties did not shrink from any kind of violence and fraud to bring in their nominees. Nevertheless, some sort of elections were actually held, right in the midst of revolutionary chaos, in the months of Nov. and Dec. The result was that the Social Revolutionaries got a large majority, thanks to the votes

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of the peasantry, while next came the Bolsheviks, who drew their chief support from the workmen in the towns and from the soldiers. The Mensheviks and the Cadets came in with negligible numbers, the latter with 15 out of a total of 600.

The Bolsheviks were not satisfied with such results. As soon as it became clear that they had not won in the gamble for votes, they began to revile the "parliamentarism" of the Constituent Assembly and of all national organizations as opposed to class groups. When the members of the Constituent Assembly came to Petrograd, and tried to get into the Taurida Palace, they were met by armed guards and ejected from the building. Leading members of the Cadet party, Countess S. Panina, Shingarev and Kokostsev, were arrested as "enemies of the people" and thrown into the dungeons of the Fortress of St. Peter and St. Paul. An order for the arrest of Chernov and Avksentiev was also issued, but they could not be found. At last, on Jan. 18 1918 the opening sitting of the Constituent Assembly was held. Trusty heroes from the Kronstadt fleet, with loaded rifles, surrounded the deputies from all sides; the galleries were packed with a howling mob. In spite of this, the election of the President resulted in a defeat for the Bolsheviks and the Social Revolutionaries of the Left allied with them. Their candidate, Marie Spiridonova, received 158 votes against V. Chernov, who got 244. Nor did the Assembly consent to register all the decrees handed in by the Bolsheviks and to abdicate its legislative power in favour of the Soviets. The armed rulers were not disposed to bow before the recalcitrant Assembly. After sitting one day, it was dissolved and ejected from the Taurida Palace.

By way of justification for this act of treacherous violence, it was maintained that the Constituent Assembly did not reflect the "will of the Revolution," that the "masses" had moved away from the standpoints represented by the party lists, and that, altogether, "formal democracy" has no right to decide in times of Revolution: the leadership ought to belong to the advanced organizations conscious of their aim and intent on achieving it. It was not difficult even for "nebulous" Social Revolutionaries of the Centre and Right to refute these sophisms. They urged with perfect truth that the will of the Revolution in this case meant simply the arbitrary sway of a gang of reckless adventurers, that the Assembly, in spite of all its defects, was the one authorized institution entitled to speak for Russia, an institution which had been recognized and made use of by the Bolsheviks as long as it suited the purposes of their propaganda. But what force had arguments in the face of rifles? The soldiers had run away from the front in order to rob and kill in the name of the Revolution: no one was ready to satisfy and to glorify them to the same extent as the Bolsheviks. Hence there was ample "pragmatic" justification for the Bolsheviks' *coup d'état*. Naturally the first acts of the new era were decrees of the Executive Council proclaiming the abolition of private property and the resolve to conclude a democratic peace.

Peace of Brest Litovsk.—Two parties were necessary in order to conclude that honourable peace "without annexations and indemnities" which the Bolsheviks announced before having informed themselves of the views of the other party as to the conditions of such a peace. Lenin, Trotsky, Zinoviev and their colleagues had, however, made up their minds about certain points, so that the ordinary negotiations were for them only a formal act, attractive in so far as they enabled their *sans culotte* delegation to exchange salutations and to sit at the same table with the diplomatists and soldiers of powerful empires. The Bolsheviks had long ago made their choice between the belligerents; they expected and preferred the victory of the Germans, who had served them and provided them with funds in the hour of need. Hypocritical invitations to the Allies to follow in their wake at Brest Litovsk could deceive no one as to their choice. And as they had done more than anyone to corrupt and disband the Russian army, they knew perfectly well that they had nothing to oppose General Hoffmann, when the latter chose to "bang his boot on the table" (Trotsky). Some show was made in their newspapers of strikes in Austria and in Berlin, but it was clearly a case of discussing terms with an opponent who had disarmed you and may dispatch you at his pleasure. No wonder that Baron Kühlmann, after accepting the formula of an honourable peace "without indemnities and annexations" on the basis of the self-determination of peoples, required the representatives of the Soviet Republic to cede Poland and Courland to the Central Empires, to recognize Finland, Esthonia and Latvia as independent States, to give up the Ukraine on both shores of the Dnieper, and to pay a contribution of 300 million rubles. Trotsky tried to get away with a theatrical gesture; he and his colleagues declared that they could not sign such a humiliating peace, and they departed in noble style. Even this little pretence was not vouchsafed to them. General Hoffmann ordered some German divisions to advance, and the revolutionary army was at once on the run. The delegation of Soviets had to come back crestfallen and to sign a second more dishonourable edition of the Treaty of Brest Litovsk. Lenin was in no way disturbed: he explained to the Third Congress of the Soviets that the Germans had their knees on Russia's chest and that it was no use struggling. Breathing space must be had at any price, in the hope of a further fulfilment of Zimmerwald predictions. The Congress ratified the Brest Litovsk document by a large majority, and a German envoy, Count Mirbach, was sent to Moscow to watch over the exact fulfilment of conditions by the vanquished. Trotsky, who is particularly fond of repeating, at every turn of his account of these affairs, such phrases as "we know" or "we expected," may well claim that this degradation had been foreseen and to a great extent brought about by his party. But the breathing space required by Lenin was provided, not by the Brest Litovsk peace, which was the opening move for the complete enslavement of Russia by the Germans, but by the unexpected fact that the Allies did not succumb, in spite of the treacherous conduct of the Bolsheviks. The Marxist prognostics of the victory of Germany as the nation best organized in a technical and economic sense was shown to be fallacious. The staying power of the Austrian, Bulgarian and German armies proved to be less than that of the soldiers of France, Great Britain and the United States. The victory of the Allies saved Russia from the consequences of Brest Litovsk.

The Rule of the Communists.—In spite of the fact that the elections to the Constituent Assembly had resulted in an overwhelming majority for the Social Revolutionists, the drastic way in which Lenin and his companions had satisfied the popular demands for peace at any price, for land and for proletarian privileges, ensured to them the more or less fervid support of the masses. The lower classes enjoyed the defeat and humiliations of their betters even apart from direct advantages and even at the cost of some discomfort for themselves. The pent-up resentment and envy of generations found vent in acts of brutal violence and disorder. It was pleasant to see maids of honour sweeping the streets, and generals insulted and sometimes murdered by their soldiers. We are told of cases when the descendants of serfs dug out the skeletons of their former squires from their graves and threw them into sewers. It was an act of frenzy on the part of revolted slaves when the commander-in-chief, Dukhonin, was torn to pieces at his headquarters and Ensign Krylenko installed in his place, or when, later, the heroes of the great war—Ruzsky and Radko Dmitriev—were massacred in Piatigorsk because they did not truckle under the threats of the disbanded soldiery. The officers slaughtered in Helsingfors, in Kronstadt, in Kiev, in Sevastopol, paid with their blood for the disaster of Tsushima, the Sukhomlinov misrule, the cruel discipline of the Old Army. As a result, Bolshevik domination spread over the land like a forest fire, and all attempts at resistance proved unavailing against its elemental progress. The cadets of the military schools of Moscow held the Kremlin for a few days with great gallantry, but they were betrayed by the head of the Moscow garrison; he surrendered them to the Communists "for the sake of peace." Occasional resistance in other towns was put down with even greater ease. The personnel of many administrative institutions went on strike, and attempted to stalemate the usurpers by refusing to serve under them: the strikers were reduced to obedience after a couple of months by

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the necessity of earning their bread somehow. Countess Panina, one of the most enlightened and public-spirited Russian women, had acted as Assistant Minister in Kerensky's last Ministry: she was thrown into prison for having supported this strike movement, which the Bolsheviks treated as a "sabotage" of Government services. She was eventually released, but two among the most idealistic, most self-sacrificing of the Liberals who had taken part in the Provisional Government, Shingarev and Kokoshkin, fell victims to a dastardly gang of murderers in a hospital where they had been lodged on account of illness.

The only serious attempt to oppose armed resistance to the bandits was offered by Gen. Alexeiev and the indefatigable Kornilov. They collected a few thousands of devoted men, most of them officers, formed them into improvised units, and took the field against the Bolsheviks in a far-off corner of the empire in Northern Caucasus. Kornilov fell in the unequal struggle, but his comrades succeeded in building up gradually a 'Volunteer Army" which held its own in the Kuban territory. It was too weak to advance because the Cossacks, instead of joining it with all their forces, wavered and negotiated. Hetman Kaledin, a brilliant general who had won conspicuous distinction in Brusilov's campaign of 1916, was so grievously affected by this lack of patriotism that he committed suicide; and his successor, Krasnov, preferred to enter into an agreement with the Germans, who were spreading their tentacles from the Ukraine to the Donets and to the Volga.

The rise of the revolutionary tide was, however, not a constant and unbroken process. The shattered forces of the past did not give way without repeated attempts to reassert their vitality. The Orthodox Church that had grown up with the Russian people in its hard struggle for existence could not be reconciled with the rule of aggressive materialists. Everywhere the clergy exerted its influence publicly and secretly against the anti-Christian rulers. Tikhon, the newly appointed Patriarch of Moscow, whose chair had been set up again by a national Council of the Orthodox Church after an interval of 200 years of Babylonian bondage to lay bureaucracy, denounced and anathematized the Communists. Everywhere processions and ceremonies recalled to the popular mind the ancient traditions of creed and ritual, and even the most hardened among the rioters and deserters responded at times to these emotional appeals. The Bolsheviks turned sanctuaries into public halls, desecrated revered shrines, tortured priests and shot bishops, but these persecutions strengthened the moral hold of the Church on the flock, purified the sunken priesthood by a new baptism of blood. Among the Intellectuals themselves, religion regained many adherents, and men like Eugène Trubetskoy or Bulgakov, who had stood up for Christian ideals in the days when it was considered ridiculous for an educated man to do so, found themselves at the head of a powerful movement.

The Liberals also did not give up the struggle. A number of more or less secret associations sprang up. The Press was being gradually gagged by the Bolsheviks, but these associations continued their underground existence in spite of the espionage and arrests. The most influential were the Radical League of Reconstruction (*Soyuz Vozrojdenia*) led by Avksentiev and Argunov, the "Centre," composed of Cadets and Left Octobrists with N. Astrov and N. Shtchpkin at their head, and a union of the Rights whose principal leaders were Krivoshein and Gourko. The question of yielding to the Germans and crushing the Communists with their help was eagerly discussed in connexion with the plan of a monarchical restoration. The idea found favour among the Rights and was supported among the Cadets by P. Milyukov, who had fled to Kiev, and considered that the game was definitely lost by the western Allies and that it was wiser to accept defeat from the Germans than from the Bolsheviks. This view was, however, decisively rejected by the Liberals and the Radicals, who remained staunch in their allegiance to the Entente and could not bear to think of German domination. The chastisement for this independence of mind followed closely upon the offence: the Cadets had held a conference in Moscow on the political situation on May 13, 14 and 15, and had endorsed the policy of their leaders to remain faithful to the Entente: on May 17 their various centres were raided and many representatives arrested. Others fled south and east, but Moscow was still the nucleus of a "National Centre."

Policy of the Allies.—How did the Entente Powers react against the disruption of their alliance with Russia? Their ambassadors, having watched with anxiety the decay of the monarchy, offered ineffectual advice, and informed their Governments of the precariousness of the situation without being able to suggest any effective course of policy. When the blow fell, the Entente Powers accepted the verdict of the Revolution as a necessary consequence of Tsarist misrule, and the President of the United States actually felt more free to join the western coalition, since the danger of a victorious advance of Tsarism had been removed. The device of a double diplomacy was adopted: while Sir George Buchanan and M. Noulens continued officially to represent Great Britain and France, special envoys were dispatched to Petrograd as emissaries of various groups of Socialists faithful to national traditions. Arthur Henderson for Great Britain and M. Albert Thomas for France were even entrusted with official missions. The main object was to steer the Russian Revolution into a warlike course, to keep up the eastern front, and to provoke a resumption of the Russian offensive. The results of this unusual diplomacy were very heterogeneous. While Albert Thomas eagerly supported Kerensky in his patriotic appeals to the army, as well as in his attempts to arrange a coalition with the Soviets, Arthur Henderson became convinced of the urgent need of peace and favoured a meeting of Labour delegates in Stockholm.

The evolution of Russia was not much affected by these contradictory views of the Entente emissaries. The offensive was tried with disastrous results. The Russian army dissolved under the influence of the "peace at any price" movement. Disappointment with the conduct of revolutionary Russia was reflected in the sympathy on the part of certain circles in England for Kornilov's attempt, a sympathy which did not help but rather hampered him. The advent of the Bolsheviks drove the western Powers into an attitude of absolute helplessness. They could do nothing to counteract the Brest Litovsk negotiations, and, at the same time, they were not in a position to break off all relations with the Communist Government for fear of its taking sides with the Germans. Even the shooting of the British naval attaché by Bolsheviks did not rouse them from their torpor. The Brest Litovsk peace, the occupation of southern Russia by German troops, the intervention of the Germans in Finland, obliged them, however, to adopt a decision. The embassies were gradually withdrawn, the semi-commercial and semi-diplomatic mission of Mr. Lockhart did not lead to any favourable results, and in the summer of 1918 all official relations with the Government of the Soviets were broken off. A state of more or less active hostility set in when the anti-Bolshevik troops were being reorganized on an extensive scale in various parts of Russia. The White forces received support from the Allies in the shape of military supplies, occasional expeditions, and a blockade of the ports controlled by the Soviets. Concurrently with this intermittent support of Russian national armies, the Allies encouraged and protected all the nationalities of the Empire which were striving for a separation from Russia: Poland and Rumania came to be looked upon by the French as the bulwarks of Western civilization against Russian barbarism and German militarism. The Baltic States (Latvia, Esthonia, Lithuania) and the Caucasian formations (Georgia, Armenia, Azerbäijän) were backed in their separatist aspirations by Great Britain. This tendency to dismemberment of the Russian Empire could not be harmonized with the ideals and efforts of Russian patriots, but the Entente Powers did not pause to reflect on the inadvisability of destroying with one hand what they were helping to build up with the other. Psychologically, their centrifugal policy was connected with old antagonism to the Russian Empire, with dreams of national self-determination, restricted somehow by the vital interests of the "Big Four," and—after the victory over the Central Powers—with the

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Versailles delusions of overwhelming power over the world. The incoherence and vacillations of Entente policy might not have been so pernicious if Russian patriots had been able to muster an overwhelming array of anti-Bolshevik forces in Russia itself. Unfortunately this was not the case.

Anti-Bolshevik Governments.—During the first months of the Soviet regime, while the power of the proletarian dictators was still shaky and unorganized, several concentrations opposing them were formed in the East. First, Colonel Semenov, a leader of Transbaikalian Cossacks, had started a guerrilla warfare on the borders of Mongolia and Manchuria, advancing in the direction of Chita when luck favoured him and retreating across the Chinese frontier when he met superior forces of the Bolsheviks, together with the Magyar, Austrian and German prisoners of war mobilized by the latter. In May 1918, he succeeded in forming a provisional government in Chita. Soon afterwards, Admiral Kolchak, a brilliant naval officer, who had distinguished himself in the Japanese War, organized another Provisional Government in Novo Nikolayevsk at the junction of the Siberian railway with the Maritime province line. The Japanese, who had landed a detachment in Vladivostok, supported him in a general way.

About the same time, in the spring and early summer of 1918, there occurred another startling event. Czech detachments which had been formed to fight for Russia from among prisoners of war, and who had fought gallantly against the Central Coalition in the last campaign, demanded to withdraw after the *débâcle* of the Russian army and the advent of the Bolsheviks. They were allowed to do so by the Soviet authorities, but they were to be disarmed, and in the course of their movement east towards Vladivostok they were subjected to offensive and treacherous treatment. Some of them refused to give up their arms; others, after having been disarmed, broke away, recovered arms and munitions, and turned on the undisciplined rabble of the Red troops. As a result of encounters of this kind, the Czechs, and some Slovak detachments which had joined them, seized great tracts of the Siberian railway line near the Volga, near Irkutsk, and by Vladivostok. Eventually, after many vicissitudes, these corps made their junction along the whole line. The total number of troops who effected this *coup de théâtre* averaged some 80,000 men. It would be useless to follow in detail the swaying fortunes of these detachments. Their daring exploits would hardly have achieved success if a considerable portion of the population of eastern Russia had not sympathized with them. As it happened, these disciplined troops succeeded in creating the backbone of resistance against the Moscow dictators: in Siberia, Provisional Governments were formed in Vladivostok, in Harbin (General Horvath), and in Tomsk, besides the centres of military administration started by Col. Semenov and Admiral Kolchak.

Unfortunately the various governments comprised different and mutually hostile groups, which could not be prevailed upon to act loyally together. The Vladivostok concentration reflected the Socialist ferment in the country, and worked for an independent Siberia. The Government formed in Tomsk was an Executive of a Siberian Duma, composed of delegates from various organizations—zemstvos, municipalities, political parties, social groups (workmen, students, coöperative associations). The majority of these constituencies followed a socialistic orientation, but their Executive adopted a more conservative policy and admitted several Cadets into its ranks. From Samara came yet another political tendency: some thirty fugitive members of the Constituent Assembly, dismissed by the Bolsheviks, had assembled there, and their political creed was expressed in the demand for a restoration of that Assembly, which they considered as the only body constitutionally entitled to wield power in Russia. Their aim was to reconstitute an All-Russian State, which would include Siberia as an autonomous part of its organization. On the other hand the administrations of General Horvath and Admiral Kolchak, while reserving the ultimate decision as to the system of Government to a new Constituent Assembly, discarded the authority of the one elected in December 1917 as not representative of Russian opinion. These administrations favoured the propertied classes and built up their personnel from the remnants of the military and civil bureaucracy of the monarchical period. Even in the face of the enemy all these groups found the greatest difficulty in establishing coöperation. The Vladivostok Government submitted to the authority of the West Siberian one, but the negotiations with Horvath were protracted and fruitless. A *coup d'état* on a small scale was attempted in Vladivostok by Horvath's lieutenant, Gen. Pleshkov, but the Allies intervened to reëstablish the Socialist administration because it was approved of by the Vladivostok zemstvo.

In the west a conference held in Ufa laid down the foundations of an All-Russian scheme in connexion with the Constituent Assembly of 1917, and succeeded in persuading the Siberian Government in Omsk to recognize its authority. The moving element in this case came from the Moderate Socialists, chiefly Social Revolutionaries, but Social Democrats of the Plekhanov persuasion and some Cadets were in agreement with them. A directorate of five consisting of Avksentiev, Zenzinov, Vologodsky, V. Vinogradov and Gen. Boldyrov was established. Admiral Kolchak accepted the portfolio of War in the Ministry which was to conduct the actual administration. This amalgamation of Governments was arranged in the beginning of Oct., and a mobilization of certain classes of the Siberian population which had been started somewhat earlier was carried out on a more extensive scale: it yielded some 150,000 men, whose military instruction had to be taken in hand under very difficult conditions. Many delays and mistakes occurred, and the different sets of people who had been brought together with such difficulty quarrelled over the task, suspected and accused one another. The officers who had served under the old régime were displeased with the policy of the Directors, whom they accused of indecision and vain talk; the Socialists chafed at the high-handed way in which they were treated by the military chiefs and the employees of the Ministries. In the night of November 18 these dissensions came to a head. A party of soldiers led by officers of the Omsk garrison arrested the Socialist members of the Directorate, Avksentiev and Zenzinov, and two of their assistants, while a third Director, Vologodsky, joined a meeting of Ministers which elected Admiral Kolchak as Supreme Ruler. In the communiqué issued on the occasion by the newly constituted Government, it was explained that "wide social circles had been discontented with the wavering behaviour of the Provisional All-Russian Government in regard to certain tendencies of the Left leading to the renewal of a destructive policy. While condemning the *coup d'état* as an illegal act the new Government endorsed it by taking advantage of the accomplished fact: Avksentiev and Zenzinov were allowed to escape and the two remaining Directors, Boldyrov and Vinogradov, retired.

Such a start did not augur well for the future of the reconstruction movement: it showed that the enemies of the Bolsheviks were still irreconcilably divided by the old feud between Conservative Nationalists and Socialistic idealists. These conflicts helped to keep alive in the mass of the people a spirit of lawlessness and distrust. And yet nothing was more needed in those days than steadiness and forbearance as regards details; those who had assumed the task of restoring order were least able to lay claim to efficient administration—the lack of experience and even honesty was felt everywhere. The mobilization, for example, was carried out in the most haphazard fashion, crowds of conscripts being left even without accommodation.

The fact that the Bolsheviks in Siberia were drawing largely for support on the Austrian, Magyar, and German prisoners, of whom about half a million were dispersed in various localities of the wide country, and the difficult situation of the Czechs astride the Siberian railway, had provoked an intervention of the Allies. Japanese, American, British and French detachments were landed in Vladivostok with instructions of varying intensity: all the intervening Powers gave assurances of their disinterestedness, of their friendship for the Russian people, of

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their resolve to leave it entirely free to decide as to its destiny; but while the Japanese were committed by their past and their future to safeguard and promote their own interests, the Americans were enjoined to restrict themselves to guarding railway communications and stores, and the French colonial troops held aloof. The British followed a middle course in the sense that part of their contingent, Col. J. Ward's Hampshire Regiment, was pushed forward right through Siberia, but there was no clear military aim in that operation and steps were retraced when the real difficulties set in. Material support was given by the British more than by anybody else, but these measures were in the nature of a risky speculation dependent on the trend of home politics and on the ability of the "White Guards" to win the game.

A somewhat different situation arose in the north of Russia, where the rule of the Soviet Commissars was overthrown both in Archangel and in the Murman, and a patriotic Government was set up under the leadership of N. Tchaïkovsky, a "Popular Socialist," who had lived in England for many years as an exile. The opposition between progressive and conservative circles, and the difficulty of conducting business with the available demoralized elements, were also felt there, but Great Britain's stake in the game was much more conspicuous, and the British detachments under Generals Maynard and Ironside formed a very important part of the forces operating against the Bolsheviks. There was, however, no real cohesion between the Russians and their British allies, although cases of acute hostility were exceptional. Apart from such dissensions the ground was felt to be shaky on account of the war-weariness and the fickle temper of the common people. The massacre of the British officers by the men of Dyer's battalion showed that Bolshevik propaganda and Bolshevik habits were by no means a thing of the past.

The southern front, organized by General Denikin after Alexeiev's death, was suffering from similar weakness. The Voluntary Army constituting its backbone had become an efficient and powerful instrument of war; the officers' division, which had formed its bulk in the beginning, had expanded gradually into several corps by drawing into its ranks veteran soldiers who had learnt their trade in the terrible battles against Germans and Austrians. But the trusty regiments named after Kornilov, Alexeiev, Markov and Drozdovsky, had to act together with the levies of the Don and the Kuban Cossacks, who, though unrivalled as irregular horsemen, had their own axe to grind in the conflict. The Don province had been subjected to repeated attacks and devastation, and many of the Cossacks were anxious to keep to their frontiers and to manage their own affairs. As for the Kuban people, they were divided among two sets: the men of the "line" in the north were patriotic enough and fought brilliantly, but the Black Sea Cossacks, mostly descendants of the Zaporog Cossacks transferred to the Kuban from the Dnieper by Catherine II., were animated by a spirit of separatism and ready to follow leaders who worked for a Cossack Republic. A great deal depended on the skill and the political insight of Denikin's administration, and in this respect, as on the eastern front, grievous blunders and abuses occurred. The main direction was necessarily in the hands of military commanders inclined to insist above all on discipline, and contemptuous as to political theories and subtle distinctions. Denikin himself, though perfectly honest and straightforward, held systematically aloof from constitutional disputes, and declared his task to be primarily one of liberation and restoration. His principal assistants, Generals Dragomirov and Lukomsky, had even less taste for political "metaphysics," and one of the civil advisers, Prof. K. Sokolov, openly expressed the view that the only régime suited to the circumstances of the time was a "democratic dictatorship" satisfying the needs of the common people. Although nothing was prejudged as to the ultimate form of Government, the organization of the southern territories occupied by Denikin was cast in the mould of the supreme authority of the commander-in-chief. By his side stood a Special Council composed of the heads of departments and of a few representatives of public opinion. All the members—some twenty—were nominated by the commander-in-chief. The elements of military and civil bureaucracy were decidedly predominant, and the "Left" was confined to three Cadets, all moderate Liberals. The Socialist parties were excluded from the Government and kept under strict supervision as regards their Press. One of their influential leaders, Schreider, was deported by order of the Government; many others left of their own accord for the Crimea. The greatest difficulty was experienced in holding the balance between the aims of the Volunteer Army engaged in the reëstablishment of a National State and the aspirations of the Cossack communities tending towards federalism. The problem of reconciling these contradictory tendencies was a most difficult one. The Kuban Rada (Assembly) manifested openly separatist leanings: its leaders, Bytch and Makarenko, were dissatisfied with a dualistic arrangement contrived after many efforts between the Higher Command and the Rada. They wanted the political independence of the Kuban to be recognized, and sought an alliance with other Cossack territories in order to strengthen their demands. This political strife reacted in a most unfavourable manner on the conduct of operations in the field.

Reds v. Whites.—Disgust with the hypocritical tyranny of the Bolsheviks and the humiliation of Russia found a vent in conspiracies and risings among the intellectuals. The German ascendency was challenged by the murder of the ambassador, Count Mirbach, in July 1918. Almost simultaneously the commissar in charge of the police in Petrograd, Uritsky, was killed, and Lenin himself dangerously wounded by a Socialist. The Social Revolutionaries made an attempt to overthrow the Bolsheviks in Moscow, but were suppressed with great slaughter. Later on, the most experienced of Terrorists, Boris Savinkov, engineered a rising in Yaroslavl and neighbouring districts; it was quelled after bitter fighting. These isolated attempts in the heart of Russia were not so dangerous as the simultaneous advance from the east and the south. Kolchak's armies reached at one time Kazan and Simbirsk, Denikin pushed as far as Orel, and in the north there was some hope that Gen. Ironside's British column might have joined hands with Kolchak's force near Kotlas. The Communists made desperate efforts to meet the onslaught. The Red hosts were reorganized by former officers of the Imperial army, with Polivanov, Theremissov, Klembovsky, Parsky, Dalmetov at their head. Even Brussilov lent the prestige of his name to the cause of the Moscow Soviet. These men were inspired not only by the pressure of want and despair, but in many cases by a fatalistic belief that they were serving the interests of Russia under the Red flag as against reactionaries and foreigners. An iron discipline was reintroduced, disobedience, treachery and cowardice were promptly punished with death, desertion was repressed as far as possible, there was no more indulgence for committee discussions or for the "self-determination" of military units which had wrought havoc in the last stage of the war against the Central Empires. In every battalion, squadron and battery nuclei of devoted Communists were inserted in order to watch and to lead the apathetic rank and file. Altogether the proletarian dictators reverted without any scruple or confusion to the practices they had fiercely denounced in the time of defeatist propaganda. The cadres of the army were gradually filled by wholesale mobilizations, and although crowds of conscripts were swept away by desertion, there remained enough in the ranks to outnumber the White forces: the fact that the Bolsheviks had got hold of the solid centre of Great Russia against the weaker outlying portions of the Empire was bound to assert its overwhelming influence in the end. Of course, if there had been an elemental popular rising against the proletarian leaders, they could not have withstood the attack. But the Great Russian peasantry, although by no means sympathetic to Communist doctrines and hostile to many of the commissars, were yet under the spell of the opinion that they were defending their newly conquered land against the squires who wanted to get it back. While this broad basis of popular support remained unshaken the dictators could exert their cruelty and lusts with impunity.

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Terror against the bourgeoisie had been proclaimed by them from the very beginning: it formed one of the main planks of their platform. It was expanded into a system of wholesale slaughter and ruthless inquisitorial measures as a means of self-defence. The Extraordinary Commission (the famous *Tchresvichayka*) thrust the Tsar's *Okhrana* into the shade; as a matter of fact, it was served to a large extent by hangmen, torture-masters and spies borrowed from the Tsarist police, but acting with much greater independence and thoroughness. By the side of this cold-blooded and systematic machinery for crushing human beings acted innumerable gangs of ruffians and criminals, who robbed and killed in the sacred name of the Red Revolution with complete impunity and with the approval of the ruling powers. It is quite impossible to estimate the number of victims who fell a prey to this campaign of hatred.

Here is an extract from Bolshevik sources which may illustrate this butchery, although it does not in any way give an idea of its real dimensions:—

"In 1918 the persons arrested on the charges of counter-revolution, crime in office, speculation, use of forged and other people's documents, etc., numbered 47,348. In 1919 the activities of the Tchresvichayka developed, and the number of persons arrested reached 80,662. Out of the total number of persons arrested in 1919, 21,032 were classed as counter-revolutionaries, while 19,673 were arrested for crimes of office. Out of the 128,010 arrested in 1918–9 54,250, or 42½%, were liberated without subsequent consequences. Eight per cent of the total number of persons consisted of hostages. Nearly 11% were sentenced to compulsory labour, 29% retained in prison, and nearly 8% sent into concentration camps. In 1918 6,185 persons were executed and 3,456 in 1919, the total number during the two years being 9,641." (Lazies, *The Fight on the Home Front.*)

In such cases it is not only the number of victims that counts, but also their quality: as in the times of Ivan the Terrible, only "God knows the names of the murdered," but let us notice by way of example that some of the most respected among Moscow's citizens, whose whole lives had been devoted to the service of the people—the Astrovs, the Alferovs, N. Shtechepkin—were shot as "spies" in the summer of 1919.

What did the Whites oppose to the Red fury? In fighting prowess the Whites were more than a match for the Reds, especially on the southern front: the exploits of Wrangel's Caucasian corps in the attack and defence of Tsaritsin, the advance of the Volunteer army's infantry against heavy odds on Kharkov and Kursk, the rally at Rostov in the last months of 1920, are proofs of the excellent quality of Denikin's troops. Kolchak's Siberians were not seasoned to the same extent, but they were good material and improved rapidly, and the Orenburg and Ural Cossacks operating between the two groups did everything humanly possible to oppose the Reds. But neither the eastern nor the southern armies were supported by a tolerably organized rear. Kolchak and Denikin moved rapidly forward in the hope of cutting off the economically important district of the Ural, the Donets, the corn-growing provinces along the Volga and in the Ukraine, but their rapid advance involved a hasty and superficial occupation of wide tracts. They flooded their regiments with unwilling conscripts and had to rely for supplies on requisitions: the corn and the horses of the peasants were seized without any regard for the needs of the farmers, while the raids of Cossack cavalry into regions held by the Reds resulted in indiscriminate looting of friend and foe. What constantly happened in such circumstances was that the advancing Whites were received with "bread and salt" and attacked in the rear when they had been in the country for some time.

If the White leaders had succeeded in persuading the people that their aim was genuinely patriotic and that private interests had to be sacrificed for the sake of the great cause, all the miseries of civil war might have been endured, if not willingly, at least with resignation. But neither on the eastern nor on the southern front did the Whites establish confidence, that condition precedent of success. There cannot be the slightest doubt that not only Denikin and Kolchak, but also their principal followers were fighting for the ideal of a reunited and free Russia, but there was too much of the hated past intermixed with their efforts; corrupt officials, greedy squires had flocked to the White banners and were clamouring and pressing for revenge and compensation. The frequent cases of lynching of commissars and Communists were an inevitable consequence of the civil war and of the hatred inspired by the wreckers of Russia: it was impossible to draw the line between justified retribution and wanton cruelty in many of these explosions of wrath. Sometimes, as in the case of Jewish pogroms in the Ukraine, subordinate officers acted against the direct orders of the High Command. But there were other signs of the time in the policy of the White leaders which created the suspicion that they were out for a counter-revolution, for the re-establishment of the old monarchy and the old gentry. The Socialists, who formed a great part of the intellectual class as far as the latter still existed, were driven back without any regard for the fact that they were natural allies in the struggle against Communism. One of the leading members of the Constituent Assembly was shot by Kolchak's Government in Ekaterinburg. The same fate befell leaders of the Kuban separatists in Ekaterinodar. The Liberal members of the Denikin "Special Council," like N. Astrov, protested in vain against a policy directed against all Socialists indiscriminately. If Denikin had not personally prevented further persecutions and open reaction, the dictatorial schemes of the generals would have been embodied in some drastic Act of the State for which Prof. K. Sokolov would have supplied a juridical formula. As it was, for the mass of the people the repeated protestations of acceptance of the social results of the Revolution seemed belied by the way in which agrarian reform[1] was to be regulated. The subtle distinctions concerning compensation and redemption tax reminded the peasants forcibly of the procedure followed by the Emancipation Act of 1861, and the Reds were not slow to take advantage of this unfortunate association of ideas. The Whites started also a propaganda office (*Osvag*), but although some 200 million rubles are said to have been spent on it, its activity was subjected to bitter criticism by various groups in the camp of the Whites. The state of affairs brought about two fatal results—confusion in the rear of the White armies, and discord between the patriotic forces in Russia and the Allies.

The conditions in the rear of Denikin's army were described by Soviet propagandists with ironical satisfaction. There can be no doubt that the activity of "green" bands of marauders, and the rise of such potentates as Makhno, a brigand whose followers are said to have mustered at times some thirty thousand, made orderly life in the rear impossible and drew off considerable forces at the most critical moments for the maintenance of some sort of communications. What proved even worse was the defection of dissatisfied Cossacks. When the Volunteer army was straining its forces to hold the line against the Reds north of Rostov, Kuban troops left their positions and went home, leaving Denikin's right flank unprotected.

A similar state of affairs prevailed on the eastern front: the population in the rear, excited by Communist propaganda and fraternizing with the lawless elements so numerous in Siberia—convicts and prisoners of war—conducted a constant guerrilla warfare against the Russian and foreign troops protecting the Trans-Siberian railway line. Kolchak tried to counteract this shocking demoralization by reorganizing his government under

[1] The following were the conditions of land reform proclaimed by Denikin on July 19 1919:—

(1) Safeguarding of the interests of the toiling population;
(2) The creation and the placing on a sound basis of small and medium homesteads out of the land belonging to the State and private owners;
(3) The preservation of the right of the landowners to their land, coupled, however, with the apportionment in each district of the amount of land that is to be retained by the former owner and the order of the transfer of the remainder into the ownership of those who are land-poor;
(4) These transfers may be achieved by *voluntary agreement*, or by *obligatory alienation for compensation*. The new owners are to acquire inalienable rights to their allotments.
(5) *Intensive aid to be given to tillers* of the soil, through technical improvement of the lands, expert agricultural assistance, the supply of implements, seeds, dead and live inventory, etc.

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the leadership of an energetic and enlightened man, Pepelayev. It was too late and the administrative personnel too insufficient to avert the catastrophe. The eastern front gave way even before the southern one. Thousands of soldiers and refugees perished in the retreat through the icefields of Siberia in the winter of 1919–20; Kolchak and Pepelayev, who had sought the protection of the Czechoslovaks, were handed over to the Bolsheviks in pursuit with the consent of Gen. Janin, the commander of the Allied contingents, and shot; while the Czechs succeeded in extricating themselves and carrying off part of the gold reserve seized during the occupation of Kazan.

Allied Intervention.—The action of the Allies in these deplorable times was contradictory and ineffective. Large quantities of munitions and supplies were furnished to the patriotic armies; sometimes the consignments arrived late or were in damaged condition, while a good deal of pilfering and embezzling occurred, but, on the whole, it is certain that the White armies could not have held the field for a month without this material assistance. Huge sums of money were provided to help the Russian commanders to tide over their financial difficulties, and it is estimated that the British spent about £100,000,000 in these transactions. But while so much was done in this direction, the diplomatic and strategic steps taken by the Allies were not only inadequate, but often mischievous. The policy of support for the patriotic movement in Russia lived, as it were, under a cloud: it was disturbed and hampered right through by the opposition of strong currents of opinion in western Europe and in the United States. There was, to begin with, the fear of infection of Allied troops by Bolshevik propaganda—a fear justified to some extent by such facts as the conduct of French sailors and soldiers in Sevastopol and in Odessa, where the red flag was actually hoisted by French men-of-war, and certain battalions of the army of occupation showed a marked disinclination to fight the Reds. This fear that war-weary soldiers of the Entente might not be proof against Communist propaganda led to the undignified scampering out of the Crimea and from the south-west. Even more important was the sympathy shown to the cause of the Bolsheviks by Socialists in France and the Labour party in England, a sympathy in which they were supported by influential organs of the Radical press. This feeling manifested itself in a variety of shapes and degrees: some regarded the violence and destruction of the Communist upheaval as the beginning of a new era in social history characterized by the overthrow of capitalism; others condoned terroristic methods as a necessary means of revolutionary action; others again were prepared to admit that these methods were justified by the misrule of the Tsars that had provoked the vengeance of the people; all were inclined to balance the misdeeds of the Reds by the excesses of the Whites and all objected to intervention in favour of the latter. The reorganization of Russia on Imperial lines was distasteful to many English Conservatives who were still under the influence of the ideals of Disraeli. Last, but not least, there was a growing number of "realists" who contended that the Bolsheviks had proved their right to rule because they had defeated their opponents in the field and that in these circumstances it would be best to recognize facts and to draw from them such advantages as could accrue to business men from the needs of a great country.

The weaknesses and failings of the White organizations in Russia presented most convenient materials for the action of all these elements opposed to Allied intervention. The result was a series of inconsistent steps which contributed to the decline of the cause of reconstruction. In Jan. 1919 came the proposal of the "Big Four" that the belligerents of the civil war should meet in Prinkipo and discuss conditions of pacification—a proposal that reflected in a striking manner the peculiar combination of unpractical idealism, superficial knowledge and the yielding to "happy thoughts," which formed one of the characteristics of the Versailles Conference. As the Arcadian perspectives of Prinkipo did not meet with the expected response on the part of the belligerents, schemes acknowledging the standing of the proletarian dictators began to crop up, in connexion with favourable reports by enterprising American journalists (Mr. Bullitt's mission). At the same time the British War Office countenanced the plan of a raid on Petrograd to be carried out by the victor of Sarikamish, Gen. Yudenich. This enterprise was attempted with insufficient forces (some 15,000 men); it was in the nature of a gamble, but even gamblers do not usually put stakes on opposite sides. In this case, however, the Allied High Commissioner, Gen. Sir Hubert Gough, paid more attention to the aspirations of Esthonians, who were anything but keen to promote Yudenich's success, than to the requirements of the Russians. The climax of that form of intervention was reached when Gen. Gough's chief-of-Staff, Col. Marsh, gave the Russians three-quarters of an hour to form a North-Western Government and to recognize the independence of Esthonia. No wonder the expedition did not prosper.

By Nov. 1919 Mr. Lloyd George had come to the conclusion that it was advisable to renounce intervention and to leave Russia to her fate. Though doing lip service to the unforgettable services of Russia in the war, he submitted that it was not in the interest of Great Britain to assist in strengthening that country. This point of view prevailed definitely in 1920. When Denikin was forced to abandon the North Caucasian territory, British policy steered towards a liquidation of the Russian imbroglio. Wrangel made a last and gallant stand in the Crimea, but he was recognized and supported by the French only, while Great Britain took up an attitude of neutrality favourable to the Moscow dictators.

In the war which Poland waged rather imprudently when the danger of restoration of Imperial Russia had vanished, Great Britain was prepared to surrender Poland to Bolshevik hegemony, and when the tables were turned before Warsaw, thanks to the assistance of the French, British diplomacy employed itself in arranging an armistice between Poles and Bolsheviks which enabled the latter to concentrate their forces against Wrangel and to crush him. This cleared the way to a "complete control" of Russia by the Communists, and enabled the British Premier to give effect to the plans of a resumption of commercial relations with "Sovdepia." There were, indeed, two aspects of Bolshevik policy to be considered—the alluring prospect of exploitation of latent and immense natural sources offered by Mr. Krassin, and the uncompromising attitude of the Third International, founded in Moscow for the express purpose of revolutionizing the world by fair means or foul. While France and the United States refused to have anything to do with a "Government of assassins," realistic considerations prevailed with Great Britain and Italy. Communist propaganda was treated as a bogey, and disarmed by certain stipulations as regards India and by vague promises of a general nature. On the other hand the door was open to trade, not indeed on account of "bulging corn bins" in Russia (as Mr. Lloyd George had once suggested), but on account of her need of everything in the way of raw materials and manufactures. The dictatorship of the proletariat was recognized as the *de facto* Government of Russia, and its leaders encouraged to adopt a policy of renunciation of their doctrines in return for retention of power.

The Soviet Constitution

It remains for us to consider the internal evolution of this newly recognized member of European society, and the results achieved by its rule.

Apart from general declarations of principles, the constructive policy of the Communists may be said to have been initiated at the fifth Congress of Soviets which met at Moscow in July 1918. It consisted originally of 1,132 members with power to vote, of whom 745 were Bolsheviks, 352 belonged to the Social Revolutionary Left, 14 were Maximalists, 4 Anarchists, 4 Social Democrats of the Internationalist group, 10 were outside any party, 3 belonged to "miscellaneous groups." At a later stage the Social Revolutionaries disappeared in consequence of disagreement and risings, and the Congress was supposed to comprise about 1,000 members. From a formal point of view the most important business transacted by this Congress was the

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acceptance of the Constitution, but this was carried in a hurried manner at the close of the session and without any debates to speak of, when the opposition had been ejected from the Assembly. Nevertheless it is advisable to begin with a summary of its most important provisions. It proclaims itself to be the Constitution of the Federal Socialistic Republic of Soviets. As a matter of fact there was no federalism about it, as no means had been provided for any genuine expression of the will of the component parts. The Ukraine, for instance, was never allowed any self-determination, but was simply conquered by the Bolshevik armies and subjected to the rule of Moscow authorities, although the pretence of separate existence and organization was kept up. The social basis of the republic was formed by the workmen and the peasants, while all those who used the labour of others for their benefit were disfranchised.[1] One of the fundamental assumptions of the system was that the normal kind of work that counts is manual work and all forms of activity which do not take the shape of manual work have, as it were, to justify their existence in relation to manual work. At best a rough equation was established between various forms of employment, at the worst people who could not claim the designation of workmen were declared to be bourgeois under suspicion. In principle no distinction was made between various kinds of performance in point of quality, and in introducing the project of the Constitution the reporter, Stekloff, appealed in as many words to the famous maxim of Fourier: "To everyone according to his needs." It may be noticed, however, that the other side of the saying—"From everyone according to his faculties"—was also acknowledged in a somewhat peculiar form (by Trotsky): those who refuse to work need not eat. The threat was directed primarily against the civil servants who had thrown up their office work, but the principle admitted of wider application and came to be applied to workmen in general.

There was no attempt at democratic equality, in any sense. As regards electoral representation, for instance, an industrial worker was treated right through as worth five peasants: 25,000 of the former were reckoned for each delegate of a Soviet Congress and 125,000 of the latter; the same ratio obtained in local and provincial organization.[2] Instead of the *direct* elections on which so much insistence was laid in the democratic stages of the revolutionary movement, all elections were managed on the principle of an ascending scale from lower to higher units. The result was that undesirable elements were weeded out in the process by means of wire-pulling or by downright violence. The clubs of Communists in the various local centres acted as committees of supervision, and terrorized the country so effectually that the Communist party, which on its own showing did not number more than 600,000 members, invariably captured three-fourths or more of the seats in the Assemblies.

The masses of the peasantry, to whom reference was so often made in the speeches of official Bolshevik orators, had much less chance of being heard than in the gerrymandered Dumas of the Tsarist regime: the so-called delegates of workmen, soldiers and peasants were generally intellectuals with a more or less incomplete educational record, but expert in journalistic propaganda and free from all received notions as to morality, humanity or justice. The Congress of Soviets should have met at least once in six months; but this rule fell into abeyance, and the years 1919 and 1920 saw only two congresses (the seventh and the eighth). The intermediate institution of the Central Executive Committee of 200 (later 300) had to act as a kind of Parliament in the absence of the Congress, and was entrusted with supreme authority all the while; but the Board of Commissars of the People, corresponding to a Council of Ministers under the Parliamentary regime, wielded the real authority. It took its lead again from its *presidium*, on which the Government of Russia entirely depended. In this way the appearance of democracy was reconciled with the reality of a very narrow oligarchy, according to the pattern worked out by the French Jacobins in the days of the Committee of Public Safety. A curious device of the sophistical combination consisted in making members of the Central Executive Council at the same time supervisors and subordinates of the commissars, as if genuine control could be expected from persons employed in working the machinery under control.

Local units were subjected to similar limitations: the bourgeois of all descriptions were condemned in every respect to the position of outcasts. Elections were to be conducted under constant pressure from the Communist clubs, and inconvenient persons were to be removed from participation in local as well as central government. A characteristic application of this all-pervading suppression of the bourgeois is the handing over of all technical means of publicity, in other words of the Press, to the workmen and peasants. This meant that there is no possibility for expressing any opinions except those approved by the Bolshevik clubs. The Press was not gagged—it ceased to exist as a free agent. It became a means of reproducing in thousands of copies the standard views decreed by the Bolsheviks. The Tsarist regime never aspired to this complete suppression of public opinion. The right of assembly was vindicated in the same way in the Constitution. The preamble of it started with a sounding declaration of freedom; but it was sufficient for commissars to declare a meeting to be counter-revolutionary in order to be entitled to put an end to it by force.

The Bolshevik legislators prided themselves on having got rid of the division of the functions of legislation and administration, and treating both as alternative manifestations of the will of the living communities of workmen and peasants. One of the effects of this unification of power in the collective unit was the right to recall representatives which belongs to the rural communities, the trade unions and the military units. In actual practice the recall was used to allow free play to the Communist wire-pullers, who were careful to watch over the orthodoxy of the various soviets. The alternation of functions opened the door to log-rolling and capricious changes of policy. Perhaps the most striking expression of the inanity of these constitutional functions was to be found in the position of the delegates of the Red army, who had to represent simultaneously controlling power in the Executive Council and the "iron discipline" of the Bolshevik regime in the ranks.

Altogether the "Constitution" of the Federal Republic of Soviets was clearly intended to be an instrument for the oppression of the formerly privileged classes and a means of propaganda for the edification of people who want to believe in the benefits of Communist rule. When reproached with the duplicity and the contradictions of this paper arrangement the Bolshevist answers: all derogations from principle are justified by the necessity to fight the counter-revolutionaries and to destroy the bourgeoisie. Pure Communism can be introduced only when the people have been ground into uniform pulp: then Law and the State will disappear of themselves. As long as there is any opposition anywhere dictatorship of the proletariat has to be kept up, and as the mass of the people is not permeated with Communist consciousness the dictatorship can only be constituted by the enlightened minority. Hence the necessity of the rule of the few for the sake of the proletariat. It is interesting to read the justification of the Soviet system on the ground that it makes popular government a reality while parliamentary institutions provide mere fictions:—

"In democracies the only way in which a workman or a peasant participates in government is that he puts a voting paper once in four years in a ballot box. The Soviets are direct organizations of the masses; they are not impermeable, there is the right of recall. . . And this is not only the case with the Soviets which form, as it were, the top of power . . . the organization does not only belong to workmen, it is indeed a working one. In democratic commonwealths the supreme power belongs to parliaments, that is, to talking-

[1] Chap. IV., 7. The Fifth All-Russia Congress of Soviets of Workers', Soldiers' and Peasants' Delegates considers that now, at the decisive moment in the struggle between the workers and their exploiters, there can be no place for the latter on any governing body.
Chap. XIII., 65. The following persons have neither the right to vote nor to be elected:—
(*a*) Those who employ others for the sake of profit.
(*b*) Those who live on income not arising from their own work.

[2] Chap. X., 53.

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shops. Power is divided into a legislative and an executive one. The sending of deputies from the workmen to parliament once in four years gives rise to the fiction that workmen share in political work. In truth even the deputies do not share in it, because they *talk*. The real rulers are the members of a caste,—of a social bureaucracy."[1]

One might think that the rule of Soviets was free from all fictions and substitution of power.

Organization of Supplies and of the Army.—The greater part of the meetings of the Fifth Congress was taken up by the discussion of two topics of primary practical importance—the organization of supplies and the organization of the army. The first of these questions gave rise to a violent conflict between the Bolsheviks and the Social Revolutionaries of the Left. For the latter the socialization of the land was a measure of paramount importance for the future of Russia, and they wanted it carried out with corresponding regularity and deliberation, in conformity with the wishes and the interests of the peasant class as a whole. Spiridonova, the leader of this faction in the Congress, objected strongly to the anarchistic way in which land was grabbed by the peasants, and reproached Lenin with his cynical declaration that as the peasants had seized the land they might divide it as best they could. As a result of this cynical indifference the country-side had been a cockpit in which villagers and householders were arming and fighting for the possession of coveted plots. These rural feuds were not distasteful to the Bolsheviks, who were intent on crushing all well-to-do and thrifty elements of the population as representing the hated bourgeoisie. In practice they wanted corn supplies, knew that some were in the hands of the wealthier peasants and did not find any other means of getting at them but the raising of the poor peasants against the richer ones. The result was the creation of "Committees of the Indigent," whose special purpose was to ascertain who had put by any supplies and to expropriate these "tight-fists." Part of the loot would go to replenish the bins of the Red Government. This was called the "Dictatorship of the Indigent," and Lenin boasted that the Bolsheviks had succeeded in driving a wedge into the compact mass of the peasantry.

The Social Revolutionaries opposed the Bolsheviks in terrorist measures as well as in the case of supplies. In the interval between the Fourth and the Fifth Congresses the Central Executive Committee had founded and organized the "Supreme Revolutionary Tribunal" from its own ranks. The Social Revolutionaries had consented in the beginning to take part in the constitution of this Tribunal, but they seceded from it in connexion with the first trial, when Adml. Shtchaskny had been condemned to death. They protested altogether against the reintroduction of capital punishment, although they did not scruple to participate in bloody repressions of risings and conspiracies. The same difference of opinion reappeared in connexion with the reorganization of the army. Trotsky came to the Congress with a complete programme for the reconstruction of the Red army which amounted to a return to the iron discipline of the ancient regime with a change of provost marshals. "*Ote-toi de là, que je m'y mette*" was the approved maxim of the time, and, after having preached and agitated for years against the death penalty and other cruel punishments inflicted "by order of the Tsar," Trotsky found it simple and convenient to adopt all these Draconian measures and to employ former officers of the Old Army to enforce them as long as there was not a sufficient number of Red commanders and officers to provide the necessary personnel. The Social Revolutionaries were again true to theory, and denounced this change of front with bitter indignation. Their opponents retorted that it was absurd to reject the death penalty when inflicted by the courts while practising terrorism and shooting people at sight. The Bolsheviks wanted a disciplined army, and were not disposed to be fettered by sentimental considerations or the reproach of inconsistency. These conflicts coincided with the assassination of Count Mirbach and the suppression of a Social Revolutionary rising on Moscow: they ended in a disastrous way for the Social Revolutionaries, whose leaders were either shot or imprisoned.

In the interval between the Fifth and the Sixth Congresses the Central Executive Committee had to settle the foundations of two most important sides of social life—the organization of justice and the establishment of school education. Of course legislation in these respects was by no means restricted to the action of the Central Executive Committee in 1918: measures were taken both before and after, but our account must for the sake of convenience be concentrated around the laws and decrees of that year.

Administration of Justice.—Taking first the province of justice, we may notice to begin with the main principle of the Judicature: it is the substitution for the various courts of professional justice of *popular courts* consisting of three judges—a chairman and two assessors. The first of these was supposed to have some knowledge of legal subjects, though he need not be a trained lawyer; the assessors represent the lay community, and the framers of the new rules give emphatic expression to the wish that the common sense and the practical spirit of the lay members should prevail over technical considerations and a superstitious regard for laws enacted by overthrown governments. They refer with disapprobation to the bad influence of former lawyers who had found their way into the new courts and complicate their decisions by a casuistic treatment of the subject in the old style. The publications of the *Narkomjust* (People's Commissariat of Justice) gave unstinted praise to decisions free from the trammels of juridical dialectic and book-learning. The hope is expressed that the popular courts will open up new avenues of legal thought by the motives and arguments of their decisions and thus create a new and beneficial source of law.

One of the leading representatives of Soviet jurisprudence, Hochberg, compares the position of public and private law in the new system, and comes to the conclusion that the latter is the creation of the bourgeois social order, as it supposes an abstention of judicial authority from interference with the contents of claims and assumes an appearance of impartial indifference. This reminds one of the attitude of Pilate washing his hands, as regards the truth or justice of the verdict. Civil law is decentralizing, anarchistic, derived from a fiction of freedom, while public law aims at concentration and coöperation, and that is the law suitable to a socialistic commonwealth.

Another article on Soviet jurisprudence dwells on the total transformation of criminal law, and the author is not less nihilistic in his appreciation of this branch of legal organization than his colleague Hochberg was as regards private law; indeed, one branch is not more necessary than the other:—

"There can be no idea of retribution, because the modern scientific view does not recognize any free or responsible will. Determinists cannot build their law on the idea of punishment. It is certain that crime is the product of social conditions, and therefore cannot be imputed to any single individual. This being so, there is no reason to despair of the disappearance of crime and of the coercive law directed against it. Menger halted half way: he thought that infringements of rights are to some extent the result of human nature, of inherent self-will. But serious infringements of rights proceed from class distinctions and class antagonisms. There will be no burglary or theft when there is no private property protected by law: all serious motives for homicide and other crimes of violence will disappear when men are all comrades and there is no wealth or privilege to excite hatred. Whatever occasions there may remain for inordinate self-will will be rare anomalies and can be treated as negligible quantities."

In spite of all these enchanting perspectives it is recognized that the stage of a lawless Elysium has not yet been reached, and in concession to human frailty certain prohibitions and rules have to be maintained in the epoch of transition. This epoch may last for a long time, because the new order can be secured only by psychological transformation, and psychological processes take many years to mature.

Meanwhile speculators, traders, hooligans and counter-revolutionary agitators have to be coerced, and this is the chief business of popular courts, reinforced in dangerous cases by the ruthless action of the Extraordinary Commission. Trade was made a punishable offence and threatened with most severe

[1] Bukharin, "The Theory of Proletarian Dictatorship," *The October Upheaval and Proletarian Dictatorship*, pp. 19, 20.

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penalties. According to Clause 1 of the decree on speculation, "a person guilty of selling, storing or keeping with a view to sell, articles of food monopolized by the Commonwealth, if he is doing this as a trade, will be punished by imprisonment for a term not less than ten years with the hardest forced labour, and by confiscation of all his goods." Clause 2 says: "A person guilty of selling, storing or keeping with a view to sell, articles of food at prices higher than the established ones, if he does this as a trade, will be punished by imprisonment for a term of not less than five years, and by the confiscation of all or part of his goods." Clause 3 says: "A person guilty of selling, storing or keeping with a view to sell, other articles the price of which has been fixed and is subject to control, if he does it as a trade, will be punished by imprisonment for a term of not less than three years, etc." Clause 4 says: "If he does not drive a trade (but does so occasionally), he will be punished by imprisonment for a term of not less than six months." Similar penalties are imposed on those who collect provision cards with a view to trade with them.

These Draconian measures were mitigated in practice by the necessity of having recourse to lawyers, who had received their education under the old regime. The majority of the personnel of the higher courts had to be drawn from that class, and did what they could to soften the asperities of Soviet legislation.

In the same way Soviet legislators had to steer a middle course as regards private law; in 1918 law as to marriage, family relations and succession was cast in a new shape. As regards marriage the chief change was the abolition of the contrast between legitimate and illegitimate unions. The only difference was one of registration: some people might think it worth while to register their convention as to sexual relations, others did not attach importance to such routine; the consequences as to family status were about the same. Consorts kept their separate goods and had equally the right of protection and duty of maintenance as to the children. In case of disagreement in the conduct of their children's affairs, they have to apply to the local court. The latter may deprive either of them of the right of supervision in case of misuse. The wife, or woman living as such, may claim maintenance from the man with whom she has been living, if she is unable to maintain herself. As to the bringing up of children, she is allowed to claim assistance from the putative father, and if she has had such relations with several men so that fatherhood is uncertain, she enjoys the additional advantage of being able to claim contributions from each one of them. Succession is abolished. No one can dispose of his fortune by will, nor do the children inherit to the exclusion of other relations; after the death of a person his or her fortune is distributed among relations within certain degrees according to the measure of their needs. Their claims are preferred to the claims of the creditors of the deceased.

It is needless to add that Soviet legislation uprooted the rules as to contract of service. All forms of service are considered as forms of servility, as varieties of exploitation. Everyone must depend on the work of his hands and combination is entirely a matter of public law. It appears in the shape of professional unions—industrial and rural alike, or in the shape of Soviet rule substituted for the old conception of the State. Members of the Soviet Republic are comrades in work, though not in service, and it is for the Soviet Commonwealth to assign them their shares in work and produce.

Here are some characteristic passages from an article in the official organ of the Commissariat of Justice[1]:—

"The project of the Provisional Government accepted as a basis of the legal order of industrial undertakings the fiction of a free bilateral contract." Under the rule of the Soviets "the industrial undertaking ceases to be governed by formal conventions or contracts and by one-sided declarations of the will of employers. The collective contract . . . loses the character of a bilateral convention and becomes an objective rule of conduct." This principle was first proclaimed as an exception in the case of the establishment of a tariff of remuneration in the metal workers' trade. It was subsequently recognized to be the normal arrangement of the status of workmen. There can be no more talk of "hire" and "service"; the conception of "coöperation" taking their place. "The sense of duty and of responsibility arising from it has dictated the following clauses to the Petrograd metal workers, when they constituted their tariff without the employers. Clause 16: 'When the working man receives a definite guarantee as to his earnings, he is bound to guarantee a corresponding amount of work in the shape of a definite form of production. Clause 23: In case of evident loafing or of premeditated slowness the workman is to be moved into a lower class and can even be dismissed.' 'The juridical life of the working men is being unified by movements in two directions—towards combining local undertakings into one common State economy and by uniting the interests of separate professional groups on the lines of a common class consciousness.'"

Education and Religion.—Another subject of primary importance considered by the Central Executive Committee in its fifth session in conjunction with trade unions was that of the proletarian school system. There was no discussion, and the conclusions of a committee for which Comrade M. Pokrovsky acted as reporter were approved *en bloc*. The report laid stress on the necessity of getting rid of all varieties in the curriculum of schools, produced by the sinister interests of the dominant class of the old regime. The old schools had been diversified not only by horizontal partitions as lower-middle and high-schools, but also by vertical sub-divisions as special types of humanistic, modern side (*cf. Realschule*), technical, ecclesiastical schools. This tendency towards specialization served the purpose of splitting up the compact and powerful mass of working men into a number of groups on which the dominant class could practice the *divide et impera* principle. The true educational ideal was to train all the youth of the country on the same lines, leading them through the various forms and stages of application of human energy to productive work. A course of nine years, beginning at the age of eight, would be necessary to achieve this object. Of course the old methods by which "gentlefolks'" children were taught to scrawl on paper would have to be discarded. The orientation of the school should be directed towards preparing for a life in which manual work was honoured and not despised. The aim should be to educate men able on leaving school to take up intelligently and successfully any kind of task. The curriculum would be a reproduction on a small scale of the cultural history of mankind. Astronomy would be shown to have guided the men of old in their observations of the seasons on which agriculture depends; zoölogy would be taught in connexion with the tending of domestic animals, botany on the live specimens of plants. The management of the school should be an introduction to civil life, the principle of collective labour permeating all details, methods of old-fashioned subjection and discipline being entirely discarded, and the school should be constituted as a "*commune*" and the senior pupils should take part in its administration together with the teachers and the representatives of the working population of the district. Punishments would not be necessary in these educational communes; order would be kept up by the sense of responsibility on the part of the pupils.

A quantity of literature was produced in Soviet Russia to spread the notions of the *Proletcult* (proletarian culture). In order to give an idea of this stuff, one or two extracts may be given from a paper by Comrade Bobrinsky[2]:—

"We have to proceed towards freedom through the iron yoke of proletarian dictatorship, towards equality through rationing according to class, towards fraternity through civil war. Proletarian science becomes in practice a weapon in the struggle for power and economic existence. Science becomes politics. The bourgeois contrast between knowledge and politics, between science and action, gives way a synthesis for the first time: science is turned into the political force of the proletariat, and proletarian politics is turned into science. . . . Natural science is combined into a unity with social science. . . . The old disputes about humanistic (classical) and realistic education, the old criticism directed against the estrangement from life, against the academic character of education find a simple and radical solution in the school of labour. . . . Technology has acquired a place of equality with other sciences and it serves as a transition from natural science to sociology. . . . Technology becomes the principal science in the system of historical materialism. According to historical materialism all changes in

[1] A. Yablonsky, The Labour Constitution in the "*Proletarian*" Revolution and Law, 5–6 issue, Oct. 15 1918.

[2] "The October Upheaval and the Dictatorship of the Proletariat," pp. 163 ff.

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social life are derived from the relations of Society to production. Everyone knows that, but it is not sufficiently recognized, that, according to Marx, the evolution of history is entirely dependent on the development of means of production and that changes in the latter are conditioned by changes in technique."

It is appropriate to mention here the policy of the Soviets as regards religion, and, more especially, as regards the Orthodox Church, as its foundations are to be found in a profound contrast of cultural conceptions. The matter is well illustrated in a paper contributed to *The Octobrist Upheaval* by Comrade N. Lukin (Antonov). He begins by ridiculing the notion that the separation of the Church from the State meant emancipation for the Church from secular control coupled with the right to accumulate property and to influence public opinion on similar lines to those which obtain in Belgium. The revolution put religious associations on the same level as other common law associations, but deprived them of the right of holding property and of other privileges of juridical persons. As a natural consequence the Orthodox Church became one of the main instruments of counter-revolutionary agitation. The Council called together in Moscow did not attract any considerable attention on the part of workmen and peasants, but it was crowded with representatives of the old aristocracy, bureaucracy and counter-revolutionary "intelligentsia." The newly elected Patriarch Tikhon excommunicated the authors of the decree of disestablishment and the Council denounced it as an attack on the national faith and the religious institutions of Russia, not omitting to mention that the clergy was being deprived of the means of subsistence. In view of such an irreconcilable attitude the Soviet power is bound to wage a ruthless war against the Orthodox Church. It is armed against it by Clause 5 of the decree of Separation forbidding all ecclesiastical ceremonies and acts directed against the Commonwealth. But it must not be forgotten that even apart from the conspiracies and direct risings, religion in general is antagonistic to the social conceptions of the new order. Even in its present state the Church is able to support ignorance among the mass of the people and to divert the proletariat from the struggle for an "earthly paradise" by making them dream about a "paradise in heaven." The example of France and of America shows that the clergy is preaching war against social democracy with no less fervour because it is deprived of those powerful means of influencing men's brains which are at its disposal in countries still maintaining State religions. In creating a new world the proletariat stands in need of a complete and harmonious scientific outlook.

Foreign and Home Policy.—The Sixth Congress of Soviets met on Nov. 6 1918. Nineteen hundred and fourteen delegates assembled in Moscow, of whom 829 were Communists; 71 had been registered as sympathizing with Communism, and 2 as Revolutionary Communists, while 6 were declared to belong to the Social Revolutionary party, 1 to the Maximalists, 3 to no party. The president Sverdlov expressed his firm conviction that distribution of seats corresponded fully and correctly to the interests of "wide masses of the working population of Russia." The debates were overshadowed by two main facts—by the victory of the Western Allies and by the appalling food crisis.

Lenin, while admitting that the situation was extremely dangerous, because Communist Russia had to reckon henceforth not with two belligerents engaged in a struggle for existence but with the united front of the victorious Entente, thought it augured well for the progress of the world revolution:—

"A complete victory of a Socialist revolution," he said, "is unthinkable in any one country. It requires at least the coöperation of several advanced countries, and Russia is not one of them. This is why the question as to the expansion of the revolution into other lands and of our success in repulsing imperialism becomes one of the principal problems of the Revolution. . . . We must raise the proletariat of all countries."

He dwelt on the benefits conferred by the Brest Litovsk peace, which gave Russia breathing-space and the possibility of reconstructing her army. Now the aim was to carry the contagion of the revolution into Central and Western Europe:—

"We can see already how the fire has broken out in most countries—in America, in Germany, in England. . . . The peace which the rapacious imperialists of England and France are going to inflict on conquered Europe will be a more humiliating and crushing one than the treaty of Brest Litovsk, but this very peace will be their undoing, because it will rouse the revolutionary feelings of the world proletariat. We are not living in Central Africa but in civilized countries in the twentieth century. They are raising a Chinese wall against Bolshevism, but Bolshevism will pass the wall and spread its infection among the working men of all countries."

In unison with Lenin, the president, Sverdlov, declared that before six months had passed they would see Soviet rule triumphant not only in Hungary, in Germany, in Austria, but in France and Great Britain.

The problem of supplies was to be solved by expropriation in the villages. Zinoviev explained that the plan of raising the poor peasants against the well-to-do ones was being carried out with energy and success. A Congress of the "poor folk" in Petrograd had been attended by 16,000 delegates; they had resolved to organize a special "poor folk" army consisting of two men from each village. In the Novgorod Government alone 2,000 "poor folk" committees had been formed:—

"Their chief aim is to drive a wedge into village life . . . to kindle class struggle, to kindle the sacred hatred of the poor folk against the rich. . . . We say . . . the 'tight-fists' must be strangled as we said before: strangle the bourgeois in the towns. . . . We know perfectly well that we cannot carry out a proletarian revolution unless we crush the 'tight-fists' in the villages—crush them in the economic and, if necessary, in the physical sense."

The Congress adopted a resolution in conformity with Zinoviev's proposal, the gist of which was that in order to get rid of strife and confusion produced by dualism in the villages it was necessary to assign to the "poor folk committees" instituted by the decree of July 11 1918, the superior authority and to carry out a reorganization of rural Soviets on the pattern of town Soviets, turning them into true organs of Soviet power.

The seventh Congress met on Dec. 5 1919. Of the 1,109 delegates with power to vote, 890 were registered as Communists and 34 as belonging to no party. In the course of the Congress some representatives of the Social Revolutionaries and Mensheviks (Dan, Martov and others) took part in the debates, declaring their adherence to the cause of the Socialist Republic under Soviet rule, but criticizing certain methods of Soviet administration. The atmosphere of the Congress was dominated by the elated feelings produced by the victories over Kolchak and Denikin. They were extolled as triumphs over the Entente. Lenin admitted in his speech that the progress of the World Revolution had been slower and more complicated than had been expected, but he maintained that on the whole the previsions of the Bolsheviks had been justified by the course of events. The miracle of the victory of helpless and backward Russia over the all-powerful Entente was traced by him to the instinctive sympathy of the working-classes of Great Britain, France and Italy towards their brothers in Russia. As a result of this feeling it was impossible for the Allies to expose their troops to a decisive conflict with the Red army; symptoms of fraternization had begun to appear in the ranks of the western soldiers and the Entente was obliged to withdraw them. The hope to combine the minor border states against Red Russia had also miscarried, and disillusionment had been brought by the collapse of the White Guards equipped by the "imperialistic wild beasts" of England whose greed and craving for world supremacy was worse than that of the Germans. Resolutions of the Soviet greeted the toiling masses in all countries, invited them to struggle against bourgeois Imperialism and declared the Peace of Versailles a shameless attempt to establish the domination of the Allies, to divide the world into conquerors and conquered, into great and small powers, without taking heed of self-determination.

Trotsky gave a glowing account of the victorious Red army. He described it as an exact reflection of the Soviet Republic. It was built up on the principle of class domination, the ruling class being that of town workmen:—

"They form about 15–18% of the army, but they lead it on account of their greater consciousness, their stronger solidarity, the higher quality of their revolutionary mettle. The responsible posts of commissars are occupied almost exclusively by workers of the

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Communist party. In every regiment, every battalion, every company is to be found a communistic cell. In this way a new communistic order of 'Samurai' has been formed. And the army is not merely a fighting organization, it is a political school the like of which has not been known to the world."

Trotsky prided himself particularly on the incessant political propaganda. "In the beginning we had not a single elementary school in the army—now we have 3,800; before the 1st of Jan. we had 32 clubs: now we have 1,315. Before the 1st of Jan. we had not a single mobile library: now we have 3,392."

As regards officers and other specialists drafted into the Red army from the cadres of the old Tsarist army, Trotsky maintained that thousands of them had reconciled themselves with their new position and were faithfully serving the new order. He was contemplating the institution of one man's rule instead of the system of commanders watched over by two commissars.

Economic Problems.—The most serious discussions took place in connexion with the problems of food and fuel-supplies. Tsurupa, the People's Commissar at the head of the *Narkhoskom* (the Commissariat of People's economics) gave an account of the working of bread monopoly. All corn supplies had been nationalized and the system was enforced by charging each province with a fixed contribution which was subsequently distributed among the districts of each province, while the districts assessed the villages with *quotas* according to estimation. The whole assessment of the country was reckoned at 324 million poods of corn of every kind: of the 30% which were charged to the first quarter some 60 millions were expected to come in by Dec. 1. This did not quite correspond to the demand, but as some provinces were not under the control of the Soviet power, the assessment might be said to have been carried out satisfactorily in the greater part of the country as regards corn. This did not mean, however, that the supply of corn was secured for those who needed it. Many thousands of poods lay stored and rotting at the stations, because there was no transport to convey them to their places of destination. As regards meat the situation was much worse. Only 600,000 poods were available instead of the five million delivered in 1918; the cause was the great falling off of the numbers of cattle held by the peasants. Butter and fats were also at a discount: the commissariat could not dispose of more than 300,000 poods for the whole of Russia, and that meant famine in respect of fats. Of fish roughly 75% of the normal supply had been caught but the transport conditions were badly hampering its distribution. The proposal of the Commissariat was to extend the State monopoly and the coercive assessment to all food products and it was adopted by the Congress.

As far as fuel was concerned, the situation had grown to be catastrophic. The loss of Baku and of the Donets coal-mines had largely reduced the quantity available. Instead of 500,000,000 poods of naphtha, *e.g.* Soviet Russia disposed of 80 million. It continued to exist only because all private stores and supplies had been confiscated. Things got better when the roads to the Donets and to Ural were cleared, but the disorganization of the transport told heavily on the distribution of fuel. As a matter of necessity Russia had to fall back once more on wood fuel, although the adaptation to a new system of heating involved immense losses. The first requirement was to provide material for the railways and that was being gradually achieved by means of labour conscription. As for domestic heating, its needs were so great that the only way of solving the problem was to cut down timber in the neighbourhood of cities, and Moscow, for example, was being served by means of the clearing of timber in an area of 18–30 square versts. The Commissariat was obliged to engage the services of private contractors and agents in order to get the required supplies. When, in discussion, fanatical Communists reproached Commissar Rykov with this deviation from the recognized principles of communism, he answered that there was no other way of collecting the timber and that, after all, the Extraordinary Commission was able to proceed against speculators and profiteers. In other words, the Soviet administrators might enable men to enrich themselves by private enterprise and then prosecute them on account of their gains.

Comrade Sofronov reported on the constructive work of the Soviet; this work had proceeded from the top to the bottom and the administration of the country had assumed the shape of parallel columns subordinated to "heads" and "centres," each managing its own concerns, but with little connexion between them and often with opposed views on kindred subjects. The *Narkomjus* (People's Commissariat of Justice), for example, was not in agreement with the arbitrary terrorism of the Extraordinary Commission, but was powerless to influence or to restrict it, because it was acting within the column of the Home Commissariat, and no solution could be found for the difference between judicial and administrative tribunals.

The discussion gave rise to attacks on the bureaucratic centralization and the suppression of freedom by the communistic dictatorship. The reporter Sofronov admitted that there was a tendency towards one man's rule in all branches of the organization, but such a tendency, explicable in the course of civil war, could not be conceded as a principle. It did not check the complete anarchy of economic and legal relations produced by the lack of harmony in administration. It ought to be corrected by a reform of elections, which would regenerate the local Soviets and thus create a basis for political reorganization at the top. An essential condition for such a reform was the removal of counter-revolutionary elements. Therefore the electoral law ought to be supplemented by stringent enactments not only disfranchising the "tight-fists," but making it a punishable offence for them to take part in any electoral or other meeting in the village.

Lenin came forward to defend the policy of Soviet rule against the reproach of anti-democratic tendency:—

"We do not promise," he said, "that our constitution guarantees freedom and equality in general. Freedom—but it must be pointed out for what class and for what ends. Equality—but who shall be equal and with whom?—for those who work and who have been exploited in the course of centuries by the bourgeoisie, who are fighting the bourgeoisie even now. This has been stated in the constitution: the dictatorship of the workmen and of the poorest peasants in order to suppress the bourgeoisie."

These ideas were more fully developed in Lenin's speech to the Congress of School Extension workers (May 6 1919):—

"It cannot be gainsaid that *freedom* is a powerful catchword for any revolution, democratic or socialistic. But our programme declares: freedom, if it obstructs the emancipation of labour from the oppression of capital, is a fraud. Any one of you who has read Marx, or even popular accounts of Marx, knows that he devoted the greater part of his life to ridiculing freedom and equality, the will of the majority and all the Benthams who commented on these things in glowing terms. He proved that at the back of all these phrases lay the interests of free trade, the freedom of free capital, which are used to oppress the workers. . . . We maintain that to grant freedom of meetings to the capitalists would be the greatest crime—it means freedom of meetings for counter-revolutionaries. We say to the bourgeois intellectuals, to the adherents of democracy: 'You lie when you reproach us with the infringement of freedom. When your great bourgeois revolutionists of 1649 in England and of 1792–3 in France carried through their revolutions they did not concede to the monarchists the freedom of meetings. The French Revolution was called the Great one because it was not like the weakly phrase-making revolution of 1848: after overthrowing the monarchists it crushed them out of existence. . . . The peasant is a hybrid being: half a workman and half a speculator. This is a fact from which you cannot escape, unless you destroy money, destroy exchange. And to do that you want long years of firm domination of the proletariat, because it is only the proletariat that can conquer the bourgeoisie.' When we are told 'you have broken equality not only as against exploiters (a social revolutionary or a Menshevik might admit that), but you have broken equality as between workmen and peasants, you have broken the equality of toiling democracy, you are criminals,' we answer: 'Yes, we have broken the equality between workmen and peasants and we maintain that you, who defend this equality, are followers of Kolchak.' . . . We ask you: 'the ruined workmen of a ruined country, in which factories are at a standstill, would they be right to submit to a majority of peasants, who do not yield to them the surplus of their corn? Have they the right to take this surplus by violence if it is impossible to do so in any other way?' The peasants are a special class: as toilers they are the enemies of capital, but at the same time they are proprietors. The peasant has been taught during centuries to consider the corn as his own, and that he is free to sell it. It is my right, thinks the peasant, because it is my labour, my sweat and my blood. It is not easy to change his psychology: it will take a difficult and long process to do so. He who imagines that the transition to socialism will be effected by one man convincing another, and this other a third, etc., is at best a child, or a political hypocrite. You can, if you have luck, smash an institution at one blow: it is

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impossible to smash a habit, whatever your luck. We have given the land to the peasant, freed him from the squire, thrown off all his fetters, and yet he goes on thinking that liberty is free trade in corn, and serfdom the duty to surrender the surplus at a fixed price."

The Eighth Congress of the Soviets.—The Eighth Congress of All-Russian Soviets was convened at Moscow on Dec. 23 1920. Approximately 80% of the delegates were members of the Communist party, the remaining 20% were not affiliated to any party. It was known that with reference to certain questions of policy there was an important divergence of views among leading Communists. These differences of opinion were especially marked in connexion with (1) economic reconstruction, including the question of concessions to foreigners, and (2) the demobilization of the army. Lenin was at the head of the so-called Right Wing, while the Left was under the leadership of Bukharin. The disillusionment of many Communists concerning Soviet administration was expressed in strong terms at the Congress. These criticisms were summarized and by one of the leaders, Ossinsky, in an article which contains the following passage:—

"For three years, the Soviet Government has seriously turned aside from the principles of proletarian democracy, and from the spirit of the Soviet Constitution. On the one hand, there have been created two legislative bodies, not provided by our constitution—the Council of Defence and the Military Revolutionary Council; on the other all constitutional organs (legislative as well as executive) have virtually disappeared. The eclipse of the Central Executive Committee is generally known. But even the Council of People's Commissars and the Council of Defence, which have ostensibly replaced the Central Executive Committee, have been, in their turn, eclipsed by still another body. In reality, the centre of political leadership has been shifted to the Central Committee of the Communist party, and even here to a smaller body, the 'Political Bureau' of this committee. Legislative measures, diplomatic acts, and military plans decided by this 'Politik-Bureau' are formally sanctioned and issued in the name either of the People's Commissars or the Council of Defence." (*The New Statesman*, 1921, p. 635.)

The Congress decided to establish Provincial Economic Conferences which should be charged with the unification of all purely local economic institutions. Meetings were to be held no less than twice a month, and the persons who were to participate in the proposed Conferences were to be designated by the Supreme Economic Council, the Commissariats of Supplies, Labour, Finance, etc. All local branches or institutions of the Supreme Economic Council in the various provinces were to be subordinated to these Provincial Councils, with the exception of so-called "principal" industries, such as important metal factories, mines, etc., which still remained directly subordinate to the Supreme Economic Council.

The number of members of the Central Executive Committee was increased to 300 and sessions were to be held at least twice a month. The managing board of the Central Executive Council was given power to cancel any decisions of the Soviet of People's Commissars. All conflicts or disagreements between the People's Commissars and Central Institutions on one side, and the local Executive Committees on the other, were to be referred to and decided by the managing board of the Central Executive Committee. All decrees and regulations of general importance, including laws, military decisions and questions of foreign policy, were to be examined by and were subject to confirmation by the Soviet of People's Commissars. The Congress considered that the Soviet of Labour and Defence which had been created at the height of struggle between the republic and an Imperialistic world (Nov. 30 1918), should be reformed so as to form a committee of the Soviet of People's Commissars. An appeal was addressed to the peasants asking them to support the republic by contributing all their surplus agricultural produce to assist the Commonwealth. Trotsky favoured a partial demobilization of the regular army and the organization of a militia.

These were the principal decisions of the Congress. The general attitude of the Communist party was best expressed in speeches delivered by Lenin and by Zinoviev. Lenin welcomed the establishment of Soviet Republics in Bukhara, Azerbäijän and Armenia, as showing that the Soviet system was acceptable, not only in industrial countries, but also in agricultural lands. It was hoped that a treaty would shortly be signed with Persia. Relations were being cemented between the Soviet Government and Afghanistan and Turkey. Lenin defended the policy of granting concessions to foreign capitalists. It would be ridiculous to talk of Russia's economic independence while the Soviet Republic remained a backward country. Guarantees would be demanded from those who received concessions and it was essential that everything should be done to promote trade relations without delay. He reminded his audience that a long series of wars had hitherto decided the fate of the revolution. They must prepare for the next chapter in this history:—

Without economic restoration they would be unable to hold their own. To achieve this economic aim it would be necessary to unite compulsion with moral suasion as successfully as they had been united in the Red army. Russia was a State of small farmers and the transition to communism was hampered by difficulties greater than those which would have arisen in other conditions. For the attainment of their economic objects the assistance of the peasants was ten times more necessary than it had been during the war. The peasants were not Socialists. The Communist workers "must tell the peasants that it was impossible to continue freezing and dying of starvation indefinitely." If such conditions continued they would be defeated in the next chapter of the war. There must be a larger area of land under cultivation next spring, and there was no hope of salvation unless this economic victory was obtained. They recognized their obligation to the peasants. They had taken their bread in exchange for paper-money. They would compensate them as soon as industry was restored. The menace of Russia to the capitalist world could not be maintained without an improvement of economic life. As long as she remained a small farmers' country capitalism would find more favourable acceptance than Communism. The foundation and basis of their home enemy (capitalism) has not been removed. Electrification would help them to remove it.

Zinoviev admitted that the Soviet regime was degenerating through the influence of an immense and inefficient bureaucracy. He laid the blame on the traditions of the old administration:—

The utilization of bourgeois specialists in the work of economic and administrative reconstruction was absolutely essential and inevitable. The worst feature of this recourse to specialists was that they exhibit a red-tape attitude towards their work, not entering into the spirit of it: they have brought the worst habits of Government lethargy and bourgeois bureaucracy into our administrative organs. Those workers and peasants, whom the Soviet Government drew into direct participation in the Government, although they saw the weak side of these specialists, were themselves powerless to raise affairs to a higher level. Thus a wrong attitude was taken up toward those who worked by brain and not by hand. Workers who stand at the lathe are regarded as useful members of society, but what about the man who counts the lathes, who works out plans of production, who carries out essential statistical work? Such men are sometimes contemptuously described as bureaucrats. . . .

The workers' and peasants' control must be transformed from an organ of supervision over the activity of Government institutions into an organization for attracting broad masses of the workers and the peasants to administrative tasks, for inculcating the methods of administration in accordance with the decree of the All-Russian Executive Committee dated Feb. 7 1920.

Russia in 1920–1

Soviet Russia had shrunk considerably by 1921 in comparison with the former Russian Empire. Instead of a population of some 180 millions it comprised in 1921 about 130 millions, of whom 10 millions were peasants and the rest were divided among the townsfolk and the nomadic and hunting tribes of the eastern steppes and of Siberia. It is estimated that the country lost 1,700,000 killed in the course of the World War, but it is impossible to form even an approximate conception of the number of those who perished from the indirect effects of the war through wounds, ill-health and privations, and of those who were destroyed by the massacres of the civil war, the misery of retreats and migrations, the epidemics of typhus, cholera, diphtheria which claimed a heavy toll in the unsanitary conditions of life. It would hardly be an exaggeration to put the number of victims of these disorders at some 10 millions. The abnormal increase of the death-rate has been definitely registered in certain cases, and there is good reason to suppose that in all centres where people congregated for political or economic reasons exceptional mortality prevailed and the health of the population was enfeebled through starvation and sickness. Petrograd, with 2,250,000 inhabitants in 1914, had been reduced to some 700,000, and Moscow to 1,000,000 instead of 1,800,000.

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But, undoubtedly, the greatest inroads had been made by the separation of large territories that had acquired political independence. Finland accounts for a diminution of 3,000,000; Poland for 11,000,000; Esthonia and Latvia for 3,000,000; Lithuania for 5,000,000; Georgia, Armenia and Azerbäijän for 8,000,000; Bessarabia for 3,000,000, the districts of White Russia and Volhynia, ceded to Poland, for 3,000,000.

Economic Disruption.—The great combination for economic intercourse guaranteed by the empire had been broken up to the detriment of most of its component parts. Of course, from the point of view of national separatism, the political independence of Esthonia or Latvia was a great conquest, a glorious assertion of self-determination, and a source of profit in the helpless condition of Russia. These Baltic States serve as a kind of neutral fringe in which Bolsheviks can be met in safety by representatives of western Powers and western commerce. Gold from the Russian State reserves was being stored there, Reval and Riga serving as outlets for whatever trade was conducted with the west by the bankrupt Government of Moscow. Undoubtedly such a position, recognized by Europe and at the same time highly useful to the Soviet, might be a lucrative one. But these newborn States hardly realized sufficiently that sooner or later an account would have to be rendered to a Russia restored to its national traditions and strength. Such a historical Russia would hardly consent to leave the gates of the Baltic in the hands of alien Governments, who had done their level best to thwart its efforts at restoration in 1919, who manifested on every occasion their hostility to the Russian people and were in more dangerous proximity to Petrograd than Ireland was to London. The Bolsheviks had no objection to using Lettish mercenaries for repressing popular risings in Russia, and Lettish stockbrokers for commercial dealings with the west, but the Russian Government could not be expected to remain anti-national for ever. In the case of Poland the necessities of the industrial situation are quite as obvious as those of the commercial one. Polish industry thrived on the economic connexion with Russia. Without the Russian market Poland is economically a lifeless strip of territory: Germany does not want Polish manufactures; the only commodity it did want from Poland was cheap labour, but recent occurrences in Silesia and elsewhere show to what an extent national animosities have obstructed intercourse, even in this respect. It will be a long time before Poland will be able to use the outlet to the sea for the purpose of considerable trade and it is not likely to become ever a sea-power of some standing. In the meantime Poland in 1921 was practically bankrupt, with its currency enormously depreciated. It would certainly not seek reunion with Russia, but it might regret the opportunity it had in 1919 for helping in the restoration of a national government in Russia. Lithuania, with its unhappy situation in the intersection of the lines of action of three powerful neighbours—Germany, Poland and Russia—had to keep up a front primarily against the Poles as its most dangerous neighbours. As German protection was excluded by the policy of the Entente and especially of France, it seemed certain that the Lithuanians would sooner or later have to lean on Russia. But it would have to be a Russia with a civilized Government and a solid national basis. As for Rumania, the seizure of Bessarabia, though confirmed by decree of the Entente Powers, and the wholesale dispossession of Russian landowners, had not pacified the province, of which half the population belonged to the Russian stock and in which even many Moldavians were reputed Russophiles. The alliance between Rumania and Poland, concluded in the spring of 1921, might serve the purpose against a possible Bolshevist offensive, but would hardly help against a reconstituted National State. In the Caucasus again, the various alien nationalities are so intermixed and so hostile to each other that it was impossible to expect the rise of any local federation or even of durable peace: the Armenians, the Georgians, the Caucasian Tartars, as soon as they were free of their movements, were inclined to jump at each other's throats, and the necessity of a strong empire holding their appetites for self-determination in check was recognized even in 1921: it formed the background of the Soviet Governments artificially created in Azerbäijän, in Georgia and in Armenia. The factor of economic interdependence was also clearly to the fore: Georgians normally hate Armenians, though the rural population of Georgian stock wants the coöperation of the Armenians in the towns. The Tartars would fain swoop down on the people in the plains, and have repeatedly tried to do so, but after a time the necessity of drawing supplies from peaceful agriculturists and traders asserts itself among them. The oil treasures of Baku are of paramount importance to any Russian State and on the other hand these oil wells cannot be exploited without drawing supplies from a "Hinterland" furnishing food and manufactured articles. Above all, these regions can reckon on peaceful development only if there is a strong police force to keep the heterogeneous elements in order. Such a force could only be provided under existing conditions by Russia. Even the Bolsheviks had found access to this disturbed region as negotiators and pacifiers although their methods of pacification were of a peculiar kind—mainly the extermination or driving out of elements opposed to the Soviets.

On the whole there could be no doubt in 1921 that anti-Russian tendencies and political arrangements found their chief support in the absurdity of Bolshevik rule as well as from a recollection of the oppressive policy of the Tsarist period. A change for the better in the direction of freedom and democracy in Russia would render it possible to restore to some degree the economic and political ties which rendered fruitful the coöperation between these interdependent elements. As things stood, Soviet Russia was in 1921 deprived of important commercial outlets and industrial auxiliaries, and had to pay a proportionate price for such help as she could get from them.

Commercial Intercourse.—The curtailment of these resources was, however, of small importance when compared with the misrule of the Communist authorities in Russia proper. As a result of the civil war, of the proscription of trade, of the destruction of the middle classes, of the ruin of currency and credit, the processes of circulation had been impeded and blocked to such an extent that one had to look back to the Mongol invasions in order to find anything similar in magnitude to the misery of the situation up to the middle of 1921. The struggles in the Ukraine, with the repeated changes of rulers (democratic Ukrainians, the German protectorate, Petlura's bands, Bolsheviks, Denikin's White Guards, the Bolsheviks again, a Polish invasion, the Bolsheviks again), and the accompanying sequence of risings and punitive expeditions had made the south-western granary of the black soil almost unavailable for years to come. In the same way the Donets basin, the Cossack territories, the Volga provinces had been the scene of bitter conflicts and disturbances which had affected their productivity in a most unfavourable way.[1]

In 1921 one could hardly talk of a Russian railway system. It was already worn out to a great extent by the war and rendered useless for the bulk of the population by the strain put on it by military exigencies. The Soviet administration had been trying hard to effect the most urgent repairs as to rails, engines and trucks, and had utilized a considerable part of the gold reserve to buy locomotives and rolling-stock abroad. But the needs were so great and the engineering resources of Russia had fallen so low, that there was no marked improvement in this respect.

The restrictions as to trade had been relaxed lately, by the decrees of March 29 and May 17 1921, and a lame attempt had been made to revive trade, but all these concessions were too much in contradiction with other standing features of Communist policy to produce an extensive change in the situation. The fact

[1] Production of coal in the Donets basin for the first four months of 1913, 1919 and 1920 (in thousands of poods).

Months	1913	1919	1920
January	143,000	36,600	14,000
February	117,000	34,800	19,300
March	156,000	33,300	24,300
April	84,000	12,500	13,800
Total	500.000	117,200	71,400

(Report of Lord Emmott's Committee.)

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remained that the dictatorship of the Soviets had employed itself systematically on cutting the connecting nerves of the economic organism and had thereby produced a state of paralysis which it was out of question to heal by a few decrees.

One of the hateful consequences of this self-inflicted disorder was the severance between town and country. The rise and the growth of towns depend directly on ways of communication and the circulation of men and goods. They are primarily centres of distribution and exchange, and if the roads to them are obstructed they are unable to perform their economic functions of distribution and exchange. There was, of course, a secondary cause to their decay in " Sovdepia," namely the fact that they were centres of industry and affected by the ruin. But their decay as centres of commerce was bound in itself to produce a back flow of the population towards the villages. Such a back flow was especially indicated in Russia, where the distinction between rural and urban life was never a very marked one, and where large numbers of the inhabitants, such as cabmen, carriers, porters, small tradesmen, were recruited from the villages for a time and accustomed to return to their rural homes at certain periods of the year. In " Sovdepia " this mixed population tried to escape from the deadening grip of the Bolsheviks in the towns to the rural districts. It could live a freer life there, and, besides, it was nearer to the direct source of food-stuffs—the tilled soil. In this way the economic evolution of " Sovdepia " might be described as a regress from commercial to natural husbandry.

Another side of this process of " naturalization " was connected with the disappearance of the mainspring of flourishing commerce—credit. The causes of this phenomenon are partly of an economic and partly of a political nature. As the whole system of Communism is based on war against capital, no accumulation of wealth or resources should be allowed in private hands. This being so, no transactions can be carried out in the strength of confidence in a person's ability to meet engagements in the future. Cash payments and (in view of the worthless currency) barter are the only legitimate forms of exchange. To this must be added the effect produced by arbitrary expropriations by the renunciation of State liabilities, at home and abroad, by the absence of any legal security against dispossession. In such conditions there can be no talk of prosperous economic intercourse. Not the market but the barrack is the social center.

The will of a people to live cannot be entirely extinguished even by a Communist regime. Practice reacts by all conceivable means against the theory. Clandestine trade had been going on in Russia all through the years 1918–21. The Sukharevka market in Moscow teemed with people bidding all kinds of goods for sale. Those who succeeded in getting a passage by rail or by river-craft carried little stores of merchandise in sacks, ostensibly for their own use, in reality for trade purposes. What prices such contraband goods fetched was another matter: people had to pay fantastic sums for the risks incurred by the traders, besides making up for the depreciation of the currency. Anyhow the flow of speculation had never ceased in spite of all the decrees of the Soviet, and the rulers had recently made up their mind to recognize the existence and to admit in half-hearted way the legality of local trade (March 1921). This was proclaimed in the west as a great victory of common sense over extremist doctrine: it was in truth an inevitable admission which did not do away with the main causes of the disorder—insecurity, disruption of communications, distrust, corrupt and arbitrary interference by the commissars. As long as these causes continued to operate, the economic life of Russia would be suffering from their cumulative effects, and the social intercourse of the country was bound to be disturbed by the fever of fraudulent and rapacious profiteering in an atmosphere of misery and disease.

Agriculture.—State of Peasantry.—One of the first decrees of the Bolsheviks proclaimed the abolition of private property and the nationalization of the land. In practice this decree sanctioned the disorderly grabbing of estates by the adjoining peasantry, and the new rulers connived at this form of appropriation for the sake of its psychological effect as a revolutionary act. This meant that they renounced " nationalization " at the same time as they professed to carry it out, and although they tried to save their face by distinguishing between the ownership attributed to the republic and the possession of land snatched by the peasants, the fact remained that the October Revolution as translated into agrarian terms meant the passage of some 50 million dessiatins (135 million ac.) from former landowners into the hands of " petty bourgeois " of the peasant class. The fact that some of the new proprietors held in village groups while others held in individual homesteads did not alter the fundamental opposition between the two social conceptions. The history of the years of Soviet domination up to July 1921 showed that the Communists did not realize at once the consequences of the agrarian revolution registered by their decree. They strove to carry out their programme of nationalization in two directions: they kept in the hands of the Commonwealth a considerable number of estates which had belonged to the State, the Imperial family and certain private landowners—they based their policy of food supply on the principle that the peasants were tenants at will of the republic liable to unlimited exactions for the benefit of the whole.

Under the first head a series of measures were adopted for the exploitation of estates on communistic principles. In the peculiar terminology of the Soviet a number of " Sovkhoses " and " Kolkhoses " were carved out of the land fund and put under the economic control of the administration. The " Sovkhoses " were economic organizations carried on under the immediate direction of the Government while the " Kolkhoses " were communes and associations of peasants enjoying economic support from the Government. Sovkhoses either carried on agriculture in general or cultivated special kinds of technical plants such as beetroot or tobacco. In the first case the Sovkhoses were mainly organized as colonies of industrial workers fitted out with agricultural implements of all kinds, cattle, seeds, etc. The object was to make town workers more independent of the " yoke " of the villages by giving them the opportunity of growing their own corn and vegetables, managing their own dairy farms, etc. These annexes of the factories, designed to rear privileged proletarians in a healthy atmosphere of occasional rural occupation and to provide the surrounding villages with examples of model farming, proved a dismal failure. According to a report presented to a congress of agricultural workers in July 1920 the delays and red tape of administrative patronage rendered the condition of the proletarian husbandmen exceedingly precarious.[1] And as for the workers it could not be expected that they would be able to give satisfaction in their amphibious pursuits. The progress of the Kolkhoses was not more successful. Some were started as actual " communes " with individual coöperation and individual " profits," and those were doomed to be a failure; other Kolkhoses merely drew assistance from the Government, and had to encounter the hostility of neighbouring, less-privileged villages. The negative results of this experiment may be gauged from the fact that the number of Kolkhoses in action decreased in one year from 1,900 to 1,500.

The immense area covered by peasant tenures on the old lines was little affected in its constitution by the Bolshevik usurpation. The attempt of the Soviet to bait the well-to-do peasants by the needy folk proved that the Communist intellectuals did not know the material with which they had to deal. There was no " village proletariat " to speak of, which could serve as a basis for the intended subversion of social relations in the villages; and such tramps and drunkards as the Bolsheviks were able to bring together in their crusade against welfare and order did not succeed in effecting much more than occasional disturbances, which ended mostly in the suppression of the " needy folk " by the peasantry.

[1] According to the decree of June 8 1919, the control of the Sovkhoses farms was given to the Glavsemkhose (the Central Board of Agriculture), which (1) united all agricultural farms organized by the industrial proletariat; and (2) united all the central boards controlling those branches of industry which were in need of agricultural plants for their production, such as " Glavsakhar," " Glavtabak," " Glavkrachmal," " Centrochai," and " Pharmacentre " (*Economic Life* Oct. 2 1919). The original area allotted to different industrial boards amounted to 200,000 dess. (540,000 ac.), but the area actually distributed amongst them was much smaller, amounting only to 80,000 dess. (*Russian Economist*, Jan. 1921).

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Much more irksome were the requisitions and expropriations exercised in virtue of the eminent ownership of the Commonwealth. The Soviet was constrained to fall back on this means of extracting some supplies for feeding the army and the towns, but the decrees enjoining the confiscation of the entire produce with the exception of the quantity necessary for the subsistence of the husbandmen, could not fail to provoke a stubborn resistance. The answer of the peasantry was that the farmers restricted the area under seed to the extent necessary to feed them and their families. Why should they toil to increase cultivation if the fruits of their labour were to be taken from them? According to a Soviet authority (Larin) the quantity used for cultivation had shrunk from 5 milliard poods in 1917 to 2½ milliard poods in 1920. The Soviet Government brought all the weight of its terroristic coercion to bear against this passive resistance. It sent punitive expeditions, it encouraged its privileged proletarians to raid the countryside for supplies, it issued a decree ordering the maximum of available soil to be taken over in cultivation and threatening recalcitrant farmers with confiscation and imprisonment: all in vain as far as the general results were concerned. The hardships and disorder were increased hundredfold, but it proved impossible to drive a mass of 100,000,000 peasants by the whip to perform work which was distasteful to them.

The Soviet dictators had to acknowledge their defeat, and in the spring of 1921 (on March 23), in view of a threatening famine, a decree was issued by the Executive Council of the Soviet recognizing and guaranteeing the private tenure of householders who would conform to the payment of a tax in kind. Instead of charging the provinces with certain lump sums to be partitioned among the *uyezds* (districts) and, lower down among the *volosts*, and to be collected from the harvest according to the requirements of the Government, a land tax was imposed which had to be assessed according to the outfit and means of each separate household. It was calculated that this substitution of a land tax for the system of repartition amounted to the reduction from 470,000,000 poods of corn to 240,000,000. It remained to be seen whether the business of assessing and collecting the tax could be carried out with sufficient skill and fairness. The one positive asset of the revolutionary period from the point of view of the peasants consisted in the passage of land from the squires to the tillers, and this was certainly a conquest which the villagers were not going to give up. All attempts at political reconstruction would have to reckon with this basic fact.

Industry.—The history of industrial economy presents the same features, and describes the same curve, from partial disorganization through blockade and war to general ruin in consequence of absurd Utopianism, and, ultimately, to desperate attempts to reconstitute production by reverting to methods condemned and destroyed by the Communists. There is, however, a notable difference: while the enormous block of the rural population was able to oppose unconquerable passive resistance to the dictators in spite of terrorism and heavy losses, the scanty stratum of the industrial workers was almost worn out in the struggle.

We have again to start in our survey in the case from the years immediately preceding the Revolution. Bolshevik experiments were the culminating phase of a process of destruction which had started long before the Oct. 1917 upheaval: the guilt of the Communists consisted in the fact that instead of fighting the evil, they did everything in their power to aggravate it. The initial stage of industrial decay dates from the time when Russia was isolated from western resources by the Central Powers in alliance with Turkey and Bulgaria. The country had to attempt the impossible task of providing by its own primitive resources for the tremendous technical requirements of the war. The criminal levity of Tsarist administration under men like Sukhomlinov had left it with exhausted equipment and munitions by the end of some nine months of military operations, and an unsoluble problem was set to its patriotic leaders in 1915; they had to make up the deficiencies and to prepare further efforts. This meant technically that all the coal and all the railway machinery had to be diverted for the use of the army while the economic needs of the population were entirely disregarded. As a result, though, with the help of Zemstvo and Municipal Committees acting for purposes of national defence, the fabrication of shells and machine-guns was to some extent reëstablished and maintained. the economic work in the rear necessary for production and repairs was rapidly deteriorating. Train service, for example, was officially suspended for weeks between Petrograd and Moscow in order to make room for military transport and the most urgent needs of food supply. Repairs of locomotives had to be carried out in a more and more imperfect and insufficient manner, and the statistics as to the state of rolling-stock presented drastic symptoms of a lamentable deterioration. The March 1917 Revolution accentuated all these evils because another cause of decay came to the fore with ever-increasing force: the discontent and the demoralization of the workers broke out like a stream of all-consuming lava. The responsibility for the sufferings of the time was laid entirely at the door of greedy capitalists, and the workers were convinced that they were justified in demanding increased wages and decreased labour. A Minister of Labour of the Provisional Government, Skobelev, upheld emphatically their contention.

The following tables give illustrations of the change in the condition of the rolling stock:—

Engines.

Year	Length of the Lines, in Versts	Number of sound Locomotives	Per cent. of Locomotives out of order	Number of sound Locomotives per 100 Versts of Line
			%	
1914 . .	64,000	17,000	15–16	27–28
1916 . .	65,000	16,000–16,800	16–17	26–27
1917, Jan.	64,526	17,012	16·5	26
June	62,952	15,930	24·2	25
Dec.	50,131	15,810	29·4	32
1918, June	25,422	5,676	39·5	22
Dec.	23,665	4,679	47·8	21
1919, June	24,688	4,739	49·0	19
Dec.	36,551	4,141	55·4	11
1920, Jan.	48,410	3,969	58·1	8
June	59,196	6,254	58·9	10·5

Repair of Engines.

	1915	1916	1917	1918	1919 Jan.	1919 Feb.
Number of Engines repaired . . .	797	1,177	640	405	25	21

Construction of New Engines.

Year	Number of new Engines constructed in Russia
1914	816
1915	903
1916	599
1917	396
1918	191
1919	85

In the cotton industry of the Moscow district the earnings of skilled and unskilled workmen per day was as follows:—

Date	Unskilled workers		Carpenters of the first category	
	In kopeks	Per cent. 1919 = 100	In kopeks	Per cent. 1919 = 100
Easter 1914 .	46	2	155	3·9
Easter 1915 .	57	2·5	160	4·0
Dec. 1915 .	59	2·6	175	4·4
Easter 1916 .	68	3·0	200	5·0
Jan. 1917 .	68	3·0	250	6·2
Aug. 1917 .	145	6·3	575	14·4
Dec. 1917 .	800	34·8	1,950	48·7
June 1918 .	1,000	43·5	2,050	51·2
Sept. 1918 .	1,000	65·2	2,650	66·2
Feb. 1919 .	2,300	100	4,000	100

All partial attempts to put a stop to constant rioting, absenteeism, and slackness availed nothing against the general intoxication of the "glorious revolutionary days."

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Working Year of the Industrial Workmen in Days.

	Pre-revolutionary	Post-revolutionary	Increase since the Revolution	Per cent of Increase
Stoppages . . .		53	53	
Sickness . . .	7·4	19	11·6	157
Absence for other causes . . .	16·6	52	35·4	214
Total of days absent	24	124	100	416
Days of rest . .	93	55	38	41
Days of work . .	248	180		
Total . . .	365	365		

The table shows that, notwithstanding the large decrease in the number of holidays after the Revolution, the working year of the workman, owing to the increase of sickness, absence from work and stoppages, has decreased by 68 days, or 25%; and if, further, the length of the working day be taken in account, in 1916, including overtime 10·1 hours, and at the beginning of 1920, 8·6 hours, then the decrease of the working year amounts to 900 hours or 30 per cent.

The Bolshevik victory in Oct. 1917 added yet another ingredient to the industrial ferment. The Marxist dictators, the industrial workers, were the chosen class, the leaders of the proletariat, and entitled therefore to carve out benefits and indulgences for themselves according to their own notions of right and expediency. More especially they were keen to ransom the employers' class, not only by appropriating the lion's share in actual profits but by exacting compensation for advantages which had accrued to employers in the past, as well as vengeance for ill-treatment of the workers in the course of centuries. The inference from this conception of economic relations between working men and their former employers was the system of *workers' control*[1] which the Soviets started in their industrial policy. It meant that each factory and workshop had to be conducted in the future under the supervision and according to the directions of a board of workmen, while the employers were degraded to the position of technical experts and banking managers.

The object of the peculiar combination between Capitalism and Socialism designated as "workers' control" was avowedly to enable the workmen to draw on the resources of the capitalist to the last drop, and in this complete success was achieved thanks to the servitude imposed on the "employer" who could neither withdraw nor oppose any decree of the workman's board. But the system had yet another effect, namely a complete industrial anarchy and consequent ruin.

The next stage was reached when the Soviets attempted to put an end to this anarchy by a regime of nationalization.[2]

[1] The Workers' Control was established by the decree of Nov. 14 1917. It directed the production, sale and storage of products and of raw materials and the administration of the financial side of the business. It belonged to all workers by the intermediary of their elected institutions with the participation of representatives of the employees and of the technical staff.

The situation in the factories became chaotic, and the disorganization of the undertakings assumed the most extraordinary dimensions. The interference of the Workers' Committees made it quite impossible to realize any scheme planned in advance. All programmes of economical policy were annulled by the "judgment" of the Workers' Committees.

[2] In the course of a report delivered to the Moscow Congress by the Supreme Council of People's Economy in Jan. 1920, A. I. Rykov, the president of the Council, made the following statement:

"The nationalization of industry has been carried out pretty fully. In 1918, 1,125 factories and works were nationalized, and by the end of 1919 the number was about 4,000. This means that nearly all industry has passed into the hands of the state (Soviet) organs, while private industry has been destroyed, as former statistics show that there were up to 10,000 industrial undertakings, including cottage industries. These latter are not subject to nationalization, and the 4,000 nationalized factories and works include not only the larger concerns, but likewise the bulk of the average industrial concerns of Soviet Russia. Of these 4,000 undertakings about 2,000 are working at present. All the rest have been closed. The number of operatives is estimated approximately at 1,000,000, which is between one-third and one-fifth of the numbers of the proletariat in 1914. Both as regards the number of hands and the number of undertakings in operation the Russian manufacturing industry is likewise undergoing a crisis."

Nationalization could be introduced into practice only by deriving economic direction and control, not from the accidental and separate groups of workmen in factories and workshops, but from the national centre. This centre was embodied in the Economic Council of the people, supported locally by subordinate councils in the provinces and districts, and relying for the execution of its decrees on a vast bureaucracy of head offices (Glaski) and "centres."

It is difficult to form an adequate opinion as to the ramifications and numbers of this all-embracing bureaucracy. We have the evidence of its own members as to the actual working of the system. In theory it had to organize the repartition of raw materials, to assign means and draw supplies and to collect products in accordance with requirements. In reality the Soviet bureaucrats struggled with each other, stifled local opinion and individual enterprise, and had generally to record lamentable discrepancies between plans and achievements.[3]

Bureaucratic nationalization proved as ineffectual as workmen's control in solving the problems of increased production and organization of labour. Theoretically, the workmen in the nationalized industries had to be considered not as privileged beneficiaries but as disciplined citizens serving the Commonwealth. Attempts to translate this view into practice were made. Workmen were mobilized for industrial purposes, sent to the Ural or to the Donets fronts, subjected to military control and martial law, armies that had been fighting the Poles or Denikin were switched off to execute economic tasks. Trotsky developed the idea of the militarization of industry as the only means of saving the country from collapse. But the results were not encouraging. Workmen deserted from the towns and hid in the villages, while those unfortunates who were unable to leave Petrograd, or other industrial towns, went on strike, made demonstrations and riots in the face of ruthless repressions; even when they performed their hard labour, it proved miserably inadequate for lack of physical health and moral energy.

Altogether, industrial nationalization proved as much of a failure as agricultural nationalization. And so the Soviets had to retreat, here as there, to a position characterized by the abandonment of all their economic doctrines and previsions. In 1921 Comrade Krassin was recommending in the West a programme that Lenin had announced to the 10th Congress of Communists and to the Central Executive Council: capital and competent leadership were acknowledged as necessary forces in the process of industrial production: the national capitalists had been robbed and driven from Russia; therefore foreign capitalists had to be called in to take their place. They were promised guarantees against arbitrary expropriation "*à la Russe*" and they might think that they were less liable to succumb to it because they were not "comrades" but citizens of civilized states, and might count on the strong arm of their Governments. But the great inducement consisted obviously in the prospect of rapid profiteering on a scale commensurate with the risk incurred by those who ventured into the wolves' den.

In comparison with these gigantic schemes of exploitation other retrograde measures were modest and mild. Small capitalists, even when Russians, were allowed to start shops, and individual enterprise was to be encouraged somehow, although Communism was not renounced as an ideal, and big undertakings were to be kept in the hands of the State. The introduction of

[3] From Jan. to June 1918, the Soviet regime at the Putiloff factory gave the following results:—

	Delivered	*Prevision*
Engines, new	2	4
Engines, new type	1	3
Engines, important repairs	2	10
Engines, medial repairs	0	12
Carriages, 3rd class, new	2	4
Carriages, 4th class, new	3	13
Carriages, for goods, new	169	309
Tramways	3	9

The real productivity of the factory is from 3 to 10 times inferior to those of the scheme of production established by the superior Council of National Economy. (Report of Mr. Molitof to the Petrograd Soviet, Aug. 15 1918, Labry, 187.)

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specialists was recommended as a necessary measure. Under the regime of the workmen's control, technical experts were treated as second-rate persons to be ordered about by the ignorant "*demos*" of proletarian boards, but experts were now invited to proceed to Sovdepia in order to help to restart productive industrial activity. In the factories piece-work was given a prominent place as against the "ca'canny" devices of time work, although previously workmen used to protest most violently against this form of remuneration. Altogether payment by results was being more and more recognized as an antidote against slovenly labour. As for working hours no account was taken of the 8-hour day, and forced labour was exacted for 10 or 12 hours when deemed necessary by the commissars.

Standard of Living.—Thus the Soviet dictators were trying in 1921 to back out of the impassé into which they had run the industry of the country. There was among the working class one group which had profited by the Oct. revolution—it was the communistic nucleus used by the Soviet administration to spy on their comrades and to coerce them. They enjoyed all the privileges of an official class and could afford not only necessaries of life but such luxuries as were to be had in the market. Apart from these privileged Communists the working class was reduced to a condition of utter destitution. Even judging by the standard of the prices fixed from time to time by the ruling powers they could not make the two ends meet, because the prices had risen during Soviet domination from 16 to 25 times. In 1921 bread cost 19 times as much as in the second quarter of 1917, manufactured goods 22 times as much, footwear and soap 25 times. Wages indeed had increased also, but their nominal increase did not keep up with the cost of living. About the middle of 1918 an *enquête* had been made in Moscow as to the budgets of 2,173 workmen, and it resulted from it that on the average a bachelor working-man's wages did not exceed 462 rubles per month, though by occasional extra work they might be brought up to 624. The head of a family earned on the average 703 rubles, and might increase his earning by supplementary labour to 1,077 rubles per month. The ordinary budget was made up in the case of a bachelor by 22·2 rubles for lodging, 46·9 for food, 47·7 for clothing, 1·1 for house implements, 19·6 for health (baths, drugs, etc.), 13·4 cultural expenses (newspapers, books, etc.), 13 (parcels sent to village home), 32 miscellaneous expenses; in all, including other items, being 609 r. For heads of families the average monthly expenses rose to 952·7, of which 672·8 r. fell on food (Zagorsky, *La République des Soviets*, 214, 215). These figures show a considerable deficit in normal and well-regulated households: any disturbance in personal conduct, conditions of labour or health, was bound to result in downright starvation and ruin. Let us also notice that distress was much more marked in 1920 and 1921 than in 1918.

The only consolation for workmen was derived from the fact that the hated bourgeois were subjected to even greater hardships. In the early stages of Bolshevik domination this kind of consolation was a potent one: the feeling of triumph of the lower class over its former superiors made up for many privations, but in course of time the bourgeois were trodden down to that extent that there was not much satisfaction to be obtained from kicking them, while new contrasts arose between the mode of life of half-starved workers and of the Soviet bureaucrats shepherding them. The food situation became catastrophic in 1921. As a result of the restriction of cultivation, transport difficulties and civil disorder, a great part of the country was visited by downright famine, with terrible prospects ahead.

Credit and Finance.—In such conditions nothing could be expected but growing decay in public credit and finance. The Soviet Government had been living on the reserves accumulated under monarchical rule. The gold fund of the Imperial Treasury had been its chief asset in conducting political and commercial negotiations. Its remnant represented something like £50,000,000 in the first quarter of 1921. The needs of the home circulation were satisfied by constant emissions of paper notes. There was no system and no limit in this process of inflation. Paper notes had even come to be measured by weight instead of being reckoned at their indicated value. The Chief of the Soviet State often spoke with contempt of money currency as a worthless product of capitalistic exploitation. But the Communist Commonwealth had not yet discovered the means of replacing this system by a more adequate instrument of exchange. Figures in rubles were still being handled as if they represented realities. The only hope left for the Bolsheviks was that when they had spent the reserves captured from the Imperial Government and from the defeated armies, the national capital represented by the natural wealth of Russia in forests, minerals, fisheries, etc., should be put into the market. The handing over of this wealth to foreigners would mean, of course, economic subjection, a state similar to that of Asiatic and African dependencies of western Powers. But the Bolsheviks were not deterred by a prospect of that kind, provided it enabled them to continue in power. They mapped out a programme of concessions on the widest scale.

The Council of the Commissars of the people laid down a set of rules as to concessions, and the Councils of Economy and of Agriculture outlined a vast scheme of natural resources which should be offered to foreigners for exploitation. The rules were as follows:—

(1) Concessions should be granted by agreement on the principle of a division of profits.

(2) In case of the introduction of special machinery and appliances the concessionnaires would be granted privileges, *e.g.* large orders.

(3) The concessionnaires would be allowed to remain in possession for long periods in order that they should draw sufficient benefits from their concessions.

(4) The Government of the Soviets guaranteed immunity to the concessionnaires from nationalization, confiscation and requisitions.

(5) The concessionnaires would have the right to hire labourers on conditions specified in the Laws of the Commonwealth or on special conditions safeguarding the life and the health of the workmen.

(6) The Government pledged itself not to make any change in the conditions of the agreement by a one-sided exercise of its authority.

It would be impossible to enumerate all the resources of the country offered to enterprising capitalists for exploitation. Two or three examples must suffice to give an idea of the booty offered to foreign capitalists by Russian Communists. In Western Siberia, along the rivers Ob, Irtysh and Taz, an area of 70 million dess. (about 180 million ac.) was reserved for them. It is covered by immense forests of pines, firs, cedars and larches. If it were found necessary at the start to restrict exploitation to a strip along the rivers some 15 versts wide along each bank, there would still be available for immediate and easy use some 16 million dess. (about 42 million acres). The timber should be sawed and worked into pulp and cellulose in mills to be erected by the estuary of the Ob. Such mills ought to make up a settlement of the size of another Archangel. The natural route westwards lies down the Ob and by the Kara sea: it had already been utilized to some extent and its future importance could not be exaggerated. The whole region should be opened up by a number of railway lines. Mineral wealth of various kinds—platinum, coal, lead—is to be found in these districts. One of the most stupendous advertisements as to mineral wealth concerned the Kuzsnetsk coal mines along the Tom river. They were estimated to contain about 250 million tons of excellent coal. In European Russia 14 uyezds (districts) were advertised for agricultural exploitation and the construction of ways of communications of all kinds. All these districts are situated in the black soil region of south-eastern Russia. The application of powerful traction engines and steam ploughs would soon convert them into one of the principal granaries of Europe.

Such were the prospects held out in 1921 to enterprising capitalists. Not a word was wasted on the social and legal conditions of the human material connected with these tracts. It remained for the concessionnaires to fashion it with the assistance of the enlightened commissars: it was evident that the 5th clause of the Soviet rules ought not to be applied in such a way as to hamper the great process of economic restoration. The principal object was to get capitalists to speculate on the material basis described with such graphic details.

It remained to be seen how they would organize and keep in order the labouring population required for the carrying out of

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the concessions—whether the foreign capitalists would obtain feudal franchises with police powers of their own, or the Soviet power would keep watch on their behalf and use coercive measures to keep the Russian workmen up to the mark.

Another side of the repressive policy of the Soviets in the stress of dire need was presented by the appeal to the help of coöperatives. These organizations had gone through a chequered existence under the rule of the Soviets. In the early days of 1917 and 1918, the proletarian dictators used them as convenient tools at home and abroad in order to counteract the impression that Russia was ruled by an uncompromising despotism. The leaders of the coöperatives were encouraged to preach a non-party attitude, and to concentrate their efforts on purely economic work without any admixture of political opposition. In the campaign for the reopening of trade with Soviet Russia it was usual to assert that such trade would be carried on exclusively with coöperators and not with the ill-famed Moscow Government. In 1919, however, a sharp turn was given to the wheel, and the coöperatives were "nationalized"—declared to be subordinate committees of the Central Economic Council. In Sovdepia this measure was explained not only as a consequence of the general policy of Communism, but also as a necessary precaution against Social revolutionaries and Mensheviks, accused of having barricaded themselves within the coöperatives for purposes of political agitation.

In the beginning of the year 1921 a new current set in: coöperatives were to some extent reëstablished as autonomous organizations. The object was to revive them as agents of repartition. The Soviet decree of April 7 1921 was drawn up, however, in such a narrow and ambiguous form, that the institution remained doomed to mechanical subjection. The Act concerned primarily coöperatives of consumers. It allows combinations for protection and traffic only in an exceptional case and in obscure terms. As far as allowed, coöperatives are included in administrative units of state origin and local delimitation. All freedom of action is curtailed and subjected to strict supervision. Lastly, the members are not voluntary associates intending to help each other according to free agreement, but people brought together by the fact of dwelling in the same locality or belonging to the same professional group.

All this shows to what extent the principle of autonomous association was felt to be antagonistic to Soviet despotism. It might be assumed that the coöperatives would either remain inactive and fictitious, or else that they would contrive to escape the jealous supervision and the step-motherly pressure exercised by the "Glavki" and "centres."

The hard facts of economic decay admitted of no controversy and could be illustrated by tabulated results. It was still impossible in 1921 to apply the same tests to the moral aspect of the condition of Russia, although there could be no doubt that the deterioration of national life in this respect was more harmful than economic decay. The aggressive tone of Communist propaganda could not deceive any one who considered the efforts of the "Proletcult" with common sense. It was not the number of schools that mattered, but their efficiency and educational influence. The prophecy of Dostoievsky in *The Possessed* had come true: the Bolsheviks had not only squandered the reserves accumulated by orderly government, and scattered some 2,000,000 of the best educated Russians across the world—they had poisoned the mainsprings of national morals for generations to come. One or two of the conclusions of Lord Emmott's Committee may be appropriately cited in this connexion; their studied moderation makes them particularly effective:—

"Child education in Soviet Russia is based upon an attempt to dissolve the ties hitherto existing between parent and child, and children are removed from the care of their parents soon after birth; we have received no information on the moral and physical effects of this policy. Education, both child and adult, is not merely secular, but directly anti-religious in bias."

As a specimen of the educational practice of Soviet Russia we will quote from the experience of a leading professor of the medical faculty of the university of Moscow, published under the pseudonym of "Donskry" in the *Archives of the Russian Revolution, I* (Berlin, 1921):—

"By order of the commissars 5,000 applicants had been admitted as freshmen in the medical faculty, although the lecture-rooms were constructed for 250. Representations had been made that it was impossible to admit persons who had received no appropriate instruction, but they were disregarded. The only thing required was that applicants should have attained the age of 16 years—the rules as to admission did not mention even the necessity of knowing how to read and write. The crowd of students dwindled to small numbers very soon, however, on account of the absence of heating during the winter and of the almost insuperable difficulty in getting materials for experimental teaching."

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RUSSKY, NIKOLAI (1854–1918), Russian general, was born in 1854. On leaving the infantry military school in St. Petersburg in 1874 he was given a commission in the Guard. Graduating from the Academy of the General Staff in 1881, he served as an officer of the general staff in the Kiev military district, and by 1896, after commanding an infantry regiment, had reached general's rank. During the war with Japan in 1904–5 he was the head of the staff of the II. Army, and planned the offensive carried out by Gen. Grippenberg which led to the prematurely abandoned offensive of Sandepu. In 1909 he was assistant commander of the Kiev military district. He enjoyed the special friendship of the War Minister, Sukhomlinov. At the beginning of the campaign of 1914 he commanded the III. Army, which attacked in Galicia, and after the vicissitudes of the bloody heavy battles about Krasnik and Rava Ruska advanced to Lvov (Lemberg), through which it passed in the further advance to the San-Dniester line. The dramatic entry of the III. Army into Lvov created for Gen. Russky a popularity and prestige out of proportion to the real importance of his success. In Oct. 1914 he was appointed commander-in-chief of the north-western and afterwards of the northern "front" (*i.e.* group of armies), but, suffering from very bad health, he had on more than one occasion to leave the front for a time. He continued, however, to hold the command, and it was at his headquarters that the final scenes of Nicholas II.'s reign and his abdication took place in March 1917. Soon after the Revolution Russky retired and in 1918 he was reported killed by the Bolsheviks.

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RUTHERFORD, SIR ERNEST (1871–), British physicist, was born at Nelson, New Zealand, on Aug. 30 1871. He was educated at Nelson College and Canterbury College, Christchurch. After graduating at the New Zealand University (M.A. 1893 and B.Sc. 1894), he proceeded with an 1851 science exhibition to Cambridge, where he entered Trinity College and prosecuted researches in the Cavendish laboratory, Sir J. J. Thomson being then the Cavendish professor. He published numerous researches upon the conduction of electricity through gases, for which he obtained the B.A. Research degree and the Coutts-Trotter studentship in 1897. In the following year he was appointed Macdonald professor of physics in McGill University, Montreal. There he carried out a series of brilliant investigations, in conjunction with Soddy, which established upon a firm basis the existence and nature of radioactive transformations. In 1903 he was elected F.R.S. In 1907 he succeeded Sir Arthur Schuster as Langworthy professor of physics in the university of Manchester, and he attracted there a large school of radioactive research workers. In collaboration with several of these the science of radioactivity was rapidly developed: among other work the production of helium as a product of disintegration of radium was shown spectroscopically, the spectrum of the emanation measured, the number of α particles (charged helium atoms) during a disintegration process counted, the properties of numerous radioactive products and the radiations accompanying their formation examined. Among the most important of the researches emanating from his laboratory was that of the experimental demonstration of the nuclear nature of the atom. It was also in his laboratory that Moseley determined the X-ray spectra of a number of elements. Rutherford was knighted in 1914 and in 1919 succeeded Sir J. J. Thomson as Cavendish professor of experimental physics in the university of Cambridge. Many British and foreign honours and degrees were bestowed upon him: the Rumford Medal of the Royal Society (1905), the Barnard Medal (1910), Bressa Prize (1908), and Nobel Prize for chemistry (1908). In 1920 he was appointed professor of physics at the Royal Institution, London. His works include *Radioactivity* (1904), *Radioactive Transformations* (1906), *Radioactive Substances and their Radiations* (1912).

RUTHERFORD, MARK [WILLIAM HALE WHITE] (*c.* 1830–1913), English author (*see* 23.940), died at Groombridge March 14 1913. His eldest son, SIR WILLIAM HALE WHITE (b. 1857), who was created K.B.E. in 1919, became a well-known physician, and during the World War was a colonel in the R.A.M.C.

RYAN, JOHN DENIS (1864–), American capitalist, was born at Hancock, Mich., Oct. 10 1864. He was educated in the public schools, for eight years was clerk in an uncle's store, and at the age of 25 went to Denver, where he was employed as a salesman of lubricating oils. In 1901 he secured an interest in a bank at Butte. In 1904 he was made manager of the Amalgamated Copper Co. in Montana, and after the death of Henry H. Rogers, in 1908, he succeeded him as president. He had been elected president of the Anaconda Copper Mining Co. in 1905, and after the merging of the Amalgamated interests in the Anaconda in 1910 he continued as president of the latter until 1918. He developed large water powers in Montana, and in 1913 electrified the railway between Butte and Anaconda (100 m.), the success of which led to a wide introduction of electrification. By 1920 hydroelectric power from the Montana Power Co. organized by Ryan was used in most of the mines of Montana and for lighting in all parts of the state. During 1917–8 Ryan was a member of the war council of the American Red Cross and after 1918 of its central committee. After the failure of America's aircraft programme had led to a reorganization, he was appointed in April 1918 head of the Aircraft Board of the Committee of National Defence, and in Aug. was appointed second assistant-secretary of war and director of air service of the U.S. army. After the signing of the Armistice in Nov. he resigned. Official investigation was made later, and Ryan was both attacked and defended. It was generally felt that the newly organized board fell heir to popular criticism of past failures for which it was not responsible, and the short time before the Armistice scarcely afforded opportunity to develop efficient production. In 1919 Ryan was elected chairman of the board of directors of the Anaconda Copper Mining Company, and he took a prominent part in connexion with other commercial and financial concerns.

RYDER, ALBERT PINKHAM (1847–1917), American painter (*see* 23.949), died at Elmhurst, Long Island, March 28 1917.

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SAAR VALLEY.—The Armistice of Nov. 1918, in restoring Alsace-Lorraine to France, again brought the French frontier close to Saarbruck and the Valley of the Saar. This region, thanks to its large coal output, had ever since 1871 been in close relations with the coal-mines of Metz and Thionville. The big metallurgical establishments of Lorraine were largely dependent upon coal from the Valley of the Saar, from which the new French frontier would have cut them off, to the detriment of the economic development of both countries. On the other hand, France had been deprived of a large portion of her output by the destruction of her northern coal-fields, a situation which had as far as possible to be remedied by Germany. The geographical situation of the coal-mines in the neighbourhood of Saarbruck clearly pointed to their utilization for this purpose. Nevertheless, and although Saarbruck had belonged to France from 1794 to 1815, the French annexation of this country was difficult without running a risk of violating the inhabitants' right of self-determination. These were the elements of the problem which the authors of the Treaty of Versailles had to consider.

Treaty Stipulations.—Section IV. of Part III. of the Treaty deals with the Saar Valley. Articles 45 to 50 lay down the frontiers of the Saar territory, and state the general principles adopted. The regime agreed upon is laid out in an annexe which follows Article 50. It is clear from the text that the authors of the Treaty intended to cede to France complete ownership of all coal deposits in the valley. This could not have been effected had the district remained under the authority of the German Government. Disturbances were to be feared between the French State, sole proprietor of the mines, and the German Government, which would have remained the only public authority. In order to get over this difficulty, and to ensure to France the free disposal of Saar coal, the territory of the Saar was completely detached from the German State, both from a political as well as from an administrative point of view.

Frontiers.—The territory (*see* EUROPE, inset on map) as created by the Treaty stretches W., N. and E. of the town of Saarbruck (60 km. E.N.E. of Metz, and 90 km. N.W. of Strassburg). On the S. and the W. there is the French frontier, from Hornbach, S. of Deuxponts, to Ritzing, W. of Merzich (Merzig). Leaving Ritzing, the frontier includes Mettlach and its suburbs, passes near Neuenkirchen, and, going E. reaches the southern frontier of the Birkenfeld district, which it follows. From Namborn the line goes S.E., taking in Homburg, and, after bending so as to exclude Deuxponts, rejoins the French frontier near Hornbach. The territory thus formed is considerably larger than the district where coal-mines are actually being worked. The peace negotiators intended, in fact, to include in it the whole coal deposit, and not only the fields being exploited. France has become sole owner of all the fields and of all mining concessions. Indemnification of the former owners was made the concern of Germany. Transfer to France of the mines being worked was made comparatively easy by the fact that nearly all the concessions belonged to the State of Prussia or to Bavaria. The rights of France in the district were still further guaranteed by the inclusion of the district in the French Customs system. This provision had extremely important economic and political effects. However, in order to avoid a brutal cessation of the close economic relations which existed between the Saar and the rest of Germany, trade with Germany was to remain free of any Customs dues until Jan. 10 1925. France was empowered to build any railways or canals which she might deem necessary in order to link up the fields with France. All the rights and duties of the former proprietors towards their employees and workmen were assumed by France, who was also free to use French currency in all its transactions within the zone. The value of the mines thus ceded was to be credited to Germany in the Reparations Accounts.

Political Régime.—Steps had to be taken to provide the district with administration and government, France, apart from the mines, being concerned only with Customs. The Peace Treaty entrusted the League of Nations with this task, as from Jan. 10 1920. The country is governed by a commission of five, which sits at Saarbruck, and consists of one French member, one member chosen among the local population, and three who may be neither French nor German. This commission is appointed yearly by the League of Nations, which may renew expiring mandates. It is presided over by one of its number, appointed by the League of Nations. This president acts as executive agent. All powers previously enjoyed by the German Empire, Prussia and Bavaria have been transferred to the commission. The commission maintains in force the laws and regulations passed previous to the Armistice, with the exception of special war measures. It has the power to modify them if necessary; collects taxes; administers justice; directs the administration of the country, and can create new administrative organs. It is responsible for public order; the safety of the inhabitants of the district, and their representation abroad; it manages the railways and looks after all public property. These powers, for the use of which the commission is responsible to the League of Nations, are subject to several restrictions. First of all, they cannot affect the rights of the French State in its capacity as owner of the mines, and no restriction can be placed upon the circulation of French money. On the other hand, the country maintains its local assemblies, its religious freedom and its tongue. No fresh taxation (Customs excepted) can be levied without consultation with elected representatives of the inhabitants. Men and women over 20 years of age have the right to vote for the local assemblies.

The Treaty in no way affects the existing nationality of the inhabitants. It stipulates that the governing commission shall be the last judge of any dispute arising from the interpretation of the Treaty itself. The régime thus formed does not establish a state of the Saar, similar to that of Luxemburg, since no new nationality is formed, and since the League of Nations is only acting as trustee. It is none the less true that the Saar territory constitutes a political and economic entity entirely independent and entirely separated from Germany and France. The Peace Treaty did not intend to prolong this state of affairs indefinitely without giving the inhabitants of the Saar an opportunity of expressing and obtaining the fulfilment of their wishes in the matter. Therefore, 15 years after the coming into force of the Treaty, that is to say, in the course of the year 1935, the future régime of the Saar was to be settled by a plebiscite.

The Plebiscite.—The details of this plebiscite were to be settled by the League of Nations. All persons over 20 years of age who were resident in the territory on June 28 1919 were to have the right to vote. Three alternatives were to be submitted to the population. First, the permanent maintenance of the system of government provided for in the Treaty—that is to say, autonomous government under the ægis of the League of Nations; second, reunion with France; third, reunion with Germany. Voting was to be taken by commune or by district, and it would therefore be possible to take into account the various votes of different portions of the territory. The League of Nations was to fix the new frontiers, if any, in accordance with the results of the plebiscite. The fate of the mines ceded to France would be decided by the plebiscite also. If the Peace Treaty régime were continued, or if the voting went for reunion with France, there would be no further difficulty; but if all or part of the coal-fields returned to Germany, Germany would have to buy out the interests of the French State in the fields which Germany would then reoccupy. The price was to be fixed by experts and to be payable in gold.

Physical Features.—The river Saar comes into contact with the territory at Sarrequemines, and forms the French frontier to a point just above Saarbruck. It then flows through the territory to a point just downstream from Mettlach. The valley, which, between Saarbruck and Merzich, is fairly wide, runs through picturesque hills covered for the larger part with forests, the working of which is a

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valuable industry. Agriculture plays but a very secondary part, and it is upon industry that the population is mainly dependent. The pop. amounts to 703,000, which, on an area of 1,900 sq. km., shows a density of 370 persons per sq. km. The population is very unevenly distributed. It is very dense in the industrial regions, in the valley around mineheads, and wherever factories have been built. It is sparse in the farm and forest lands. The chief towns are Saarbruck (110,000), Voeltlingen (19,000), Sarrelouis (16,000), Dillingen (8,000), Merzich (9,000), which are all in the valley itself. Then there are the mining towns elsewhere: Dudweiler (21,000), Sulzbach (23,000), Friedrichsthal (14,000), and the industrial town of Neuenkirchen (35,000). The chief towns in the Bavarian portion of the territory are St. Ingbert (19,000), Homburg and Bliekastel. The chief industry, and the only one mentioned in the Peace Treaty, is the extraction of coal. The mines being worked in 1921 are situated in a district bounded on the one side by the Saar Valley from Burbach to Fraulautern, and by two lines drawn from Waldmohr (N.E. of Neuenkirchen) to Burbach and Fraulautern. Mines are most closely clustered in the little valleys between Saarbruck and Neuenkirchen, and before the war all of them, with the exception of those at Hostenbach and Frankenholz, belonged to Prussia or Bavaria. The total production of the basin averaged 12,000,000 tons a year. It exceeded 13,000,000 tons in 1913, and, in the opinion of experts, a very considerable increase in output ought to be obtained without much difficulty. All the mines are worked for France, with the exception of that of Frankenholz, which was left in the hands of the company which previously owned it. Output fell off during the war, as the result of fewer working hours and less productive labour. In 1920 about 9,500,000 tons were produced, and in 1921 the output would have been bigger had it not been for the general economic crisis. The mines employ over 70,000 persons, and, taking into account their dependents, it may be safely said that about a third of the total population of the country relies upon the mines for its living. The output is consumed, to the extent of about 50%, locally. The rest is exported to Alsace-Lorraine, France and Southern Germany. The export market varies in accordance with the general economic situation. The coal is not very satisfactory for the purposes of steel manufacture, and has to be mixed with coal from the Ruhr before it produces good coke. On the other hand, it is very suitable for heating and the manufacture of lighting gas, and therefore finds a ready sale to railways and municipal authorities. Metallurgical industry is highly developed, and there are no less than 31 blast-furnaces and many steel plants. The factories, which are run by powerful companies, are situated at Burbach, Brebach, Voeltlingen, Dillingen, Neuenkirchen and St. Ingbert. The steel output in 1912 was over 2,000,000 tons. Since the Armistice French capital has been largely invested in the metal industries of the Saar and metal workers and miners receive their wages in francs. There are a number of works producing machines and machine tools, so that after coal the iron and steel trades rank as second in importance. Glass and ceramic industries, the former at Sulzbach and St. Ingbert, and the latter at Mettlach and Merzich, are the next important employers of labour. There are over 120,000 persons, counting 70,000 miners, industrially employed. The majority of the workmen are natives of the country, and labour therefore has a stability not often to be found.

Communications.—A good system of communications provides an outlet for these industrial products. Saarbruck is at the junction of the Metz–Mayence and Strassburg–Trèves–Cologne line, and is also on a direct line towards Ludwigshafen and the Rhine, as well as in connexion with a number of minor or local railways. There is also a canal through the Saar, which has been canalized upstream from Sarrelouis in order to meet the mine canal and the Marne–Rhine canal in Lorraine. There is no waterway towards the Moselle.

General Considerations.—It will be seen that the population is almost entirely industrial. In the towns there are wholesale and retail dealers, and the works and factories are owned by big limited companies. There is therefore but a small middle class and a backward intellectual and artistic development. From a religious point of view Catholics are in a considerable majority, although there is a fairly strong group of Protestants at Saarbruck. Since the German revolution the Socialists and Catholic Centre have been practically numerically equal; and trades unions are either Christian or Red. It is economic questions, output and wages which chiefly concern people. In 1921 there were a number of problems to which no definite solution had been found. There were the change of the Customs frontier, the coexistence in the Saar of the French franc (with its higher and more stable rate of exchange) and the German mark, and the natural increase of economic relations with France. The great resources of the country, however, enabled one to hope that the Saar would be able to adapt itself to these new conditions. The stipulations of the Treaty of Peace, in placing the territory under the authority of a government independent both of France and of Germany, were peculiarly calculated to assist the economic development of the region. They gave to the Saar the means of protecting its own interests, and at the same time spared it the burdens and worries which are the common fate of all great states. (P. DE T.)

SABINE, WALLACE CLEMENT WARE (1868–1919), American educator, was born at Richwood, O., June 13 1868. He graduated from Ohio State University in 1886 at the age of 18 and after two years' further study at Harvard received the degree of A.M. In 1889 he was made assistant in physics at Harvard and the following year instructor. After passing through the usual stages of promotion he was appointed professor of mathematics and natural philosophy in 1905 and the following year assumed the deanship of the newly organized Graduate School of Applied Science. He was an inspiring teacher but his publications were confined to papers contributed to scientific journals. In 1916 he went to France as exchange professor at the Sorbonne but devoted most of his time to removing French tuberculous patients to Switzerland under the auspices of the Rockefeller Foundation. In 1917, however, he lectured on architectural acoustics, a subject of which he had made a special study. He himself fell a victim to tuberculosis and died in Cambridge, Mass., Jan. 10 1919.

SAGE, MRS. RUSSELL [MARGARET OLIVIA SLOCUM] (1828–1918), American philanthropist, was born at Syracuse, N.Y., Sept. 8 1828, being descended on her father's side from Capt. Miles Standish. After graduating in 1847 from the Troy (N.Y.) Female Seminary, afterwards known as the Emma Willard School, she taught, first in Philadelphia, and later in Syracuse and Troy until 1869 when she became the second wife of Russell Sage (*see* 23.1002). She proved herself a shrewd business woman and for several years before his death had full control of his affairs. She had long been interested in charities, and in estimating the services of Sage himself it should be remembered that he left to her without restriction his entire fortune, over $64,000,000, doubtless foreseeing its probable final distribution to charity. In 1907 the Russell Sage Foundation was incorporated under the laws of the state of New York, for the "improvement of social and living conditions of the United States of America," and to it she gave $10,000,000. The Foundation made many surveys of social and educational conditions in various states and issued many publications dealing especially with housing improvement and reform. In 1912 Mrs. Sage bought Marsh I., off the Louisiana coast, containing about 79,000 ac., later turned over to the state as a permanent refuge for birds. She died in New York City Nov. 4 1918. Her will provided that after enumerated bequests to relatives and friends amounting to about $12,000,000, the residue, some $36,000,000, should be divided into 52 parts and variously distributed to many colleges, museums, hospitals, charitable institutions, Bible societies and missions. To most of these she had made gifts during her lifetime. The largest portion, seven parts, was left to the Russell Sage Foundation. It was estimated that during her life she had made public gifts of some $40,000,000.

SAID, HALIM, PRINCE (1859–1921), Turkish statesman, was born at Cairo in 1859, a nephew of the Khedive Ismail. He was a keen politician, and became the official head of the Young Turk party, which carried out the revolution of 1908. He was called upon by Sultan Mahommed V. to form a Cabinet in 1911, and remained at the head of affairs until July 1912. After the murder of Shefket Pasha in June 1913 he became grand vizier and Minister for Foreign Affairs, and during his tenure of power was a strong supporter of German influence in Turkey. He resigned in Feb. 1917. He was murdered in Rome Dec. 6 1921.

SAID PASHA (*c.*1830–1914), Turkish statesman (*see* 23.1008*), again became chief minister in the autumn of 1911, and in Dec. proposed to restore to the Sultan the power of dissolving the Chamber without the assent of the Senate. This proceeding gave rise to many storms, and Said Pasha reconstructed his Cabinet Jan. 22 1912. On Jan. 21 he published in the London *Daily Telegraph* the proposed reform programme of his Ministry. He was forced to resign July 17 1912 owing to the strength of the revolutionary movement in the army. He died in 1914.

ST. ALDWYN, MICHAEL EDWARD HICKS BEACH, 1ST EARL (1837–1916), English statesman (*see* 23.1013), was created an earl in 1915. He died in London April 30 1916.

ST. JOHN, FLORENCE (1854–1912), English actress, whose maiden name was Greig, was born at Tavistock, Devon, March 8 1854. She was three times married, first to Mr. St. John, R.N., secondly to Lithgow James, and lastly to C. D. Marius, both on the stage. Her first appearance was in 1868, and she subsequently

** These figures indicate the volume and page number of the previous article.*

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played in a very large number of light operas, winning special success as Germaine in *Les Cloches de Corneville* and in *Madame Favart*. In 1902 she abandoned opera for drama, playing Nell Gwynne in *English Nell* and other comedy parts. She retired in 1910 and died in London Jan. 30 1912.

ST. LOUIS (*see* 24.24).—The pop. of St. Louis in 1920 was 772,897, an increase of 85,868 since 1910, or 12·5%. In the preceding decade the increase was 111,791 or 19·4%. The area remained as fixed in 1876, but the increasing pop. and industries have spread beyond these limits. The city, the counties of St. Louis and St. Charles in Missouri and the counties of St. Clair and Madison in Illinois are grouped as the St. Louis district and treated as a whole in the U.S. industrial census. In 1920 the district contained 1,145,443 inhabitants.

Municipal Government and Activities.—A new charter adopted in 1914 reduced the elective officers to mayor, comptroller, president and board of aldermen, collector, treasurer, recorder of deeds, sheriff and coroner, with terms of four years. The legislative branch is unicameral. Each of the 28 wards has a resident alderman elected by the entire city vote, one-half of the board retiring biennially. Mayor, comptroller and president of the board of aldermen form a board of estimate and apportionment. An appointive board of public service consists of a president and four directors of divisions, public welfare, public safety, public utilities, and streets and sewers. Municipal departments and bureaus are grouped in the four divisions. The president of the board has charge of public work and improvements. In 1919 the city's outstanding bonds amounted to $19,884,000, to which in 1920 was added $5,500,000 for removal of railway grade crossings, for a municipal farm to afford better treatment of the tubercular and insane, for new engine houses and reconstruction of streets and for municipal lighting equipment. The tax rate for 1920–1 was $2.55 per $100 assessed valuation, divided as follows: state purposes, $0.18; public schools, $0.78; municipal government, $1.51; public library, $0.04; art museum, $0.02; zoölogical park, $0.02. The assessed valuation of realty and personalty for 1920–1 was $777,500,000. City planning was undertaken in 1912 with a commission of nine citizens and five *ex-officio* members. The work done includes a concrete dock, mechanically equipped to convey freight between river and railways. A zoning law determines definitely the residential, industrial and commercial districts; 29 street widenings, openings and cut-offs were under construction in 1921. Neighbourhood parks, playgrounds and squares were increased to 80, embracing 2,908 acres. A pageant and masque given by 2,000 participants before audiences of 100,000 led to the construction in 1917 of a municipal theatre in Forest Park, with accommodation for 9,270. At a cost of $7,200,000, the city completed in 1917 a municipal bridge of massive steel construction, double track and double deck, across the Mississippi. About five years earlier the McKinley bridge was erected by the Illinois Traction Co., primarily to admit interurban electric trains. Kingshighway viaduct, 855 ft. long, completed in 1912 at a cost of $500,000, crosses the railway tracks and unites western sections of the city. A municipal court building, a city jail and a children's detention house, all of stone, were erected, the first in 1912, the others in succeeding years, at a cost of $1,855,000.

Charities and Education.—At a cost of $5,000,000 a new medical school, hospital and children's hospital, occupying several city blocks fronting on Forest Park, have been completed since 1911. The hospital, opened in 1914, represents an investment of $2,000,000, the sum left 50 years ago by Robert A. Barnes, a banker whose name the institution bears. The medical school, a department of Washington University, includes laboratory, anatomical, clinical and other buildings. In 1914 James Campbell left an estate, valued at $10,000,000, in trust to St. Louis University (subject to the life income of certain surviving relatives) for the erection and support of a hospital and for the advancement of medicine and surgery. From the surplus of the Louisiana Purchase Exposition was constructed in 1914 the Jefferson Memorial costing $485,000 and devoted to the collections of the Missouri Historical Society. On new public school buildings, and expansions of old, St. Louis expended during 1910–20, $3,177,000.

Finance.—In 1920 the assets of the banks and trust companies of St. Louis were $637,615,811.45, and bank clearings were $8,294,027,135; in 1910 the latter were $3,727,949,379. The First National Bank, with total resources of $155,953,137, was formed in 1919 by a consolidation of three existing banks.

Commerce and Industry.—According to the records of the Merchants' Exchange and the Chamber of Commerce, 35 lines of industry in the St. Louis district did a business in 1920 of $1,582,957,145. Some of the largest items of wholesale trade in 1920 were dry goods, $240,000,000; carpets, rugs and linoleums, also $240,000,000; boots and shoes, $175,000,000; groceries, $175,000,000; railway supplies, $210,000,000; hardware, $115,000,000; foundry products, $125,000,000. St. Louis receives 70,000 H.P. by a 110,000-volt transmission line from the Keokuk dam in the Mississippi at Keokuk, Ia. Motor licenses issued in 1914–5 numbered 9,867, and 45,949 in 1919–20. The position of St. Louis as the largest horse and mule market in the world was maintained, the volume of business in 1919 being $50,000,000. The city continued to be the largest primary fur market of the world, with sales of $27,200,000 in 1920. Sales of meat products in 1919 were $128,000,000; hog receipts, 3,650,534; head cattle receipts, 1,500,000. The foreign trade of St. Louis was $100,000,000 in 1920, an increase of $25,000,000 over 1919. The total tonnage shipped out of St. Louis in 1920, domestic and export, was 29,036,405 (by rail) and 166,140 (by water); tonnage received in the same year was 43,104,519 (by rail) and 177,925 (by water).

The more important new buildings of the period 1910–20 with the amounts they cost were: the Statler hotel, $3,000,000; the Warwick hotel, $400,000; the cathedral of St. Louis, $2,000,000; the Missouri athletic club, $500,000; the Railway Exchange, $3,000,000, 18 storeys, covering an entire city block; the University club, $600,000; the Young Women's Christian Association, $500,000; the Boatmen's bank, $750,000; the Arcade, $1,250,000; the Post-Despatch building, $500,000; the Bevo Manufacturing Company, $1,000,000. The cost of new buildings in 1919 was $20,538,450.

The *St. Louis Republic*, a morning newspaper founded in 1808, was purchased in 1919 by the St. Louis *Globe-Democrat* (a Republican paper), and discontinued. This left two morning newspapers, the *Globe-Democrat*, and the *Westliche Post* (German). There was a marked increase in the circulation of the evening papers.

When the Armistice was signed Nov. 11 1918 one in 13 of the city's pop.—56,944—was in the army, navy or marine corps. The total casualties were 2,511, of which 1,384 were killed in battle. Of the three Liberty Loans, St. Louis took the equivalent of 25% of the assessed value of the city's realty and personalty. On the third, fourth and fifth calls for loans the St. Louis Federal Reserve district was the first to subscribe its quota. On the third loan the city subscribed $65 for every man, woman and child, nearly three times the quota. (W. B. St.)

ST. MIHIEL, BATTLE OF: *see* Woevre, Battles in the, section 2.

ST. PIERRE and **MIQUELON** (*see* 24.41).—During the early years of the decade 1910–20 this little French colony suffered severely as a result of unprofitable fisheries, and large numbers of its people emigrated to Nova Scotia and Quebec. After the World War began in 1914 the French draft law called all the male inhabitants of conscript age to France where they took part in various services. As their withdrawal crippled the fisheries, which could not be prosecuted by the older people and the women and children, the survivors were returned as speedily as possible and ordinary operations were resumed. But during the decade, also, the use of the steam trawlers in the fisheries was on the increase, displacing the wooden sailing vessels previously employed, and this also lessened the number of those finding steady employment. However, during the later years of the war, with fish increasing in value, the colony became very prosperous, and after the Armistice the French Government decided to build a large refrigerating plant, costing about £1,000,000 at St. Pierre for the treatment of cod and other fishes. The financial success of this project was doubted by many, but this deep-sea fishery was being supported by France as a training school of men for its navy, and for the same reason generous bounties are given on all the fish caught. The pop. was in 1920 about 4,500, but the prosperity of the little community was impaired by the difficulties of exchange.

SAINT-SAËNS, CHARLES CAMILLE (1835–1921), French musical composer (*see* 24.44), died at Algiers Dec. 16 1921.

SAINTSBURY, GEORGE EDWARD BATEMAN (1845–), English man of letters (*see* 24.45), published subsequently to 1910 a *History of English Prose Rhythm* (1912); *The English Novel* (1913); *A First Book of English Literature* (1914); *The Peace of the Augustans* (1916); *A History of the French Novel* (2 vols., 1917–9) and *Notes on a Cellarbook* (1920).

SAIONJI, KIMMOCHI, Prince (1839–), Japanese statesman, was born in Kyoto, in 1839. When less than 20 years of age, he took part in the councils which led to the Restoration and at 19 was commander-in-chief of an imperial army. He studied in France from 1869 to 1880, and returned home imbued with democratic ideas. In 1881 he commenced his official career and in the following year accompanied Mr. (afterwards Prince) Ito to Europe and the United States to investigate the parliamentary system. In 1885 he was appointed minister to Austria; in 1888 he occupied a similar post in Berlin and in 1891 was appointed president of the Board of Decoration. In 1893, he became vice-

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president of the House of Peers and was raised to the Privy Council in 1894. In the same year he received the portfolio of education in the second Ito Cabinet, temporarily acting as Minister of Foreign Affairs during the illness of the late Count Mutsu. He was again Minister for Education in the third Ito Cabinet from Jan. to June 1898, and was nominated president of the Privy Council on the death of Count Kuroda, three times acting as prime minister during the interval between the resignation of one Cabinet and the formation of the succeeding one. In July 1903, he became the leader of the Seiyu-Kai and in 1905 formed his first Cabinet as prime minister; he was again premier in 1911 to 1912. In 1919 he represented Japan as chief envoy at the Peace Conference and was invested with the Grand Order of Merit. He was made a prince in 1920 in recognition of his services in connexion with the World War and the Peace Conference.

SAKHALIN (*see* 24.54).—The Japanese portion of the island of Sakhalin, to the S. of the parallel of 50° N. lat., known officially as Karafuto, was ceded to Japan under the treaty of peace with Russia in Oct. 1905. The area is about 13,148 sq. m. and the pop. in 1920 was 105,765. The taxes and other sources of revenue from the island, with the addition of a grant of about 700,000 yen from the national treasury, are sufficient to cover the administration, the budget balancing at about 10,000,000 yen.

The chief industry of the island, and one of the oldest, is that of the fisheries, and these are being successfully developed. The most important is the herring fishery, followed by trout and salmon, these all being relegated to specially controlled areas; cod and crab are also plentiful, the latter being canned and exported chiefly to America.

About 17,000 ac. of land were under cultivation in 1918, the chief crops raised being oats, barley, potatoes, peas and buckwheat. More than 900,000 ac., suitable for cultivation and pasturage, are still available and many settlers are engaged in agriculture, the climate and soil rendering this a profitable undertaking. There are over 8,000,000 ac. of practically untouched forest, chiefly conifer, on the island, providing in the future an almost inexhaustible supply for the manufacture of pulp for paper-making. In consequence, five pulp manufactories have already been established, each producing over 10,000 tons per annum, and five more are projected.

There are three important coal-fields in the island, producing about 136,000 tons annually. Alluvial gold is found in the river beds, iron pyrites exist in large quantities in the Notoro peninsula, and in 1907 and 1913 oil-bearing strata were discovered on the W. coast in large areas at Anshi and Notasamu. (H. SA.)

SALANDRA, ANTONIO (1853–), Italian statesman, was born at Troia in 1853. He first entered parliament as member for Lucera and from the beginning of his political career he sympathized with the views of Baron Sonnino. When the latter became Treasury Minister in the Crispi Cabinet of 1893, Salandra was chosen under-secretary in that department. He was Minister of Finance in the first Sonnino Cabinet of 1906 and Treasury Minister in the second (1909–10). When in March 1914 Sig. Giolitti resigned, Sig. Salandra was called upon to form the new Cabinet, and he was Premier when the World War broke out in Aug. following. On the death of the Marquis di San Giuliano in Oct. he offered the Foreign Office to his former chief, Baron Sonnino, who accepted it. It was the Salandra Cabinet which took the momentous decision of bringing Italy into the World War on the side of the Allies, and it conducted the Government of the country during the first months of the campaign more successfully than any of the succeeding war Cabinets. On resigning office in June 1916, he continued to support both the Boselli and the Orlando Cabinets. As professor of Constitutional Law in the university of Naples he published several important works on legal subjects, and translated Spencer's *Principles of Sociology*.

SALISBURY, JAMES EDWARD HUBERT GASCOYNE-CECIL, 4TH MARQUESS OF (1861–), English politician, eldest son of the 3rd marquess (*see* 24.76), was educated at Eton and University College, Oxford, where he took a second-class in History in 1884. The next year he entered Parliament as member for Darwen. He was defeated in 1892, but he returned as member for Rochester in 1893 and remained in the House of Commons till he succeeded his father in 1903. He fought in the S. African War with the 4th battalion of the Bedfordshire regiment, and was mentioned in despatches. On his return in 1900 he became Under-Secretary for Foreign Affairs, a post which on succeeding to the peerage he quitted for that of Privy Seal in the Cabinet of his cousin, Mr. Arthur Balfour; and he held, for some months in 1905, the office of President of the Board of Trade. Lord Salisbury never loomed large in the House of Commons, though he was for some years chairman of the Church Parliamentary Committee, and discharged competently his duties as Foreign Under-Secretary. But he gradually came to occupy a position of increased authority in the Upper House. He threw in his lot in 1911 with the "Die-hards," and spoke in favour of defeating the Parliament bill and daring the Government to create sufficient peers to carry it. During the early years of the war he was energetic in the discharge of his military duties as lieutenant-colonel of his yeomanry regiment. He did not join either Coalition Government, but was critical of both, taking an independent line. As the war drew to a close he gradually came to assume the informal leadership of a Conservative and Unionist Opposition in his House, showing himself particularly sensitive to departures from the old policy of his party on Irish and ecclesiastical questions. He married in 1887 Lady Cicely Alice Gore, daughter of the 5th Earl of Arran, and had two sons and two daughters. He was created K.G. in 1917.

SALONIKA CAMPAIGNS, 1915–1918.—Under the heading of SERBIAN CAMPAIGNS the conquest of Serbia in 1915 by Austro-Hungarian forces is narrated. The idea of reinforcing the Serbian front with Allied forces had been contemplated both in England and in France some time before it was carried out. British and French guns, in charge of naval missions, had taken some part in the campaign of 1914, and stores had been sent up from Salonika at intervals. In the winter of 1914–5 Lord Kitchener several times considered the advisability of sending a number of the British Army Divisions into Serbia *via* Salonika. On the part of the French, M. Briand, it is said, proposed later in 1914 to make a serious military effort in the Balkans. But the Dardanelles campaign diverted attention from this project, and it was not till in August 1915, when the failure of the Dardanelles offensive was evident, that the creation of an Anglo-French army on the Balkan front was seriously undertaken. General Sarrail, whose military reputation stood very high in France, had been suddenly deprived of his command of the III. Army by Joffre, ostensibly owing to an unsuccessful combat at Boureuilles in Argonne, but really as the result of long-continued friction between the two. Sarrail, however, stood in close relations with the political leaders of the Left, and the autocratic methods of Joffre's G.Q.G. had already raised considerable opposition in the Government and the Chamber; it suited the Government, therefore, to satisfy the Left, to snub the G.Q.G., and to remove to a distance a forceful and ambitious personality, by sending Sarrail to the Mediterranean as commander of an army yet to be created.

Appointed on Aug. 5, Sarrail was ordered to study the military situation and submit proposals. In his written projects he came to the conclusion that it was impossible to abandon ground in the Gallipoli peninsula, and had asked for both his own and the British contingents to be made up entirely from forces in France or in England. An inter-Allied conference, held at Calais early in September, had agreed to this, but with the reservation that no forces were to go till after the forthcoming Champagne and Artois offensives had taken place. But the news of the Bulgarian mobilization drove home at last the urgency of the crisis. Orders went to the Dardanelles on Sept. 26 for two British Divisions—in the sequel one—to go thence to Salonika; the French "Expeditionary Corps" was likewise to send a Division, and the Greek authorities had agreed to permit the landing. Sarrail himself was to bring a mixed brigade from France, as an earnest of the forces promised later.

On Oct. 3 advanced parties of the French landed at Salonika without difficulty, only a formal protest being made by the authorities on the spot. Next day M. Venizelos in a speech at Athens declared that Greece would come to the aid of her ally Serbia against any attack by Bulgaria, and at once a crisis arose at Athens. On the 5th King Constantine informed Venizelos that the policy indicated had not his support, and the Government fell, to give place to the neutralist Zaimis cabinet.

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During the first few days instructions from Paris to Bailloud (commanding on the spot pending Sarrail's arrival) varied several times, apparently in accordance with political nuances. At first (Oct. 3) the word was to concentrate at Nish, in the heart of Serbia; next, the Greek frontier was not to be crossed (Oct. 10); and then again (Oct. 12) authority was given to take over protection of the railway between Demir Kapu defile and the Greek frontier against possible attack from Strumitsa in Bulgaria, thereby releasing a small Serbian force to rejoin its own army. Meantime the Serbians demanded more direct assistance, but Sarrail (who arrived on the 12th), taking into account the size of his force—only 1½ divisions plus the British 10th Div. which was not under his orders—and the fact that it could only disembark and push on by driblets, determined to limit his advance to the near side of Demir Kapu. On Oct. 14 the leading French troops arrived at Strumitsa station (in Serbia) in time to aid the Serbian railway guards in repelling an inroad from Strumitsa.

In Sarrail's opinion the only service he could render was to concentrate on the routes to Strumitsa, and, by an offensive into Bulgarian territory, to draw off as many Bulgarian forces as possible from the main attack further north. General Mahon, commanding the British 10th Div., took the same view,[1] and formed a mixed force which began to move up to Doiran, on the right rear of the French group in the Rabrovo region. On the 17th, however, in answer to a request from the Serbian commander at Uskub, Sarrail began to push a brigade beyond the Demir Kapu defile to Krivolak, but he refused to advance it to Veles, though again pressed to do so by the Serbs, and in fact a sharp attack developed from Strumitsa on Rabrovo on the 21st and 22nd, which, till it was repulsed, threatened to isolate all French detachments N. of Strumitsa station. Meanwhile, Paris sent further instructions to the effect that all possible help should be afforded to the Serbs, subject to the limitation that the French communications with Salonika were in no case to be compromised. In reality, the French and British Governments were very uneasy about the attitude of the Greek Army, a considerable force of which lay in the region N.E. of Salonika. The fall of Venizelos had put an end to the prospect of Greek coöperation, and under the new régime the local military and civil authorities began to oppose every move of the Allies, which was not entirely covered by Serbia's treaty rights, to the use of Salonika and the railway. Thus, when Mahon's force moved forward the use of the Salonika-Kilkish (Kukush)–Doiran line was refused, and it had to use the main line, detrain in the midst of the French, and work thence outwards towards its post at Doiran.

On Nov. 1 the 122nd French Div. began to arrive from France, and Sarrail had already prepared to attack from Rabrovo towards Strumitsa with Bailloud's 156th Div., with Mahon in echelon behind his right, while his forces about Krivolak and Kavadar (51st Div.) made ready to attack in flank any Bulgarian force which should advance up the Cerna (Tserna) in pursuit of the Serbians. On Nov. 3 an attack was accordingly delivered northward from a front E. of Rabrovo; weather and the difficulty of the country brought it, however, to a standstill on the 6th, though local advances were made later. At this moment (Nov. 4) Galliéni, having become War Minister in the new French cabinet, telegraphed orders for the French Army to operate towards Veles, adding that four more British divisions were to be sent, which on arrival would take over the front leftwards from Doiran. The British 22nd Div. was in fact already close to Salonika, with another under orders to follow. But Sarrail judged that it was impossible to wait for these reinforcements. Todorov's Bulgarian Army had already thrust itself between the Serbian Main Army and Krivolak, and the urgent thing was to relieve pressure on that part of the Serbian forces which was retiring by the Babuna pass on Prilep, while reserving the possibility of action towards Veles if the Serbian Main Army should after all seek to break through towards its Allies. Orders were therefore given to the Krivolak-Kavadar force (57th Div. to be reinforced by the 122nd Div.) to take the offensive westward over the Cerna, so as to strike the pursuers in flank or rear. On the 6th–9th accordingly the 57th Div. crossed the Cerna and pushed an advance into the mountains towards the Babuna, still held by the Serbs. But the Bulgarians were in force, and the French retired to their Cerna bridgeheads, which the Bulgarians attacked without success on the 12th, 13th, 14th and 15th.

During these and the following days instructions came repeatedly from Paris to modify the French commander's views and dispositions, now laying emphasis upon coöperation with the Serbs, now upon dangers from the Greek Army in rear. Finally on Nov. 21 Sarrail was given a free hand to decide what aid he could give to the Serbians and at what moment he should retire on Salonika. He adopted at first a middle course. He wished neither to attack at the risk of involving two-thirds of his forces in the Serbian *débâcle* (the Babuna had been turned by the N. on Nov. 14), nor to fall back to Salonika, where prestige counted for so much, but to hold on in the entrenched camp of Kavadar in the hope of "something turning up." On the 21st–22nd, however, the retirement of the 122nd Div. over the Cerna under some pressure, together with the general military situation and a definitive refusal of reinforcements from France,[2] decided him in favour of falling back to Salonika, a decision approved by Galliéni. Four days later Sarrail was officially informed that the Serbians were retreating in the Adriatic direction. The preparations for the Vardar retirement had already begun on the 24th with the seizure of a position on the E. bank, to prevent interference with the retreat of the Krivolak-Kavadar force on Demir Kapu. On Dec. 1 only rear-guards remained at Krivolak. By the night of the 3rd–4th all troops were inside Demir Kapu, and on the 6th this position also was given up. On the 8th the Bulgarians, who had from time to time attacked the rear-guards on the Vardar and the positions near Kosturino on the Strumitsa route, delivered a more concerted attack on the front Ormanli (now held by the British)–Kosturino–Gradets on the E. and Mirovcha Petrovo on the W. of the Vardar. Their evident intention was envelopment, and on the 9th, judging the centre of his line to be too pronounced a salient, Sarrail took up a position along the Petrovska stream, W. of the Vardar and the heights of Dedeli E. of it, the village of Dedeli being held by Mahon's forces, which from that point were echeloned back to Lake Doiran. From this position also the Allies retired under threat of envelopment during the night 11–12, after holding their ground against attacks on the 11th. Lastly, the French 122nd and 57th Divs., at Gyevgyeli (Gevgeli) and near Doiran, covered the evacuation of part of Mahon's force on to the Salonika railway and the reconstitution of the 156th French Div., which had been considerably split up.

Thus the drive into Serbia came to an end, with little material loss, but a sad diminution of prestige, and the forces fell back to the following positions about Salonika: advanced guards of 120th French Div. Karasuli with a detachment at Gumenye, and of 57th French Div. with cavalry, Kilkish, with a detachment at Kilindir; main body (122nd, 156th, 57th) in position on the line Doganyi–Daudli. British 10th and 22nd Divs. Salonika, with other British forces arriving. Important points on the railway had been destroyed during the retreat. Meanwhile, on Dec. 4,

[1] According to Sarrail, the British Government instructed Mahon that his troops were to remain at Salonika, and it was on his own initiative that the British general formed a mobile force. Further instructions authorized Mahon to move forward but forbade him to cross the Greek frontier, until on Oct. 27 a final telegram removed this restriction.

[2] At that moment, according to Falkenhayn, the combatant strength of the Allies in France was to that of the Germans in the ratio of rather more than 3 to 2. Sarrail says that in his interview with Lord Kitchener on Nov. 17, the latter informed him that Joffre had declared that he would not give him (Sarrail) another man, and that the British would furnish five divisions instead. In accordance with this promise, besides the 10th and 22nd Divs., the 27th and 28th Divs. from France landed at Salonika in the last days of Nov. and first days of Dec., and the 26th Div. also from France, early in Jan. 1916.

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the Serbs had evacuated Monastir in their now frankly westward retirement.

The reassembly of the Allied Salonika forces around their port of origin naturally raised the question—were they to remain there? Their *locus standi* had been the fact that they were Allies of Serbia using a line of communications to which Serbia was by treaty entitled. This part of the case no longer existed, Serbia being wholly in the hands of the enemy, and could only be revived if and when the Serbian Army were transferred from the Adriatic ports on which it had retreated to Salonika. Another part of the justification for the Allies' presence was the admitted fact that they had come at the request of Venizelos, and for the purposes of common action with the Greeks, but since Venizelos's fall even the Zaimis cabinet, representing "benevolent" neutrality, had given way to a cabinet representing at least strict neutrality,[1] which gave the Germanophil element at Salonika all the official justification it needed to pursue the policy of obstruction that it had already initiated in the Zaimis period. On the other hand the factor of prestige was one of great weight, especially in view of the pending abandonment of the Dardanelles compaign, and although Sarrail suggested that evacuation followed by a dramatic offensive at some other point would more than restore the lost prestige, it was decided that Salonika should be held. Beyond that decision, however, no clear military or political intention was at that time formed. The policies of the British, French and Russian Governments were in unison as to the problem of Greece, and it seems to have been thought that, by remaining, the Salonika force would confront the enemy with as difficult a diplomatic problem as its own. This was, indeed, the case. The policy to be followed by the Central Powers, both towards Greece and in occupied Serbia and Albania, was wholly unsettled. "While the troops of the two Imperial Armies were hastening from victory to victory," says General von Cramon, the German military commissioner at Austrian headquarters, "behind the scenes, at the two general headquarters, the clouds were gathering of that conflict which in the end brought about the reverses of 1916." Although on Nov. 6 it had been agreed that operations were to be pushed with all energy towards Salonika, Falkenhayn almost immediately began to check the further south-westward advance of German troops, and though Conrad succeeded in bringing the German command to renewed coöperation, this was obviously to be limited to a minimum, both on account of supply difficulties in the Balkans and of the pressing requirements of the two main theatres—in particular those of the forthcoming attack on Verdun, of which only a few men in the German headquarters and none in the Austrian had the secret. Falkenhayn's view was that the Bulgarians alone should undertake the campaign in southern Serbia. But, whatever the attitude of Greece towards Germany, it was so hostile towards Bulgaria that to cross the frontier in pursuit of Sarrail without a large proportion of German troops being included in the advance was politically impossible. Austria herself was absorbed in Montenegrin-Albanian enterprises, and could give no direct assistance in the advance to Salonika that her general staff advocated. Moreover, Conrad had his secret as well as Falkenhayn—he was planning to carry out his offensive of Asiago, with or without the aid of Germany.

At the end of 1915 therefore, though the Central Powers had succeeded in their purpose—Serbia being conquered and the railway to Constantinople reopened—whereas the Entente had failed, the outlook was no clearer for the former than for the latter. The pursuit was accordingly suspended at the frontier, partly perhaps in the hope that the Entente would itself take the initiative in closing down the operations. If they did not do so Falkenhayn was determined that eventually the Bulgarians alone should remain on this front. They were, by the terms of the military agreement, unavailable for any other, and if they succeeded in containing even a smaller force of Entente troops that was not so limited, something was gained for nothing. On the other hand this idea implied a defensive position short of the Greek frontier, as a purely Bulgarian advance into Greece was impossible. Thus, at the beginning of 1915, the opposing forces stood roughly 20 m. apart, each limited against its own will to a strict defensive by political conditions and each regarded by its own superior authorities as a "commitment."

At the end of the year two incidents occurred to illustrate the complexities of the Salonika front. On Dec. 30, though Bulgarian and German forces were forbidden to cross the frontier, German aircraft, by order, bombed the city of Salonika itself, where nine out of ten of their possible victims were neutrals and the tenth an agent of their own side. Sarrail promptly retaliated by arresting the German, Austrian and Bulgarian consuls, hitherto left unmolested. Another air raid took place on Feb. 1 1916, to which the Allies replied by bombing the village of Petrich, just within the Bulgarian frontier, but as the village contained Greek and Serbian as well as Bulgarian inhabitants, a complaint was made, and Sarrail received orders not to repeat such raids. A few days before this another incident showed that the personal estrangements of Joffre and Sarrail were still operative. The army of the Orient had been brought under Joffre's command[2] early in December, and Joffre had taken the opportunity to send out Castelnau to report on Sarrail's management of the situation. Castelnau, however, pronounced himself satisfied with what he saw, and only issued a few instructions as to details. Nevertheless, in various ways the friends and the enemies of Sarrail alike busied themselves with accusations and counter-accusations, out of which a regular *affaire* was growing up to complicate an already confused situation. Relations between Sarrail and Mahon on the other hand were excellent, and although each was independent of the other, and the British general was himself under the command of General Sir C. Monro, commander-in-chief in the Mediterranean, no important divergencies of policy developed during the phase of passive defence in the precincts of Salonika.

With the Greeks, naturally, all possible causes of friction existed. Army commanders operating under war conditions are not prone to sacrifice realities to appearances, and what seemed to them plain military common sense was, from the point of view of the Greeks, high-handed conduct to be resisted by all safe means of obstruction. Amongst the major questions at issue were the disarmament of the coast defences of Salonika, the use of the Salonika-Doiran railway for the British contingent, the feeding of the Greek forces E. of Salonika who were dependent for supply upon railways seized by the Allies, and the continuance or non-continuance of the Greek garrison in Salonika city. Minor questions of an administrative character were naturally innumerable. Most of the energy of the staffs in Salonika and the legations at Athens was devoted to finding solutions for conflicts which the equivocal position of the Allies made inevitable.[3] During these conflicts the Salonika lines,

[1] The first act of the Skouloudis ministry had been to announce that any of the Allied forces in Serbia which retreated into Greece would be disarmed and interned. A prompt note from the British and French Governments closed this incident, but the indication of policy was unmistakable. About the same time Skouloudis notified the Bulgarian Government that it would not permit the latter's troops to cross the frontier.

[2] Joffre was *Commandant en Chef* of the "North-Eastern group of Armies," no other formations having been contemplated before the war. On being sent to the E. Sarrail was appointed *Commandant en Chef* also. But, in Dec., Briand placed Sarrail's forces under Joffre's supreme command

[3] On Jan. 12 1916 the bridge of Demir Hissar on the Struma was blown up by a special force sent out by Sarrail in the presence of the Greek forces stationed there—a high-handed act which could only be excused or justified by the necessity of preventing the Bulgarians and Germans from deploying heavy artillery against the N.E. part of Salonika in case of siege. On Jan. 28 1916 another problem received an enforced solution, after negotiations had failed to find an "elegant" one. Anglo-French forces by a *coup de main* occupied the Greek coast-defence batteries on the Gulf of Salonika. These incidents naturally intensified the hostility of the Greek officers and officials to the Allied occupation, or at least gave them tangible grievances. In particular, the feeding of the Greek forces isolated by the cutting of the Struma railways caused difficulties, and from it, in part at any rate, arose the critical question of demobilizing the Greek Army in the Spring of 1916.

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with the aid of civil labour, were made defensible by the first weeks of the new year. The line selected ran from the Vardar mouth, round by Doganzi and Daudli to the neighbourhood of Langaza, whence it passed along the barrier of lakes to the head of the gulf of Orfano—80 m. of frontage for a force of nine divisions.[1] Of this frontage, however, nearly 45 m. was guarded by lake and swamp; and, taking into account the presence of large bodies of Greek troops in the Seres–Rupel region to the right front and in the Vodena–Florina region to the left front, Sarrail considered that danger was practically confined to the central sector between Lake Langaza and the Vardar, in the event the position was ever attacked.

During this period (Jan.–Feb. 1916), the Bulgarians were reinforced by the German XI. Army (von Gallwitz) consisting or the IV. Res. Corps (101st and 103rd Divs.) and the Alpine Corps, and by their own 1st Army, all these forces aligning themselves along the Greek border from Lake Ohrida to the point at which the Struma enters Bulgarian territory. The 1st Bulgarian Army, with flank guards at Dibra and Elbasan in Albania, had two divisions[2] on the front S. of Monastir–Duditsa; the XI. German Army, with 1½ Bulgarian Divisions attached, held the Vardar valley between Duditsa and the Belashitsa Planina, and Todorov's II. Bulgarian Army of three divisions that ranged from Strumitsa to Petrich, with detachments further E. at Nevrekop (Mesta valley). But in March Falkenhayn began to withdraw all the German formations save the 101st Div., which continued in the Balkans and was gradually reduced to a cadre. On his side Sarrail made some slight demonstrations towards Doiran and towards Vodena, but otherwise no move occurred. Early in March 1916, however, in the crisis produced by the attack on Verdun, Joffre telegraphed orders to Sarrail to advance in order to fix the enemy's forces on his front. On the other hand General Mahon, on asking for instructions, was forbidden to move until authorized by the British Government.[3] The relief offensive, therefore, was limited to a skirmishing advance by the French, which began on March 13, and gradually brought the French 51st Div. to the N. of Kilkish, and the 122nd to the N. of Lake Amatovo, the 156th between them (March 31).

During April 1916, while French cavalry moved out W. of the Vardar towards Vodena and the 17th Colonial Div. came up behind the centre, the British in their turn began to move up to Kilkish, authority to participate "in an operation of a demonstrative character" having been given by the War Office about April 10 (Joffre to Sarrail, April 20). Lastly, the Serbian Army, reconstituted and partially reëquipped at Corfu, was beginning to land at Salonika, and by June 1 118,000 combatants and non-combatants were present, completing their equipment and organization in the Chalcidic peninsula. These methodical proceedings, however, did not satisfy Joffre, whose instructions to Sarrail from March onwards were to prepare for an offensive in earnest. To Sarrail's demand for reinforcements for such an offensive, the French commander-in-chief replied that the French Army of the E. must prepare to attack at the moment fixed by himself, even without the British. In explanation, he hinted that when that moment came, not only would British objections be removed, and all five British divisions be equipped for mountain warfare (making Sarrail's total force, with the Serbians, 300,000 strong to the enemy's 260,000), but Rumania and Greece would be in the field as his Allies. Thus for the first time since the Serbian retreat the Salonika force was assigned to a positive purpose. It will appear in the sequel how much of reality and how much of illusion was contained in the scheme, which, in sum, was to attack at a date chosen in relation to other theatres and especially Rumania, with Sofia as the objective.

[1] The withdrawal from Helles freed further French troops, from whom a serviceable brigade was made up and combined with a brigade from France to form the 17th Colonial Division.

[2] The Bulgarian division had twice the infantry strength of a French or German division.

[3] Sarrail's orders were issued by G.Q.G. without consultation with the British government or Lord Kitchener. (Sarrail, p. 83.)

Meantime, an important incident had taken place on the Struma frontier. In accordance with their declared policy of standing aside and leaving a "lists" for the combatants, the Greeks had disarmed and evacuated their fort of Dova Tepe, situated on the watershed between the Vardar and Struma basins and commanding a knot of communications. In the course of his gradual advance to the frontier, Sarrail put a detachment into this fort on May 10. But further to the right, outside his reach, lay a still more important fort, that of Rupel defile. This fort was not merely disarmed but actually handed over to the Bulgarians by the local Greek general, with or without authority from Athens (May 26).

Events had moved. Though the German forces (except the cadre of the 101st Div.) had by this time been withdrawn from the Balkan front, the Greeks had apparently overcome their repugnance to a purely Bulgarian inroad, to the extent of actually facilitating it. The Allies' right was, potentially, turned, and if the occurrence were any indication of probabilities of the future, their rear also was endangered. Action was taken promptly by Sarrail. A mobile group of all arms was moved into the Struma region, and with the agreement of Gen. Milne (who in May succeeded Mahon in command of the British) and of the Entente Governments, the Greek authorities at Salonika were deprived of power by the proclamation of a state of siege (June 3). A day or two later London and Paris also acted. An economic blockade of the Greek coast was declared, and on the 18th Sarrail was ordered to send a brigade by sea to Athens. King Constantine accepted the ultimatum of the Allies (June 21), and Zaimis returned to power on the basis of friendly neutrality. A little later the Rupel incident had its last and most important sequel in the Venezelist *coup d'état* of Aug. 30.

Militarily the seizure of Rupel, carried out at the suggestion of Falkenhayn, seems to have had no truly offensive intention. The Central Powers had abandoned the idea of invading Greece once for all about the end of March, and the Bulgarians acted with the idea of guarding their left, and securing connexion with any Turkish forces which might be sent to their aid by the Constantinople–Seres railway, though in view of the situation in Armenia such a reinforcement was unlikely. As for Sarrail, so also for his opponents, the Balkan front was already involved in a larger game.

As has been noted above, the idea of an Allied offensive from Salonika in coöperation with a Rumanian intervention came under discussion as early as mid-April; at that time Joffre seems to have thought that this intervention might come in a few weeks, for he overruled Sarrail's objections to commencing operations in the hot weather, and fixed the month of June for the beginning of the offensive. Under these instructions Sarrail formed his first plan (May 2) which was, in brief, to employ the Serbs on the left wing for the attack of Monastir (frontally and by envelopment), and for pressure on the Cerna bend and the passes further E. towards the Vardar; to place a French division on the Vardar and the railway; to have three British divisions, with a fourth on their right rear, so placed as to execute a demonstrative attack on the strongest part of the enemy's front, viz. Vardar–Doiran; and to attack with three French divisions from Popovo Surlovo–Dova Tepe and Poroy northwards through the Belashitsa Planina, while the French Struma mobile group demonstrated towards the Demir Hisar angle of the Struma, and the fifth British division with cavalry watched the lower Struma front. In case the semi-offensive, semi-demonstrative, operations should develop into a real advance, the Serbs were to take Veles and Shtip, the British Radovishta–Strumitsa, and the French Jumaya as their objectives. The armies would thus condense their front as they advanced, the route Monastir–Veles marking the extreme left of the Serbian movement, and that of the upper Struma, famous in the war of 1913, taking the French into positions on the Bulgarian line of retreat. But the negotiations of the Allies with Rumania, and their internal discussions relative to their Salonika operations and their policy in Greece, dragged on. On June 6 Gen. Milne was

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informed by the British Government that he was not to engage in offensive operations, and was only to consider himself under Sarrail's orders in respect of the defence of the entrenched camp. He informed Sarrail accordingly, and suggested that the British should take over the Struma front, to which Sarrail agreed. The Serbs were now preparing to take up the front from Vodena to Lyumnitsa, with their centre of gravity on the right, the French held from Lyumnitsa to the Poroy road, and the British to the right of that road from Loznitsa to Orlyak. On the 12th Sarrail was ordered not to take any action that would involve the British in operations unconcerned with the defence of Salonika itself, and to limit himself to threatening the Bulgarians by a deployment close up to the frontier; and on the 14th he was notified that the French Government had agreed to the British proposal to postpone the offensive.

A few days later, on the 25th, he was informed that though the instructions of the 14th held good in general, events might rapidly make it necessary for him to attack, though with a limited objective, and using the French and the Serbians only; and on July 15 he was told that the British Government had agreed that if Rumania intervened all British troops equipped for mountain warfare should participate in Sarrail's offensive, and instructed to prepare to "pin the Bulgarians on the Greek frontier and put them out of action so far as serious operations against Rumania were concerned." Three days later, on July 17, G.Q.G. informed the French commander that the Entente-Rumanian military convention would probably be signed on the basis of (*a*) an offensive from Salonika on Aug. 1, to cover the final preparations of the Rumanians and their initial operations against Transylvania; (*b*) a Russo-Rumanian offensive beginning on Aug. 8, and directed against Bulgaria; and finally (*c*) a combined advance of the Russo-Rumanian Army and the Salonika forces with a view to uniting and crushing the Bulgarian Army in the field. A few days later a formula agreed upon between the various Allies constituted Sarrail commander-in-chief of the French, British, and Serbian Armies, as also of the Italian and Russian contingents,[1] Gen. Cordonnier being appointed to command the *Armée française d'Orient* as a constituent part of the Allied Army.

Sarrail's new plan was to dispose Milne's available forces on the front Dova Tepe (exclusive)–Lake Ardzan (exclusive) or to the Vardar if possible, to reduce Cordonnier's troops E. of Dova Tepe and Milne's on the Struma front[2] to a minimum, and with Cordonnier's Army to attack on the front Vardar–Doiran, while the Serbs from above Vodena made their main attack on Huma and subsidiary advances towards the Cerna bend and possibly Monastir. This plan was approved by Joffre, who added that the British Army would receive instructions from the War Office not to limit itself to defensive or demonstrative action. But these instructions, from Gen. Robertson to Gen. Milne, introduced an important limitation in their general approval. Milne was "not to try to take the enemy's positions until an adequate equipment of heavy artillery and other conditions gave a reasonable expectation of success," and the offensive was "not to be taken till Rumania definitely came into the field," an event of which Sir W. Robertson, like Sarrail, had his doubts. Presently came the first hitch in the military convention negotiations. Rumania was not to move till Aug. 14, and Sarrail was to act ten days before that date. But on Aug. 3, the eve of the offensive, the convention was still unsigned, Rumania having expressed the intention of not declaring war on Bulgaria unless large Russian forces were added to her Danube Army; in these circumstances Sarrail's mission was reduced to "harassing" the Bulgarian Armies on his front, without ulterior purpose, from a date to be determined later (telegrams from Joffre to Sarrail Aug. 3 and 6). Finally, the convention was signed on Aug. 17, without any engagements on Rumania's part to declare war on Bulgaria. On that very day the Bulgarians began to push forward. Proposals for shortening and improving their line by pushing it forward on the one hand from the Monastir frontier towards Ostrovo, and on the other from Rupel to the angle of the Struma, had, in the spring, been put before Falkenhayn by Mackensen (who still commanded, under somewhat indeterminate conditions, the forces of the Central Powers in Bulgaria and Macedonia). Falkenhayn had declined at the time owing to the risk of bringing Greece into the ranks of the enemy. Now, however, it seemed safe to ignore this danger, and desirable to forestall the relief offensive that would doubtless accompany Rumania's intervention,[3] and on Aug. 17 a series of encounter-combats began between Sarrail's various groups, advancing for their deployment on the frontier, and the wing elements of the enemy. In the centre, the 17th Colonial Division, the British assisting to some extent,[4] took, lost and retook Dodzelli (Aug. 17–8). But on the left the French cavalry group, already mentioned, which was operating E. of the Struma bend, was driven in by a serious Bulgarian movement from Rupel and through the mountains from the Nevrekop region, and, had it not been that the Bulgarians used part of their forces in taking possession of the coveted coastal strip of Kavalla, the Struma line itself might have been forced. As it was both the French cavalry group and the British force further down the river were able to establish a sufficiently strong defence of the river. On the other flank the Bulgarian attack encountered the Serbians in the process of concentrating forward.

The new Serbian Army, commanded by the Prince Regent Alexander, with Boyovich as his assistant, was organized in three weak "Armies," the I. Army under Mishich, the II. under Stepanovich, and the III. under Yurichich-Stürm, who was shortly afterwards succeeded by Col. Vasich; of these the I. was in touch with the left of the French 122nd Div. about Lyumnitsa, the II. on its left, and the III. formed the left wing, advancing methodically and by short stages towards Banitsa. On the 17th advanced elements of the Danube Div. (III. Army) were driven out of Florina, and on the 18th a hasty counter-attack on that point failed. The Bulgarian Army developed considerable strength (6th and 8th Divs. I. Army) and on the 19th, the Danube Div., attacking again, was flung back a considerable distance to beyond Banitsa. Meantime the II. Army, working up in the Moglena district, repulsed such attacks as were made on it, and continued its deployment in front of the Moglena mountains, the left directed on Kaimakchalan, and the I. Army, between the II. and the French left at Lyumnitsa, remained undisturbed.

[1] In the case of the Italian Division the powers of the commander-in-chief were specially limited. The Russians were, however, unreservedly at the disposal of the French. In general the formula from which Sarrail derived his authority was somewhat similar to that which was agreed upon later in the case of Nivelle. It was far from being a real international command such as that of Foch in 1918.

[2] The prevalence in that region of malaria, discovered by experience, had caused Sarrail to abandon the earlier project of delivering a principal attack with three French Divisions on the Belashitsa front in the summer months.

[3] A new military convention between the four Central Powers had provided that, in case Rumania declared war on Austria, Bulgaria and Turkey would do so against her.

[4] On the 18th the French divisional commander asked for British aid to secure his flanks and enable him to hold what he had won. But, Rumania having refused to declare war against Bulgaria, Milne, having regard to War Office reservations, declined and appealed to Sarrail to refrain from putting him, as a soldier, in the impossible position of being an inactive witness of enterprises that had no chance of success without his assistance. Sarrail, however, says that Milne had promised, before the movement on Doiran began on Aug. 10, that although he was not authorized to take the offensive, he would not leave the French with their flanks in the air. Taking these two pieces of evidence together, the only conclusion possible is that the formula defining Sarrail's authority as commander-in-chief was too limited to be of much practical value in ensuring military unity, yet too extended if the Governments desired to preserve their control of policy. Too much was left to interpretation, and the commander-in-chief was obviously exposed to the temptation of planning his operations so as to create the case for the promised assistance. Indeed Joffre's directions of July 15 contained a personal instruction to Sarrail in this sense (see Sarrail, p. 361, telegram 4977/M., 4979/M, and especially 4980/M *pour le Général seul*). The story of the Salonika campaign can only be understood by bearing in mind the political and personal undercurrents affecting it.

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Impressed by the attacks on his flanks and in particular that on his left, and limited by the outcome of the Rumanian negotiations to fighting without ulterior purpose—instructed, further, by Joffre (apparently on the 16th) to attack three days after the signature of the Rumanian convention, viz. on the 20th—Sarrail changed his plan. Everything E. of the Vardar was to be defensive, everything W. of it offensive. On the extreme left irregular bands (which Sarrail had formed or subsidized) were to cut communications between Florina and the S., and to work their way into southern Albania, where coöperation had been promised by the Italian troops at Valona. An improvised French brigade was to move over to support the left of the Serbians by an attack round the S. and W. sides of Lake Ostrovo. The Serbian left was to hold up the Bulgarian advance, and the four remaining divisions to attack Kaimakchalan and the range to the E. of that point, supported by part of the French 122nd Div. in front of Lyumnitsa. East of the river, the remainder of the 122nd Div. was to stand fast, the 17th Colonial to attack W. of Lake Doiran and the 57th to demonstrate E. of it, all available British artillery participating in the effort of the 17th Colonial. The British divisions in this region (22nd and 26th) were to follow, and the Italian Div. of Gen. Pettiti, in process of disembarkation, was to relieve the 57th French Div., which was then to be transferred to the left wing. East of Dova Tepe the defensive front was to be under the command of Gen. Briggs and held by the British 28th Div., the French cavalry group (which was to explore on the further bank as before) and part of the British 27th Div., the remainder of Milne's Army being in reserve.

At this date, according to a French parliamentary paper, Sarrail's total force, combatant and non-combatant, inclusive of all details, had a ration strength of about 350,000 (four French, five British, six Serbian, and one Italian division, and a Russian brigade), and a combatant strength of 145,000 rifles, 3,000 sabres, 1,300 machine-guns and 1,032 guns, of which, however, 36,000 British infantry were not available for general service, and the 11,000 Italians only began to disembark in the last days of August.

During the regrouping process the Serbian left was driven back slowly, but in order, and on the 23rd the Vardar and the Danube divisions were about the N.W. corner of Lake Ostrovo with part of Timok, and the French Provisional divisions and the French 122nd Div. were engaged in various partial combats on the line Kaimakchalan–Lyumnitsa. On the Doiran and Struma fronts small engagements were frequent, and the French cavalry group, which again attempted to operate E. of the Struma, was driven in by superior forces with somewhat heavy losses. The Bulgarian attacks, however, as has been said before, had no more serious purpose than shortening the line and sketching out a sort of preventive attack, and they died down about Sept. 1, at which date the position of the Serbian left was practically the same as it had been on the 23rd, while the Struma front was unmolested.

Meanwhile the Rumanians had come into the field, and Bulgaria had declared war upon them. In a directive of the 24th, therefore, Joffre ordered Sarrail to continue to check the Bulgarian advance, thereby fulfilling his mission of protecting the Rumanian deployment, and to prepare for a counter-offensive, the date and objective of which was practically left to Sarrail's discretion. For this offensive Sarrail relieved the 57th Div. from the Dova Tepe front and the 122nd from the Vardar valley front, the Italians replacing the 57th, and the British divisions already on the spot taking over the whole front from Doiran to the Vardar. This enabled a group to be formed under Cordonnier consisting of the French 57th and 156th Divs. and provisional brigade, the Serbian Morava Div.[1] (released from the Lyumnitsa region by the 122nd), the Russians, and the various irregular bands above mentioned. As soon as this group should be ready the offensive was to be launched against the right flank of the enemy's new line. This was carried out on the whole front on Sept. 10. On the Struma front (Briggs) six British detachments, and another French cavalry group also, were sent over the river at different points to engage and hold the enemy in that quarter. No permanent foothold was gained or sought, and the troops were withdrawn on the 11th. On the Doiran–Vardar front, after heavy bombardments on the 11th, 12th and 13th, a salient in the position of the German 101st Div. was stormed on the night of the 13–14, but given up under counter-attacks on the following day. The French 17th Colonial Div. and the Italians made similar local attacks, and from time to time other *coups de main* took place as well as patrol activity and aerial bombing, with the object of detaining as many troops of the German XI. and Bulgarian II. Armies as possible, while the main attack was being developed W. of the Vardar. This began on the 11th, both for the Serbians and for the Cordonnier group. The former pushed up towards Kaimakchalan and Vetrenik mountains with three divisions (aided by the French 122nd Div. which carried Mayadag) and grouped the Vardar, Danube and Morava divisions for the attack of the mountain pass of Gornichevo W. of Lake Ostrovo. The Cordonnier group, much hampered in its concentration by road difficulties, and by the piecemeal arrival of the formations composing it, advanced to Rakita and Hill 633 on the Kayalar–Banitsa road on the 11th, with the Russians, as flank guard at the mountain pass of Vlachoklisura. On the 12th Cordonnier's main body reached Rudnik, the Russians the mountains 1414 and 1348 N. of Vlachoklisura, and a Serbian liaison group occupied Sotir. On the 13th there was fighting along the whole front from Kaimakchalan to the Russian positions, Cordonnier gaining a line at the foot of the Malareka ridge, and on the 14th the Serbs broke through the hostile line at Gornichevo, capturing 32 guns.

Unhappily, in these operations an acute difference arose between Cordonnier and Sarrail. The former, the man on the spot, conducting his offensive on the methodical lines of the battles of France, from which he had recently come and in which he had played a brilliant rôle, moved too slowly to satisfy Sarrail, who, released at last from all restrictions of higher policy, was determined to signalize his name and silence his opponents with a first-class victory. As to which was in the right it will be for history to say; probably it will be found that this is no more than one of the incidents between a higher command in a central command post and a subordinate command in the field that are so common and indeed inevitable in moments of crisis. But the peculiar factors of this case, personal and international, gave the incident a lasting importance. In the event, the Bulgarians, broken by the Serbians at Gornichevo, were able to retreat across the front of Cordonnier's force and reëstablish themselves on the line of the Brod, blowing up in their retreat the important viaduct of Ekshisu.

The battle now entered upon a second phase, which lasted from Sept. 15 to Oct. 30. In this period small actions on the Struma and Doiran front were continued; thus the British sent several detachments over the Struma on the 15th and 23rd, and a more serious move was made on the 30th, when Gen. Briggs initiated a methodical advance which brought him by Oct. 8 to the line Agomali–Elishan–Ormanli with advanced elements along the Belika stream facing Seres. On the Doiran front several local enterprises were carried out by the British and Italians. Meantime, on the Adriatic coast, the Italians were moving onwards from Valona along the Voyusa valley, Premeti being occupied on Oct. 9.

The practical effect of these holding attacks and demonstrative moves on the main battle-front between Vardar and Brod seems, however, to have been much smaller than it had been in the first stage. According to Sarrail twenty Bulgarian battalions were shifted over from the British front to that of the French and Serbians in the last days of September. This was only to be expected. When the real front of battle became definite, merely potential battles ceased to possess effective binding power. But the Struma front, though militarily eccentric, had possibilities in the political sense; an advance on that side threatened the Bulgarian occupation of the Kavalla region

[1] In the sequel this division was taken to support the Gornichevo attack, and did not join Cordonnier.

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almost before it was established—for the Greek garrisons were still in being. General Milne therefore chose this front on which to exercise such holding action as was possible in the conditions.

On the main battle-front Cordonnier's advance on the left of the new Bulgarian position continued on the 15th and 16th, the Russians in the mountains, combined with a newly constituted French force[1] working round, and the main body moving directly on Florina and the line of the Brod. On the 17th Florina was taken by parts of the 57th and 156th Divs.; on the 18th Sarrail intervened again to press the advance towards the rear of the Bulgarians opposing the Serbians on the Brod and Kaimakchalan front. But, probably from supply difficulties due to the blowing up of the railway viaducts, but also because Cordonnier thought it necessary to clear the mountains on his left before swinging in, the advance came to a standstill again on the 19th. On the 20th the Serbians made an important advance in the region of Kaimakchalan, and held their gains against counter-attack. The Franco-Russian Div. on the extreme left also maintained its positions, and on the 23rd Cordonnier was ready to attack in concert with the Serbians along and W. of the Brod line.[2] But, meantime, reinforcements were arriving on the Brod from the British front, where the policy of demonstrations had at last been detected by the enemy. On the 24th and following days, while the artillery of Cordonnier's force was being got into position for the attack of the Brod line, and the mountain country W. of Florina was being cleared, the Bulgarians made fierce counter-attacks on the Serbian positions about Kaimakchalan. That point itself had been stormed by the Serbians on the 20th, and their hold was not shaken, but it was the 29th before the whole area was in their possession. On Oct. 3 a concerted attack of Cordonnier and the Serbs was delivered on the whole front from Kaimakchalan westward, while the British on the Struma front developed the holding-offensive already mentioned. This general attack was initiated by a vigorous Serbian push in the mountains W. of Kaimakchalan, and, finding their line turned on its left, the Bulgarians fell back, with only rear-guard resistance, to a position defined by four geographical points: German on Lake Prespa, point 1906 in the Baba ranges, Kenali in the plain, the extremity of the Cerna bend and the ridge N. of Kaimakchalan.

This closed the second phase of the battle. The Bulgarians were being effectively held, at the least. As a relief offensive, coincident in date with a new Russian offensive on Brussilov's front, with the seventh Isonzo battle on the Italian, with renewed efforts on the Somme front, and with the battles of Hermannstadt and Dobrich on the two Rumanian fronts, the Balkan battle in its first two phases accomplished all that could be expected of it. But from the point of view of the Salonika forces it was disappointing, especially to the ardent Serbians who at Kaimakchalan had reëntered their own country.

The next phase was the general advance against the Kenali–Cerna bend line. It occupied the period Oct. 4–19, and was marked by even more internal friction than the previous phase. The operations themselves consisted in artillery bombardments and local attacks, in which the Serbs advanced to the Cerna bend (7–8 Oct.) and over the river and on to the plateau N. of Velyeselo (Oct 18–19). Otherwise no important progress was made, and, indeed, a set-back occurred on the 6th, when a French and Russian attack W. of Kenali failed with somewhat heavy loss. General Cordonnier thereupon reverted to the idea of a wider turning movement, but Sarrail, who believed, from the reports of his agents and from incidents on the Serbian front, that the whole Bulgarian Army was ripe for a moral collapse, insisted vehemently on direct action. The frontal attack was carried out on the 14th, for the first time with the aid of gas shell, but it failed, with heavy losses to the French and particularly to the Russian contingent. A violent interview on the battlefield between Sarrail and Cordonnier, in the presence of many Allied officers, completed the disorganization of the command. Cordonnier, who was suffering from almost mortal disease, was sent home a few days later, being replaced for the time being by Gen. Leblois, but for some days the Serbian attack on the Cerna bend went on unsupported, until Sarrail took the step of placing the available French forces under the superior command of the Serbian Gen. Mishich with the idea of restoring moral as well as tactical unity to his dislocated offensive. The necessity of continuing it, and the chances of a striking success if it were persevered in, were equally evident. The Bulgarian *moral* had suffered from stagnation and from the rude shock of meeting an enemy risen from the grave. The German elements of the XI. Army had mostly been withdrawn,[3] its commander von Winckler (who succeeded Gallwitz in July) was in early October no longer under Mackensen's orders but under those of the Bulgarian higher command; and Gen. Otto von Bülow, summoned with the staff of the VIII. Army from Lithuania to take general charge of operations in Macedonia, only arrived in the middle of the battle. No higher purpose than gaining time and avoiding defeat was or could be contemplated on the part of the Germans and Bulgarians, and self-sacrifice in such a rôle requires either the constant *moral* of a professional army, such as that of the old regular divisions of Milne's command, or the crisis-*moral* of the citizen soldier. In these conditions, although the lateness of the season and the sharp enemy offensive in the Dobruja made a junction with the Rumanians impossible, Sarrail had reason to hope for an important victory. In any event, the turn of events in Rumania (Hermannstadt, Fogaras, Kronstadt), and on the Italian front (eighth and ninth Isonzo battles), dictated a continued offensive towards Monastir.

For some days after the Serbian success at Velyeselo weather and counter-attack prevented their further progress, and this time was utilized by Sarrail in strengthening them with French troops drawn both from the Vardar (where the British took over their line), from the western mountains (where the Italians[4] relieved them), and from the centre about Kenali, where the weather flooded the country. At the same time the artillery was established in position, the maintenance service organized to supply the battle, and touch gained on the extreme left with the Italian force advancing in Albania,[5] while Milne's Struma troops made a strong diversion by attacking and carrying Barakli Dzuma (Juma) on Oct. 31. Finally, on Nov. 10, the Serbians with French support opened a new strong attack in the Cerna bend. Between the 10th and the 13th Polog, the ridge to the E., and Iven were taken, while the artillery on the Kenali front kept up interdiction fire to prevent enemy reinforcements from crossing the Cerna; and on the 14th a general attack brought the Serbians to the ridge on which Jaratok Monastery stood, with lesser advances to right and left. The Kenali lines being now completely turned, the enemy on the night of 14–15 fell back, covered by rain and snow, to a position but little in front of the line Peristeri–Monastir–height 1378–Grunishta. But this time the advance did not halt. On the 15th, in terrible weather, the French left pushed forward to the Viro brook; in the mountains, though mud was absent, rain and snow were still more violent, but the Serbians continued to progress. On the 17th Mishich's troops, with the French aiding and conforming on their left, captured height 1212, and the 18th they stormed 1378, pursuing to Makovo in the night following, while the French centre and left forded the Viro, the Russians S. of Monastir took Kanina, Zabiani and Holeven, and the Italians, French and Russians in the western mountains developed an outflanking movement right and left of Lake Prespa.

On the morning of the 19th the town of Monastir was found evacuated, and the third phase of the Allied offensive, definitely

[1] Henceforward called the Franco-Russian Division.

[2] There was some overlapping of the Serbians and French about Boresnitsa, due to a Bulgarian counter-attack on the 19th.

[3] Apart from staffs, there only remained 17½ battalions and corresponding artillery and army troops.

[4] A newly-disembarked Italian force relieved these in their position in the Dova Tepe region.

[5] Apart from the movement of the Valona force up the Voyusa, a fresh Italian contingent had landed at Santi Quaranta and advanced by the Turkish military road to Koritsa, and thence to the region of Okhrida and Prespa Lakes. This line became a regular line of communication.

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victorious, closed with the occupation of a line from Krani on Lake Prespa[1]–Saddle 2227–Orizar N. of Monastir–Makovo–heights S. of Staravina–N. slopes of Kaimakchalan.

In view of the weather victory had come in the nick of time. The force of the attack rapidly died out, even the Serbian Army with its positive and eager *moral* being too weary, and all formations being too far ahead of their administrative services[2] to be able to push on. Fighting went on in the Cerna bend till Dec. 12; the French operating in this quarter captured Dobromir on the 21st and height 1050 on Nov. 27, and the Serbs Staravina on Dec. 4; but the troublesome height 1248, overlooking Monastir and the plain, remained in the hands of the Bulgarians, and the town was under shellfire throughout the winter.

By this time the evident defeat of the Rumanians and the consequences of the Venizelist *coup d'état* at Salonika called for a reconsideration of policy. The offensive, considered as a relief offensive on Rumania's behalf, had completed its usefulness, and on Dec. 11, Sarrail was instructed to establish his forces on a defensive line, holding as much of the regained territory as possible and keeping in mind the resumption of the offensive at a date that was to be fixed according to the general plan of campaign for 1917, and particularly according to the date at which the Rumanian Army, reorganized by Gen. Berthelot, should be ready for the field. Meantime, the contingency of rapid action against Greece was to be provided for.

Henceforward, for some months, it is this last element in the problem which governs the action or inaction of the Salonika Armies. In answer to the Venizelist *coup* of Aug. 30, King Constantine began a threatening concentration of troops in Thessaly, on Sarrail's left rear. To this the Venizelist forces, hardly yet in being, were no counterpoise, and Venizelos's policy, which was also that of Sarrail, and as a rule that of the British and French Governments, was to prevent contact between the two Greek parties.[3] Sarrail therefore drew a neutral zone of some kilometres width from the Koritsa basin to the sea. Nevertheless, throughout the period of his offensive, anxieties for the flank and rear limited the play of such reserves as the Allied commander-in-chief possessed. On Dec. 1 the attempt to enforce the delivery of certain war material to the Entente representatives at Athens produced an *émeute*, in which the Allied landing parties suffered severe losses and the Legations were for a time practically besieged. This affair brought the confusion of the Greek problem to a climax. Though on Dec. 2 Sarrail's demand for authority to advance into Thessaly was refused, and some disjointed efforts at naval and military action led to nothing, sufficient unity of policy was achieved to enable the Allies to deliver an ultimatum on Dec. 14, demanding withdrawal of the Greek forces in Thessaly.[4]

The policy of the Salonika forces for 1917 was fixed at the Inter-Allied conference held in Rome in Jan., to which Sarrail was summoned. The first conclusion was that Greece was not to be attacked, both for other reasons and especially owing to the effect that any high-handed action would have on American sentiment, which was at that moment in the crisis of deciding for peace or war. The second was that operations on the front should be governed by a waiting policy—a compromise between Sarrail's demand for forces sufficient for a grand offensive, and Robertson's and Cadorna's demand for a withdrawal[5]—and that the divisions sent or to be sent to Salonika should be liable to recall, in the event either of a crisis on the Italian front, or of one in Palestine. On the other hand the full subordination of the British contingent to the Allied commander-in-chief was agreed to,[6] and (according to M. Mermeix) Sarrail's personality made so favourable an impression on Mr. Lloyd George that the agitation for his recall came to an end for the time being.

In the first weeks after the end of the battle and these decisions, the Salonika front was for the first time formed as a regular and continuous system. On the right, as far as the Vardar, were the British under Milne, consisting now of the 10th, 22nd, 26th, 28th, 29th, and 60th Divs. (the last newly arrived) with some organized units of the Venizelist forces in support. On the left of the Vardar the national contingents were more intermingled, the Lyumnitsa region being held by the French, the Kaimakchalan–Vetrenik–Duditsa front by the Serbs (6 Divisions),[7] the Cerna bend by the Italians (1½ Divisions), and the remainder of the front by the French main body, to the command of which Gen. Grossetti was shortly appointed in succession to Cordonnier. The French Army were now being reinforced, and included besides the old 57th, 17th Colonial, 122nd and 156th, the 16th Colonial (arrived early Dec.), 76th (arrived end Dec.), 30th (arrived Jan.) and 11th Colonial (newly formed from odd units on the spot). In all, therefore, there were no less than 21½ Divisions in this theatre at the outset of the 1917 campaign, besides two Russian brigades, and the Greek National Defence Army in embryo. The Italians in Albania are not counted, as they were not under Sarrail's command, and operated entirely as a separate force in their own theatre, interesting the Salonika force only in so far that their positions protected the opening up of the line of communication Santi Quaranta–Koritsa–Lake Prespa. This force was strong enough to hold all its line and yet to have larger reserves than in 1916, for either an offensive northward or a march into Thessaly.

The Bulgarians on their side established themselves solidly on the final battle line of 1916, and improved it on Feb. 15 1917 by the recapture of height 1050 in the Cerna bend from the Italians, who had only shortly before taken up this sector. An attempt to retake it failed on the 28th. The end of active operations against Rumania about the middle of Jan. released additional Bulgarians for the Salonika front. As a beginning Sarrail sent his newly arrived 76th Div. inland to Koritsa[8] just in time to prevent the seizure of that point by an Austrian force coming down from Pogradets (early Feb. 1917); the division then moved on to clear the Santi Quaranta road—the new alternative line of communications—of bands and make the junction with the Italians in Albania, which at present only existed by wireless and aeroplane. This mission was completed by the meeting of the French and Italian troops at Ersek, Feb. 17, after which the limit between Sarrail's International Army and the purely Italian force of Gen. Ferrero in Albania was fixed at a little N. of that point. The 76th Div. was then

[1] The French on the W. side of Lake Prespa occupied Liskovats, a village on the same latitude as Krani, and then Horesovo.

[2] The viaduct at Ekshisu was not repaired till Nov. 27.

[3] The first battalions organized by the Venizelists were sent to the British front on the Struma. At one time the idea seems to have been entertained of reconquering Eastern Macedonia (Drama–Kavalla region) by means of an advance of these troops, presumably in concert with a British expedition. Nothing, however, was done in this direction. The regular Greek forces on this side, cut off by the Bulgarian invasion, had accepted an offer of internment as "guests of the German Government" (Sept. 14) and been transported to Germany, except a small force which from Seres had made its way to join the Allies.

[4] In the midst of these events came mutterings of trouble in the Serbian Army. Little is known as to the details, but as early as the beginning of Jan. 1917 a division commander and several brigade commanders and senior staff officers were deprived of their posts; by mid-March over twenty such officers were in prison at Bizerta charged with plotting against the Prince Regent. Finally, a number of these were brought to trial, some being condemned to death and (July 29) shot, others sentenced to 15 years' imprisonment.

[5] The idea of a Salonika front had never had any real support in the British War Office, and the Italian point of view seems to have been that the abolition of an Inter-Allied force in the Balkans would give Italy greater freedom of action in Albania.

[6] Sarrail had already been released from control of the French G.Q.G. when Joffre left it and was replaced by Nivelle (Dec. 1916).

[7] Owing to losses the Serbian Divisions were now reduced from the old high establishment and were equivalent in rifle strength to French Divisions, viz. 9 three-company battalions.

[8] Here, in the previous summer and autumn, French cavalry had operated to disperse irregular bands that were practically bandits, and to intercept communications between Athens and the enemy. For a time Venizelist sympathizers reigned at Koritsa, and the idea of annexing the district to Greece was not far in the background; but in the face of protests from Italy and from Essad's Albanian party at Salonika, Sarrail replaced them by an autonomous government of inhabitants under French protection, a course which he considered would commit nobody and yet give no excuse for the formation of Royalist bands.

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reassembled N. of Koritsa, in readiness to participate in the general offensive when this should be ordered.

Meantime the British advance beyond the Struma, originally developed out of the demonstrations made during the first stages of the Monastir offensive, had been consolidated on the line Jenimah–Osman Kamila–Hrostian Kamila–Nevolyen–Kukuluk–Elishan–Barakli Dzuma–Alipsa (Ali Pasha). This position formed a useful bridgehead in case Sarrail should be able to resume the old scheme of an offensive by way of Demir Hisar and Rupel against the Bulgarian communications, and meantime it immobilized a Bulgarian force of approximately equal strength. But the supply of the lines beyond the Struma was difficult and laborious during the winter months, and it was to be expected that the valley would be a hotbed of disease in the summer. On the Doiran front several small local attacks were made on the enemy's positions on and about Dub mountain—the Achi Baba or Hermada of this front.

The scheme which Sarrail intended to carry out was the old scheme of a principal blow from the mountain front in the direction of Demir Kapu, cutting off the defenders of the Doiran and Lyumnitsa fronts. Combined with this, local and subsidiary advances were to be made on the Cerna bend and Monastir fronts, with, to the left of all, an enveloping movement by the 76th Div. from Koritsa by Resna upon the rear of the Bulgarians N. of Monastir. Meanwhile, the British, after exercising a holding action which was to increase in intensity from left to right and culminate in a real attack on Seres, would quickly shift their centre of gravity to Demir Hisar, and thence, by Rupel and the Struma, force their way to a position on the rear of the Bulgarian line of retreat. If, as in 1915, Sofia was to be the ultimate objective—if, in short, the campaign was intended to be a decisive one—the sweep of the extreme left would pass through Uskub and Kumanovo, that of the left centre through Veles and Shtip, while the Italians bore down on Demir Kapu and the British marched on Simitli—a romantically complete success. In many ways, indeed, the scheme is identical with that eventually carried out by Franchet d'Espérey in Sept. 1918. But in both cases there were four postulates:—(*a*) Greece friendly or under entire control; (*b*) synchronization of the offensive with those in the main theatres, so that the enemy could not transfer German reinforcements in time to the Balkans; (*c*) enough men; and (*d*) enough material. Of these postulates Franchet d'Espérey was in the sequel to possess all four. Sarrail, on the other hand, though (*b*), the most important strategically, was within his power, had little real security as to (*a*) and a definite lack of means in respect of (*d*), and this last ranked as one of the most important factors for the tactical break-through on which all the rest depended. Several of these requisites being absent, Sarrail was under no illusions as to the chances of pushing success to the gates of Sofia. But he considered that there was a possibility, becoming a probability if he were given more heavy guns, of forcing the offensive of his left centre in the mountains so far north-eastward as to compel the evacuation of the Lyumnitsa–Doiran–Belashitsa front. In the absence of these additional heavy guns, however, the tactical break-through in the Moglena–Cerna region would be a matter of great difficulty, and Sarrail accepted a proposal of Milne that the British holding attack should be delivered on the Doiran front—where its effect on Sarrail's battle would be immediate and tactical—instead of towards Seres. This change of plan, made between Feb. 9 and 19 was due in the first instance to the difficulties of movement in the Struma valley, where exceptionally bad weather had made motor transport almost impossible. But the decision was one of grave importance since the height of Dub, now chosen for the British attack, was one of the strongest points on the whole front, and it was an attack, and not a demonstration, that was intended.

In this form the scheme was accepted by the Inter-Allied conference that met at Calais on Feb. 27—in circumstances of great tension—and Sarrail was ordered to hold the enemy to his ground, and authorized to seize any opportunity which offered itself to inflict real damage. So far this represented merely the waiting policy of the Rome conference. But an important modification of that policy was implied in the actual instructions to Sarrail, for not only was he told that the plan of operations had been agreed to by the British War Council, but he was instructed to be ready to launch his offensive about April 15—a few days after the date selected for Nivelle's battle on the Aisne—in spite of the fact that no Russo-Rumanian offensive could be expected so soon. That authority should be given for an attack of any kind in the conditions of the time was of doubtful wisdom. But that the conference sanctioned an attack on the strongest parts of the enemy front in order to obtain the very limited results at which it aimed is a fact that is more than difficult to explain. The strategic results that would or might accrue from a break-through in the Moglena region were indeed so great (as 1918 showed) that special tactical risks might fairly be taken to achieve this break-through. But the conference of Calais not only had no great strategic results in mind, but had expressly agreed that the circumstances of the time excluded them. And when, in addition, we find that Sarrail was, at one and the same time, told that the decisive defeat of the Bulgarians was excluded, and instructed to "take"—according to the Calais *procès-verbal*—or "seek out"—according to the French Ministry of War telegram—"every favourable opportunity for inflicting a serious check," we can only conclude that the Calais conference was so preoccupied with troubles nearer home that it could think of nothing better, as regards Salonika, than to shift the responsibility and trust to luck.

But before the offensive period arrived events had already blurred the scheme. The British were to attack the Dub, and demonstrate at other points; the French, Russians and Italians in and W. of the Cerna bend were then to move, and lastly the Serbians were to deliver the principal blow between the Cerna and the Duditsa mountain, E. of which were the French 122nd Div. and part of the Greek "Archipelago" Div. (the first of the Venizelist National Defence formations), ready to drive forward on the Huma–Vardar front so soon as the flank attack had begun to make itself felt. But the Serbians, still angered by the breakdown of joint action in the Monastir battle, and also seriously affected by their internal troubles, refused to move till after the Allied general offensive had opened in France. The Russians were deeply shaken by the revolution in their own country. Weather conditions were terrible, and the zero day of battle was several times postponed, both owing to these conditions and to the slowness with which the preliminary offensives at and W. of Monastir were developing.

As early as March 12 the French 76th Div. had begun its advance from Koritsa on Resna. But owing to snow and to the harrying tactics of enemy irregulars—who were supported by small Austrian forces from Pogradets—it made but little progress, and on March 19 Sarrail suspended the movement. Meanwhile, on the 18th, Grossetti, after several days of local attacks, delivered a larger attack on the front N. of Monastir, which by the 27th had advanced the line in this sector to height 1248, Snegovo and Rastani, with corresponding gains to the left on the spur of Peristeri called Crvena Stena, and to the right about Dobromir and height 1050. Over 2,000 prisoners were taken, and these gains eased the uncomfortable position of Monastir, but they were not pressed, as Sarrail not only held his reserves for the April offensive but sought to disengage part of the troops engaged at Monastir for the same purpose.

On the Doiran front the British attacks began about the middle of March with enterprises intended to secure advantageous positions for the general engagement. On April 22, after several postponements, the artillery preparation began, in terrible weather, and on the evening of the 24th the infantry assault was delivered on a two-division front against Dub and its under-features. The positions of the defence were strong in themselves and strongly entrenched, and, as in the trench-warfare battles of the French front in 1916–17, the attack preparations and especially the prolonged bombardment had given full warning. Along the whole front the infantry reached

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the hostile front trenches, but only on the left were they able to maintain the ground won, and nowhere was progress made beyond the first enemy system. Heavy fighting, which only died down on the 28th, was necessary to consolidate the new line, and meanwhile for "climatic and other reasons"—to use the words of Milne's despatch—the rest of the front remained inactive. It was only on May 5 that the other secondary elements of the battle (W. of the Cerna, Cerna bend, Lyumnitsa–Mayadag front) began their artillery preparations. At last, on the 9th—in the case of the British the evening of the 8th—the infantry went forward on all fronts. The British, attacking between the Petit Couronné and Lake Doiran, were repulsed, but they made good an advance further W., where 500 yards in depth were gained over a frontage of two miles; these gains were held and consolidated. On the Lyumnitsa front the French 122nd Div., aided for the first time by Greek forces, carried out methodical advances by fractions at a time, and even for a moment held the Srka di Legen. Elsewhere all holding attacks were repulsed after the usual momentary successes. But the serious feature of the situation was the fact that the Serbians, who were to have been the shock element of the attack and to have begun their advance on the 9th, like the rest, came to a standstill on the 11th after engaging only one of the three divisions between Kaimakchalan and the Cerna. More, they asked to be taken out of the line, and with this the offensive scheme practically collapsed. Sarrail did, indeed, induce them to engage again with two divisions, and on the 15th attacks in aid were delivered or threatened at other points.[1] This time, after some loss, they demanded that the offensive should be abandoned altogether. Already Sarrail had received authority from Paris to suspend operations and establish his defensive line (May 15), and on the 23rd, after the second Serbian disappointment, he issued orders accordingly. It could be claimed, with justice, that these operations had pinned the Bulgarian Armies to their ground, and indeed only one Bulgarian division remained in the Danube theatre, all the rest having been drawn into the Balkans by the developing threat of the offensive. But Sarrail had hoped for much more. His object had been Veles and Demir Kapu at the least, instead of which only slight advances on the Struma, Doiran, Lyumnitsa and Monastir fronts—without exception secondary elements in his scheme—had resulted. The offensive was, in short, a failure, and one, moreover, in which it was palpable that disunity had played the major part.

The reasons are to be sought partly in the Serbian breakdown and partly in the general war situation. Allusion has already been made to the fact that the Serbian Army had for some time been passing through an internal crisis, and to the demands made by the Serbian Government and higher command for tangible evidence that all the Allies would frankly engage their forces in the battle. The engagement of the French and Greeks on the Lyumnitsa front, and above all that of the British on the Doiran front, where attacks were made in earnest, local gains secured, and heavy losses incurred[2] in aid of the projected main attack, might have been supposed to be an effective answer to this last demand, even though the Italians and French in the Cerna bend showed no great vigour.[3] But in fact it is premature to enquire how far a sense of having been left in the lurch in the autumn battle and how far internal troubles respectively contributed to the Serbian refusal. In any case a strong motive at the back of all others was that expressed in the phrase, "What is the use of delivering Serbia if no Serbs are left to inhabit it?" But there were other elements of discouragement. Exalted hopes of a great general advance to victory on all fronts had been dashed to the ground by the Aisne battle and its tragic consequences, and they were followed by a revulsion in which the war-weariness, soldiers' grievances, and the tremors of revolution produced alarming mutinies. The Russian contingent was affected not only by the revolution,[4] but by rumours of what had happened to their comrades in France, and they in turn affected the Serbs. When, on the main front and in the presence of the main enemy, the *moral* of a homogeneous army was shaken to its foundations, it was not to be expected that on this secondary front a patchwork of contingents, every one of which was exiled from its homeland, would fare any better.

In the midst of these conditions of exasperation the Greek question at last came to a head. M. Jonnart was sent out as Allied High Commissioner, and Sarrail was authorized to invade Thessaly (June 10). He had already begun to prepare a force for this purpose immediately the offensive was abandoned, and, to make certain, other troops went to Athens, to Corinth, and to Itea in the Gulf of Amphissa, whence a line of supply for the Thessaly force was opened via Bralo. Except for a skirmish at Larisa on June 12 no fighting took place. The dethronement of Constantine and the succession of King Alexander, with Venizelos as his first Minister, were successfully accomplished and most of the troops withdrawn again during July.

But the settlement of the Greek problem came too late to have any influence on operating against Bulgaria. The events of the Spring had affected governmental policies as well as common men's passions. Thus, the British War Office began to withdraw troops for the forthcoming Syrian campaign; the Italian Government began similarly to press for the withdrawal of their 35th Div. for operations in Albania; and the French Government, reconstituted after the Aisne crisis, had made it a definite policy to economize the reduced man-power of France by avoiding battle. Meantime, the Italian advance into Epirus, made concurrently with the French operation in Thessaly, antagonized Greek opinion, the relations of Greeks and Serbians were little better, and those of the French and Italians at the margin of the respective spheres of occupation in Albania none too good. The personalities of the Venizelist, and those of the regular Greek Armies, now to be amalgamated, were inevitably opposed. Finally, Essad Pasha reappeared, with a national Albanian policy and the nucleus of an Albanian contingent.

Sarrail, nevertheless, attempted to maintain a certain military activity; in particular, an enterprise on the extreme left was carried out by a French force under Gen. Jacquemot,[5] which captured Pogradets (Sept. 11) and thence advanced N. almost to Lin. In Oct. a further advance was made into the upper Skumbi valley, but this was suspended, owing to representations by the Italian Government, and the French then withdrew to Pogradets, leaving Essad's bands to operate in the Skumbi region independently. Finally, the whole front relapsed into practical stagnation.

On Dec. 10 Sarrail was relieved of his command by the new Clemenceau ministry on the renewed demand of the British and Italian Governments, and of General Foch in his capacity as chief of the staff of the French Army. This put an end to a situation which had become impossible. The proximate cause of his dismissal, so far as the French Government was concerned, had nothing to do with Salonika, but was Sarrail's relation to the parties of the Left, who, in the troubled summer of 1917, had become pacifist in character, and were suspected, rightly or wrongly, of dealings with similar elements on the enemy's side.[6] So far as the Allies were concerned, it was due partly to the personality of Sarrail, and partly to the insistent and thrusting policy of France in dealing with Greece. In effect, the over-

[1] The British on the Struma took Kupri and Ernekeui on this day.

[2] According to Sarrail the British losses in the two offensives were 8,000.

[3] The Russian brigade in the Cerna bend on the contrary *s'est fort bien conduit*, according to Sarrail (p. 257).

[4] It is only just to record, however, that to the end of the year they continued to take their share in duties in the line. The evidence of Sarrail, especially p. 289, is emphatic as to this.

[5] The superintendence of this operation was the last service of Gen. Grossetti, who left Salonika on Sept. 24 suffering from poisoning, like his predecessor Cordonnier. He died a few months later.

[6] M. Clemenceau in his explanation before the army commission late in Dec. 1917 seems to have laid stress principally on the fact that unless satisfaction was given to the Allies in respect of their complaints against Sarrail, they would not accept a French Commander-in-Chief on the western front. (Mermeix.)

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throw of the Constantine régime was the only logical outcome of maintaining a Salonika front at all. But between that logical extreme and the other logical extreme of evacuation, which was always the desire of the British War Office, diplomacy built up a series of compromises which satisfied nobody. It was to the indefinite and equivocal position created by these compromises, even more than to any military factors or personal disagreements, that the positive ineffectiveness of the Macedonian forces was due. It remains to the credit of Sarrail that he was sanguine in the most confused and difficult conditions and resolute in carrying the occupation to a common-sense issue. In spite of proposals to retreat again into the entrenched camp, he maintained the army on the front from which, nine months later, it was to deliver the great offensive blow for which he had always hoped. On the other hand he left the Allied Army in a state of badly shaken *moral*. The consciousness of ineffectiveness, the blight of malaria, the infrequency of leave, the sense of being a forgotten "side-show," the international causes of friction—all these factors told on the *moral* of the Salonika forces at the most critical period of war-psychology.[1] A period of *remise en main* was necessary before the troops could be employed either in this theatre or in another, and Sarrail had taken the line of defending his army against all criticism, fair or unfair. It was essential, therefore, if the army was to be pulled together, that new men should be put in power.

General Guillaumat, the new commander-in-chief, set himself to this task under favourable conditions. No important military operations were in prospect. The Greek danger had been liquidated. The atmosphere of exasperation was largely dispersed by his appointment alone. With Russia and Rumania in collapse, and the final military trial of strength obviously imminent in one or both the western theatres, not one of the three great Powers concerned was inclined to press its Balkan interests very closely. His military position, too, soon came to be much stronger than that of his predecessor. Although the British had withdrawn two of their six divisions (the 60th in June and the 10th in Sept. 1917, both proceeding to Syria), and one battalion per brigade in the four remaining (spring 1918), the French and Italian contingents remained practically unaltered (save for the withdrawal of the Russians), while the Serbians acquired a whole new division created from Yugoslav prisoners of war, and the Greeks were taking their place as a regular Allied contingent, the "national defence" divisions at Salonika (Archipelago, Crete, Seres) being augmented by those of the regular army, reorganized by a French military mission.

The question of the use of these forces had been put on one side by the central councils of the Entente. German pressure on the Western Front, beginning with March 21 and culminating on July 15, threw all other questions into the background, and when the tide began to recede it proved as difficult as ever to convince the directors of the War that good could come from a Salonika offensive, while, at the same time, it was impossible to offer the Central Powers the opportunity of repeating at Greece's expense their customary autumn triumph. No decision imposed itself and none was taken. The only event of the early summer was a brilliant *coup de main* with limited objective, which on May 30 carried the Srka di Legen on the left of the Vardar. In July Guillaumat, after practically completing the work of reorganization, was recalled to Paris, where an energetic governor was needed in case of a German breakthrough. He was succeeded by Gen. Franchet d'Espérey. At Paris he continued to act as advocate of, and so to speak agent for, the principles of a Salonika offensive. After much persuading he obtained for his successor authority to prepare one, but authority to begin was not given till a few days before the battle.

Meantime, operations in Albania, which for two years had been in the nature of post and police warfare, rose for a moment in the summer of 1918 to the level of major operations.

In the winter of 1917–18 the posts of the Italian XVI. Corps (Gen. Ferrero) in Albania ran along the Voyusa from the sea to Memaliadz, where it turned abruptly N. and then N.E., facing Glava and Cafa Glava, Parasboar, Barguzyasi, and Cerevoda. Here it joined the French posts, which ran in a N. to S. line along the mountains to Golik in the Skumbi valley and thence nearly E. to Point 1704 S. of Lin on the shore of Lake Okhrida. Early in July 1918 a frontal advance of Ferrero's Italians from the Voyusa and combined by flank pressure by the French 57th Div. in the mountains of the Devoli regions, forced the two Austrian Divs. (47th and 81st) of Gen. Können-Hozak's XIX. Corps to evacuate the whole Berst region in haste, with a loss of nearly 3,000 prisoners. By July 20 the Italians lay along the Semeni and the lower Devoli from the coast to Petrohaudi (with a bridgehead in front of Fieri), and thence in an E. to W. line to the foot of the Mati Siloves range which was held by the French. The positions of the latter formed a marked salient, the apex of which lay at the confluence of the Holts and Devoli rivers, and the right flank of which passed by Kumichan to Golik on the old front. The importance of this salient lay in the fact that it kept the right wing of the general line echeloned well forward, threatening the rear of the enemy's lines near Berat and ultimately the connexion between Elbasan and Lake Okhrida.

In August the Austrians, now commanded by Generaloberst von Pflanzer-Baltin and reinforced by the 45th Div., as well as by the fresh 12th Bulgarian Div. in the Okhrida–Skumbi sector, began a counter-offensive all along the line. Between August 20 and 24 they recaptured the line of the Semeni and the Devoli and drove back the Italians to positions only slightly in front of Fieri and Berat. On August 24 those towns fell again into their hands, and the Italians then withdrew to a line from just S. of Fieri, along the Janitsa, S. of Berst, and along the Osum to Mt. Tomor. Meantime, the French, the left rear of their Devoli salient being thus threatened, had had to fall back in the Devoli and Tomorica valleys to regain touch with the Italians at Mt. Tomor, while still holding on to their posts between the Devoli and the Skumbi. These operations are of interest as being the last military success won by forces of the Central Powers in the War. Three weeks after their conclusion the Bulgarian front was in ruins.

At the close of these operations and the eve of the final act on the Salonika front, the numbers and positions of the forces of the Central Powers were approximately as follows: In Albania, XIX. Austro-Hungarian Corps (45th, 47th, 81st Divs.) under Generaloberst von Pflanzer-Baltin; between Skumbi Valley and Lake Okhrida the 12th Bulgarian Div.; from Lake Okhrida (exclusive) to Koziak Mountain (inclusive), the XI. German Army (Gen. von Steuben), consisting of, from right to left, the LXII. German Corps staff, with under it the Bulgarian 1st, 6th and Composite Divs., and some few German and Austrian units, the LXI. German Corps staff, with the 302nd German Div. (staff German, troops Bulgarian), the 4th Bulgarian and the 2nd Bulgarian Div., and the 3rd Bulgarian Div.; from E. of Koziak to Lake Doiran (inclusive) astride the Vardar, the I. Bulgarian Army (Gen. Nerezov), three Bulgarian Divs.; from Lake Doiran (exclusive) to Lake Tahinos (inclusive), the II. Bulgarian Army (Gen. Lukov), three Bulgarian Divs.; from Lake Tahinos to the mouth of the Struma, thence eastward in coast defence positions, the IV. Bulgarian Army (Gen. Petrov), two Bulgarian divisions. The whole of these forces were under the control of the German headquarters, which had formerly been Mackensen's and Bülow's but was now the *Armeegruppe Scholtz;* Gen. Scholtz was, however, for certain purposes under the control of the Bulgarian higher command, at Sofia, over which Todorov presided. An exact account of the forces of Bulgaria at the crisis can hardly be given,[2] but, save for one division in Rumania and some coast

[1] Nevertheless it is clear that the phase of the mutinies passed off more easily than the corresponding phase in France.

[2] Some of the newer divisions had an irregular constitution whereas the older ones still retained the six-regiment organization of 1915, and some of these even the old four-battalion regiments. Moreover, at that moment movements were in progress for replacing 15 German battalions by 45 Bulgarians; the Germans had departed, all but three battalions, but few of the Bulgarians arrived in the XI. Army in time.

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defence units in Thrace and E. Macedonia, the whole of Bulgaria's mobilizable force was present between the Devoli in Albania and the mouth of the Struma. In the depots were practically only the 1919 class recruits, just called up; 55,600 men had fallen in battle since 1915, some thousands were prisoners, many thousands had died or been invalided. Thus the ration strength of the Bulgarian Armies on the Macedonian front can hardly have exceeded 420,000, with some 8,000 Germans (principally Jäger battalions, heavy artillery and mountain machine-gun detachments). The combatant strength may be taken roughly as 310,000 Germans and Bulgarians. The Italians of Ferrero and the Austrians of Pflanzer-Baltin, whose operations in Albania were entirely unconnected with the battle on the main front, are ignored in this calculation.

On taking up their battle grouping the larger formations of the Entente Armies were arranged thus: Devoli valley to Staravina (E. of the Cerna bend), the French Army of the East, in seven French, Italian and Greek Divs.; Staravina to Nonte (exclusive), the Serbian I. and II. Armies under Boyovich (3 Divs.) and Stepanovich (5 Divs.) respectively, the latter consisting of the Strumaja, Timok, and Yugoslav Divs., and the French 122nd and 17th Colonial Divs.; Nonte to Lyumnitsa, Gen. Anselme's group, Greek and French Divs.; Lyumnitsa to Dub (exclusive), astride Vardar, 26th and 27th British Divs.; Dub to Dova Tepe, 22nd and 28th British and two Greek Divs.; Dova Tepe to mouth of Struma, 3 Greek Divs.; Salonika, 1 Greek Div.; in all, 28 divisions. In addition there were a small Serbian cavalry Div., a French cavalry brigade, and other lesser formations and details. The ration strength of these forces, after making allowances for men invalided during the hot months, was about 550,000, and the combatant strength perhaps 350,000.

In sum, then, there was no great numerical disparity between the opposed forces. The equipment of the Entente Army in heavy artillery was, however, considerable. Sarrail's repeated requests for an adequate equipment in this respect had been in the end met, just before his recall. As to the number of heavy batteries on the other side accounts differ, but in any case the regrouping of guns to meet an attack, in the movement conditions of Macedonia, would be difficult if not impossible for the defence, and the mere possession of a reserve of such artillery was, in the conditions, a big element in favour of an attack, provided the duration of the artillery phase of it was reduced to a minimum. On the other hand, to oppose to the powerful material of attack, the Bulgarians had all the advantages of natural and artificial strength of position. But the success or failure of an offensive would turn more on *moral* than on material factors. Presuming that the tactical break-through was possible, would the Bulgarians knit up again on a new line further back? Or would it be found that the third winter had completed the war-weariness on which Sarrail had twice vainly counted, so that one heavy blow would finish the matter? In the light of events the answer is easy. The new government in Bulgaria was pacifist in character. Ludendorff regarded a breakdown as almost certain and detailed several divisions from the eastern front early in Sept. to proceed to Bulgaria and Serbia, the nearest indeed being ordered to Sofia to keep order. On the front itself, according to German accounts, conditions were "indescribably pitiful," and for food the greater part of the troops were dependent on ox-transport from a base 60 m. distant, and upon what they had themselves grown behind the lines, this last fact indeed making it almost impossible to induce a unit to quit its sector for a concentration. But 1917 had for the Entente been a tragedy of disappointments founded on optimistic estimates of the enemy's broken *moral* and vanished man-power, and in 1918 a not unhealthy scepticism prevailed in their intelligence staffs, although it was agreed that Bulgarian *moral* was low. Then, too, there was the question of Serbian *moral*. Since the deadlock of May 1917 the Serbians had consistently followed the principle that it was useless to rescue Serbia if no Serbs were left to inhabit it, yet they alone possessed the fire and passion which would convert tactical victory into strategic triumph, who would disregard food and rest sufficiently to exploit success by leaps and bounds, who would not stop short of the Danube. And nothing less than victory without remainder would be of any value to the Entente.

When the plans were under consideration this latter question was unexpectedly answered by the Serbs themselves. They proposed an offensive with limited objective in the Moglena sector, *i.e.* that lying between Kaimakchalan and the Srka di Legen. At once the situation was cleared up. If they were ready to carry out an attack on the mountain front for no more than a limited objective, it was unlikely that an offensive from that group with the objective of Belgrade would not fall to pieces as in 1917. On June 29 the plan was definitely fixed, and about July 7 the Serbian headquarters (now directed by Mishich) agreed to engage all its forces in the operation. The date of the offensive (which needed a good deal of material preparation as the Moglena sector had never been equipped for battle) was fixed for Sept. 15, though, owing to objections and preoccupations in Paris, the higher command did not give leave to carry it out till little more than a week before that date (Sept. 4).

On Sept. 14 a bombardment opened which, less overpowering than those of the western front, was far heavier than anything previously witnessed in the Balkans. Next day—the original date—the offensive was launched. From the Lechnitsa river to the Sokol mountain the I. Serbian Army (Boyovich), consisting of the Danube, Drina and Morava Divs., had a frontage of 5 kilometres per division. From Sokol to the Suchitsa brook the II. Serbian Army (Stepanovich) formed the break-through force. In front of the Dobropolye were the two French assault Divs. with the Shumaja Div. on their right, and the Exploitation Divs., Timok and Yugoslav behind them. The I. Army and the Exploitation Divs. were not to move till the French had carried Sokol, Kravitsa and Vetrenik heights. Then, passing through, the Yugoslav Divs. were to master the Koziak, and the II. Army front was to advance at the utmost speed on Gradsko, flankguarded by the I. Army on the left and the Timok Div. on the right.

The attack succeeded according to programme. It continues to be a matter of controversy whether the Bulgarians offered an earnest and fierce resistance. The impression left on the Allied infantry was that they did so; the Germans in their midst assert the contrary. In any case, it is probable that the backbone of resistance was the German mountain machine-gun detachments which were dispersed in the battle zone. Be this as it may, the French Assault Divs. carried their objectives by the evening of the 15th, the Yugoslav Div. passed through them in the night of the 15–16, carried Koziak on the 16th, and on the 17th drove a deep wedge, of which the point was armed midway between Gradsko and Demir Kapu, and the lengthening left flank along the Cerna was taken up by the I. Army. On the other side there was little or no tactical handling in the ensemble. Machine-gun groups and specially resolute parties of riflemen in broken ground constituted the whole resistance. This, indeed, was the typical form of defence in all theatres of war by 1918, but here it lacked the essential element of organized counter-attack. Here and there a unit turned upon its pursuers, but in the main the rear of the enemy's position was void of reserves, although it is said that only 12,000 Bulgarian and German infantry were in line on the front attacked. Later, all attempts at reinforcement always failed, as the troops concerned had to traverse instead of following the valleys and ridge-systems. In sum, by the 19th, the wedge had developed two horns, of which one, following the Cerna, was at the outskirts of Kavadar, and the other was engaged in rolling up the front opposed to Anselme's group.

Meanwhile, on the 18th, the British and Greeks of the Doiran front, under orders from Gen. Franchet d'Espérey, assaulted the whole enemy line from the Vardar to beyond Lake Doiran, with the general idea of cutting the communications between the Bulgarians opposed to Anselme, and the apex of their own country at Strumnitsa. Here, at any rate, the Bulgarians

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fought vigorously. Their positions were as strong by art as the Moglena positions were by nature, or stronger, and the attack lacked depth owing to the detachment of a division to work with Anselme's force, and to the low effective strength of units.[1] Thus it met with the same fate as those of 1917—small gains of ground consolidated and held after far larger gains had been for a moment achieved. A second attack next day was no more successful. But for these critical days a large force of the enemy had been completely held.

On the 20th and 21st the exploitation of the break-through was completed. The Serbian I. Army, no longer simply guarding the flank of the II., crossed the Cerna and began a drive along the mountains of the Cerna bend to which the Italians and the French of the "A.F.O." conformed little by little. The Serbian II. Army reached the Vardar between Krivolak and Demir Kapu, and its right horn continued to push due eastward along the mountain positions in front of Anselme's force, which progressively came into action from left to right. By the afternoon of the 21st the Doiran–Vardar front was in collapse, and the British aeroplanes were bombing the intermingled troops and transport of the enemy which was seeking to make their way through Kosturino to Lyumnitsa.

From that day, though progress was sometimes slow, sometimes fast, the Allied offensive became a strategic pursuit in the full sense of the word, marked by a consistent policy of outflanking, as rapidly as possible, any solid line of resistance which the enemy managed to create. Thus, on the 24th, the resolute front offered by a hastily assembled German force on the line of the Vardar near Gradsko (the administrative centre and organized base of the enemy's centre) was turned on the N. by the steady advance of the Serbian I. Army on Veles (24th–25th), and once released thereby the Serbian II. Army marched at high speed on Shtip (25th), Nochaua (26th), and Tsarevo Selo (27th), behind the rear of the forces that were giving ground before the British, who in turn worked down the Strumnitsa basin and (in concert with the Greeks further to the right) ascended the upper Struma region, with their aeroplanes sent ahead to bomb the Kresna defile.

Thus, too, when infantry fighting threatened to become stable between Veles and Shtip, the French cavalry brigade under Gen. Jouinot-Gambetta, instead of becoming involved in the Veles fighting, made an independent dash upon Uskub, and to the astonishment of both sides seized that vital centre on the morning of the 29th. This event, which secured the communication between the (so-called) XI. Army and the remainder of the Bulgarians, forced the latter into the region of Egri Palanka, and the former into that of Kosovo. Thenceforward the I. Serbian Army, with the upper Morava as the axis of movement, moved steadily northwards with its right on the Bulgarian border, and its left following approximately the line Gilau–Kinshumlia–Kralyevo, reached Racha–Krushevats–Pirot on Oct. 15, Kralyevo–Parachin–Zayechar on Oct. 23, Pozharevats–Arangyelovats–Uzhitseon Oct. 28, Belgrade–Lyuboviya on Nov. 1, and the old barriers of the Drina, Sava, and Danube on Nov. 4. Meantime, the II. Army had reconquered Kosovo and the Sanjak of Novipazar, reaching Priboy and Plevlye on Nov. 1. By that time the strategic pursuit further E. had become a series of movements authorized by the terms of an armistice, and to the W. Pflanzer-Baltin was evacuating in turn Albania and Montenegro, with, as his only purpose, the maintenance of his divisions as formed military units. The Balkan Campaigns were at an end.

For the Salonika campaigns 1915–17, the principal authority is Sarrail's *Mon Commandement en Orient*, which is profusely documented; with this should be taken Gen. Milne's despatches. The German part in the Cerna bend battles of 1916 is described in K. Lubmann's monograph *Herbstschlacht in Mazedonien*, written from official archives. The crowning offensive of 1918 is dealt with fairly fully in C. Photiades *La Victoire des Alliés en Orient*. (X.)

SALTING, GEORGE (1835–1909), British art collector, was born at Sydney, N.S.W., Aug. 15 1835. His father, a Dane, had made a large fortune by sheep-farming and sugar-growing, and on inheriting this Salting devoted himself to collecting, with great taste and discrimination, Chinese porcelain and English and French furniture and pictures. He led a very simple life and was of retiring and somewhat eccentric habits. On his death, which took place in London Dec. 12 1909, it was found that his priceless treasures had been left to the nation. They are now housed in the Victoria and Albert Museum, the British Museum and the National Gallery.

SALVADOR (*see* 24.96).—The estimated pop. in 1912 was 1,161,425; in 1917 1,700,000, indicating a pop. denser than that of any American republic except Haiti. In 1918 births numbered 49,783, deaths 33,884 and marriages 3,653. Of the births 21,528 were legitimate and 28,255 illegitimate. Most of the upper class are of European descent and reflect European influences; the lower class has a higher standard of living than has that of Nicaragua or Guatemala. The agriculturists are prosperous and alert; few of them are foreigners. Coffee is the principal crop; some 70,000,000 lb. a year are normally exported to the United States, France, Germany, etc. It constitutes 80% of the total exportation. In 1916 there were 153,517 ac. under cultivation, containing 95,000,000 coffee-trees. The 1917 crop was damaged by the great earthquake of June 7, which partly destroyed five towns. Other products are cacao, tobacco, rubber and sugar. Cultivation of cotton and wheat is being encouraged. Corn is extensively raised, because of the domestic demand. Live stock was estimated in 1919 at 284,013 head of cattle, 74,336 horses, 21,457 sheep, and 422,980 hogs. Mine products include gold, silver, iron, copper and mercury. There are native mining companies as well as English and American. The gold output runs about $1,500,000 per annum.

Foreign trade is in the hands of English, Dutch and German exporters and wholesalers. Its annual value 1912–8 was:—

	Imports	Exports
1912	$6,744,859	$ 9,942,184
1913	6,173,545	9,938,724
1914	4,958,624	10,796,495
1915	4,022,167	10,563,871
1916	5,668,000	9,970,000
1917	2,719,095	10,588,900
1918	5,979,000	12,069,000

In 1919 the exports to the United States were $4,146,113, the imports from the United States $5,821,920. National revenues and expenditures, in pounds sterling, were reported as follows:—

	1915–6	1916–7	1917–8	1918–9	1919–20
	£	£	£	£	£
Revenues	850,114	908,325	1,998,810	1,382,644	1,670,056
Exp'd't's	1,058,219	916,704	1,013,842	1,874,079	1,692,692

The estimated revenue for 1920–1 was stated at 14,726,170 colones, and expenditures 16,227,580 colones, leaving a deficit of 1,501,410 colones. The colon was fixed at $0.50 by law of Sept. 11 1919. Prior to that time it was normally worth $0.3978, but in 1917 it was worth $0.60 and by Dec. 31 1918 $0.72. The national debt at the end of 1918 was $11,098,000.

Education has long been nominally free and compulsory, but until recently received little attention from the Government. In 1911 there were 173,495 children of school age and only 21,569 in primary schools, which numbered 486; in 1916 only about one-fourth of the 245,251 children of school age were in the 989 primary schools. In the principal towns the schools have done excellent work, though with poor accommodation. In rural districts there were in 1916 only three grades, with a fourth year of industrial instruction added. The lower classes were thus purposely left without educational facilities in order to exclude them from the professions. The secondary schools, of which there are 27, lacked trained teachers and funds, as did the National University. In the latter, graduates of the secondary schools are offered courses in jurisprudence, medicine, pharmacy, dentistry, and engineering. In 1919 a law for eradicating illiteracy was enacted, and a campaign begun to reduce the proportion, then 70%, ignorant of the alphabet. The budget estimate for 1920–1 contained an appropriation of 1,831,374 colones for education. Other social measures were a campaign against alcoholism inaugurated by the Superior Council of Health, and the inception of a federation of working-men's societies.

History.—After 1909 Salvador remained substantially at peace within her borders and with her neighbours. President Fernando Figueroa was succeeded by Manuel Enrique Araujo

[1] At that time influenza was raging in the British force.

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in 1911, but the latter was murdered in 1913 and succeeded by the vice-president, Carlos Meléndez. He resigned in Aug. 1914. Alfonso Quiñónez Molina temporarily held the presidential power and when Carlos Meléndez was elected president in 1915, Molina became vice-president. On March 1 1919 Jorge Meléndez was inaugurated for the term ending 1923. The tranquil condition of Salvador was due to the decrease of hostility between Conservatives and Liberals, and to the frequent insistence by the United States upon the preservation of peace.

During the World War Salvador was the only one of the five isthmian republics which did not declare war against Germany, although, by note of Aug. 24 1917, she permitted U.S. vessels, regardless of armaments, to use her ports. When the Monroe Doctrine was adopted without definition in the Covenant of the League of Nations, she interrogated the U.S. Government as to the interpretation of the doctrine; later, in 1920, a movement was made to initiate an international bureau or court excluding the United States from membership, but this movement gave way to another looking toward Central American union, which Salvador had long advocated.

On June 24 1920 the Salvador Department of Foreign Relations sent a circular telegram to the other four isthmian republics inviting their participation in an isthmian congress to review, and, if needful, change the Washington Conventions of 1907, which were intended to safeguard the interests of all Central American countries and to promote the settlement of difficulties through arbitration. The congress was also to plan for unification of the national constitutions and law codes, provision for uniform secondary and professional education, equalization of customs duties with free trade in Central American products, adoption of uniform extradition laws, moneys, weights and measures, and a single coat of arms and flag. From such unification political consolidation was expected to ensue. Conferences began Sept. 15 1920. Nicaragua seemed for a time to prevent complete accord, but a preliminary agreement as to union was reported as having been effected Jan. 21 1921. To this pact of union Salvador, Honduras and Guatemala became signatories; Nicaragua and Costa Rica rejected its terms, which became effective Feb. 10 1922. Salvador has an arbitration treaty with the United States, ratified in 1913, and a treaty encouraging commercial relations, ratified in 1919. (H. I. P.)

SALVINI, TOMMASO (1829–1915), Italian actor (*see* 24.103), died at Florence Dec. 31 1915.

SALZBURG (*see* 24.104), a Territory of Austria, borders for a considerable distance on the Italian Tirol. In 1910 it had 214,737 inhabitants; in 1920 only 213,877 (77 to the sq. mile). In 1900 16·0% of the soil was unproductive. The productive areas included 39·2% forest; 39·8% grazing lands, mostly high-lying; 9·8% meadow; 0·3% gardens; and only 10·8% arable. The most important towns are Salzburg (pop. in 1920, 36,450); Hallein (pop. 6,746); St. Johann, in Pongau (pop. 1,709). The opening of the Tauernbahn has greatly increased the importance of Bad Gastein and Hof Gastein, and the latter has developed into a modern health resort. The Gastein springs are rich in radium.

SAMSONOV, ALEXANDER (1859–1914), Russian general, was born in 1859. After being at the Cavalry school in St. Petersburg he served in the war with Turkey in 1877–8. On passing out of the Academy of the General Staff in 1884 he was appointed on the general staff. From 1896 to 1904 he was commandant of the Cavalry school at Elisavetgrad, and in 1902 he was promoted to the rank of general. In the war with Japan in 1904–5 he commanded the Ussuri mounted brigade and the Siberian Cossack division. He distinguished himself greatly as a leader of cavalry, and was awarded the St. George Cross of the fourth class. In 1909 he was made Ataman of the Don Cossacks, and in the same year he became governor-general and commander of troops in Turkestan. In Aug. 1914 he was appointed commander of the II. Army, which was concentrated on the Narev. Sentiments of loyalty to an ally and the desire to take pressure off France at the earliest possible moment led the Russian supreme command to give a premature order for an advance into eastern Prussia. Notwithstanding his report that his army was not ready for an advance the order was repeated, and as a result of the absence of support from Rennenkampf's I. Army Samsonov's army was destroyed in the battle of Tannenberg on Aug. 26–29. Convinced that the battle was hopelessly lost, he gave orders to his staff to extricate themselves from the German ring, while he went into a wood and shot himself. He was buried, with other Russian soldiers, not far from Villenberg. His wife, coming later to Germany with the Red Cross, recognized his body by a medal that he wore.

SAMUEL, SIR HERBERT LOUIS (1870–), British politician, was born at Liverpool Nov. 6 1870, the son of the banker Edwin Louis Samuel. He was educated at University College school and Balliol College, Oxford, where he took his degree in 1893. In 1895 and 1900 he unsuccessfully contested South Oxfordshire as a Liberal, but in 1902 was elected for the Cleveland division of Yorks. He entered Sir Henry Campbell-Bannerman's Government in 1905 as Parliamentary Under-Secretary to the Home Office. From 1909 to 1910 he was Chancellor of the Duchy of Lancaster, with a seat in the Cabinet, and in 1910 became postmaster-general. He held this office until 1914, and then became for a year president of the Local Government Board. From 1915 to 1916 he was again postmaster-general and Chancellor of the Duchy of Lancaster, and in 1916 became Home Secretary. He acted as chairman of the select committee on national expenditure (1917–8), and in 1919 was a British special commissioner to Belgium. In 1920 he was appointed high commissioner to Palestine and was created G.B.E.

SANDAY, WILLIAM (1843–1920), English theological scholar, was born at Holme Pierrepont, Notts., Aug. 1 1843, the son of William Sanday, a well-known breeder of sheep and cattle. He was educated at Repton and Balliol College, Oxford, afterwards becoming a scholar of Corpus Christi. He took a first-class in classical moderations in 1863, a first in the final classical schools in 1865, and was ordained in 1867. He became a fellow and lecturer at Trinity in 1869, and in 1876 was chosen principal of Hatfield Hall, Durham. In 1883 he was appointed Ireland professor of Exegesis at Oxford, and in 1891 Lady Margaret professor of Divinity, a post which he held till 1919. He died at Oxford Sept. 16 1920.

As a theological and biblical critic of the apologetic school Sanday took a very high place. His chief works are *The Authorship and Historical Character of the Fourth Gospel* (1872); *The Gospels in the Second Century* (1876); *The Oracles of God* (1891); *The Early History and Origin of the Doctrine of Biblical Inspiration* (1893); *Commentary on the Epistle to the Romans* (with Dr. Headlam, 1895); *Outlines of the Life of Christ* (1905; a republication of an article in Hastings' *Dictionary of the Bible*); *Christologies, Ancient and Modern* (1910) and *Personality in Christ and in Ourselves* (1911).

SAN FRANCISCO (*see* 24.144) increased in pop. during 1910–20 from 416,912 to 506,676 or 21·05%, making it the eleventh city in the United States. The metropolitan district, as designated by the U.S. Census Bureau in 1920, included all the communities in the extensive area surrounding San Francisco bay. This area had in 1910 a pop. of 750,000 and in 1920 1,121,631, being the fifth population centre of the United States.

Transportation and Commerce.—The railway service of San Francisco was greatly improved in the decade 1910–20. In 1917 the Southern Pacific spent approximately $1,500,000 on yards and carshops in the city. The other railways correspondingly improved their terminal yards on the bay. Steamer service grew remarkably, in part because of the opening of the Panama Canal. In 1911 the ship tonnage of the port was 5,519,556 entered and 5,545,530 cleared. In 1919 4,617 vessels entered the port and 4,696 cleared, carrying a gross tonnage of 12,261,669. In 1920 the 48 steamship lines operating out of the port had over 250 steamers; 29 lines were in foreign and 19 in coastwise trade. The U.S. Shipping Board in allotting ships gave the port 250,000 tons, including seven ships of 21,000 tons each. The urban railway mileage increased from 289·6 m. of single track in 1910 to 352·88 m. in 1920. The opening of a municipal line in Dec. 1912 caused the retention of a five-cent fare. The number of passengers carried during the fiscal year 1919 was 307,000,000 as against 157,722,720 in 1911. The south-western quarter of the city was brought within 25 minutes of the business district by building a tunnel under Twin Peaks (1917). In 1921 the port of San Francisco had 41 modern piers with a total area of 4,560,000 sq. ft., providing for more than 1,200,000 tons of cargo per month, an increase of 100 % over the accommodation available in 1910. The Belt railway, which serves all but three of the piers, had in

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1920 54 m. of track. A tunnel under Fort Mason, connecting the Government docks and the Presidio with the Belt line, was completed in 1914. The harbour was self-supporting, paying all maintenance, interest and redemption of bonds. In 1911 the people of the state voted $9,000,000 and in 1914 $10,000,000 in bonds for port development. In 1920 the harbour board approved plans for an extensive combination dock and warehouse, accessible by ship and rail. The freight discharged and landed over the wharves of the port of San Francisco, exclusive of federal and private wharves, increased from 6,866,148 tons in the year 1910–1 to 10,257,612 tons in 1918–9. The foreign trade of the port in the period 1909–19 increased 274%; while the increase for the United States during the same period was 107%. The value of the foreign trade for 1920 was: exports $220,257,771, imports $212,021,768, a total of $432,279,539. The tonnage movement for the same period was: outgoing 7,033,480, incoming 7,183,042, total 14,216,522.

Industries and Finance.—Since 1916 shipbuilding has been the most important industry of San Francisco. In the three-year period 1916–9 there were constructed in the metropolitan district 97 cargo ships of a total of 945,783 tons and 110 naval craft, including three super-dreadnoughts. In 1920 there were completed 68 cargo ships of 607,650 deadweight tons.

In Jan. 1921 the estimated number of factories in the city was 2,500, employing more than 55,000 wage-earners. The principal industries, with the estimated value of their product in 1920, were printing and bookbinding, $20,000,000; fruit and vegetable canning, $15,000,000; slaughtering and meat-packing, $20,000,000; foundry and machine-shop products, $17,500,000; lumber and timber products, $7,500,000.

Bank clearings increased from $2,427,075,543 in 1911 to $8,122,064,916 in 1920, placing San Francisco eighth in the United States in bank clearings. The assessed valuation of property in 1920 on approximately a 50% basis was $819,820,078.

Public Works.—The plans of the city in 1910 to own its own water supply culminated in the Hetch-Hetchy water and power project. The city owns a watershed of 420,000 ac. in the Sierras on the headwaters of the Tuolumne river, 160 m. distant, from which 400,000,000 gal. of water can be secured daily and 250,000 H.P. produced. The work of development was well under way in Jan. 1921. A railway 68 m. long to Hetch-Hetchy valley and the Lake Eleanor dam were already built, over 18 m. of tunnel were under construction and a hydro-electric plant of 4,000 H.P. was in operation. The contract for the Hetch-Hetchy dam was let for $5,400,000. Bonds for $45,000,000 were issued and $8,000,000 spent by March 1921.

Buildings and Parks.—The value of private building operations was $22,873,942 for 1910, $18,626,199 for 1915, $18,644,343 for 1919, and $32,869,009 for 1920. Among the notable public buildings are those of the Civic Center, located in the heart of the city and surrounded by a plaza. They consist of three main buildings: the city hall, costing $4,000,000; the auditorium, with a seating capacity of 12,000, given by the Panama-Pacific International Exposition and costing $1,275,000; and the public library, costing $1,000,000. A state building costing $1,000,000 was in Jan. 1921 in process of construction near the Civic Center. Among recent buildings were the First National Bank, American National Bank, Robert Dollar building, Balfour building, Bank of Italy and the Southern Pacific building. The Exchange building, the building of the California Title Insurance Co., the Crocker building and the Furniture Exchange building were under construction in March 1921. In Jan. 1921 there were 34 parks in San Francisco with an area of approximately 2,500 acres. The Golden Gate Park Memorial Museum had been completed. Nine playgrounds were in use and several more under construction. The public library, as part of the Civic Center, was in 1921 housed in a magnificent building; there were also nine branches and 13 deposit stations with a total of 240,000 volumes, with a home circulation of 1,368,685. The Palace of Fine Arts of the Panama-Pacific International Exposition was given after the fair to the San Francisco Art Association; many of the art treasures shown in 1915 remained there. In Feb. 1921 ground was broken in Lincoln Park for a California Palace of the Legion of Honor as a memorial to the Californians who gave their lives in the World War and as a museum of art.

Education.—In 1920 there were 107 public schools, including high schools, with 1,928 teachers and an enrolment of approximately 80,000 pupils. The university of California, at Berkeley, and the Leland Stanford Jr. University, at Palo Alto, each had important teaching departments in San Francisco.

History.—The opening of the Panama Canal was celebrated, Feb.–Dec. 1915, by the Panama-Pacific International Exposition at San Francisco, representing an investment of $50,000,000. The exhibits, numbering about 80,000, were valued at $300,000,000. Thirty-nine foreign nations and 37 states and three territories of the United States were represented at the exposition. The attendance began with 245,000 on opening day, Feb. 6, rose as high as 348,500 on Nov. 2, San Francisco Day, and reached a total of 18,500,000. The architecture was of a highly varied and monumental character. One of the artistic merits of the exposition was its effective colour scheme, while the night illumination was extremely ingenious and impressive. In spite of the World War the foreign exhibits were remarkably complete. Financially as well as artistically the exposition was a success. After presenting to the city of San Francisco the auditorium already noted, the exposition authorities had on hand a final net profit of a little more than $1,000,000. The whole enterprise had been undertaken without Government subsidy; the city and state, however, appropriated $5,000,000, while private contributors added $7,500,000 more. Receipts from concessions were $7,809,565 and from admission fees $4,715,523. The beginning of a new era in world trade, which the exposition celebrated in connection with the opening of the Panama Canal, was delayed by the World War, but with the resumption of normal conditions trade increased. Following the prosecutions begun in 1907, corruption in the city government was largely eliminated, but it reappeared, though on a smaller scale, after 1909. The election under a new primary system in 1911 of a mayor and city government opposed to "graft" brought in an era of reform. In Dec. 1911, by an extension of the city charter, members of the police and fire departments were placed under civil service. A number of other charter amendments were made during the decade 1910–20, but there was no material enlargement in the power of the city.

(R. A. V.)

SAN GIULIANO, ANTONINO PATERNO-CASTELLI, MARQUIS DI (1852–1914), Italian statesman, was born at Catania in 1852, a member of a very ancient and noble Sicilian family. After graduating in law at the university of Catania, he began his public career in the field of local politics and in 1879 was chosen mayor of his native city. In 1882 he was elected to parliament and proved an active worker on committees, speaking frequently and well on foreign and colonial affairs, railway, agricultural, social and fiscal problems. In 1891, as member of the committee of inquiry on Eritrea, he opposed the African policy of both the Crispi and the Rudini Cabinets. When in the following year Sig. Giolitti became premier, the Marquis di San Giuliano was selected as undersecretary for agriculture, while in the Pelloux ministry (1899–1900) he held the portfolio of posts and telegraphs. During the next few years he devoted himself to travel in the near East and in North Africa and to the study of the problems concerning those regions. Having been defeated at the elections of 1904, he was nominated senator; in parliament he had long been a staunch follower of Sig. Sonnino; but when, in Dec. 1905, Sig. Fortis became prime minister, he accepted the post of minister for foreign affairs, and on the fall of the Cabinet early in 1906 he was appointed ambassador in London, where he remained until 1910, gaining much popularity and contributing to render Anglo-Italian relations ever more cordial. He enjoyed the special regard of the late King Edward VII., who afterwards visited him at Catania. From London he was transferred to Paris; but he soon returned to the Consulta as member of the Luzzatti Cabinet (1910–11), and continued at the same post in Sig. Giolitti's administration. In the autumn of 1911 the crisis with Turkey broke out, and it is believed that it was he who convinced the premier of the national necessity for the Italian occupation of Libya. During the whole tenure of office the Marquis di San Giuliano was an ardent believer in the Triple Alliance, on which he thought that Italy's foreign policy should be based, and attached the greatest importance to a good understanding with Austria, an attitude not calculated to win him popularity in many circles; under his guidance consequently Italy opposed Serbia's desire for a port on the Adriatic and Greece's aspirations in Epirus, and supported the policy of creating an independent Albanian State. On Giolitti's resignation in March 1914, San Giuliano retained office under Sig. Salandra, at the latter's urgent request, and was soon faced by the responsibilities arising out of the outbreak of the World War. Public opinion was inclined to attribute the declaration of Italian neutrality to the premier rather than to the minister for foreign affairs. But it is certain that, once the decision had been taken, the Marquis di San Giuliano carried out the policy it involved with the most complete loyalty.

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The strain and overwork, however, of the three years of office together with grief at the death of his only son in 1912, had told on his constitution; and after an acute attack of gout, he died in harness at the Consulta on Oct. 16 1914. He was a man of wide literary, historical and artistic culture, a Dante student, and the author of several books and articles on social questions, the conditions of Sicily, foreign affairs, etc.; his *Lettere dall'Albania* are deservedly appreciated, and his geographical studies led to his being elected president of the Italian geographical society.

SAN MARINO (*see* 24.153), area 38 sq.m., had in 1920 a pop. of 12,069. The estimated revenue for the year ending March 31 1921 amounted to 34 million lire, derived mainly from customs; tobacco, matches and salt monopolies; and taxes on patrimonial estates and on urban and rural lands and buildings. There is no public debt. The regents (*Capitani Reggenti*) exercise executive power through four principal committees nominated from the supreme "Council of Twelve," viz.: a *Congresso Economico di Stato, dei Legali, degli Studi* and *Militare*. A "treaty of good relations and friendship" with the kingdom of Italy, concluded in 1897, was revised and renewed in 1908, 1914 and 1920. The republic has extradition treaties with England, Holland, Belgium and the United States and is represented by Consuls-General at Rome, London and Barcelona and by a *chargé d'affaires* at Paris. England also has an accredited representative resident in Florence. During the World War, though nominally neutral, the republic took a share in providing hospital equipment for the Italian front and put no obstacle in the way of her nationals volunteering for service in the Italian army. San Marino was represented on the International Radio-telegraphic Congress of Basle (1913) and had a wireless station (receiving only) on Monte Titano but, on the entry of Italy into the war, complications arising with Germany, it was dismantled and in 1920 had not been reinstalled.

SANTAYANA, GEORGE (1863–), American philosopher and writer, was born in Madrid, Spain, Dec. 16 1863. At the age of nine he came to America and was educated at Harvard (A.B. 1886; Ph.D. 1889), where he taught from 1889 to 1912 as instructor, assistant professor, and, after 1907, as professor of philosophy. He then retired to devote his time to literary work. In 1905 he was Hyde Lecturer at the Sorbonne. He was a member of the National Institute of Arts and Letters. His chief work is *The Life of Reason: or the Phases of Human Progress* (1905–6), 5 vols., entitled respectively *Reason in Common Sense; Reason in Society; Reason in Religion; Reason in Art* and *Reason in Science*. His other writings include: *Sonnets and Other Verses* (1894); *Lucifer, a Theological Tragedy* (1899); *Three Philosophical Poets* (1910); *Winds of Doctrine; Studies in Contemporary Opinion* (1913); *Egotism in German Philosophy* (1916) and *Character and Opinion in the United States; with Reminiscences of William James and Josiah Royce, and Academic Life in America* (1920).

SANTO DOMINGO (*see* 24.194).—The decade 1910–20 witnessed a succession of abrupt changes in the political status of Santo Domingo, accompanied by corresponding economic and social developments. The civil security and material well-being ushered in by the Dominican-American Convention of 1907 came to an end with the assassination of President Ramon Caceres on Nov. 19 1911. Gen. Alfredo M. Victoria, the dominant military figure, secured the selection of his uncle Eladio Victoria as president. Revolutionary outbreaks of the traditional type followed, culminating in the appointment of a special commission by the President of the United States, to aid in the reëstablishment of peace and order. Conferences resulted in the resignation of Victoria and the election of Archbishop Adolfo A. Nouel as provisional President. Friction developed, and on March 31 1913, Monsignor Nouel resigned and embarked for Europe. The Dominican Congress selected as provisional successor, Gen. José Bordas Baldez. Revolutionary disturbances again broke out and the United States once more lent its good offices by sending a commission, with whose advisory aid Dr. Ramon Baez was selected as provisional president Aug. 27 1914. Some months later Juan Isidro Jiménez was chosen as constitutional president. A brief period of peace and progress ensued, terminated in April 1916 by an outbreak led by Gen. Desiderio Arias (a chronic revolutionist from Monte Christi), which President Jiménez, aged and infirm, failed to check. Arias seized the military control of the capital, practically deposed Jiménez and assumed the executive power. With another civil war thus imminent, with its patience strained by the events of the preceding years, and with the international situation developed by the World War threatening foreign intervention, the United States now took definite action. Naval forces were landed. President Jiménez resigned the presidency and retired to Porto Rico, and in May–June 1916 the pacification of the country was effected with nothing more serious than minor encounters with revolutionary forces. On July 25 1916, the Dominican Congress selected Dr. Francisco Henriquez Carvajal as temporary president. The United States, refusing recognition until assured of the non-recurrence of civil disorder, proposed a new treaty based upon the convention just adopted between the United States and Haiti (*see* HAITI), which should repair the shortcomings of the 1907 convention in providing for the collection of customs under American auspices, the appointment of an American financial adviser and the establishment of a constabulary force officered by Americans. President Henriquez refused to enter into this arrangement, with a resultant deadlock intensified by the withholding by the American authorities of the revenues collected by its officers. Matters came to a head with Henriquez's intention not to retire from the presidency upon the expiration of his provisional term but to present himself as a probable successful candidate for popular election. On Nov. 29 1916 by proclamation of the American commander of the forces of occupation, Santo Domingo was placed under the military administration of the United States. Executive departments were taken over by American naval officers, ex-president Henriquez left the country, order was quickly established, and Santo Domingo entered upon four years of civil quiet and economic improvement. The termination of this status was foreshadowed Dec. 24 1920 by a proclamation of the military government that "the time has arrived when it may, with a due sense of its responsibility to the people of the Dominican Republic, inaugurate the simple processes of its rapid withdrawal from the responsibilities assumed in connexion with Dominican affairs." Announcement was made that a commission of representative Dominicans with a technical adviser was to be appointed, entrusted with the formulation of constitutional amendments and the revision of the laws of the republic, such proposals upon approval of the military governor to be submitted to a constitutional convention and to the national congress.

The economic experience of the country in the decade reflected closely the successive political changes outlined above. Agriculture continued the mainstay of the country's life; and cacao, sugar and tobacco leaf remained its staple crops. Increased production in the years following the convention of 1907 showed arrest in 1912–4 changing to abrupt increase in 1915. With the war-induced rise in prices and the conditions born of military occupation, the upward movement in export values continued through 1920, assuming sensational proportions in the last-named year. The combined volume of imports and exports was less in 1914 than in 1911; but the increase in 1915 over 1914 was greater than the total exports in 1905, and the increase in 1916 over 1915 was almost as much as the combined exports and imports of 1905. The combined value of imports and exports was $105,257,117 in 1920, as compared with $61,621,019 in 1919 and $17,945,208, in 1911. An increasing proportion of this trade has been with the United States, 77·17 % of imports and 87·03 % of exports in 1919, as compared with 59·29 and 52·31 % respectively, in 1911. In the first half of the decade political disturbances delayed the course of financial extrication ensured by the convention of 1907; but after 1916 rapid progress was made. On Dec. 31 1920, the sinking fund established for the $20,000,000 U.S. customs administration loan amounted to $11,457,373, ensuring amortization long before maturity. A loan of $1,500,000 authorized by the United States to discharge internal debts contracted in 1911–2 was finally liquidated in 1917. A further issue of $4,000,000 authorized in 1918 to liquidate and fund all outstanding internal indebtedness, as adjusted by a claims commission appointed by the military government, will be paid off by Dec. 31 1922. Economic and social conditions, although suffering from the political agitation prior to 1916, remained throughout far above the preconvention state. Since the military administration progress was notable. Roads and bridges were built, schools established, public sanitation extended, steps taken to clear up the complicated land title situation, internal taxation made effective and competence and regularity introduced in administrative service. Whether this was achieved at the expense of weakened capacity for

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self-government may be doubted. The policy of the United States was to make evident to the best elements in Santo Domingo what honesty and efficiency in administration could accomplish, as well as the futility and cost of "government by revolution."

The military government of Santo Domingo completed in 1921 the first census ever taken of the republic, and reported the number of inhabitants as 897,405. The population is scattered chiefly in a fringe along the shore and in the Cibao Valley especially in the region thereof known as the Royal Plain. In the mountainous interiors are vast uninhabited stretches and valleys which have not been visited since the days of the Conquest.

See Otto Schoenrich, *Santo Domingo: A Country with a Future* (1918); Report of Military Governor on Conditions in Santo Domingo, in *Annual Report of Secretary of the Navy* (1920). (J. H. Ho.)

SARGENT, JOHN SINGER (1856–), Anglo-American artist (*see* 24.219), exhibited in 1910 the open-air paintings "Albanian Olive Gatherers," "Glacier Streams," "A Garden at Corfu" and "Vespers." In 1911 appeared "A Waterfall" and "The Loggia." His portrait of Henry James was exhibited in 1914, and was one of the pictures damaged in that year by suffragette attacks. He contributed in 1915 a blank canvas to a Red Cross sale at Christie's, which was secured by Sir Hugh Lane just before his death for £10,000. In Dec. 1916 the third series of his mural decorations in the Boston Public Library was unveiled. This concluding series is entitled "The Theme of the Madonna." The first series (1895) depicts "The Judaic Development"; the second (1903), "The Dogma of the Redemption." The theme of the whole is "Judaism and Christianity." In 1917 he was elected a trustee of the Tate Gallery. During the World War he made a number of paintings of scenes on the western front; and his large picture "Gassed" in the Royal Academy in 1919 attracted great attention. In Nov. 1921 his decorations in the rotunda of the Boston Museum of Fine Arts were unveiled.

SARRAIL, MAURICE PAUL EMMANUEL (1856–), French General, was born at Carcassonne (Aude) April 6 1856. He qualified for both St. Cyr, and the École Polytechnique but chose to enter the former. He passed out Oct. 1 1877 with the distinction of third place and was posted as a sub-lieutenant to the infantry. His regimental service and promotion followed the normal course; he became lieutenant Oct. 1882, captain in 1887, and *chef-de-bataillon* in 1897. In 1901 he was appointed Commandant of the École Militaire d'Infanterie (St. Maixent), and the following year was promoted lieutenant-colonel. From 1904 to 1906 he held the appointment of Military Commandant of the Palais Bourbon, being made colonel in 1905. In 1907 he became Director of Infantry at the War Office—an appointment which he held 4 years. He was made general-of-brigade in 1908. Three years later he was promoted general-of-division and on Nov. 1 1913 was given command of the VIII. Army Corps, being later (April 24 1914) transferred to the VI. Corps, which he commanded on the outbreak of the World War. But though General Sarrail's military capacity was recognized prior to 1914 it was principally by his semi-political activities that he was best known; and as a member of General André's military cabinet he played a conspicuous part during a very troubled period of French army history. On Sept. 2 1914, after commanding the VI. Corps with credit in the Battle of the Frontiers, he was appointed to succeed Ruffey as commander of the III. Army. This army formed the pivot of the wheel-back of the Allied forces during the retreat to the Marne, and Sarrail maintained it as such on the N.W. front of Verdun, although authorized and indeed ordered to fall back. This left him in an exposed position, but one in which the swinging-in enemy himself might present a flank to Sarrail's attack. His part in bringing about the situation which enabled Joffre to counter-attack was thus as important and as brilliant as Gallieni's on the other flank. During the trench-warfare operations of 1914–15, however, he was less successful, as he was essentially a leader of temperament, and growing friction with Joffre led to his dismissal from this command after the action of Bourdeilles. Almost immediately thereafter, under circumstances described in the article SALONIKA CAMPAIGNS, Sarrail was appointed Commander of the French Army of the East, and at a later date he became commander-in-chief of the Allied forces on that front. The troubled history of this command, which lasted till his recall in Dec. 1917, is told in the article referred to. After his return to France he saw no further active service. In April 1918 he was placed on the reserve on reaching the age limit. He became a Grand Officer of the Legion of Honour in Nov. 1914 and was awarded a Grand Cross of the same Order in Jan. 1916. He was given the Médaille Militaire in Sept. 1917. Soon after the end of the war he published his account of the Salonika operations under the title *Mon Commandement en Orient*.

SASKATCHEWAN (*see* 24.225).—This Canadian province includes 243,382 sq.m. of land area and 8,318 sq. m. of water; 251,700 sq. m. in all. Its southern boundary is the 49th parallel and its northern the 60th: it is 390 m. from E. to W. and 760 m. from N. to S. The province comprises portions of the old districts of Assiniboia, Saskatchewan and Athabasca, which formed part of the old North-West Territories, with the town of Regina as the capital and the residence of the lieutenant-governor.

The province may be divided into four more or less well-defined zones. (1) The prairie zone forms the most southerly portion, extending from the U.S. boundary as far N. as the town of Saskatoon, and marked by open rolling prairie country of the richest possible agricultural character. (2) The prairie and woodland zone extends from Saskatoon to the southern edge of the great northern forest, consisting of mixed prairie country and woodland adapted for farming and stock-raising. (3) A dense forest zone is bounded on the S. by a line passing from the Swan river in a N.W. direction near the town of Prince Albert, and on the N. by a line drawn from the northern part of Reindeer lake to the southern part of Lake Athabasca. This zone is well watered and well timbered, being covered with a forest growth of spruce, tamarack, jack pine, poplar and birch. (4) The sparsely wooded forest zone includes the remainder of the country northward.

The geology of Saskatchewan is simple. Formations of very ancient, highly crystalline, contorted and foliated or schistose rocks, together with metamorphic rocks and eruptives, form a floor or basement complex referable to the Laurentian and Huronian systems, and upon this floor of primitive rocks there rests unconformably an uninterrupted succession of evenly bedded and for the most part stratified sedimentary formations ranging from the Keweenawan of supposed Cambrian age, through the palæozoic and mesozoic, to the Tertiary and Quaternary ages inclusive.

The province has an elevation of from 1,500 to 3,000 ft. above sea-level, which accounts for the dryness and clearness of the atmosphere. As in southern Alberta, portions of the country need irrigation, and the requirements of water and the sources of supply are problems being dealt with by the several governments interested.

The following table shows the growth of pop. since 1901:—

	Male	Female	Total
1901	49,431	41,848	91,279
1906	152,791	104,972	257,763
1911	291,730	202,702	494,432
1916	363,787	284,048	647,835

In 1916 the urban and rural pops. were 176,297 and 471,538 respectively. The census showed 150,292 families with an average of 4·31 persons per family housed in 140,359 dwellings. The origins were: Canadian-born 352,920; English 90,435; Irish 62,551; Scotch 64,735; Welsh 1,451; French 24,011; German 34,091; Austro-Hungarian 24,195; Scandinavian 13,064; Dutch 5,448; Indian 10,736; Polish 2,559; Russian 11,623; Ukrainian 2,175; others 8,806. The U.S. immigrants of various nationalities born in the United States were 87,907; of these 46% were British descendants. There is a largish community of Russian Doukhobors. The Indians of Saskatchewan are chiefly plain or wood Crees, with a mixture among them of Saulteaux. Towards the S. small bands of Assiniboines are found, and here and there small companies of refugee Sioux from the United States. They number 10,736 and are all on Government reserves. Steady progress had been made in enabling the Indians to become self-supporting, and to live in comfortable houses, growing crops of grain, making hay and possessing herds of cattle. At the various industrial schools young Indians, both male and female, receive a practical education.

Regina, on the main line of the C.P.R., is the capital, and had in 1920 a pop. estimated at 27,000. It was formerly the headquarters of the Royal Northwest Mounted Police. It contains the provincial legislature buildings, one of the provincial normal schools and the Regina College.

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Moose Jaw (estimated pop. in 1920, 17,000) is situated on the main line of the C.P.R. It has extensive stock-yards and flour-mills, also a storage elevator with a capacity of about 3,500,000 bushels.

Prince Albert, on the banks of the North Saskatchewan (pop. in 1920 about 7,000), bids fair to become a manufacturing centre. It contains large sawmills and flour-mills, and is the centre for the fur-trading industry.

Saskatoon (pop. 1920, 22,000) has been one of the rapid urban growths of the Middle West. It is an important railway and distributing centre, through which the C.P.R. and two Canadian National railways pass. Tributary to the town is a large area of arable and prairie land.

North Battleford, Swift Current, Weyburn, Battleford, Maple Creek, Melville, Estevan, Yorkton, Humboldt, Indian Head, Moosomin, Qu'Appelle, Kamsack, Rosthern and Wolseley are local centres, deriving their importance chiefly from their situation in the midst of rich agricultural districts.

The executive Council of Saskatchewan consists of 7 members and the Legislative Assembly of 62 members. The province is represented in the Federal Parliament by 16 members of the House of Commons and 6 senators.

Education, both primary and secondary, receives earnest attention from the Government. The schools are free and supported by the Government and local taxation. Collegiate institutes and high schools are found in every important centre. Normal schools for the training of teachers are maintained at Regina and Saskatoon. The university of Saskatchewan at Saskatoon is supported and controlled by the province. In connexion with it is the agricultural college, which is well equipped for its special purpose and conducts very practical work among the farmers of the province. Saskatchewan schools in 1918 numbered 3,941 and maintained 6,062 teachers. The total enrolment in that year was 147,232, and the entire cost of administration $9,110,925 (in 1906 it was $1,465,361).

The province is essentially agricultural. The soil, made up of the detritus or debris of a great variety of rock materials and rich in natural phosphates, is characterized by its ability to produce a high average yield of wheat, oats, barley and potatoes for many years in succession without the application of artificial fertilizers. From experiments carried on at Indian Head—the headquarters of the experimental farm subsidized by the Dominion Government—it has been ascertained that the high average yields of wheat, oats, barley and potatoes on that farm are not only maintained from year to year, but are actually larger than at any of the other Dominion experimental farms scattered throughout Canada.

Saskatchewan has probably the greatest possibilities of production of all the provinces in the Dominion. Of the land area of 243,382 sq. m. a little over 25,000 were under crop in 1918, and it is estimated that, apart from forest land requiring clearing, 112,000 sq. m. are suitable for agriculture. In its southern parts the returns equal those of Manitoba, which have been regarded as exceptional. On the average of 1915–7 the yield was 163,264,100 bus. of wheat at a total value of $207,590,833. The limited area under cultivation yields a grain crop exceeding 350,000,000 bus. in a single year. The following are yields and values for the year 1920: wheat 113,387,300 bus., value $175,700,000; oats 141,590,000 bus., value $58,035,000; barley 10,501,000 bus., value $6,931,000; rye 2,535,000 bus., value $3,194,000; mixed grains 615,000 bus., value $769,000; flax-seed 5,705,000 bus., value $10,383,000; potatoes 6,861,000 bus., value $8,576,000; turnips, etc., 3,145.000 bus., value $2,956,000; hay and clover 328,300 tons, value $3,283,000.

With the exception of wheat and oats, the field crops are mainly grown for home consumption in stock-raising. The erection of silos in connexion with well-appointed farm buildings indicates the improvement of methods and the growing prosperity of farmers. The cattle industry of Saskatchewan has reached a very important place. There are many large herds scattered throughout the province, subsisting for a large portion of the year on native grasses and for the remainder of the year—the winter months—on outdoor feeding. So rapidly has the cattle industry advanced in the past few years that it has been found necessary to establish large stock-yards at Prince Albert and Moose Jaw. Dairying, naturally associated with the cattle industry, is making rapid progress, and at important points in the province are established up-to-date creameries. The output of dairy and creamery butter for one year amounted to 19,368,668 lbs., valued at $6,192,213, to which is to be added milk and cream to the value of $7,450,000, or a total of $13,642,213. In 1907 there were only four creameries in operation with 213 patrons, and in 1920 there were 20 creameries with 7,500 patrons and in addition four cold-storage plants. The raising of sheep has become general throughout the province, particularly in the northern part, where the conditions are most favourable.

The lumbering district of Saskatchewan lies N. of Prince Albert. Trees consist mainly of spruce, larch, jack pine, white and black poplar and white birch. Much of the timber is used for railway ties, and the recent annual cut amounted in value to about $2,000,000 a year. In the northern section of the province the Dominion Government set aside a number of large areas as forest reserves. The forests of the north still abound in fur-bearing animals, the principal being bear, otter, beaver, marten, wolf and mink. Prince Albert and Battleford are local centres of the fur trade, the annual value of which is about $1,450,000.

Manufacturing industries are not yet important in Saskatchewan. There are a number of flour-mills throughout the province, and the making of cement and bricks is coming more and more into prominence. Coal-mining, however, promises to be the principal industry of the province. Mining has been carried on for several years in the vicinity of Estevan. The lignite deposits of Saskatchewan, which underlie an area of 7,500 sq. m. and are estimated to contain 200,000,000 tons of lignite coal, were in 1920 being experimented with by processes of carbonization and briquetting. Gold, silver, copper, cobalt, iron, mica, peat, pigments, ochres and natural gas are among the mineral resources of the province. The value of minerals raised in 1919 was $1,118,055. The fisheries of Saskatchewan are still in their infancy. The lakes and rivers of northern and central Saskatchewan abound in fish sufficient to supply millions of people. The value of the fisheries in 1919 was $475,797.

For more than 30 years up to 1921 the main line of the C.P.R. had crossed the province of Saskatchewan from E. to W., about 100 m. N. of the border of the United States. One of its most important branches is the "Soo" line from Moose Jaw to St. Paul, Minn. Its lines to Edmonton and Lacombe, Alberta, have daily increasing traffic and passenger service. The main lines of the Canadian National railways also cross the province, with many branches tapping its rich agricultural districts. Saskatchewan has now over 6,000 m. of railway. The province is so well served by the C.P.R. and the Canadian National railways, with their numerous branches, that few of the established settlements are more than 10 to 20 m. from a means of transport. The Hudson Bay railway when completed will afford a short haul to ocean shipping from the Saskatchewan grain-fields. The building of roads and bridges within the province has been taken up energetically by the Government, and large sums have been expended. (W. L. G.*)

SAVAGE, MINOT JUDSON (1841–1918), American divine and author (*see* 24.239), died in Boston, Mass., May 22 1918.

SAVINGS MOVEMENT.—The origin and development of what became known in England as the "War Savings Movement" provides the subject-matter of one of the most interesting chapters in the economic history of the World War. In the United States, to which reference is made in a subsequent section, the Savings and Economy movement was no less remarkable.

United Kingdom

Institutions for the normal encouragement of thrift on the part of the people of the United Kingdom were making steady progress up to the date of the outbreak of the war in 1914. From that date onwards the pace of their advance was materially accelerated. The amount due to depositors in the Post Office Savings Bank increased 28% in the decade 1903–13, while during the five years 1913–8 they increased by 42%. The amount due to depositors in the Trustee Savings Banks increased 3·2% in the decade 1903–13, while during the years 1913–20 it increased by 12·5%. These figures give a general indication of the growth of the savings of the people during the war period, but they do not tell the whole story. In the atmosphere created by the War Savings movement, and in the circumstances which for a time materially improved the financial position of the wage-earning classes, not only did existing savings institutions develop rapidly, but a new national thrift machinery was brought into being and its operations met with remarkable success.

Cost of the World War.—Within six months of the outbreak of hostilities in Aug. 1914, it became evident to those who were more closely in touch with realities that the World War would be a prolonged struggle, in which it would be necessary for the combatant nations to marshal their entire resources of production. Modern warfare was seen to demand not only that there should be a high percentage of the population in the fighting forces, but also large numbers of civilians producing on a huge scale military equipment of the most varied character. The enormous volume of goods and services which had to be requisitioned is best expressed in terms of the national expenditure. The largest amount spent by Great Britain in war in a single year before 1914 was £71,000,000. The Revolutionary and Napoleonic wars cost in the aggregate £831,000,000 spread

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over 20 years, an average annual expenditure of £42,000,000; the Crimean War cost £675,000,000 in three financial years, or an average annual expenditure of £225,000,000; while the S. African War of 1899–1902 cost £211,000,000 spread over four years. In the face of the expenditure during the World War of 1914–9, these figures are insignificant. The money spent by the Government of Great Britain during the five financial years cannot be placed at less than from £8,000,000,000 to £9,000,000,000. At one period the average daily expenditure rose to the enormous figure of nearly £7,000,000 sterling.

It was not, however, till the year 1915 was well advanced that the full meaning of the cost of the World War in terms of goods and services began to be appreciated, even by those in high places. During the first few months of the war the inevitable dislocation of industry caused by the calling-up of men of military age and the interference with the normal markets led to a considerable amount of unemployment, and steps were taken by the Government and by the public for the relief of distress. This period of unemployment lasted but a short time and far less distress was caused than had been anticipated. The increased demand for men for the fighting forces and the rapid organization of special war work in many directions quickly absorbed the unemployed. Women were drafted into industry in ever-increasing numbers. In the meantime, the normal production of goods was reduced and stocks diminished. Prices rose rapidly owing to the excess of demand over supply and wages were raised sympathetically. Gradually a large amount of overtime became general, and, in many instances, owing to several members of the same family being in receipt of good wages and on account of overtime, the incomes of working-class families reached very substantial figures. By the summer of 1915 the purchasing power of the people of the country had been very considerably increased.

With the increased demand for goods which followed this rise of the purchasing power of the masses, prices mounted still higher; and with the growth of credit, which was required to cover the increased payments of wages, a dangerous situation was created. By the middle of 1915 it was obvious that it was of paramount importance that the personal expenditure of the people of the country should be checked, and that, in fact, the stopping of individual expenditure was quite as important as the raising of money for the war. It was seen that while from the financial point of view it was desirable that the expenditure on the war should be covered as far as possible by monies raised by taxation, and next by loans from money saved by the people of the country, it was equally important that the mass of the people should reduce their personal expenditure in order to release the resources of the country in capital and labour for the production of the essentials of war. The military advisers of the nation were calling for still larger numbers of men for the fighting forces. Recruiting became more and more urgent. The war factories were crying out for tens of thousands of hands for the production of the vast stores needed on all the fighting fronts. At the same time, the demand of the people through their daily expenditure, stimulated by high wages and big incomes, was automatically retaining labour in the production of things which were not only not necessary for their subsistence, but were often mere luxuries. Again, the expenditure of individuals tended to increase the purchase of imported goods, necessitating either increased exports demanding labour for their production, or adversely affecting the Exchanges and necessitating the export of gold or the sale of foreign securities. The real difficulty of the situation was seen to be the scarcity of human labour to produce the necessaries of war rather than the finding of money to pay for them. Thus the exigencies of the recruiting agencies and national factories led directly to the "goods and services" point of view and to an imperative demand for personal saving.

The dangers of the situation were emphasized by Mr. Lloyd George in May 1915, and it soon became evident that drastic steps would have to be taken to enforce economy throughout all ranks of the community and particularly among the wage-earners, whose aggregate purchasing power had reached dimensions which made their personal expenditure the largest factor in the situation.

Early Efforts for Saving.— During the autumn of 1915, a vigorous mission was undertaken by a voluntary body known as the United Workers, who by the holding of lectures and meetings throughout the country did much to explain the facts to the people and prepared the ground for more concentrated effort later. About the same date a Parliamentary War Savings Committee was established, and through its efforts local war thrift committees were set up in a number of the larger towns of the country. All these efforts were, however, to a large extent ineffective, owing to the absence of any form of investment security specially adapted for persons of small means. The machinery of the Post Office Savings Bank and the Trustee Savings Banks, allowing for deposits at low interest, was inadequate to cope with the situation.

The history of the Post Office Savings Bank during the first year of the war fairly accurately indicates the trend of events. The outbreak of the war saw a sharp run on the Post Office Savings Bank deposits, a run accentuated by the actual shortage of coinage which persisted even up to the end of August. The net withdrawals from the Post Office Savings Bank Department from the declaration of war to the end of Aug. were £2,500,000 in excess of deposits. After Aug. 1914 confidence was quickly restored and deposits began to come in freely. Before the end of Sept. they had exceeded the withdrawals, and so completely did the tide turn that the deposits for the three months ended April 30 1915 exceeded the withdrawals by £4,400,000, or were £3,000,000 in excess of deposits in the corresponding quarter of 1914. For the five months from Jan. 1 1915 to May 31 1915, the balance due to depositors increased by over £6,500,000 as compared with an increase of £1,700,000 during the corresponding period of 1914.

Good as these results were in themselves, it became, however, increasingly clear that the Post Office Savings Bank alone, with the rate of interest on deposits at 2½%, was not sufficient to stimulate saving in the country to the extent that was necessary. Several times pressure was brought to bear on the Government with a view to getting the interest on the savings bank deposits increased, but this pressure was resisted. Other small attempts were made to attract saving. During the issue of the 4½% War Loan in June 1915, scrip vouchers of 5s. and 10s. and scrip certificates of £1 and £5 were issued by the Post Office. The scrip vouchers, when they amounted to £5 or a multiple of £5, and the scrip certificates could be exchanged at any money order post-office during the first fortnight of Dec. 1915, the owner being duly registered as a holder of a corresponding amount of War Loan and being given a stock certificate. Interest was allowed on the scrip vouchers according to the month of purchase and provision was made for repurchase by the Post Office at face value of any vouchers in excess of the £5 multiple. The aggregate result was that, between Nov. 1915 and Dec. 1920, scrip certificates amounting to £3,967,965 and scrip vouchers amounting to £1,049,838 were exchanged for 4½% or 5% War Loan or Exchequer bonds. The £5 scrip certificates were only exchangeable for 4½% War Loan, but the scrip vouchers could be held for subsequent loans. These were the chief official steps taken to facilitate saving by the people up to the end of 1915. In Nov. of that year the Government was pressed to increase the maximum sum which depositors might pay into the Post Office Savings Bank in any one year, but it was pointed out that this would require fresh legislation, the existing limits having been fixed by the Savings Bank Acts of 1891 and 1893.

Expression had been given to the need for action in a letter to *The Times* in the summer of 1915 from "A Banker."[1] The force of his contentions was widely recognized, and this letter may be regarded as the germ from which the War Savings movement was started. This was followed by an important manifesto signed by some of the foremost men in the world of business published in *The Times* in November. It was a straight-

[1] The author was Mr. R. H. Brand, a partner in the London firm of Lazards, and a well-known writer on finance. (H. Ch.)

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forward statement calling the nation to thrift and urging concentration on the production of essentials only, eschewing non-essentials by universal personal economy.

Montagu Report.—Finally, in Dec. 1915, the Chancellor of the Exchequer (Mr. R. M'Kenna) set up a Committee under the chairmanship of the financial secretary to the Treasury (Mr. E. S. Montagu) to consider the question of getting contributions to War Loans from the working-classes. The final report of this Committee (Cd. 8179), dated Jan. 26 1916, marked the birth of the War Savings movement as a national organization.

An interim report had been issued on Dec. 28 1915, recommending the removal for the period of the war and six months after of the restrictions which limited the amount deposited by any one depositor in the Post Office and Trustee Savings Banks to £50 in any one year and £200 in all. The Committee also recommended that Exchequer bonds of the denominations of £5, £20 and £50 should be placed on sale at all post-offices, provision being made for the deposit of the bonds at the post-office and the issue of books in which the deposit of the bonds would be recorded. The Chancellor of the Exchequer recommended the adoption of these proposals and they were concurred in by a Treasury minute of the same date. Two series of bonds, with interest at the rate of 5% per annum and 6% per annum respectively, were on sale in 1916 and brought into the Exchequer nearly £44,000,000.

The final report of the Committee pointed out that there were two separate objects to be attained by the successful solution of the problem of the small investor: (*a*) the reduction of general consumption, which would tend to check the rise in prices; and (*b*) the raising of a certain amount of money for the prosecution of the war. The needs of the small investor were described as being: (*a*) a simple method of investing savings; (*b*) a guarantee that the capital value of the investment will not depreciate; (*c*) the ability to withdraw savings at short notice; and (*d*) the knowledge that as high a rate of interest is paid on the money of the small investor as on that of the large. It was further pointed out that both propaganda and organization were essential to success in making any appeal for savings. The report recommended the appointment of two committees—one to carry on propaganda and to establish on a large scale voluntary War Savings associations for coöperative saving, and the second to devise and approve various schemes of saving and to safeguard their financial soundness. In order to meet the needs of the small investor the Committee recommended the issue of a new form of Government security in the shape of "War Savings Deposits" of 15s. 6d. each, each deposit entitling the subscriber to receive £1 on the fifth anniversary of the date of the deposit.

National War Savings Committees.—The Chancellor of the Exchequer adopted the recommendations, and on Feb. 8 1916 the two committees were appointed. (These two committees were amalgamated in the following April under the title of the "National War Savings Committee," separate committees being established for Scotland and Ireland.)

War Savings Certificates.—On Feb. 19 1916, the projected savings deposits were issued under the revised title of "War Savings Certificates." The War Savings certificate must rank as one of the most ingenious and successful financial instruments ever conceived. For the first time in history a security was offered to the people which by its nature tended to concentrate the mind on the growth of capital value through the accumulation of interest, rather than on the annual return in the form of dividends. This feature of the "small investor's Treasury bill," as it has been called, has had, undoubtedly, a far-reaching psychological effect. It may be said to have projected the mind of the investor towards an ultimate personal use of the accumulated proceeds of his investment after a considerable term of years, and to have reduced the motive of investment merely as a means of providing an annual sum to be spent on its arrival. To the intrinsic merits of the certificate the success of the War Savings movement is, to a great extent, attributable. The certificates were purchasable for 15s. 6d. and could be cashed at any time. At the end of 12 months a certificate could be cashed for 15s. 9d. After this period its cash value increased by a penny a *month*, and at the end of five years it could be cashed for £1; that is to say, an additional 3d. was added to the value at the end of the fifth year beyond the increase of a penny a month. Subsequently, by Section 4 of the War Loans Act, 1919, the life of the certificates issued, or to be issued, was automatically increased to ten years, the value of the certificates rising after the end of the fifth year by a penny a month until the end of the tenth year, when a further 1s. would be added, making the final encashment value 26s. By the Finance Act, 1918, Section 41, and the War Loans Act, 1919, Section 4, it was provided that the encashment of certificates held by any individual owner could be postponed beyond the period of maturity until the maturity of the last-dated certificate in his possession, such certificates held over increasing in value at a flat rate of a penny a month. Section 42 of the Finance Act, 1916, provided that the accumulated interest payable in respect to any War Savings certificate issued by the Treasury through the Post Office, under which the purchaser by virtue of an immediate payment of 15s. 6d. became entitled after five years to receive the sum of £1, should not be liable to income tax so long as the amount of the certificates held by the purchaser did not exceed the amount for the time being authorized to be held under regulations made by the Treasury. To avoid the serious consequences which would result to the revenue if income taxpayers generally were to use this form of investment, it was originally arranged to confine the issue of War Savings certificates to persons whose total income from all sources did not exceed £300 a year. Experience, however, showed this limitation to be undesirable. The necessity for a declaration as to income at the time of the purchase of the certificates caused administrative difficulties, and by reason of the income limit many wage-earners who were temporarily drawing large wages were unable to buy certificates. In view of these facts, the Committee recommended the Treasury to abolish the income limit, and the restriction was removed on June 10 1916. All formalities in regard to deduction and recovery, proof of exemption or title to abatement from income tax were dispensed with, and a limit of 500 certificates was put on the number allowed to be held by any one person.

By the Finance Act of 1918, it was provided that if a person's holding was brought by inheritance above 500 £1 certificates or their equivalent, the excess might be held without liability to any penalty or to income tax, so long as the person did not purchase for his own benefit, or have purchased for him, any further certificates while holding more than 500 certificates in all.

The War Savings certificate was ingenious not only from the financial standpoint, but also in its form. The certificates were issued in books, upon the cover of which the name of the holder and his address had to be inscribed. The book was of no value except to the person whose name was written upon it. The certificate contained a small panel on its right-hand side, to which the receipt for the purchase price had to be affixed, and the certificate was not valid until this had been done. The receipt was printed on green paper, and each receipt had a number which became the official number of the certificate. The certificate was registered at the money order department of the Post Office as belonging to the particular individual in whose name it was issued. It was necessary to have the signature of the owner to prevent the certificate being cashed by any unauthorized person. In order to provide for this, the receipt which was affixed to the certificate was only the left-hand portion of an original form of receipt, while the right-hand portion, having upon it the corresponding number, had to be filled in by the applicant and handed back to the postmaster. This portion contained the full name and address and signature of the purchaser and formed the basis of the registration system. When the certificate was cashed at a later date, the number on the certificate and the signature of the applicant on the request for repayment could be compared with that portion of the receipt which had been filed. Certificates might be bought by one person on behalf, and in the name of, another person, the signature of the beneficial owner being, if possible, supplied. A cut-out signature from a letter or other document was accepted, but if a signature was not available, it was obtained later by the Post Office. In the case of children under seven years of age the signature was not required. After the receipt had been stuck in the certificate book and a certificate had thus been completed, it could only be transferred to another person in exceptional circumstances and by permission of the Postmaster-

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General. A fee of 1s. was charged in respect to each transferee. Certificates were not negotiable, and their value would not be paid to anyone but the holder whose signature was registered by the Post Office. Holders over 16 years of age could make nominations of their holdings in case of death. Every nomination had to be on a proper form, which could be obtained from the Controller of the money order department, and required to be received by the Controller during the lifetime of the holder. In addition to the receipts for the payment for single certificates costing 15s. 6d., each of which was stuck into a certificate book, single documents representing 12 or 25 certificates could be obtained from any money order post-office and most banks. These consisted of two parts divided by a perforation, the left-hand portion for registration, and the right-hand portion to be retained by the purchaser. Books were not supplied for these certificates. Documents were also issued for any number of certificates from 26 to 500, both inclusive. These were not kept at local post-offices, but were issued by the Controller and Accountant General of the Post Office, to whom application with remittance was made direct or through a bank. They were applied for on a special form and issued a day or two after receipt of the application. If a certificate, or book of certificates, were lost, a new certificate, or book of certificates, would be issued at a charge of 1s., provided the serial numbers could be furnished to the Controller of the money order department.

On Dec. 4 1920, the old print of War Savings certificates was withdrawn from sale at post-offices and banks, and on Dec. 6 "National Savings" certificates were substituted. The change was legalized by the Savings Bank Act of 1920, and was one of title only. The conditions attaching to the old certificates still applied.

The savings certificate formed the basis of the operations of the War Savings associations, which were established under the auspices of local War Savings committees and affiliated to the National War Savings Committee.

War Savings Associations.—Not less important than the War Savings certificate was the system of association, or club, proposed by the Montagu Committee. In their final report the Committee pointed out that the would-be investor should not, if it could be avoided, be left to himself to seek for an investment. Facilities for investment should be provided by agencies in close touch with him; and these agencies, having succeeded in inducing him to save, should endeavour by careful propaganda and by thorough organization to persuade him to make the continuance of saving a matter of habit. The Committee emphasized the advantages of placing an agency between the small investor and the State which could collect and manage the savings of the small investor. It was pointed out that the Government could enter into no contractual relationship with the individual investor, unless it assumed complete control over the schemes adopted and also supervised in detail the actual administration of the societies themselves. They added that the organization of such control and supervision would require the creation of a new Government department, which, apart from the question of the expense involved, it would have been impossible to staff during the war. Also, the rigidity of procedure which a State system would inevitably involve would be fatal to the free local initiative on which the success of such a scheme would depend. At the same time, if societies, many of which have at their command no expert financial knowledge, were left free to develop schemes without supervision or control, some of them would not unlikely become insolvent. The problem was to obtain the best safeguards which could be secured for the financial soundness and efficient administration of the different schemes, while leaving the responsibility for both administration and results with the societies themselves, and they recommended that the committee which should be appointed by the Government, and to which the various investment societies might be affiliated, should be regarded, not as representing the Government, but as an independent body of experts acting on behalf of the societies themselves. Its duties would be primarily of an advisory character, but it could properly refuse to recognize any society the constitution and rules of which it did not approve and withdraw recognition from any society which might fail to satisfy the committee that it was being properly administered. The committee could, if it saw fit, organize a system of inspection and audit of the operations and accounts of the affiliated societies and by these means secure a very substantial measure of control over their operations.

Local War Savings Committees.—In accordance with these views, the War Savings Committee embarked upon a widespread scheme for the promotion of savings associations, delegating the propagandist work in a large measure to local committees which were set up throughout the country. Before the war was over there were in existence in England and Wales 60 county committees and 1,840 local war savings committees acting as propagandist agencies under the general control of the central body, while the War Savings associations set up under their auspices numbered over 40,000 with a membership of approximately 4,000,000 people. (At the end of 1920 there were still 1,701 local committees and over 28,000 associations.) A savings association could be formed by any number of people who were willing to work together to secure the attainment of its objects. In practice it was found that an association could readily be formed by those who were already corporate in some way; for example, by those who were members of a trade union, a friendly society or a coöperative society, by fellow workers in a shop or factory, or by the members of a church, chapel or social club. Each association had its governing committee, secretary and treasurer.

Scotland and Ireland, with their separate organizations, developed the movement on similar lines. The total number of voluntary workers in the movement was estimated to be between 200,000 and 250,000.

Official Agents.—By the end of 1917, when nearly 30,000 War Savings associations had been affiliated, there had been established on an average one association for every 1,200 inhabitants in England and Wales. Most of the social and industrial groups were covered, but it was realized that a large section of the wage-earning population and, possibly, the most highly paid, did not readily join War Savings associations. Many employees objected to joining associations to whose books their employers might have access. They were of opinion that knowledge of the fact that they were saving money might tend to diminish the force of any claim they might make for enhanced wages on account of the increased cost of living. With a view to reaching the prospective small investors of this class, it was decided to add to the number of places where War Savings certificates and National War Bonds could be bought. Certificates were on sale at all money order offices and at most banks, but the majority of the class of persons under consideration had no banking account and had no reason to enter a bank. The Post Office staff was obviously unable to make any special effort to push the sale of Government securities, having regard to the heavy mortgage on their time caused by the manifold additional duties which the exigencies of the war period cast upon them. It was therefore arranged to license certain tradesmen and firms as official agents for the sale of certificates and bonds. These agents purchased the securities outright with their own funds and received the certificates and bonds dated, but unregistered. They then resold the certificates and bonds to their customers and others. By the end of the war, these securities were on sale at more than 14,000 shops and other establishments throughout the country. Very large numbers of certificates in the aggregate were sold in this way. The success of the system is noteworthy in that it involved the sacrifice by the official agents of the interest upon the capital used for the purchase of stocks of certificates between the dates of purchase and sale.

Savings Schemes.—The National Committee, following the guidance of the Montagu Committee, had also set itself the task of preparing various model schemes of coöperative saving to meet the requirements of the people. The following schemes were evolved at various times:—

Scheme 1.—Money subscribed through a savings association was invested in Post Office Exchequer bonds. For each £5 Exchequer Bond a subscriber paid 2s. a week for 50 weeks, or 10s. a month for 10 months. All sums subscribed were remitted to the Treasury each week, the Treasury paying interest on the amounts received at the rate of 5% per annum. The bonds and cash payments due to members were distributed half-yearly, *e.g.* in the case of subscriptions beginning May 1916 bonds and cash were distributed June 1 1917, weekly subscribers receiving a cash payment of 2s., and monthly subscribers 1s. 9d. The cash distributed was free of income tax, but had to be included in the income-tax return of mem-

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bers. It could be paid at the Post Office or could be credited to an account in a savings bank. This scheme was not adopted on a wide scale and was abandoned at a later date. Schemes involving subscriptions for certificates were found in practice to be more popular and more easily worked.

Scheme 2A.—Monies subscribed through an association are invested in War Savings certificates. Subscriptions of 6d. or any number of sixpences are accepted. War Savings certificates are purchased from the Post Office with the cash received by the secretary from the members, and they are dated at the time of purchase, but they are not registered. Each member when he pays his first subscription is given a book. His subscriptions are entered in the book as and when they are paid. When the subscription of any member amounts to 15s. 6d., he is given a certificate and the registration portion of the certificate is then filled in and lodged at the Post Office. The method of distributing certificates of different dates and consequently of different encashment values is settled by the committee of each association. Members can withdraw before reaching the full 15s. 6d. and the amount deposited is repaid, but without interest. The advantage of the scheme lies in this, that if 31 people individually save 6d. a week for 31 weeks, they will each have a certificate at the end of 31 weeks, but if they join an association to which they pay 6d. a week, the association is able to buy one certificate each week, and at the end of 31 weeks it will have 31 certificates. The first of these certificates is dated 30 weeks earlier than a certificate bought by any member acting alone. On the average, they will be dated 15 weeks earlier and consequently will mature 15 weeks earlier. The books are provided free of cost by the National Committee. The book-keeping is necessarily somewhat detailed, but it is essential for the protection of members.

This scheme was probably the most widely adopted.

Scheme 2B is similar to Scheme 2A, but the certificates are not distributed until one year after the subscriptions of any member amount to 15s. 6d. The scheme was not widely adopted, people preferring to get their certificates immediately they had made up their 15s. 6d.

Scheme 3 is in essence a savings bank—all the money received being invested in War Savings certificates. The minimum subscription is one penny. Any number of pennies are accepted. Subscriptions are withdrawable at 14 days' notice, or without notice in urgent cases. Each member has a book in which subscriptions are entered. On the completion of the payment of 15s. 6d. the member is registered as being entitled to the payment of £1 at the end of five years. The certificates are not distributed but are held by the association until they mature. A few associations in schools adopted this scheme, but after a time the majority ended by distributing the certificates to their members and adopting Scheme 2A.

Scheme 4 was a scheme for investment by instalments in Exchequer bonds and War Savings certificates, the Treasury paying interest on the amounts received at 5% per annum. During the war no part of the amounts paid into the Treasury were withdrawable in cash. When an Exchequer bond or certificate was fully paid for the Treasury issued the security to the association for delivery to the member entitled to it, the cost of the securities being charged to the amount standing to the credit of the association with the Treasury. Cash was to be returned to the association three months after the end of the war. This scheme was not found satisfactory and was little adopted.

Scheme 5 is a scheme similar in principle to Scheme 2A, but subscriptions are paid by buying from the association sixpenny coupons. The coupons are of a special "Swastika" design and can only be used for subscribing to associations by whom they are issued. The association is supplied on credit with coupons issued by the Central Committee and these have to be accounted for. The association overprints its coupons with its own serial number. Members get a coupon for each 6d. and place the coupon on a card. When the card is full it is exchanged for one of the certificates already purchased by the combined subscriptions of the members. As full cards of coupons come in they are sent to the Central Office in reduction of the association's liability for those supplied on credit. (At a later date the coupons were issued to the associations in the standing imprest system.) This scheme involved little or no ordinary book-keeping. A register of the issue of certificates was kept. The only clerical work involved of necessity was the keeping of a careful stock of the coupons. The scheme was adopted on a large scale and by some of the largest associations. As a general rule, local committees handled the distribution of the coupons in their districts. This threw a heavy burden on the local secretaries. Considerable difficulty was experienced in many instances in clearing coupon stock accounts, and the distribution of coupons on an enormous scale threw a large amount of work on the head office. The scheme is gradually being replaced by a more simple system of cards and savings stamps procurable from any post-office.

Scheme 6 is a special scheme under which employers purchase certificates in advance for employees with their own funds. The certificates are purchased in blank, that is to say, unregistered, and sold to the employees by any form of instalment system preferred. The employer in effect makes a free grant to his employees of the interest accruing on the money between the date of purchase and the date of sale.

Scheme 7 is a development of an earlier system under which the Post Office issued cards upon which 31 ordinary sixpenny postage stamps could be affixed by anyone. A card when filled with stamps was exchangeable at any money order office for a War Savings certificate. There was no advantage from coöperation. It was merely a simple device to enable people to save the money for a certificate by instalments of 6d. each.

When the Armistice was signed the National Committee gave careful consideration to devise some alternative scheme to avoid the heavy clerical labour entailed in the working of Schemes 2A, 2B, 3 and 5. This labour had been obtainable during the war on a voluntary basis and it is possible that the very labour itself indirectly assisted the movement in its early days in that it gave the officials of associations the knowledge that they were doing something definite for the benefit of the country in wartime. In 1918, the Post Office agreed to the issue of a distinctive adhesive war savings stamp with the Britannia head design. This stamp was placed on sale at all post-offices. Special savings cards containing 31 spaces were issued to savings associations. Treasurers and secretaries of associations provided themselves with stocks of the stamps, which they were authorized to procure as credit stocks, and they issued these to their members for cash. With the cash they purchased more stamps. The cards when filled were exchangeable for certificates at any money order office, and savings stamps purchased at any post-office or through any agency could be used. The scheme possessed considerable elasticity, as it enabled members of one association on transferring their residence to join another association and complete their subscriptions, or they could fill their cards with stamps purchased anywhere and exchange them for certificates anywhere. The disadvantage lay in the absence of the benefit of the early dating of certificates which was given by the other schemes—an advantage which, it was found in practice, was so generally appreciated that the new scheme, in spite of the saving of labour to the officials of associations, was not widely adopted. After considerable thought the scheme was revised and early in 1921 a system was introduced which, while maintaining the simplicity of Scheme 7, also gave the benefit of the early dating of certificates. The predating of certificates is secured by the use of date labels. The date labels (printed in pairs) are supplied by the National Savings Committee to the association officials. Whenever the official purchases Britannia head savings stamps, he can present at the post-office one pair of these date labels for every 31 sixpenny stamps purchased. The post-office official stamps the labels with a date stamp of that day. When a member of the association presents a card filled up with savings stamps all of which have been purchased from the association, the secretary affixes to the certificate which is issued in exchange for the card one of the officially dated date labels—one date label is affixed to the signature portion of the certificate and its fellow or counterpart is fixed on the counterpart of the certificate in the certificate book. This scheme therefore preserves the full benefit of early dating due to coöperative purchase and yet reduces the clerical work of the association official to the smallest compass. The only book which it is thought advisable for the official to keep is a control receipt book for acknowledging receipt of members' completed cards given in exchange for certificates, this serving also as a register of certificates, in case the member loses his certificate book.

The value of savings stamps sold to Nov. 30 1920 was £1,739,000, of which approximately £1,464,000 had been exchanged for savings certificates.

Municipal Savings Banks.—The Municipal Savings Bank (War Loan Investment) Act, 1916, authorized the establishment, subject to certain restrictions, of municipal savings banks in municipal boroughs with populations exceeding 250,000. The only municipality to adopt this Act was Birmingham, where a bank was started at the end of Sept. 1916. The "Birmingham Corporation Act, 1919" extended the powers of the Corporation and authorized it to establish a savings and housing bank.

Navy, Army and Air Services.—Although military savings banks and facilities for saving in the army had existed since 1859, with the recruiting of large numbers of civilians for the new armies it was found that the normal methods of saving were insufficient to attract very large sums of money.

On the issue of the 4½% War Loan in June 1915 it was felt right that due facilities should be afforded the men in the army for making their investments through the Post Office issue of the Loan. Arrangements were accordingly made for any soldier whose pay account was sufficiently in credit to invest by instalments of 5s., 10s., £1 or £5, the amount being debited to his account and transferred to the Post Office through the regimental paymaster. Similar arrangements were made for the navy and the scheme was found to work so smoothly that it was eventually extended to Exchequer bonds and War Savings certificates as they became available, and ultimately for deposits

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in the Post Office Savings Bank. The Post Office undertook the safe custody of the War Savings certificates and bonds for the investors. Later in 1916, by arrangement with the War Office, a special officer was entrusted with the work of establishing war savings associations in the army, with very satisfactory results. In 1917, £186,682 was saved through the army associations; in 1918, £3,162,975; in 1919, £1,804,580; and in 1920, over £1,000,000, making a grand total of £6,000,000. In June 1920 the Army Council, finding the savings associations had such a beneficial effect, made an order that all units both at home and abroad should form savings associations, and arrangements were made for command paymasters stationed abroad to hold stocks of certificates. The Air Ministry at the same time issued an order on similar lines. The War Savings movement was also carried into the navy and merchant service, suitable arrangements being made for remittance of monies through the paymasters and pay offices.

Schools.—It would be impossible to give even the briefest summary of the War Savings movement without reference to the work done by the savings associations in the schools of the country. Thanks to the influence of the Board of Education, and, particularly, to the efforts of a number of inspectors of the Board who were lent for service with the National Committee and who acted as the secretaries of the county committees and as local representatives of the Committee in the provinces, but, above all, thanks to the whole-hearted efforts of thousands of schoolmasters and mistresses throughout the country, there was scarcely an elementary school in the United Kingdom without an efficient and vigorous association. Before the war a very large number of schools had their penny banks. No attempt was made to supplant these. With the coöperation of the savings banks in connexion with which these penny banks were operated, arrangements were made to continue the penny bank system with the savings association methods, and often the two systems were carried on in the same school side by side. The old penny bank system as a "short term" saving machinery had a value which it would have been undesirable to destroy, while it naturally led by stages to the "long term" saving by means of the certificate. Most of the schools continued their banks and associations after the Armistice, and in no section of the community is the movement more alive and progressive to-day. It is impossible to say what proportion of the savings of the country stand in the names of the children, but it must amount to many millions sterling and this alone must have an incalculable effect on the future.

Propaganda.—The human machine created by the National Savings Committee was stimulated, from time to time, by every kind of publicity method. Thousands of public meetings were held and lectures given; educational pamphlets and leaflets dealing with the elements of economics were distributed; special campaigns with such stimulating machinery as "tank banks" were inaugurated; a system of commissioners and organizers in touch with headquarters kept closely in touch with the local committees; special organizations dealt with the army and the navy, munition works and other factories. The local authorities rendered invaluable assistance to the local committees by the loan of staff, the provision of office accommodation and in many other ways. The London and provincial press were consistently sympathetic to the movement and gave freely of their space to record its activities and assist its campaigns. During the war the organization was, from time to time, utilized by the Chancellor of the Exchequer to assist in the public issues of War Bonds and War Loans. During these periods invaluable help was given by leading press experts, who, in coöperation with the National War Savings Committee, undertook the control of special publicity campaigns (*see* WAR LOAN PUBLICITY CAMPAIGNS). These campaigns for the special issues greatly stimulated the small investor. On each occasion of the issue of a great public loan numbers of new associations came into being and the weekly purchases of certificates were very much increased. One of the most significant results of the adoption of these methods of publicity and propaganda was the great extension of the numbers of individual citizens holding Government securities. Whereas before the war it was estimated that there were some 345,000 holders of Government securities, it is calculated that no less than 17 million people have to-day a holding in some form of State loan; while the aggregate amount subscribed by small investors through the Post Office for War Loans and other Government securities, including savings certificates, was nearly £500,000,000 at the end of 1920.

Withdrawals.—The Montagu Committee laid emphasis on the fact that the small investor wishes to be able to withdraw his savings at short notice without loss of capital. "The financial emergencies of life come upon the working man with startling suddenness. He may be thrown out of employment, or an illness or death in the family may result in an immediate call. He has not the facilities for credit which the wealthy or even the middle classes enjoy and money only obtainable at six or twelve months' notice is of little use to him." There is no doubt that the losses sustained by the working-classes from their investments through the Post Office in Consols and other similar long-dated securities through the automatic fall in capital value due to the rise in the general rate of interest has had in the past an adverse influence on thrift. Hence the arrangements that War Savings certificates should be repayable at a definite value which is never less than the amount invested, and within two or three days of demand, that is to say, allowing time for identification of the registered holder to avoid payment to a wrongful possessor.

An analysis of the withdrawals of savings certificates is interesting. The total number of certificates sold in the United Kingdom from Feb. 16 1916 to the end of Dec. 1920, was 440,076,000 in £1 units, of a total value at 15s. 6d. each of £343,259,000. The total repayments due to withdrawals, including interest, amounted to £61,404,089, of which £3,521,948 8s. 7d. represented interest. The percentage of the value of certificates repaid (excluding interest) to total value of certificates issued was 18·01 per cent. This percentage may be considered satisfactory when one considers the calls upon the small investor and the fact that the current rate of interest on the shares of well-established commercial and industrial concerns since the Armistice has been very attractive. Much money has been withdrawn for housing, as is evidenced by the case of Higham Ferrers in Northants, a town of 2,500 people, where no less than 50 men have bought their houses through investments in savings certificates.

Post-Armistice Period.—In 1917 a committee was appointed by the National Committee to consider what facilities for saving should be provided for the small investor after the war. The committee in their report stated that the habit of saving had, as a result of the War Savings movement, been formed by many people of all classes who had not previously acquired it, and that this habit ought not to be allowed to lapse and that the State should continue to encourage saving after the war by continuing to offer special facilities to the small investor. They saw no reason to suppose that the State would at any time be unable to use profitably the money of the small investor. They pointed out that the ordinary borrowing capacity of the State would be severely taxed by the necessity for renewing and, when possible, consolidating the floating debt, and they considered it worthy of serious consideration whether a plan might not be adopted for applying the proceeds of post-war borrowing from the small investor in order to secure funds for public utility services, such as the housing of the working-classes and other projects of social urgency, the funds for which it might be difficult, if not impossible, to raise otherwise for a considerable period. The committee strongly advised the preservation of the savings machinery established during the war and recommended the permanent continuance, subject to modifications, of the War Savings certificate. The continuance of the savings organization was also recommended by the "Committee on Financial Facilities" appointed in 1917. In their report, dated Nov. 21 1918, they said:—

"We are impressed by the enormous potential increase in the number of the small investors. The continuance on the part of the people of this country of the habit of investing their savings constitutes a most important factor in the provision of the capital necessary for the rapid reconversion of trade and industry. It is impossible to over-estimate the value of the work done by the war savings associations throughout the country, in encouraging habits of thrift

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BRITISH SAVINGS ASSOCIATIONS AFFILIATED AT DEC. 31 1919

County	Population	Business Firms	Churches	Schools	Friendly Societies	Clubs and Institutes	Miscellaneous	Totals
England:—								
Beds	194,588	73	27	92	3	6	59	260
Berks	271,009	76	21	116	4	..	130	347
Bucks.	219,551	50	16	68	..	2	124	260
Cambs	198,074	22	21	97	1	2	91	234
Ches.	954,779	248	82	364	8	38	179	919
Corn.	328,098	31	16	243	3	10	111	414
Cumb.	265,746	33	27	194	7	23	91	375
Derby.	683,423	182	37	345	6	23	106	699
Devon	699,703	127	26	250	8	40	253	704
Dorset	223,266	21	23	85	..	14	109	252
Dur.	1,369,860	324	74	236	2	75	174	885
Ess.	1,350,881	178	52	265	..	37	255	787
Glos.	736,097	243	70	126	6	26	219	690
Hants.	950,579	274	72	404	19	52	225	1,046
Hereford	114,269	3	11	89	5	7	57	172
Herts.	311,284	56	22	52	3	21	116	270
Hunts.	55,577	12	15	37	..	6	46	116
Kent	1,045,591	223	77	293	11	57	303	964
Lancs.	4,767,832	1,147	330	1,167	30	176	343	3,193
Leics.	476,553	335	29	218	1	17	100	700
Lincs.	563,960	152	37	250	9	36	217	701
Lond.	4,521,685	1,607	163	254	79	85	526	2,714
Middlesex	1,126,465	190	60	240	9	40	100	639
Norf.	499,116	58	18	79	3	8	225	391
Northants	348,515	166	18	163	10	18	106	481
Northumb.	696,893	198	41	101	15	36	164	555
Notts	604,098	184	30	334	3	28	108	687
Oxon.	199,269	24	15	39	1	7	103	189
Rutl.	20,346	..	..	16	..	2	23	41
Salop	246,307	46	20	116	5	7	122	316
Som.	458,025	109	39	168	2	14	260	592
Staffs.	1,348,259	508	63	478	9	27	154	1,239
Suff.	394,060	85	18	209	3	19	236	570
Sur.	845,578	156	55	233	11	47	200	702
Sus.	663,378	68	63	134	18	34	226	543
Warwick	1,040,409	311	55	264	8	40	166	844
Westm.	63,575	12	8	43	3	5	58	129
Wilts	286,822	82	19	64	1	13	153	332
Worcs.	526,087	138	23	265	5	19	97	547
Yorks, E. R.	432,759	112	30	85	10	22	87	346
Yorks, N. R.	419,546	42	13	103	..	7	130	295
Yorks, W. R.	3,045,377	1,160	294	1,235	52	166	313	3,220
Wales:—								
Anglesey	50,928	6	10	22	..	4	19	61
Brecknock	59,287	4	11	32	..	..	11	58
Cardigan	59,879	3	14	101	1	..	17	136
Carmarthen	160,406	21	28	158	2	2	24	235
Carnarvon.	125,043	12	7	19	..	7	45	90
Denbigh	144,783	14	35	55	1	2	53	160
Flint	92,705	4	9	18	2	2	16	51
Glamorgan	1,120,910	285	146	386	7	42	101	967
Merioneth	45,565	1	..	34	1	..	19	55
Monmouth	395,719	111	41	261	3	4	58	478
Montgomery	53,146	9	3	37	1	1	23	74
Pembroke	89,960	4	10	99	..	2	14	129
Radnor	22,590	..	4	30	1	1	21	57
Overseas Army Associations	..	..	..	..	..	..	20	20
	..	..	..	..	..	..	936	936
Totals	...	9,540	2,452	10,866	392	1,379	8,242	32,967

In addition the undermentioned Savings Associations were affiliated under special schemes:—

Employers	1,721
School Post Office	587
Government Offices	121

SALES AND REPAYMENTS OF NATIONAL WAR SAVINGS CERTIFICATES (*Feb. 1916–Dec. 1920*)

Period	Certificates £1 units	Purchase Price	Repayments including exchange for War Loan, etc.	Interest paid
		£	£	£
1916 Feb.–Dec.	54,430,604	42,183,718	287,448	..
1917 6 months ended June	56,381,849	43,695,933	1,294,750	492
" " " Dec.	30,083,722	23,314,884	1,840,983	10,972
1918 " " " June	74,210,407	57,513,066	2,372,099	36,524
" " " Dec.	65,594,472	50,835,716	3,914,892	85,216
1919 " " " June	53,173,874	41,209,752	7,926,293	272,769
" " " Dec.	48,778,963	37,803,697	11,938,325	597,968
1920 " " " June	32,741,850	25,374,933	17,096,541	1,202,495
" " " Dec.	25,045,649	19,410,378	14,733,338	1,316,381
Totals Feb. 1916–Dec. 1920	440,441,390	£341,342,077	£61,404,669	£3,522,817

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CONTRIBUTIONS OF THE BRITISH SMALL INVESTOR, 1914–9
(Decreases are printed in italics)

Date	Post Office and Trustee Savings Bank Deposits (Net Receipts)	Post Office Issues: 4½* and 5%† War Loans	Post Office Issues: 5 and 6% Exchequer Bonds	Post Office Issues: 5% National War Bonds§ 4% Victory Bonds ‡ 4% Funding Loan **	War Savings Certificates Purchase Price	Certificate Repayments including Exchanges for War Loans, etc.	Net Cash Total
	£	£	£	£	£	£	£
Total for five months 1914	1,152,000	..	..	..	..	..	1,152,000
Total for year 1915	*6,456,000*	39,961,000*	..	..	..	..	33,505,000
Total for year 1916	11,938,000	*138,000*	43,900,000	..	42,371,000	*290,000*	97,781,000
Total for year 1917	5,683,000	36,606,000†	4,092,000	10,856,000§	66,824,000	*3,133,000*	120,928,000
Total for year 1918	38,813,000	..	..	38,700,000§	108,349,000	*6,287,000*	179,575,000
Total for year 1919	43,541,000¶	..	..	13,700,000§ 9,900,000‡ 7,400,000**	79,013,000	*19,864,000*	133,690,000
Aug. 1914 to Dec. 1919	94,671,000	76,429,000	47,992,000	80,556,000	296,557,000	*29,574,000*	566,631,000

¶ The deposits included £55,109,506 on account of war gratuities to soldiers and sailors.
N.B.—During the year ending Dec. 31 1920, 57,787,499 certificates of a cash value of £44,785,311 were sold, and repayments, including exchange for War Loans, etc. (excluding interest), amounted to £31,829,879.

and economy. Government securities furnish by far the best and safest medium for the investment of small sums of money, and we are glad to notice that steps are to be taken, by means of savings associations, to continue the policy which had proved so successful during the war."

Immediately after the Armistice steps were taken to consolidate the position of the organization and to render permanent the machinery which had been set up during the previous three years. The county committees were disbanded, their work having been delegated to local committees which they had formed in practically every local area in the country. Steps were taken to devise a complete representative system throughout the organization. Adopting the association, or savings club, as the fundamental unit of the movement, steps were taken to ensure representation of the associations on the local committees. The local committees in their turn elected representatives on a new body called "The National Savings Assembly," which was to meet twice a year to discuss questions relative to the movement and at one of these meetings to elect representatives on the National Savings Committee, which, by the authority of the Government, dropped the word "war" out of its title. At the same time the personnel of the National Committee was considerably strengthened. In 1921 it formed a powerful body composed of representatives of Government departments and corporations and interests connected with thrift, together with representatives of the savings organizations in London and the provinces elected on a wide franchise, so that its continued influence could not fail to be beneficial to the community.

Savings and Local Government Finance.—In the summer of 1920 a step was taken which might well have far-reaching effects on the relations between local and Imperial finance.

The Finance Act 1920, Section 59, provided that 50% of the proceeds of the sales of savings certificates could be invested through the National Debt commissioners in local loans stock or bonds on the security of the local loans fund. Half the proceeds of the gross sales after Oct. 1 1920, in the area of each local authority, would be available, if required, for loans to meet authorized expenditure in connexion with the assisted housing scheme of that authority. These loans were to be made, irrespective of the ratable value of the local authority, by the Public Works Loan commissioners, on the terms in force for the time being for ordinary loans to local authorities from the local loans fund for subsidized housing schemes. In the first instance, such loans would be restricted to housing purposes, but it was hoped that, when the existing difficulties with regard to housing finance had been overcome, the scheme would be given a more general application and that the system would become a permanent feature of local finance, bringing to the aid of local authorities a new source of capital which many of them had long been seeking. The authorities derive the greater part of the benefit under the scheme, since, although they receive only half the proceeds of the certificates sold, they are not responsible for finding any of the money required to meet withdrawals.

A critic of the ordinary savings bank in the last century said: "The savings bank is after all only a slot in the wall, with a sure grasp, but no tongue to advise it. Having no fructifying use for the money that comes to it from productive employment it closes over it like a grave and effectually sterilizes it"; and Sir E. Brabrook, Chief Registrar of Friendly Societies in 1897, said he "could look upon ordinary savings banks merely as infantile efforts in thrift." He regarded "a person who deposited his money in a savings bank so that it should be kept safe for him by someone else as very much less worthy of encouragement than a person who used his savings in some way in coöperation with other people for his own benefit or the benefit of others." He "did not look upon the progress of the savings bank with unalloyed satisfaction, but only as one step to self-help."

The system of linking up National Savings certificates with local finance becomes, in effect, a national credit bank spread over the whole country. The credits of the small investor, even the half-pennies and pennies saved by the school-children, are rendered through the machinery of the savings certificates, the Post Office, the National Debt commissioners, the Treasury, the local loans fund and the local authorities, available for investment in social and beneficial enterprise for the good of the people themselves. Owing to the widespread area from which the money is raised, short-term borrowing can be used for long-term loans with the minimum of risk, while saving is stimulated amongst the very class to whom in the past it has been most difficult to teach economy and saving. The linking-up of "saving" with the definite use of the money saved continues effectually the teaching of the war and inculcates the lessons of economy, and goes far to meet Sir E. Brabrook's criticism of the savings bank. The system is certain to stimulate the interest of the small investors in local finance generally. Not only will this be a source of financial strength to the local authorities, but educationally it will be a great advantage, and the active coöperation of the local authorities and the savings committee should do much to stimulate habits of thrift and saving.

OTHER COUNTRIES

The American savings movement is dealt with later. As regards other countries in the war it may be noted that the British National Committee had its organization in the East for the sale of War Savings certificates, the China and Japan War Savings Association having nine centres in China and three in Japan. The Japanese Government itself during the war sent its representatives to inquire into the methods of the National Savings Committee, and established its own system of National Savings certificates with terms of three, five and ten years.

In Canada, war savings and thrift stamps were issued by the Canadian Government.

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The Government of S. Africa after the Armistice placed "Union Loan Certificates" on sale at every post-office where savingsbank or money order business is transacted. The S. African scheme cosely resembled the British savings scheme. Cards were issued with spaces for 15 one-shilling stamps. The cards were issued at an nitial price of sixpence. When the card was completed, it could ie exchanged for a 15s. 6d. certificate which is worth £1 in five years. The maximum purchasing limit is £387. 10s. od. for 500 certificates. The S. African Government also adopted the scheme of associations in savings clubs on the British model.

STATISTICS.—In the preceding tables statistics are given of the results of the work done under the National Savings Commitee.

(T. G. CH.)

UNITED STATES

Upon the declaration of war by the United States in Apil 1917 it became evident that the nation must practise strict economy if the huge war-time expenditures were to be successfully financed and material aid given to the Allies. Not merely in money, but in consumption (which means money), the resulting movement for economy among the American people was vigorously taken up. As a first step toward conservation, President Wilson on May 19 1917 outlined a food control programme and appointed Herbert Hoover Food Administrator, and Congress passed the law commonly known as the Lever Act, effective Aug. 10 1917—"an Act to provide further for the national security and defence, by encouraging the production and conservation of supply and controlling the distribution of food products and fuel." The administration of the Act was under the direction of a U.S. Food Administrator and a U.S. Fuel Administrator. The Food Administration summed up its purpose in the motto: "Food will win the war." The following specific ends were sought: (1) to save food and eliminate waste; (2) to distribute food equitably and cheaply; (3) to stimulate production; (4) to prevent hoarding; (5) to save transportation; (6) to provide for the needs of the U.S. army and navy. (7) to secure the largest possible amount of food for the Allies.

The most vital early need both for America and for the Allies was the conservation of sugar and wheat. The shipping shortage was so acute that it was impossible to procure the large surplus of raw sugar in Java, amounting to nearly 1,000,000 tons. Exports of sugar from the United States for the year 1917 were more than 17 times the average for the three years preceding the war. In Aug. 1917 the cost of spot sugar reached $9.15 per cwt. seaboard basis, and the demand was still unfilled. During this month an International Sugar Committee was appointed. Under the operation of this committee the price of Cuban raw sugar declined to $6.90 by Sept. 14, which was the fixed maximum for the season's crop. The prices to the consumer were maintained at from 8½ cents to 10 cents per lb., varying with the location. As the difference of one cent per lb. added to the price of sugar meant an added burden on American homes of $72,000,000, the importance of the sugar regulations is evident. As the needs of the United States and of the Allies became more acute, the Licence System governing dealers in food supplies was put into effect and various regulations adopted which governed the producer and consumer alike. In order to control the sugar situation it was announced on May 2 1918 that on and after May 15 sugar should not be sold for manufacturing purposes either by refiners, wholesalers or retailers, except upon the presentation and cancellation of certificates issued by a State Federal Food Administrator, showing the quantity of sugar sold. Retailers were restricted from selling sugar to consumers in quantities greater than 2 lb. for city residents and 5 lb. for those residing in the country, except for home canning, in which cases the dealer was required to secure certificates for the amount sold. By the operation of this system and the voluntary restriction of household consumption, a saving of between 400,000 and 600,000 tons was effected in 1918.

The most serious crisis faced by the Food Administration during its operations was the wheat shortage of the season 1917–8. In the United States the crop, following the exceedingly short harvest of the previous year, was only sufficient to meet normal demands for home consumption. France and England, which together normally produce about one-half the wheat they consume, both suffered very great crop losses, and their total production was considerably less than one-third their normal consumption. In Jan. 1918 an official communication was received from Great Britain stating that, unless America could send the Allies at least 75,000,000 bus. of wheat over and above what they had exported up to Jan. 1, there was grave fear that the war would be lost because of the lack of food. The United States Food Administration replied to this advice: "We will export every grain that the American people save from their normal consumption. We believe our people will not fail to meet the emergency." All manufacturers in the United States using wheat flour in the production of various foods were placed under licence, and either strictly limited in their use of wheat to a definite percentage of their normal requirements or were denied the use of wheat entirely. Wheatless days and other measures for wheat conservation were established. Mills were permitted to grind only a certain percentage of the amount of wheat milled during a corresponding period the previous year. Wholesale dealers were prohibited from purchasing wheat flour in excess of 70% of the amount they had purchased during a corresponding period of the previous year. In sales to consumers the retailers were required to sell an equal quantity of substitutes to the purchaser at the time wheat flour was sold. The pledge-card campaign was started in Oct. 1917, and between 13,000,000 and 14,000,000 women registered in support of food conservation by substitution. Between Oct. 1 1917 and Aug. 1 1918 hotels, restaurants, dining cars and clubs of the country effected a saving of more than 50,000,000 lb. of flour and wheat products. Flour-mills were required to raise their percentage of extraction to 74% and to eliminate altogether the sale of patent flours. This resulted in a saving of 13,504,300 bus. of wheat. Bakers were required to use a certain percentage of substitute flour in all breads, and this resulted in the saving of 16,830,000 bus. of wheat. These various measures made it possible for the United States to send abroad in 1918 approximately 140,000,000 bus. of wheat.

The importance of fats and oils in the diet of a people caused the Food Administration to lay stress on the conservation of meat products. Export of fats to neutrals was greatly restricted and the amount of fats used in bakery products limited. In 1918 1,125,397 short tons of hog products were exported as against 839,000 in the fiscal year ending June 30 1899, the largest in any previous year. In March 1918 exports averaged 10,000,000 lb. a day. Normally the United States exports yearly a little over 10% of its total pork production. In 1918, under the pressure of war needs, nearly 20% of a much larger production was exported. In 1918 773,000,000 lb. of beef were exported, or over three and a half times the exports on the average of the three war years. These supplies were made available by the conservation of meats formerly wasted, by volunteer rationing and by the adoption in many localities of meatless days and meatless meals.

As the demand on transportation facilities became increasingly heavy, it was vital to keep the routes by which food passed from the producer to the consumer as active as possible. The tremendous increase in the exportation of food and munitions, coupled with the shortage of ocean tonnage, congested eastern terminals. To remedy this condition, a regulation was promulgated providing an average increase in the minimum car-loads of about 50% over those of the published tariffs of the carriers. Thus the number of cars required for the distribution of the commodities on the list of non-perishable groceries was reduced fully 25%. Much material formerly wasted was salvaged by the Waste Reclamation Service, organized originally under the War Industries Board and later transferred to the Department of Commerce. One million five hundred thousand tons of book and writing material were made in 1918 from old paper. The total value of all waste material reclaimed during 1918 was approximately $1,500,000,000. In monthly reports as to garbage utilization during 1918 it was shown that the redemption plants reclaimed more than 50,000,000 lb. of garbage grease and 160,000 tons of fertilizer tankage from garbage.

Several conservation projects were developed in conjunction with food conservation. The National Emergency Food Garden Corporation put 1,500,000 ac. of city and town land under cultivation in 3,000,000 gardens, resulting in an increase of the food supply to the value of over $350,000,000 in one year. The School Garden Army, 6,000,000 strong, raised and preserved fruits and vegetables and also aided in the utilization of waste products. Community canning kitchens were widely conducted. The Women's Land Army had during the summer of 1918 units in 20 different states, showing an enrolment of 10,000 in camps and 5,000 in emergency units. They were engaged in fruit packing, dairy work, truck gardening and general farming. Cash-and-carry plans were encouraged and the limitation of deliveries to one a day to any family or on any one route was recommended.

The U.S. Fuel Administration began its work in Aug. 1917, with Dr. Harry A. Garfield as director. The Administration set out to accomplish: (1) increased production; (2) better distribution; (3) fair sale prices; (4) the elimination of waste. Small production was largely due to strikes. The Fuel Administration succeeded in getting employers and employees into agreement and eliminated much of this difficulty. In April 1918 a nation-wide plan designed to insure equitable distribution of coal was put into effect. An essential feature was the zoning system, by which more than 5,000,000 tons formerly shipped from eastern mines to western territory adjacent to western mines was saved for the eastern states where the demand of war industries was greatest. All the price-fixing was done by territory. Inspectors visited each one of the 250,000 industrial plants in the United States using large amounts of coal and worked out with the management systems of conservation. In one week 50,000 tons of coal were thus saved in Pittsburgh alone. Rationing was put into effect, the supply of coal to non-essential industries being greatly reduced. It was estimated that this saved over 1,000,000 tons. All industries were held to their minimum needs. Stores and office buildings were encouraged to take their electric current

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from central plants. The "skip-stop" system on electric street railways by which no stops were made at unimportant crossings resulted in a great saving. Economy was also effected by lightless nights, which affected window lighting, electric display and street illumination. Home instruction was given in the operation of heating systems and in the use of electricity. For several weeks heatless Mondays were observed in stores, office buildings and places of amusement. A saving of 12,700,000 tons of coal for the first half of the coal year was thus effected.

On March 19 1918 the President approved the legislation entitled "An Act to save daylight, and to provide standard time for the United States." The purpose of this legislation was to conserve daylight and the Act is commonly known as the "Daylight-Saving Law." It provided for setting the clocks of the nation ahead one hour at two o'clock on the morning of the last Sunday in March of each year and for retarding them by one hour at the same time on the last Sunday in Oct. of each year. By the same piece of legislation the United States was divided into five standard zones. After the repeal of this Act in Aug. 1919, several of the states enacted daylight-saving laws. The operation of the daylight-saving plan caused the saving in seven months of approximately 1,250,000 tons of coal.

Gasoline-less Sundays were inaugurated in Aug. 1918. A cessation of Sunday motoring from 75% to 99% was effected. This resulted in an estimated saving of 1,000,000 bar. of gasoline, from which it is known that 500,000, or 10 shiploads, were sent overseas. The order governing the use of gasoline was withdrawn on Oct; 20 1918.

Under the provisions of "An Act to authorize the President to increase the military establishment of the United States," approved May 18 1917, and later amended, the President was authorized to raise and maintain military forces by selective draft "under such regulations as the President may prescribe not inconsistent with the terms of this Act." Under this law certain exemptions were made removing the liability to military service from those whose industrial occupations were deemed essential to the proper prosecution of the war. Along similar lines several of the states passed like enactments, commonly termed "Work or Fight laws," by which those who had been exempted from military service were forced to accept employment in essential industries or else join the military or naval service and thus conserve the man-power of the nation. Non-essential occupations were listed and because of the simultaneous enactment of a drastic law against loafing in the state of New York the New York City Federal Employment Service was overrun with applications. Over 6,000 were registered July 1, and the next day after the order had been given publicity one bureau registered over 10,000. The majority were from the non-essential occupations, together with a small percentage of the idle or vagrant classes.

The Conservation Division of the War Industries Board was established May 9 1918. Its purpose was to eliminate wasteful or unessential uses of labour, material, equipment and capital. Its specific aim was: (1) to secure the maximum reduction in the number of styles, varieties, sizes, colours or finish of products of the various industries; (2) to eliminate accessories which used material for adornment or convenience, but which were not essential; (3) to substitute materials which were plentiful for those which were scarce; (4) standardization; (5) reduction of waste; (6) economy in samples; (7) economy in containers and packing. The length and swing of men's sack coats and overcoats and the width of facing were limited, the size of samples reduced and each manufacturer restricted to not more than 10 models of sack suits for the season. This resulted in a saving of from 12 to 15% of material. A saving of 33% of wool used in the knitting of sweaters was effected by the reduction in styles and colours. For example, only one shade of green was used where formerly there were many. Manufacturers of shoes were restricted to white, black and tan; wasteful features were eliminated and height limited. As a result one tanner reduced his line from 81 colours and shades to 3, and manufacturers in general reduced their line by about two-thirds. A schedule issued Sept. 13 1918 to manufacturers of rubber footwear provided for the elimination of 5,500 styles, with an estimated annual saving of 29,012,600 cartons, 5,245,300 sq. ft. of shipping and storage space, 2,250,272 lb. of material to be dyed, 74,750 lb. of starch, 30,380 gal. of varnish, 125,300 lb. of tissue paper and 49,617 days of labour.

In addition to the efforts of the War Industries Board there were numerous appeals by Government officials and patriotic organizations to conserve clothing and shoes. As a result a very great proportion of the people wore garments which in normal times would have been discarded. Patching and remaking of clothing became popular practices. Although it is impossible to estimate the saving effected, it is undoubtedly true that many millions of dollars, which would ordinarily have gone for the purchase of wearing apparel, were used to purchase Liberty Bonds and to aid various war philanthropies.

The Pulp and Paper Section of the War Industries Board was organized June 6 1918 to restrict the use of paper and its products and thus to save fuel, transportation and labour. On July 5 1918 the following preliminary economies were requested of all newspapers publishing daily and weekly editions: that they (1) discontinue acceptance of the return of unsold copies; (2) discontinue the use of all samples and complimentary copies; (3) discontinue giving copies to anybody except for office working copies or where required by statute law in the case of office advertising; (4) discontinue giving free copies to advertisers except not more than one copy each for checking purposes; (5) discontinue arbitrary forcing of copies on news-dealers; (6) discontinue the buying back of papers at either wholesale or retail; (7) discontinue payment of salaries or commissions to agents, dealers or newsboys for the purpose of securing equivalent of return privileges; (8) discontinue all free exchanges. On Sept. 20 the following additional regulations went out: no publisher shall sell his paper at retail less than his published prices; no publisher shall use premium contests or similar means to stimulate his circulation; no publisher shall issue holiday, industrial or Sunday special numbers. These regulations brought about a saving in paper during Sept. of 10·4% of the average monthly tonnage during the six months preceding and in Oct. of 5%. There was produced in Sept. 1918 104,209 tons and in Oct. 110,498 tons. All regulations relative to paper were withdrawn on Dec. 15 1918.

The universal response by the people of the United States to the request that they lend money to the Government to provide necessary funds for the prosecution of the war was one of the most significant things of the war period. Millions of people purchased Liberty Bonds and Victory Notes in various denominations from $50 to $10,000 (*see* LIBERTY LOAN PUBLICITY CAMPAIGNS), and other millions invested in the smaller War Savings securities. Early in the war President Wilson made the statement: "I doubt that many good by-products can come out of a war, but if our people learn from this war to save, then the war is worth all it has cost us in money and material." This statement, together with the desirability of having the entire nation participate in financing the war, suggested the underlying purpose behind the war savings movement, which was put into operation in Dec. 1917. Section 6 of the Second Liberty Bond Act, approved Sept. 24 1917, authorized the Secretary of the Treasury "to borrow from time to time on the credit of the United States for the purpose of this Act and to meet public expenditures authorized by law, such sums as in his judgment may be necessary and to issue therefor at such price or prices and upon such terms and conditions as he may determine War Savings Certificates of the United States on which interest to maturity may be discounted in advance at such rate or rates and computed in such manner as he may prescribe." The Act further provided that "each War Savings Certificate so issued shall be payable at such time, not exceeding five years from the date of its issue, and may be redeemable before maturity, upon such terms and conditions as the Secretary of the Treasury may prescribe." A limitation of $2,000,000,000 was placed by the Act upon the amount of War Savings Certificates which might be outstanding at any one time; it also provided that no person should be sold at any one time certificates amounting to more than $100, and it also placed a $1,000 limitation upon the amount of certificates which might be held by any one person. The original Act was amended by the Act approved Sept. 24 1918, which increased the amount of certificates which might be issued from $2,000,000,000 to $4,000,000,000, removed the $100 limitation on the amount of certificates which might be sold to any one person at any one time, and also altered the previous Act by allowing persons to hold an amount not to exceed $1,000 worth of any series of certificates.

Pursuant to the authorization contained in the original Act, the Secretary of the Treasury appointed a committee of five, with Frank A. Vanderlip as chairman, to confer with him as to the form of security and the terms on which it should be issued. Following the recommendation of this committee, the Secretary of the Treasury offered for sale on Dec. 3 1917 an issue of War Savings Certificate Stamps, Series of 1918. Each certificate stamp when affixed to a War Savings Certificate (a folder with spaces for 20 stamps) would have a fixed maturity value of $5, with the date of maturity not to exceed five years, the purchase price to vary one cent each month throughout the year of issue, beginning in Jan. at $4.12, increasing to $4.23 in December. The stamps might be redeemed before maturity, their redemption value increasing one cent each month. There were also provided 25-cent Thrift Stamps, bearing no interest and not redeemable for cash, but to be accumulated on a Thrift Card until there were 16, when they could be exchanged for a War Savings Certificate Stamp by paying the additional odd cents necessary to cover the current price of the War Savings Cer-

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tificate Stamp. Succeeding issues of War Savings Certificate Stamps were on Jan. 1 1919, Jan. 1 1920 and Jan. 1 1921.

In addition to the original securities there were offered in July 1919 Treasury Savings Certificates, one of $100 and the other $1,000 maturity value. Treasury Savings Certificates were registered at the Treasury Department at the time of purchase and increased in redemption value monthly on the same interest basis as War Savings Certificate Stamps. In Jan. 1921 there were offered for sale $1 non-interest-bearing Treasury Savings Stamps and $25 Treasury Savings Certificates, in addition to the other Treasury Savings Securities.

Following the working out of the types of securities in 1917, an organization for their sale was effected. In addition to the National War Savings Committee, consisting of the chairman and four members, the Secretary of the Treasury appointed six Federal directors, each having general supervision over approximately two Federal Reserve Districts; and 52 state directors, each of whom had complete charge of War Savings activities in his state or part thereof. The National War Savings Committee and the six Federal directors functioned at the National War Savings Committee headquarters in Washington. It was the duty of this sales organization to obtain coöperation from the heads of all enterprises operating nationally and then to decentralize the work through the Federal directors to the respective state directors coming under their jurisdiction, the ultimate goal being to offer every man, woman and child in the United States the privilege of aiding the Government by investing in Government securities, and at the same time to develop habits of thrift. The War Savings securities were put on sale at every post-office, at banks and in thousands of voluntary agencies. House-to-house canvass for their sale was made by postmen, boy scouts, representatives of insurance companies and members of women's organizations. In the autumn of 1918 the Treasury Department created a Savings Division of the War Loan Organization, which took over the work previously carried on by the National War Savings Committee, so that the people of the country might be taught for their peace-time value the lessons of thrift and saving learned during the war. The specific ends sought were: (1) to develop and protect all war issues of Government securities; (2) to sell Treasury Savings securities; (3) to make permanent the habits of regular saving and investment in U.S. Government securities. The Savings Division was placed in charge of a Director of Savings, with an organization in Washington, and one in each of the 12 Federal Reserve Districts.

School Government Savings systems were established. Instruction in thrift, saving and the principles of sound finance was introduced in schools throughout the nation. At the annual convention of the National Education Association in July 1920 a committee of state superintendents was appointed to work out with the Savings Division the best plans for placing the savings movement permanently in the American school system. The American Federation of Labor and various labour bodies passed resolutions commending the work of the Savings Division and calling on the Government to make permanent the policy of issuing small securities. Many local labour organizations invested their reserve funds in Government securities. In industrial plants throughout the country Government Savings Associations were established and the employees put aside small amounts regularly each week in Government Savings securities. Women's organizations of the country during the years 1919 and 1920 created the office of thrift chairman in their boards of officials. They took up the study of finance at club meetings, promoted the use of the household budget and with the savings thus effected purchased Government securities.

The total sale of War Savings securities from Dec. 3 1917 to Jan. 1 1921 amounted in round figures to $1,176,111,000. The total redemption of War Savings securities for the same period amounted to $415,174,000. (W. M. Le.)

SAXONY (*see* 24.265).—The pop. of the Territory and Free State of Saxony, according to the census of 1919, was 4,663,298; in 1910 it was 4,806,661.

During the last few years before the World War political life in the German kingdom of Saxony was dominated by a conflict about the constitution. The parties of the Left had for years demanded a reform of the First Chamber, the Upper House, by which the predominance of the Agrarians in that House should be broken, and commerce, industry, and handicrafts should obtain greater influence. In Jan. 1910 the National Liberals, the Liberals (*Freisinnige*) and the Social Democrats once more introduced resolutions with this object in the Second Chamber, the Lower House, but these proposals met with the keenest opposition from Government, which shared the opinions of the Right. Notwithstanding the majority in the Lower House for the Reform, it was defeated by the refusal of the Upper House to accept it. It was only in Dec. 1917, that the Government introduced a bill for the reform of the Upper House, which again led to fierce conflicts between the Right and Left parties in Parliament, but the advent of the Revolution put an end to these conflicts. Simultaneously controversy concerning a new Electoral Law for the Lower House had constantly been going on since 1910. In Nov. 1911 a Social Democrat was for the first time elected Vice-President of the Diet. With the outbreak of war these questions fell into the background. In the educational sphere the reform of the National Schools System, which was especially advocated by the teaching profession in Saxony, aroused sharp conflicts of opinion among almost all classes of the people. The teachers were fighting for a development of the school system on lines of greater liberty and particularly desired that religious instruction should be regarded in a more liberal light. In 1912 the Government introduced a bill, which did not fully meet the wishes of the school teachers. After some elaborate debates in the Lower House, which produced great excitement throughout Saxony, the bill was rejected in Dec. 1912.

On Nov. 30 1910, Dr. von Rüger, who had been Minister of Finance for many years and at the same time had presided over the Ministry, retired, his successor as Finance Minister being von Seydewitz, while the minister of Justice, von Otto, took over the presidency of the Ministry and was in turn succeeded by the Minister of War, Freiherr von Hausen, in Sept. 1912, who on May 21 1914 gave place to von Carlowitz. The latter resigned his office to Lt.-Gen. von Wilsdorf on Oct. 27 1915 on taking a command in the field.

The year 1913 saw the opening in June of an airship base at Leipzig, the largest in Germany at that date.

On Oct. 18 1913 the unveiling of the monument commemorating the *Völkerschlacht* (the great victory of the continental Allies over Napoleon Oct. 16–18 1813) took place in Leipzig, a celebration at which the Emperor William II. and all the German sovereigns were present. After the ceremony the foundation stone of the German Library was laid, an institution which has since been completed and put in working order. All German publishers have undertaken to place a free copy of every work published by them at the disposal of this library, so that it already possesses more than a hundred thousand volumes. On July 29 1916 the Technical School of Mining at Freiberg, the oldest institution of its kind in Germany, celebrated the hundred and fiftieth anniversary of its foundation.

Saxony, which is chiefly an industrial country and cannot boast of much agriculture, suffered more under war conditions than most other German states. As a country which had been hitherto provisioned from outside, it found the problem of supplying food to its population extremely difficult. There was in many places a real dearth in the most important foodstuffs, such as corn and potatoes, so that the population was frequently obliged to have recourse to substitutes (*Ersatzmittel*).

Shortly before the outbreak of war, during the week July 17–24 1914, King Friedrich August of Saxony was on a visit to the Russian court at Petrograd; then on Aug. 2 the King's warlike appeal to the civilian and military population was published. At the beginning of the war the Saxon troops suffered heavy losses during their advance into the north of France. Already in 1917 the extreme Left in the Saxon Diet had begun an agitation, which never abated, for the early conclusion of peace; this demand led to violent debates between the Left and the Government, the latter being supported by the parties of the Right. On Oct. 26 1918 the Cabinet was forced to resign and to give place to a new Government of a more Liberal colour under Dr. Heinze. On Nov. 9 1918 the revolution broke out, and King Friedrich August abdicated on Nov. 13. A Cabinet of Commissaries of the People (*Volksbeauftragte*) was formed and was entirely composed of members of the extremist section of the Social Democrats, the Independent Socialists. The revolutionary conflicts of Jan. 1919, which entailed sanguinary street fighting in Leipzig, Dresden and other Saxon cities, led to the resignation of the Cabinet, which was succeeded by a Government of the right wing of the Social Democratic party. The extreme Left instituted demonstrations against this Government through-

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out the country, and there were serious excesses, especially in Plauen and Leipzig. In April 1919 a Councils (Soviet) Republic was proclaimed at Leipzig. It was only on May 12 that the *Reichswehr* (the regular army of the *Reich*) under Gen. Maerker entered the city and put an end to the Soviet Republic. Serious disturbances followed in the Vogtland and in Chemnitz in June and August. On Oct. 2 1919 the (non-Socialist) Democratic party joined the Ministry, which was now composed of Social Democrats and Democrats. The Ministry kept in power till April 25 1920. It was replaced by a Coalition of Social Democrats and Independent Socialists; which, when the Diet reassembled, received a vote of confidence. This Cabinet was vigorously combated by the non-Socialist parties, all of which voted against the salaries of ministers in April 1921.

The insurrectionary movement of the spring of 1920 had been very formidable, especially in W. Saxony. In Leipzig sanguinary fighting continued for several days, and there were heavy casualties. In the Vogtland the Communist Hölz formed a band of several hundred men, with which he conducted a reign of terror in the towns and villages. The Government long hesitated to take action against him; finally, however, Hölz's force was surrounded and dispersed by *Reichswehr* troops. Hölz himself fled across the frontier into Czechoslovakia, where he remained until the Communist rising of March 1921 in central Germany, when he returned and took command of the insurgents. After the collapse of the insurrection he was for a time in hiding in Berlin, where he was ultimately arrested, and after a trial which lasted a fortnight was condemned to penal servitude for life with the loss of civil rights (June 1921).

In July and Aug. 1920 there were widespread food riots in Saxony, but they did not assume the dimensions of the fighting in Leipzig and in the Vogtland. In the first half of 1921 there had been no further disturbances. (C. K.*)

SAZONOV, SERGIUS DMITRIEVICH (1866–), Russian statesman, came of a family of great Russian landowners. He was educated at the Alexandrovsky Lycée. In politics he was connected with a group which formed the Right Centre in the Council of the Empire and supported the general policy of Stolypin. Enlightened and convinced of the necessity of reforms, he remained, however, a staunch supporter of the monarchical and orthodox tradition of Imperial Russia. He entered the diplomatic service, and his first important post was that of Councillor of Embassy in London, where he assisted Count Benckendorff in the task of improving the relations between Great Britain and Russia. He subsequently acquitted himself successfully as Russian Minister at the Vatican. He was appointed Minister of Foreign Affairs in St. Petersburg at a critical juncture when Isvolsky left that office for the Paris Embassy. Russian policy had just disengaged itself from the coils of the traditional friendship with Germany, and the Kaiser, though still corresponding with "Dear Nicky" and keeping a personal representative in attendance on the Tsar, had given up the scheme of cementing an alliance with Russia against England and forcing France into the combination. Germany was demonstrating "in shining armour" by the side of Austria-Hungary, and was drawing Turkey away from her former protectors, the Western Powers. The idea of the penetration of the Near East was developing the more effectually as the scheme of directing Russia towards the Far East had proved unsuccessful. The backing of Austria and Turkey by Germany meant necessarily the crushing of the Slavonic Balkan States and a conflict with Russia. Sazonov was the most appropriate person to oppose this aggressive tendency with firmness and dexterity, but without chauvinism. He managed to strengthen the ties of mutual confidence between Russia and Great Britain by avoiding all kind of provocation in Central Asia or in Persia; as to France, the solidity of the alliance was beyond question. The treatment of the Balkan nationalities was a much more complicated problem. And when, after the disastrous squabble between the Balkan allies in 1913, the peace of Bucharest left Bulgaria bleeding, humiliated and weakened, the result was not only the destruction of the Balkan League, but a lasting alienation of Bulgaria from Russia and from the Western Entente. Russian diplomacy did not shine in those days: ineffectual attempts at arbitration between Serbia and Bulgaria, ineffectual discontent with the progress of the negotiations at Bucharest, and eventual recognition of defeat in the end, did not enhance the prestige of Russian foreign policy.

When the great crisis broke out in 1914, after the assassination of the Archduke Franz Ferdinand, the Tsar and Sazonov found themselves heavily handicapped by events. Both had tried to avoid the outbreak of war: but it was impossible for Russia to look on while Serbia was being delivered to the tender mercies of an Austrian inquisition, or to allow Germany to mobilize under the protection of specious formulas without herself taking any steps as regards the slow mobilization of the Russian army. Sazonov saw clearly that war had been decided upon in Berlin, and he helped to make it clear to the Tsar that the German talk about the ancient tie between the two Empires and the services rendered to Russia during the Japanese war was mere manœuvring for position. The precise sequence of events is narrated elsewhere. Suffice it to say that the early course of the war itself showed how the Balkan situation had been irremediably jeopardized by preceding diplomatic mistakes and mishaps. Turkey, Bulgaria and Greece fell away one after the other. Possibly none of these events could have been averted, but it is sufficiently clear that neither the Entente Powers nor Russia in particular were prepared for them, and that they did not take in time measures which would have made them less injurious: the Straits could have been forced when the "Goeben" and "Breslau" passed them; Bulgaria might possibly have been won over by concessions, or attacked with advantage before she was ready to strike. In any case the actual results were disastrous; they determined the isolation of Russia at a time when she stood greatly in need of technical help from her allies. As an indirect consequence of the Balkan events there was a gradual change in the Russian demands as regard Constantinople. It is interesting to compare the reports of two conversations between the Tsar and the French Ambassador, M. Paleologue. In Nov. 1914, Nicholas II. restricted his claims to the opening and neutralization of the Straits, the expulsion of the Turks from Europe and international administration for Constantinople. In March 1915 he declared that the Russian people were more and more intent on the annexation of Constantinople as the ancient site of orthodox Christianity. Sazonov succeeded in getting from the Western Powers a promise to grant these demands in the hour of victory.

It is superfluous to say that Sazonov was staunch in his fidelity to the Entente and in his opposition to the projects for a separate peace or armistice, which at times cropped up in court circles; he had however, like all other moderate Liberals, the greatest difficulty in resisting the discreditable influences which swayed the Government in its reactionary policy. He opposed as far as he could the assumption of the Army command by the Tsar, as this measure could not effect any improvement in military matters, weakened the home Government and made it more accessible to intrigues. He strongly urged the necessity of winning over the Poles by a real measure of Home Rule, and he seemed to have convinced the Tsar of the necessity of such a measure, but this apparent success was really the occasion of his fall. The Empress Alexandra brought pressure on the Tsar; the measure was countermanded, and Sazonov was dismissed.

He was preparing to start for London as ambassador to succeed Count Benckendorff, when the revolution of March 1917 broke out. He deplored its advent, which brought an end to Russia's participation in the war and plunged the country into an abyss of uncertainty and misfortune. He consented, however, to proceed to London as an envoy of the Provisional Government when the fall of Milyukov and the subsequent degradation of the Government made it necessary for him to step aside. He was again put in charge of the Ministry of Foreign Affairs by Adml. Kolchak, and proceeded to London and Paris in the hope of contributing by his personal authority to win a recognition of the claims of historical Russia from her former allies. Such hopes proved to be in vain. The Peace Treaty of Versailles made only general allusions to the possibility of her reappearance in the

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future. Nor was Sazonov the man to curry favour with Esthonia, Latvia and Georgia, in order to obtain help, at the cost of a renunciation of the imperial interests of his country. (P. Vi.)

SCAPA FLOW, an expanse of sea, in the S. of the Orkneys, bounded by Pomona on the N., Burray and South Ronaldshay on the E. and S.E., and Hoy on the W. and S.W. The area contains seven small islands and is about 15 m. in extreme length (N. to S.), and about 8 m. in mean breadth. There are two chief exits—one, 7 m. in length and 2 m. in mean breadth, into the Atlantic Ocean by Hoy Sound, and the other, 3½ m. in length by 2 m. in mean breadth, into the North Sea by Holm Sound. Scapa Flow contains several good anchorages, the best being Longhope in the island of Hoy. When the danger of a war with Germany came first to be apprehended, it was proposed to establish the chief British naval base, in the event of war, at Rosyth in the Firth of Forth, but it was afterwards decided that a larger base in a natural harbour farther N. would be required, and in 1912 it was proposed to construct defences both at Cromarty and at Scapa Flow. Permanent defences at Scapa were, however, abandoned in 1913, owing to the developments of submarine warfare, which rendered it very costly to protect the various entrances. Immediately on the outbreak of war, batteries were erected at Scapa and the Territorial Garrison Artillery of the Orkneys were mobilized to man them. Scapa Flow was preferred to the Cromarty Firth as his chief naval base by Admiral Jellicoe, but no preparations had been made and everything had to be improvised, guns being landed from the ships to strengthen the defences. The absence of preparations came to be felt more strongly with the rapid growth of the submarine menace, for the depth and number of the entrances made it a serious problem to establish adequate defences. By the middle of Oct. 1914, "U" boats were active in the neighbourhood of Scapa Flow, and on Oct. 16, an enemy submarine was reported to be in the Flow. The few capital ships which happened to be there put to sea, and it was recognized that the base would be unsafe until anti-submarine defences were installed. While the necessary operations were in progress, the fleet occupied temporary bases in Skye and Mull and in the defended harbour of Lough Swilly in Ireland, and the absence of the fleet was successfully concealed. By the end of 1914, the entrances of Scapa Flow had been adequately protected, facilities for carrying out all but the most serious repairs were installed, and Scapa Flow gradually assumed the aspect of a great naval station, which it retained to the end of the war. As a precaution against espionage, navigation in the adjacent waters was very severely regulated, and an ever-widening region of the mainland (ultimately extending as far S. as the Caledonian Canal) was proclaimed as a prohibited area. The German ships which were surrendered in Nov. 1918 were interned in Scapa Flow, where on June 21 1919, all the battleships and battle cruisers, with the exception of the battleship "Baden" and five light cruisers, were scuttled. Three light cruisers and some smaller vessels were beached.

SCARBOROUGH, England (*see* 24.301).—The pop. decreased from 38,161 in 1901 to 37,224 in 1911. In 1913 the municipal area was increased from 2,562 to 2,902 acres. The town was bombarded by a squadron of German cruisers on Dec. 16 1914; 18 persons were killed, 84 injured, and damage done to 231 buildings. On April 27 1917, it was ineffectually shelled by submarines, but in a second attack, on Sept. 4 of the same year, 3 persons were killed. The repair of the castle walls and keep, considerably damaged in the bombardment of Dec. 1914, was in progress in 1921.

Excavations of archæological interest were carried out on the foundations of the old Northstead Manor House at Peasholme, and the remains of the Roman camp on Castle Hill have been bared and opened up. To the amenities of Scarborough were added during 1911–21: a bathing pool measuring 350 by 190 ft. at the foot of the cliff in South Cliff Gardens; a new Floral Hall of Glass in Alexandra Gardens, with accommodation for 1,500 people; Peasholme Park as a public garden, with a boating lake; and the Spa Promenade was extended and a bandstand and large café added. A town-planning scheme was prepared in 1921. Some industrial works were established during the decade, including a piano factory at the Mere, clothing factories, a motor-body works and a colour-printing works.

SCARFOGLIO, EDOARDO (1860–1917), Italian journalist, was born at Paganico (Aguila) in 1860, and died at Naples Oct. 6 1917. He was one of the most vigorous and ablest journalists of his time and an excellent newspaper manager as well as editor. He founded the *Corriere di Roma*, the *Corriere di Napoli*, the *Ora* of Palermo and the *Mattino* of Naples. It is with the latter paper, which he owned and edited for many years, that his name is chiefly associated. He was the husband of the novelist Matilde Serao (*see* 24. 661), from whom, however, he had been separated for many years.

SCHARLIEB, MARY DACOMB (1845–), British surgeon, was born in London June 18 1845, the daughter of William Candler Bird. She was educated privately, and married a barrister who was then practising in India. She wished to study medicine, at that time an extremely difficult profession for a woman to adopt, and entered the medical college at Madras, receiving its diploma in 1878. She afterwards went to England and studied at the London School of Medicine for Women, taking her degree as Bachelor of Medicine and Surgery in 1882 with very high honours. In 1883 she returned to India, and became lecturer in midwifery and gynæcology at the Madras Medical College and examiner in the same subjects to the university of Madras. In 1888 she took her London degree of M.D., and from 1887 to 1902 was surgeon at the New Hospital for Women, being senior surgeon from 1889. In 1887 she was appointed lecturer on forensic medicine to the Royal Free Hospital, in 1889 lecturer on midwifery, and in 1902 chief gynæcologist. She retired from these posts in 1909. In 1917 Mrs. Scharlieb was made C.B.E. She was a member of the royal commission on Venereal Diseases (1913–16), and published *A Woman's Words to Women* (1905); *The Mother's Guide* (1905); *The Seven Ages of Woman* (1915); *The Hope of the Future* (1916); *The Welfare of the Expectant Mother* (1919).

SCHEER, REINHOLD (1863–), German admiral and ultimately commander-in-chief of the German battle fleet in the World War, was born Sept. 30 1863 at Obernkirchen in Hesse-Nassau. He served in the German colonial wars in Cameroon and E. Africa and was appointed in 1903 to the command of the 1st Torpedo Division. Subsequently he was for a time at the head of the Central Section in the Imperial Navy Office. In 1913 he was promoted to the rank of vice-admiral and was made commander of the 2nd squadron. In 1916 he was appointed to the command of the German battle fleet (Hochseeflotte). He was in command of the Fleet at the battle of Jutland, and in his book *Deutschland's Hochseeflotte im Weltkrieg* claimed to have won a victory there. In July 1918 he was made chief of the Admiralty staff and again in Aug. of the same year chief in command of the Fleet. In Dec. 1918 he was retired.

SCHEIDEMANN, PHILIPP (1865–), German Social-Democratic leader, was born July 26 1865 at Kassel. He was by trade a printer, but in 1895 took to editing Socialist newspapers, first at Giessen and afterwards successively at Nürnberg, Offenbach and Kassel. In 1903 he was elected member of the Reichstag for the great industrial constituency of Solingen, and in the course of the World War he became the leader of the Social-Democratic party. In his reminiscences of the war period, which he published in 1920 under the title of *Der Zusammenbruch* (The Collapse), he gives an account of the attitude of the Socialist party as a whole at the beginning of the war, and of the change of policy which, to the disappointment of international socialism in other countries, led the German Socialists to give an all but unanimous vote in the Reichstag for the first war credits. He refers to the hurried visit of his Socialist colleague Hermann Müller to Paris on Aug. 1 1914 to discuss the situation with the French Socialists, and the effect of Müller's report, when with great difficulty he had managed to make his way back to Berlin. Scheidemann represented the attitude of the great majority of the Socialists in the Reichstag, if not in the country, by persistently supporting the Government in the main lines of its war policy, up to the months immediately before the so-called "Peace Resolution" of July 19 1917 at any rate. In conjunction with Erzberger he was one of the leading authors of this Resolution, which demanded "peace without annexation or indemnities." Before this date the

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improvement in the position of the Socialist party in German political life had been shown by the way in which its leaders, particularly Scheidemann, were frequently called into conference with the imperial chancellor, Bethmann-Hollweg. Scheidemann, in his book, gives a vivid account of some of these conferences, and also of the celebrated interviews which the leaders of parties in turn had with Hindenburg and Ludendorff in Berlin when the army authorities endeavoured to obtain the modification of the so-called "Peace Resolution" before it was produced in public. It was largely owing to the firm attitude taken up by Scheidemann and the Majority Socialists that the chancellorship of the incompetent Michaelis (July to Oct. 1917) was brought to a close. In June 1918 Scheidemann was elected vice-president of the Reichstag, and on Oct. 3, on the formation of the last imperial Ministry by Prince Max of Baden, he received a secretaryship of State without portfolio. The part which he and his associates in the leadership of the Governmental or Majority Socialists played on the eve and on the outbreak of the Revolution was somewhat ambiguous. There is said to be evidence that, while insisting upon the abdication of William II. and the renunciation of the Crown Prince's rights of succession they were prepared to tolerate the continuance of the monarchical form of government in the shape of a regency, with, perhaps, the Crown Prince's eldest son, a young boy, as the prospective monarch. If this be so their plans were speedily brought to naught by the greater vigour of the Minority or Independent Socialists, led by Haase. The Independents had been active in sowing the seeds of revolution among the troops at the front, the sailors at Kiel and Wilhelmshafen, and the workmen in the munitions and other great factories. It was the Independents who forced the hand of Scheidemann and his associates by the arrangements which they had made in Berlin in the first week of Nov. 1918 for a general strike, a demonstration of the masses, and an appeal to the soldiers of the garrison to follow the example which had just been set in Kiel and other northern towns. And it was for this reason that the leaders of the Minority Socialists had to be admitted on equal terms and in equal numbers into the Provisional Government of the "Commissioners of the People," formed on Nov. 10 by Ebert, Scheidemann, Haase and three others. How little Scheidemann's party had been prepared for the course events took was shown by the fact that a proclamation appeared in the Socialist *Vorwärts* on Nov. 10, announcing that Prince Max of Baden in resigning the chancellorship had handed over the conduct of affairs to Ebert, who accordingly signed this proclamation as "Imperial Chancellor" (*Reichskanzler*). On Nov. 9, when the revolution in Berlin was slowly and, at first, peacefully spreading throughout the city, it was only after the announcement of the Kaiser's abdication had been published by Prince Max of Baden on his own initiative, at noon, and after the troops which were in occupation of the Reichstag building had thrown their rifles into the Spree and gone home, that Scheidemann appeared in front of that building at two o'clock and dramatically proclaimed the republic.

Scheidemann was closely associated with the policy, alleged to have been inevitable, which led the provisional and, afterwards, the first properly constituted republican Government to retain the services of reactionary officers and troops for the suppression of communist disorders. He was, therefore, together with Ebert and Noske made the subject of violent denunciations, not only by the Communists but also by the Minority Socialists after they had seceded from the Provisional Government at the beginning of Jan. 1919. When the National Constituent Assembly met at Weimar on Feb. 6 1919 Scheidemann was selected as president of the first regularly constituted republican Ministry of the Reich. He guided the affairs of Germany through the stormy period of the first half of 1919, when it repeatedly looked as if the communist insurrections, which broke out in various parts of the country, might result in the overthrow of the democratic republic and in an experiment in some kind of Bolshevism. On July 20 1919, being unable to agree to the signature of the Treaty of Versailles, he resigned with the rest of his Ministry. He then resumed the leadership of the Majority Socialists in the National Assembly and subsequently in the first republican Reichstag. In Jan. 1920 he was elected chief burgomaster of his native town, Kassel.

SCHIFF, JACOB HENRY (1847–1920), American banker and philanthropist, was born at Frankfort-on-Main, Germany, Jan. 10 1847. He was educated in the schools of Frankfort and for a time worked in a banking house. In 1865 he went to New York City and two years later organized there the brokerage firm of Budge, Schiff & Co., which was dissolved in 1873. In 1875 he married a daughter of Solomon Loeb, head of the banking firm of Kuhn, Loeb & Co., was taken into the firm and, on Loeb's retirement in 1885, succeeded to the leadership. Meanwhile, largely due to Schiff's energy, the firm had greatly expanded its business and had become known throughout the financial world. In 1897 his house took an active part in reorganizing the Union Pacific railway, which later secured control of the Southern Pacific, assisting E. H. Harriman in these transactions. In 1901 a struggle took place between Schiff and the Harriman interests on the one side and James J. Hill and J. P. Morgan on the other for possession of the Northern Pacific railway. The resulting compromise was the formation of the Northern Securities Co. as a holding company for their joint interests (*see* 27.733). After the outbreak of the Russo-Japanese War in 1904 Schiff introduced Japanese war loans in America and subsequently was decorated by the Mikado. In his later years he gave much personal attention to charities, especially for the Jewish people, and on his seventieth birthday distributed $700,000 among various charitable organizations and public institutions. He was a founder and president of the Montefiore Home for Chronic Invalids, New York City, and vice-president and trustee of the Baron de Hirsch Fund. In 1903 he presented a Semitic Museum to Harvard. He was vice-president of the N.Y. Chamber of Commerce and a director in many large corporations. He died in New York City Sept. 25 1920. His estate was estimated at about $50,000,000. He bequeathed $1,350,000 to various institutions, most of which had received benefactions during his life. The largest bequests were $500,000 to the Federation for the support of Jewish Philanthropic Societies of New York City and $300,000 to the Montefiore Home.

SCHIMMEL, HENDRIK JAN (1825–1906), Dutch poet and novelist (*see* 24.326), spent his last years in work on spiritualistic research. He died at Bussum in 1906.

SCHLESWIG.—The older "Schleswig-Holstein Question" (*see* 24.335) had an important sequel as the result of the World War, in the severing from Germany of part of Northern Schleswig.

The Peace of Vienna of 1864 had set up a joint administration of Schleswig-Holstein by Austria and Prussia. In the Peace of Prague (1866) Austria surrendered to Prussia her claims to both duchies. As regards the administration of Northern Schleswig (Nord Schleswig), an eventual cession to Denmark was reserved if the population should decide in this sense by a free vote. In 1878, however, Austria gave up this reservation, and Denmark in the Treaty of 1907 with Germany recognized that by the agreement between Austria and Prussia the frontier between Prussia and Denmark had finally been determined. The Danish population of Northern Schleswig had, it is true, never acquiesced in this settlement. Propaganda for union with Denmark never ceased, although it had greatly diminished in the years which preceded the World War. At the first elections for the Reichstag the Danes of Northern Schleswig won two seats, but after about 20 years they retained only one of them.

During the World War the movement in Northern Schleswig for separation from Prussia seemed to be in abeyance. It was only the Armistice of 1918, which gave prominence to certain points in President Wilson's programme, that once more inspired among the Danish population a vigorous demand for a plebiscite to decide the nationality of the North-Schleswigers. The Danish Government had at first adopted an attitude of reserve. But from the spring of 1919 onwards a propaganda was conducted in Copenhagen for "South Jutland," the chief leader in the movement being Hansen-Nörremölle, who till then had

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been the representative of the Danish population in the German Reichstag. The German Government declared its readiness to apply President Wilson's programme for the "self-determination" of nationalities to the Danish portions of Northern Schleswig. The Treaty of Versailles provided for a plebiscite in that region. The original intention was to take the plebiscite throughout the whole of the Duchy of Schleswig, which for this purpose was to be divided into three zones. Finally, the idea of taking a plebiscite in the most southerly zone was abandoned, as the population of that district was purely German.

Article 109 of the Treaty established two zones for the plebiscite. The northern, or first, zone was bounded on the S. by a line passing through the islands of Röm and Sylt, keeping S. of Tondern, and then running to the N. of Flensburg, through the middle of the Flensburger Fjord, and leaving the island of Alsen to the N. of the line. The second zone included the islands of Sylt and Föhr and ran on, after bulging somewhat to the S. to the Flensburger Fjord on the east. Within this second zone lay Flensburg. The whole of the plebiscitary area had to be evacuated by the German troops and civil authorities within 10 days after the Treaty of Peace came into force. Powers of administration were transferred to an Inter-Allied Commission. In the first zone the plebiscite was to take place, at latest, three weeks after the German evacuation; in the second zone, at latest, five weeks after the plebiscite in the first zone. The decision regarding the assignment of territory to Denmark or to Germany on result of the plebiscite was to be taken on the proposal of the Inter-Allied Commission with due consideration for the special economic and geographical conditions of the region. The Danish Government appointed the former Reichstag deputy Hansen to the post of Danish minister for Schleswig, with the task of maintaining Danish interests in the plebiscitary area. All persons, without distinction of sex, who had completed their twentieth year and either had been born in the plebiscitary area or had lived there before Jan. 1 1900, were entitled to vote. On the German side, a German committee for Schleswig was formed, and was entrusted with German propaganda and preparations for the plebiscite.

On Jan. 15 1920 the Inter-Allied Commission, which had previously assembled at Copenhagen, took over the administration of the plebiscitary area. The German officials had to leave this territory, and their place was taken by native *Landräte* and administrative officials appointed by the Commission. The German troops evacuated the region by Jan. 20. A battalion of British troops was stationed at Flensburg, a French battalion at Hadersleben and another at Sonderburg. The Inter-Allied Commission was composed of Marling (Great Britain), Claudel (France), Heyste (Norway), and von Sydow (Sweden). It promptly issued regulations for the plebiscite, dealing with the voting qualification and the registration of votes. A control over persons entering the plebiscitary area was also established. A vigorous propaganda was initiated both on the Danish and on the German side and led to a number of incidents especially at Flensburg. The plebiscite in the first zone took place on Feb. 10. On the whole it passed off quietly. It resulted in a great Danish majority; 75,151 votes were cast for Denmark and 25,231 for Germany. The larger towns, Tondern, Hoyer, etc., had in all cases a German majority, while the rural population, with the exception of a few German *enclaves*, voted almost in its entirety Danish. The campaign was much keener in the second zone, where the polling day had been fixed for March 14. There were sharp conflicts, particularly at Flensburg, where the burgomaster, Todsen, was expelled by the Inter-Allied Commission. When a prohibition against the display of flags on the day of the plebiscite was issued on March 6, the German assessors of the Inter-Allied Commission resigned their posts. Repeated collisions with the French troops of occupation took place at Flensburg, and were not unattended by bloodshed. The plebiscite resulted in a great German success; about 51,000 votes were recorded for Germany and only 13,000 for Denmark. There were only two communes which had a Danish majority.

The determination of the frontier took a long time. Germany advocated the so-called Tiedje line, while on the Danish side propaganda was made for the so-called Clausen line. The Council of Ambassadors of the Allies gave its decision at the beginning of June. On June 15 the president of the Paris Peace Conference handed the German delegation a note in which the German-Danish frontier was fixed as follows. It begins at the entrance to the Flensburger Fjord, passes through the middle of that fjord, reaches the mainland immediately to the N. of Flensburg, leaves Flensburg to the S. and then follows a line which reaches the North Sea at Sieltoft. The island of Sylt falls to Germany, the island of Röm to Denmark. On the whole this meant the adoption of the Clausen line. The territory assigned to Denmark was at once handed over to her on June 15, while the territory that remained German was forthwith placed once more under German administration. German troops reëntered Flensburg on June 16 after the members of the Inter-Allied Commission had left the town.

The detailed settlement of the territory to be ceded to Denmark was effected by a treaty concluded between Germany and Denmark and signed in the middle of July. At the beginning of July Denmark gradually took over the administration of the ceded districts, the administration of justice being the last department to become Danish. It is worth noting that the day of the plebiscite in the second zone coincided with the Kapp *Putsch* in Berlin. (C. K.*)

SCHLICH, SIR WILLIAM (1840–), British forestry expert, was born at Darmstadt Feb. 28 1840, and educated there and at the university of Giessen. In 1866 he entered the Indian Forests Department, became conservator of Forests in 1871, and ten years later inspector-general of Forests to the Government of India. He was one of the pioneers of the study of forestry in England, organizing the first school at Cooper's Hill, which was afterwards transferred to Oxford in 1905. He was appointed professor of Forestry at Oxford the same year. Among his books on the subject are *A Manual of Forestry* (1889–95; 3 vols.), and *Forestry in the United Kingdom* (1904). In 1901 he was elected a fellow of the Royal Society, and in 1909 he was created K.C.I.E.

SCHMOLLER, GUSTAV (1838–1917), German political economist (*see* 24.344), died in 1917.

SCHOLL, AURÉLIEN (1833–1902), French author (*see* 24.356), died in Paris April 16 1902.

SCHÖNAICH, FRANZ, FREIHERR VON (1843–1916), Austro-Hungarian general of infantry and Minister of War, was born at Vienna in 1843, and entered the army as a lieutenant in 1861. He spent the greater part of his service on the general staff and on special employments, especially as a chief of sections in the War Ministry. For a short time in command of the IX. Corps he became head of the Austrian Imperial Ministry of Defence, after which he took over the charge of the Imperial War Ministry. Schönaich had an attractive personality, was a practised orator, and well-informed in political matters. Therefore he knew how to maintain good relations with the parliamentary parties, to whom his capacity as an organizer, in the crisis of the winter of 1908–9 (the annexation of Bosnia and Herzegovina), was of great advantage. He was less successful in connexion with the Defence Act of 1911, the financial basis of which he was only able to arrange with important restrictions and serious limitations. In this matter he came into conflict with other influential personages, a circumstance which led to his retirement in the autumn of 1911. During the World War he was in supreme command of the War Provisioning Department, and died at that post in the spring of 1916.

SCHOULER, JAMES (1839–), American lawyer and historian (*see* 24.377), published in 1913 a seventh volume of his *History of the United States of America Under the Constitution*, covering the period of reconstruction (1865–71). The original plan of his work had been enlarged by the publication in 1899 of a sixth volume, covering the period 1861–5.

SCHREINER, OLIVE (*c.*1862–1920), pen-name of Mrs. Cronwright Schreiner, was born in Basutoland, the daughter of a German missionary sent out by the London missionary

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society. She was a sister of W. P. Schreiner, afterwards Prime Minister of Cape Colony, and married in 1894 Mr. S. C. Cronwright, also a S. African politician. Early in 1882, when she was 20 years old, she brought to England the MS. of her first novel, *The Story of an African Farm*, and submitted it first to George Meredith, then reader for Chapman & Hall. He praised the book and suggested certain alterations, most of which she accepted. Eventually it was published by the firm in 1883, over the pseudonym "Ralph Iron." Its success was immediate, but nothing else that she wrote had quite the same literary quality. Her later work includes *Dreams* (1891); *Trooper Peter Halkett of Mashonaland* (1897), a much-criticized attack on the first settlers in Rhodesia; *An English South African's View of the Situation* (1899); and *Woman and Labour* (1911), a fragment of an earlier MS. which had been burnt with other papers during the S. African War. She died at Cape Town in Dec. 1920.

SCHREINER, WILLIAM PHILIP (1857–1919), South African lawyer and statesman, the youngest son of a German missionary, was born in the district of Herschel, Cape Colony. He studied law at Cape Town and at Cambridge and London universities. He was called to the bar (Inner Temple) in 1882 and the same year returned to the Cape where he was admitted an advocate of the Supreme Court. He soon attained success and was for many years leader of the Cape bar. In 1893 Schreiner, who had been legal adviser to the High Commissioner since 1887, began his political career as attorney-general in the second Ministry of Cecil Rhodes. He resigned the same year, took the same portfolio again in Sept. 1894 and remained in office until the Jameson Raid brought about the downfall of the Rhodes Ministry. In 1898, having helped to bring about the fall of the Sprigg Ministry, Schreiner became Prime Minister of Cape Colony and held that position when the Anglo-Boer War of 1899-1902 began. During the crisis which preceded the outbreak of hostilities he allowed the passage of armaments to the Dutch republics, and when the war broke out he wished to keep Cape Colony neutral (*see* 5. 244). Acute differences in the Cabinet caused Schreiner to resign office in June 1900. Later he advocated, unsuccessfully, the federation instead of the unification of the South African colonies. In 1914 he accepted the office of High Commissioner of the Union in London and held that post until his death. He died at Llandrindod Wells on June 28 1919. Schreiner married, in 1884, Frances, sister of F. W. Reitz, President of the Orange Free State. He was a brother of Olive Schreiner, the novelist. Schreiner was a man of high attainments, great industry and impressive speech. His qualities showed at their best at the bar, and the proper crown of his career would have been a seat on the bench. But as a politician he suffered from a lack of suppleness which disqualified him from becoming a popular leader. He had also too much of the cross-bench mind. He was a sincere friend of the natives, and, in 1908–9 successfully defended Dinizulu against the charges of treason and murder brought against him. He also went to London as a delegate of the Coloured Races Political Association to oppose restrictions in the Act of Union.

SCHULTZ, HERMANN (1836–1903), German theologian (*see* 24.382), died in 1903.

SCHURMAN, JACOB GOULD (1854–), American educationist (*see* 24.386), was appointed in 1912 U.S. minister to Greece and Montenegro, serving one year. During the World War, when Germany began unrestricted submarine warfare, he urged that American rights be firmly insisted upon; he pointed out that the destruction of the "Lusitania" in 1915 threatened to efface the distinction between combatants and non-combatants long recognized by civilized peoples. In 1915 he was first vice-president of the N.Y. State Constitutional Convention. In Oct. 1917 he was appointed a member of the N.Y. State Food Commission, resigning in June 1918 to go to France as lecturer to American soldiers under the auspices of the Y.M.C.A. He was opposed to many of President Wilson's policies, especially in connexion with Mexico, and also to Article X. of the Covenant of the League of Nations, believing that it would involve the United States in war. As early as 1913 he urged the independence of the Philippines in the near future; in 1914 he declared in favour of woman suffrage. He resigned the presidency of Cornell University in 1920. He was appointed minister to China in 1921. He was the author of *The Balkan Wars 1912–1913* (1914, lectures at Princeton).

SCHUSTER, SIR ARTHUR (1851–), British physicist, was born in Frankfort-on-Main Sept. 12 1851, the son of Francis Joseph Schuster, of Frankfort, who in early life made his home in London, where he carried on a successful business as merchant-banker in Cannon St., his three sons, Ernest Joseph (b.1850), subsequently a well-known lawyer, Arthur, and Felix (see below), being brought up, like himself, as British subjects. Arthur Schuster was educated at Owens College, Manchester, and at Heidelberg University, and devoted himself to a scientific career as an astronomer and mathematical physicist. He was chief of the "Eclipse" expedition to Siam in 1875, and from 1888 to 1907 was professor of physics in Manchester University, his main work for many years being connected with advanced research in spectroscopy, on which subject he contributed the article in the 9th ed. of the *E.B.* in 1887 (as also to the 11th ed. in 1910). He was awarded the royal medal of the Royal Society in 1893, and was one of the secretaries of the Royal Society from 1912 till 1920. He was president of the British Association in 1915, having in 1892 acted as sectional president for astronomy, and he became well known throughout the scientific world, receiving hon. degrees from both Oxford and Cambridge. He was also secretary of the International Research Council, and during the World War, both in that capacity and as a representative of the Royal Society, he did invaluable work as a scientific adviser in connexion with the organization of research in various departments. He was knighted in 1920, and was appointed a member of the royal commission on the universities of Oxford and Cambridge. His numerous publications include works on *Theory of Optics* (2nd ed. 1909), *The Progress of Physics* (1911) and *Britain's Heritage of Science* (1917).

His brother, SIR FELIX SCHUSTER, Bart. (1854–), was also educated at Owens College, Manchester, and studied further abroad, afterwards making his career in London banking. From 1895 he was identified, as governor, with the Union Bank of London, afterwards the Union of London & Smiths Bank, and in 1918 amalgamated with the National Provincial Bank as the National Provincial & Union Bank of England. He was a member of the Council of India from 1906 to 1916, and became chairman both of the Central Association of Bankers and of the Committee of London Clearing Banks. In these years he established for himself a leading position in financial and economic circles, and was made a member of several important Government committees and royal commissions, his annual addresses to the shareholders of his bank being recognized, with those of Sir Edward Holden (of the London, City & Midland Bank), as among the most important contributions of the day to sound thinking on current monetary problems. He was created a baronet in 1906.

SCHWAB, CHARLES MICHAEL (1862–), American capitalist, was born at Williamsburg, Pa., April 18 1862. He was educated in the public schools and at St. Francis College, Loretto, Pa., where he gained an elementary knowledge of engineering. From 1878 to 1880 he was a clerk in a store at Braddock, Pa., and then became a stake driver in the engineering corps of the Edgar Thomson Steel Works of Carnegie Bros. & Co. His ability brought him rapid promotion and in 1881 he was made chief engineer and assistant manager. Six years later he was appointed superintendent of the Homestead Steel Works. In 1889, on the recommendation of Henry Frick, he was made general superintendent of the Edgar Thomson Steel Works, and in 1892, after the formation of the Carnegie Steel Co., he was made also general superintendent of the Homestead Works. In 1897 he was elected president of the Carnegie Steel Co., and when this was merged in 1901 in the U.S. Steel Corp. he was made president of the latter. He resigned in 1903. He then turned his attention to shipbuilding and a few years later with other capitalists secured control of the Bethlehem Steel Corp.,

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which owned the Bethlehem Steel Co., and several other corporations engaged in the iron, steel and shipbuilding business. He was made chairman of the board of directors. After the outbreak of the World War in 1914 and before the United States entered it, these companies filled orders for the Allies aggregating between 400 and 500 million dollars. The manufacture of submarines for England raised the question of neutrality, but this was solved by shipping parts to Canada, where they were assembled. It was generally understood that German interests made attempts to secure control of the Bethlehem works in order to shut off munitions from the Allies, and a report that Mr. Schwab was offered $100,000,000 for his interest was not only widely published but was given prominence in a reception given to him by the New York Chamber of Commerce, and neither then nor at any other time denied by Mr. Schwab. After America's entrance into the war special attention was given to the speeding up of shipbuilding, and in April 1918, at the urgent request of President Wilson, Mr. Schwab became director-general of the shipbuilding board of the Emergency Fleet Corp. His power of rousing enthusiasm among workers by personal contact began immediately to produce results. The resulting output for 1918 was 410 steel vessels (2,570,077 deadweight tonnage), 106 wooden ships (376,480 deadweight tonnage), and 10 composite ships (37,500 deadweight tonnage), a total of 526 vessels. After the signing of the Armistice in Nov. 1918, feeling that his services were no longer required, he resigned from the Emergency Fleet Corp. in Dec. and returned to his position as chairman of the board of directors of the Bethlehem Steel Corp. Later, charges were brought that he had wrongfully used Government money for expenses unrelated to public duties during his tenure of office, but official investigation completely exonerated him. His benefactions include a Catholic church at Loretto, as well as buildings and endowment for St. Francis College; a church at Braddock, Pa., a school at Weatherly, Pa., and a country home on Staten Island, N.Y., for children of the New York Foundling Hospital.

SCIENTIFIC MANAGEMENT.—This is one of the names adopted for a certain body of principles and methods of management which have been propounded as applicable to industrial undertakings, other names being Efficiency Engineering and Industrial Management. Developed in the United States, mainly since about 1905, and particularly in connexion with engineering work, the methods of Scientific Management have exercised a profound influence on methods of factory management in England and on the continent of Europe, as well as in America. Though applicable to most of the problems of industrial administration, they have in fact been worked out mainly in connexion with the control of workshop processes.

The theory underlying Scientific Management is briefly that there is "one best way" of doing every act that has to be performed in a workshop, and that it is the duty of the management to discover that "one best way" and to make such arrangements as will ensure that it is always carried out. The method of procedure may be indicated by propounding the following three questions:—

1. What are the factors which limit the speed of a particular workshop process or machine?
2. Why is it that the volume of output from a particular process is always less at the end of the week than the product of the speed of the process or of the machine, multiplied by the working hours in the week, would lead one to expect?
3. Why do some workers produce so much more than others working under the same conditions?

An attempt to discover full answers to these questions leads to very far-reaching inquiries, and radical changes in organization and administrative methods may become necessary if the results of such inquiries are to be put to effective use.

Thus, the investigations prompted by the first question may be expected to lead to modifications of the mechanism and construction of a machine to enable it to run faster; to modifications of tools or appliances used; to changes of the material used for machine parts, for tools or for accessory purposes. Changes in the design of the work to be done might also follow, which, while leaving the product just as suitable for its purpose as before, would enable the process to be carried out faster. A different method of handling the work, the machine or the tools might be developed, involving a new series of motions on the part of the workman which would result in a saving of time. Not only would specific improvements be made of the kind suggested above, but the effect of each of the many elements which influenced and limited the speed of a process would be reduced to a law, the knowledge of which would save a great deal of experimentation in applying the process to changed conditions.

Investigation of the second question might lead to equally valuable discoveries. For instance, it might be found that the process was stopped altogether for portions of the working week for such reasons as lack of continuous supply of material to be worked on; changes of the "set-up" of a machine due to change in the nature of the work to be done; breakdowns of the machine; adjusting or sharpening of tools; waiting for instructions and many other possible causes. The attempt to remedy these would lead to the development of methods of work-control and planning. These would aim at ensuring that material was always ready to hand to be worked on; that all work of a like nature was carried through at the one time, to avoid needless resetting of machines; that tools and appliances were ready to hand; that instructions as to the next job were prepared and ready in advance; that the nature of each new piece of work was clearly described and so on. Schemes of periodic inspection or adjustment of machines or tools might be indicated in order to reduce time lost through breakdowns.

The third question would lead to the discovery that different workmen had slightly different ways of doing the same thing, and that the ways of the faster workers could be explained to and adopted by the others; that some workers were temperamentally more suited to a particular kind of work than others; that some were not trying; that others were trying too hard and were worrying themselves by their failure; that in some cases the relations between the workmen and the foreman were happy and in other cases not.

The remedying of these troubles would lead to careful methods of choosing workmen for particular jobs, to ensure that men of suitable temperament as well as capacity and skill were employed; to schemes of instruction for showing the worker exactly what was required of him, and for teaching him the methods which had been found to be the best for carrying out the work in question. A scheme of payment by result might be developed, to give the workman the necessary incentive to ensure that he would profit by the instruction given him and would follow the methods laid down. The methods of control, the relationship of the various grades of personnel and the demarcation of the spheres of authority of the various officers of the workshop might also require rearranging, to allow of the foregoing changes and to ensure satisfactory relations between the workmen and those directing them. Built up on the result of such investigations as have been indicated, a variety of systems of management have grown up, one emphasizing one factor and another specializing in another direction, and all known by the general description of Scientific Management.

The origin of the movement is traceable to the work of F. W. Taylor, an American engineer, for many years a manager in the works of the Bethlehem Steel Co., Midvale, Pa. His investigations, leading later to the development of his methods and principles of management, sprang from the attempt on his part to lay down a standard fair day's work and to see that he got it from the men under his control. This led him into a deep analysis of the elements affecting the amount of work that could be done in a given time, and in turn by the kind of steps already indicated to the formulation of his system. One of the largest single pieces of investigation carried through by him was concerned with establishing the laws governing the rate of removal of metal by cutting-tools in a machine. This was carried on at intervals during 26 years. One result of it was the discovery in 1899 of modifications in the composition of tool steel from which the modern high-speed steel was developed. The whole results were

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published in 1906 in the *Transactions of the American Society of Mechanical Engineers* under the title "The Art of Cutting Metals." In this Taylor distinguished 12 different factors as influencing the possible speed, and he established formulæ expressing the effect which each had on the rate at which metal could be removed during a machining operation. He found that the maximum speed of working could only be attained by a correct adjustment of each variable in relation to all the others. To enable this calculation to be made quickly, one of Taylor's assistants, C. G. Barth, devised a type of compound slide rule, by which the best adjustment of the 12 variables referred to could quickly be found, so establishing the combination of conditions under which the work could be done in the shortest time. An account of these slide rules was published in the *Transactions of the American Society of Mechanical Engineers* (1904). A special slide rule was needed for every variation of every type of machine, and in order to reduce this complication it was necessary to group together all machines capable of doing similar work and to modify them so as to make their movements identical. One calculation and one slide rule would then serve for all the machines of a group. In other words, machines were, where possible, standardized.

To enable maximum cutting speeds to be attained Taylor established, as a result of the foregoing investigation, a set of standard cutting tools for the commonest kinds of machine operations, such as lathe work. These standard tools were specified as to contour of cutting edge, all angles of cutting edge, size of shank and hardening treatment, etc.

Another piece of standardization work resulting from Taylor's investigations was in connexion with the design and use of belt drives. Obviously, if a machine was to be called on to give its maximum performance the means of driving it must be suitable to ensure adequate power. This necessitated an investigation into the laws of power transmission by belting and the drawing up of rules for the standardization both of the material of the belts themselves and of the conditions under which they should be used. One of the most important of these conditions is the tightness of the belt before starting up the drive. Besides laying down suitable rules for this, apparatus was designed for measuring and checking it. Accounts of this work were published by Taylor in 1894 and elaborated by Barth in 1908, both in the *Transactions of the American Society of Mechanical Engineers.*

Concurrently with all this investigation another line of thought had been receiving attention, both from Taylor and others, again mostly in connexion with the engineering trade. This was the problem of obtaining from the workman a higher level of effort than he gave under ordinary methods of workshop management. Although "piece work"—payment by the piece as against payment by the hour or day—was in very general use in many industries, the practice of "cutting the rate" had reduced its efficiency as a stimulus to maximum effort. One of the earliest attempts was the development during the 'eighties by H. R. Towne of the Yale & Towne Mfg. Co., United States, of a scheme called by him "gain sharing," according to which improvements in the efficiency of a works department resulted in the payment to workers in it of a bonus on a prearranged scale. Other plans were the Rowan scheme, which consisted in the fixing of a variable rate per piece, the rate falling according to a fixed scale as the workmen's output rose. By this plan, although the workman benefitted by extra effort, the rate of increase of benefit constantly diminished. The aim was to avoid the temptation to "cut the rate" while still making an attempt to fix a standard of expected output from the workman. This plan was published in 1891.

In 1895 Taylor published his *Differential Piece Rate*, which may be considered to be the basis on which all the multitudinous systems of payment by result of the Scientific Management movement are founded. Taylor's system contained two revolutionary ideas. The first was the careful specification in great detail of the work to be done, with standard times allowed for each element of the work as against the "overall" time hitherto specified for the complete job. The second was the offering of an increased rate of return to the worker for increases in his efficiency—exactly the opposite to the Rowan plan. This was achieved by offering two alternative piece rates, the lower to apply if the work was done at less than the standard speed and the higher if it were done at the standard speed or faster. The feasibility of this scheme depended entirely on the accuracy with which the "standard time" could be determined. So important did this become that the idea of "time study," with its later development of "motion study," is probably the best-known feature of Scientific Management, and indeed is often taken to be synonymous with it.

Many modifications of Taylor's scheme of payment by result were developed by other workers in the movement. All retained as their basis the setting of a standard time by careful time study, the time being built up of the times for the elements of the work, and the nature of the work to be done and the methods to be followed being specified in great detail. All provided that the rate of incentive should increase at or about the efficiency needed to accomplish the task. The best known of these other schemes are the "Gantt bonus plan" by H. L. Gantt, published in 1901, and that of Harrington Emerson, published in 1909.

It will be realized that the characteristic features of Scientific Management so far touched on—the standardization of appliances and methods, the detailed specification of the work to be done, time and motion study, setting the workmen's task, regulating his payment by his performance of it—all lead to increased complication of management functions.

The material equipment of a works requires special attention to keep it in conformity with the standard. The quality of raw material must be more carefully regulated to enable it to be worked at the standard speeds and on the standard methods. The elimination of waiting between jobs requires elaborate planning of work; the making of time studies is the work of experts; the studies themselves require constant revision to suit changes in design, working methods or material; the incentive to output necessitates systematic inspection of work to ensure the standards of accuracy or finish being maintained. In these and numberless other directions work of a much higher order than hitherto is demanded from the management staff if the system is to function at all.

In order to enable the works management to cope with the new demands made upon it, Taylor devised a new method of administrative organization known as functional control, and applied it particularly to the sphere of the shop foreman.

Under the usual methods of organization a foreman has complete charge of the men under him. All instructions from the higher management pass through him and reach the workman as though they were the foreman's own orders. Taylor's idea was that the instructions which had to be given to the workmen under his system were so much more detailed and elaborate, and dealt with so many more aspects of his work than hitherto, that it became impossible to pass them through a single foreman. It was impossible, he claimed, to find a foreman sufficiently expert in all the sides of the control work or having a sufficiently rich endowment of qualities to carry out the multiplicity of functions now embodied in management. Thus, he would have to be sufficiently skilled at the particular process to teach the men under him how to carry it out; he should have the impartial judgment of an inspector; he must have the assertiveness and force of character needed to get a good day's work out of his men; knowledge of character, sympathy and sense of justice to deal with matters of discipline; he must be methodical and sufficiently versed in clerical and statistical methods to plan out his work and avoid loss of time between one job and another. He must understand costing, methods of handling material, time study and the setting and adjusting of piece or bonus rates, and so on. Because of the obvious impossibility of creating a staff of foremen who should be experts in all these lines, Taylor replaced the single foreman having complete charge of a group of men by a number of "functional foremen," each specializing on one aspect of management control. Each individual workman

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would now receive his orders from perhaps half a dozen experts. One told him which job to do next, or in what order to do a series of jobs. Another supplied him with the instructions as to the nature of the work to be done or the article to be worked on. Another told him at what speed to run his machine. Another saw to the upkeep of the machine; another set the piece rate; another judged the quality of the product, and so on. Behind each of these functional foremen was a special department looking after a particular aspect of management, of which he was the mouthpiece, as far as the workman was concerned.

This rigid and literal working-out of Taylor's idea of "management by experts" had usually to be modified in practice on account of the friction and confusion it almost inevitably led to, due to the difficulty of defining sufficiently clearly the sphere of each functional foreman, or to the clash of personalities.

Harrington Emerson embodied the necessary modification of Taylor's scheme in his plan of "Staff and Line" organization, published in 1909. In this the usual chain of executive authority, the "line," was maintained, by which a group of men was wholly answerable to a single foreman, a group of foremen to a departmental manager, several of these to a works manager, and so on. The experts, on the other hand, were collected into special "staff" departments, and their functions were to advise or instruct the "line" officials as to what instructions should be given, or how their work could best be done. This plan gives scope in the line organization for that personal leadership which was fatally destroyed by Taylor's functional foremanship, but still enables the methods of work and the technical policy to be laid down by experts in the various functions.

The last of the three questions propounded at the beginning of this article did not receive the same amount of attention as the other two at the hands of any of the leaders of the Scientific Management school of thought. Taylor in his paper on Shop Management (1903) does, it is true, make a feature of selection of the worker to suit the job, but his ideas in this direction were very different from those of the later school of applied psychology. Taylor's aim was the discovery, by records of individual performance, which men were as a matter of fact most successful in carrying out the task set them. The less successful were to be shown the correct methods of working, but if they still failed to reach the predetermined level of achievement, which was that of a good man, not an average worker, they were to be discharged to make room for others. A follower of Taylor, Dr. Katherine Blackford, made an attempt at selection of the workers beforehand, in distinction to Taylor's selection by trial and error on the job. In her book, *The Job, the Man and the Boss* (1914), she attempted to devise tests which should indicate the capacity of men for various kinds of work, *i.e.* their chance of making good if taken on and given trial. In view of the recent progress of applied psychology in this field, her work is not, however, worthy of serious consideration.

It may be useful to summarize the features embodied in Scientific Management systems as actually applied to an industrial undertaking.

Standardization of all machines doing similar work; of all factory equipment, *e.g.* driving and power transmission gear, factory furniture, etc.; of all tools and appliances; of materials to be worked on; of routines; of quality of work, etc. The maintenance of the standards usually necessitates several special departments, *e.g.* for inspection of quality, for upkeep of machines and tools, for dissemination of information, etc.

Time and Motion Study.—Time studies are made of the elements of all jobs, as distinct from overall times. Motion study is a development of time study, being an analysis by special methods (including photographic and even cinematographic) of the motions involved in an element of work. From this study motions or parts of motions which are useless are eliminated and the new method taught to the worker. The results of time and motion studies are embodied in written instructions for the use of the worker. These are in considerable detail, covering not only a full description of the work to be done but also of the exact methods of doing it, the tools to be used, the "setting" of the machine, etc., with times for each element both of the machine's work and the work of handling.

Payment by Result.—Some schemes of extra payment for the successful performance of the task as laid down in the instruction based on the time study.

Functional Management.—This may vary from complete functional foremanship to functional study of methods, technique and procedure, the results being conveyed to the workman via a departmental foreman.

Planning.—A special functional department is charged with laying down the order of preference of all work, the sequence of operations or moves through which each job has to pass, the arranging beforehand that all material, tools, appliances, etc., shall be on hand for each job when needed, the conveying of all instructions either to the foreman or to the workman according to the degree of functional management in operation. The planning department is also the central statistical bureau of the factory where all records of the state of advancement of all jobs, of costs, of machines available, often of stores, of men available, etc., are kept.

These features do not exhaust all the functions of management, but may be taken as those which distinguish Scientific Management schemes of organization from earlier types. Of course, certain of these features have been selected and applied in many instances where the full and complete scheme has not been adopted. A scheme which could claim to be ranked among the instances of Scientific Management would, however, include all the above features.

This account would not be complete without some mention of the attitude of labour to Scientific Management. Taylor himself, and later some of his followers, made extravagant claims to the effect that the new methods, by enabling standards of work to be laid down and the worker's achievement to be measured and his exertion rewarded on a prearranged scale, solved the labour problem. Not only has this happy result failed to materialize, but the attitude of labour, suspicious at the outset, has tended to harden into declared antagonism. The extension of the system in America was opposed more and more vigorously as time went on, leading to a serious strike against it in the Watertown Arsenal in 1911.

As a result of growing antagonism the United States Commission on Industrial Relations in 1914 directed that an investigation into the working of Scientific Management should be made, and appointed for this purpose Prof. R. F. Hoxie, of the university of Chicago, with the assistance of a Scientific Management expert and a labour leader. This Commission visited many of the chief establishments in the United States at which Scientific Management was in operation, and its findings are given in Prof. Hoxie's book *Scientific Management and Labor*. Everywhere the investigators found labour antagonistic; the objections which, with minor ones, appear to be fundamental were as follows:—

The system leads to "driving" the worker and to sweating, due to its attempt to speed up all to the speed of the fastest.

The minute splitting up of jobs leads to very much increased specialization of the worker, to the narrowing of his range of skill, and consequently to the destruction of craftsmanship. The work became more monotonous and less satisfying to the worker.

It was claimed that the individual task and reward, and the constant selecting of the fastest workers, destroyed the solidarity of the workers in a factory. The knowledge of a "trade" was no longer necessary to the workmen; all the specialized knowledge having been acquired by the management, the workman had less to sell than previously.

For these and other reasons it was claimed by the workers that the system was anti-social; that it was undemocratic; that it treated the worker as a tool, denied him scope for his personality, and condemned him to endless routine meticulously laid down and arbitrarily enforced.

There can be no doubt that much of the resentment of labour has been aroused by the personality and mental attitude of the Scientific Management experts and the staffs they created in the works which they reorganized, rather than by the fundamental ideas of their system. Their conception of industry was entirely mechanical. Their organizations were ingenious structures of men, machines and routines. Each of these had its place in their buildings, but like steel, brick and cement, though differing in their qualities, all alike were simply building materials, inanimate and obedient to the hand of the builder.

This cast of mind inevitably bred bitter antagonism in labour, and by the year 1921 there was already distinct evidence of a change on the part of the most advanced organizers, both in America and in England. It was significant of this change that Taylor's scheme of functional foremanship had come to be re-

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garded as mistaken even by many of his closest followers, who were inclining to believe that in forfeiting the vital factor of personal leadership the loss was greater than could be compensated for by any amount of intensification of expert knowledge. There was a growing tendency too to concentrate study and standardization on the inanimate side of industry, on machines, tools and equipment, on materials and their treatment, on handling methods and appliances, on labour-saving devices, rather than on speeding up and regulating the motions of the worker. The same distinction was seen in the attitude of British labour leaders to Scientific Management. Among the more intellectual leaders the accumulation of more and more of the technical knowledge of an industry in the hands of the management and the more detailed regulation and instruction of the manual worker which results were recognized as inevitable. They were seen to be merely a continuation of the process of replacing hand labour and hand skill by machinery. Such men accepted the need for the application of science to industry as far as the inanimate factors were concerned, and concentrated their antagonism against the treatment of the worker as mere impersonal mechanism.

By the end of the World War some 100–200 American undertakings, largely engineering concerns, had adopted Scientific Management in one or another of its forms, as a complete system. In Great Britain the number of such firms was perhaps one-tenth of those in America, and the positions in France and Germany were perhaps less advanced still. The influence of the movement, however, cannot be estimated by any such figures. For every concern that had adopted the system in its entirety there were 10 or 20 that had adopted portions of it, or had modified their previous methods of management under the influence of ideas first given prominence by the Scientific Management school. The conception of "the one best way," the belief that every act, every relation and every implement of industry is worthy of close and systematic study, has provided an inspiration and a stimulus to management methods in all industries and in every country, the effect of which can hardly be less than that of the introduction into industry of machinery a hundred years ago.

(C. G. R.)

SCOTLAND (*see* 24.412*).—The history of Scotland from 1910 to 1921 resolves itself largely into the effect of the World War (1914–9) and of the conclusion of peace upon industry and commerce. In the history of actual military operations, Scotland played, naturally, a small part, although for the first time in the history of Great Britain as a sea-power, the main activities of the fleet took place in Scottish waters. Zeppelins attacked Edinburgh and the E. coast on April 2 1916. On May 2, in the course of a raid which was upon an unusually large scale, but had very slight results, a Zeppelin (L20) missed Edinburgh and sailed as far N. as Aberdeenshire, where it dropped bombs which fell harmlessly on fields. Another fruitless expedition to the S.E. of Scotland took place on Aug. 9 1916; the raiders got into thick weather and their bombs were dropped in rural areas. On May 15 1918, St. Kilda was bombarded by a German submarine and damage was done to the church and some other buildings. The surrender of the German fleet is the only other operation definitely associated with Scotland. German naval emissaries arrived in the Firth of Forth on Nov. 15 1918, and the surrender began on Nov. 21. It was in Scapa Flow that the crews of 70 German warships scuttled their ships on June 21 1919.

The part played by Scotland in supplying man-power and in providing munitions of war was worthy of the national tradition. The Scottish recruiting record in the period preceding the introduction of compulsory service will compare with that of any other portion of the United Kingdom, and Scottish industries, like those of England and Wales, were directed to the production of war material. The Clyde, naturally, took a large part in naval construction and repairs, and all over Scotland, munition factories came into existence. In the naval warfare, the E. coast of Scotland was of great strategic importance.

Apart from the war and its effects, the ten years witnessed few important internal events or movements. Trade and commerce were frequently interrupted by strikes, but the only serious riots took place in Glasgow on Jan. 31 1919, when considerable damage was done to buildings. Political interests, before the war, pursued their traditional course, and in the general election of Dec. 1910, Scotland returned 58 Liberal, 11 Unionist, and 3 Labour or Socialist members. By the date of the Armistice, party politics had undergone a complete transformation, and, at the general election of Dec. 1918, Scotland, which by the Reform Act of 1918 received two additional members, returned 58 supporters of the Coalition, 7 Independent Liberals, 7 Labour representatives and 2 Independents. A feature of the period has been the large number of state visits paid by King George and Queen Mary. An Accession Court was held at Holyrood in June 1910, and, a year later, the King dedicated the new chapel of the Thistle in St. Giles's cathedral, Edinburgh. Royal visits to Edinburgh, Glasgow, Dundee, Perth and Stirling took place in July 1914. During the war, the King paid some private visits to centres of munition industries, and the programme of state visits was resumed in July 1920, when the King and Queen held a Court at Holyrood, and in their yachts visited the Clyde during the regatta known as the "Clyde Fortnight."

In church affairs, the most important events have been the issue in 1910 of the final Report of the Royal Commission appointed under the Churches (Scotland) Act of 1905, allocating the property of the old Free Church between the United Free Church and the Free Church, and the series of negotiations for union between the Church of Scotland and the United Free Church, which became a matter of practical politics after the discussions in the Assemblies of 1912 and had advanced so far by 1919 that, on Dec. 17, the commission of the Assembly of the Church of Scotland agreed to approach the Government with a view to carrying a bill through Parliament.

The recent growth of a keener appreciation of the value of historical records and monuments is illustrated by the enactment in 1913 of the Ancient Monuments Consolidation and Amendment Act, by the work done by the Royal Commission on Ancient Monuments, originally appointed in 1908, and by the gift of four great historical buildings to the nation. In 1918, Lord Glenconner presented Dryburgh Abbey to the nation, and in the same year the Duke of Buccleuch followed his example by the gift of Melrose Abbey. In 1919, the Duke of Roxburghe made an arrangement with the Commissioners of Public Works and Buildings by which Kelso Abbey became a national monument and is maintained by the State, and in 1920 Col. Hall Dempster placed Restenneth Priory (Forfarshire) in the charge of the Commissioners of Works for national guardianship and for the benefit of the nation. On the other hand, by an outrage attributed to suffragettes, Scotland lost on Feb. 26 1914 the church of Whitekirk (Haddingtonshire), one of the few beautiful pre-Reformation churches surviving.

Two important centenary celebrations took place in the period—the quin-centenary of the foundation of the university of St. Andrews, held in 1911, when Lord Rosebery was installed as Lord Rector and made a famous oration, and the sex-centenary of the victory of Bannockburn (June 24 1314), which was celebrated by a procession and a banquet at Stirling on June 27 1914, when Sir George Douglas delivered the address. The town council of Aberdeen commemorated the quin-centenary of the battle of Harlaw, fought in 1411, and the town council of Arbroath, in Sept. 1920, held a patriotic and religious service to celebrate the sex-centenary of a famous assertion of the independence of Scotland in a letter addressed to the Pope by a Parliament which met in the abbey at Arbroath in 1320.

More practical evidence of renewed interest in Scottish history was given by the success of the Scottish Historical Exhibition at Glasgow, opened by the Duke of Connaught in May 1911, the proceeds of which formed the main endowment of a Chair of Scottish History and Literature founded in the university of Glasgow in 1913.

The demand for some form of Scottish Home Rule has been insistently pressed by its advocates since 1910 but there has been no evidence of any wide-spread feeling on the topic, apart

** These figures indicate the volume and page number of the previous article.*

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from the more general question of the adoption of a system of Devolution for the United Kingdom, a suggestion which received much parliamentary support in the years 1918–20.

Apart from the extensions of Edinburgh and Glasgow, the most important municipal event is the amalgamation, in 1920, of Motherwell (about 42,860 inhabitants) with Wishaw (about 27,484 inhabitants) to form a single municipality known as Motherwell and Wishaw.

Legislation.—In addition to the emergency war legislation which affected Scotland equally with England the decade 1911–20 was marked by a series of important legislative enactments, intimately affecting the political and social life of the country. A vast change was made in the parliamentary electorate by the Representation of the People Act of 1918, which increased the number of voters (counties, burghs and universities) from 800,448 at the general election of Dec. 1910, to 2,211,178 at the general election held in Dec. 1918. The Fourth Reform Act (1918) not only made a wide extension of the franchise; it also, by its redistribution of the constituencies, severed the last link with the old tradition of Scottish parliamentary representation as it existed before the union. The shire ceased to be the unit of county representation, and the old Scottish system of separate burghal representation was abandoned. The burgesses had sat in the Scottish Parliament, as a separate estate, from a much earlier period than the commissioners of shires, and the royal burghs, which they represented, had special trading privileges which distinguished their interests from those of the counties in which they were situated. The principle, adopted in 1707, of grouping together small burghs, sometimes geographically distant, as separate constituencies, was retained in 1832, 1868 and 1885; *e.g.* the inland burgh of Elgin voted with the distant seaport of Peterhead, instead of forming part of the constituency of Morayshire. In 1918 the burgh of Perth, which had enjoyed separate representation, and eight groups or districts of burghs were merged in county constituencies; six districts of burghs still exist, but the constituent members of each group are in close geographical proximity. The last vestiges of the privileges of royal burghs, in which the distinctively Scottish system of distribution originated, had been removed as long ago as 1846.

The other important Acts of the period may be described as social legislation, dealing with housing and provision for medical attendance, land questions, temperance and education. An Act of 1909 had extended to Scotland the Housing of Working Classes Acts, 1900–3, with certain modifications, and had given powers to local authorities, with the consent of the Scottish Local Government Board, for the compulsory acquirement of land; for the borrowing of money from the Public Works Loan Commissioners to provide working-class dwelling-houses; and for the execution of town-planning schemes. The shortage of houses which became a serious social danger after the war, not only led to various emergency Acts limiting rents and mortgage interest and severely restricting the powers of landlords to terminate existing tenancies, but was also one of the causes of the creation of a Scottish Board of Health by an Act of 1919. The powers and duties of the Local Government Board for Scotland, and the Scottish Insurance Commissioners and also some powers of the Privy Council conferred by a large variety of recent Acts, were transferred to the Board of Health, which was entrusted with the execution of all measures conducive to the health of the people. A Housing (Scotland) Act of the same year (9 & 10 Geo. V., C. 60) gave to the new Board of Health the supervision of the schemes of local authorities for the provision of working-class dwellings, and empowered it, in the event of the failure of local authorities to prepare schemes, to make a public inquiry in any such locality and to arrange for the preparation of a scheme. The Act made provision for financial assistance (under the supervision of the Board of Health) to local authorities, public utility societies, and housing trusts, for the building of houses, largely increased the powers of local authorities as regards compulsory purchase, and made it compulsory for them to prepare town-planning schemes. Other measures affecting public health which were passed during the decade were the Highlands and Islands (Medical Service) Grant Act of 1913, which created an annual grant of £42,000 for the improvement of medical services and nursing in the Highlands and Islands; and the Midwives (Scotland) Act of 1915, which provided for the training and certification of midwives. The powers granted to the Privy Council under these two Acts are among those transferred to the Board of Health. The first Annual Report of the Board of Health (for the year 1919) showed that 212 housing schemes had been submitted by local authorities, providing for the erection of 112,573 houses, the total pop. represented by the authorities being 4,169,501. The report brought out the interesting point that, even in localities which are near stone quarries, the cost of building in stone exceeded, by a considerable sum, the cost of building in brick.

A very important measure dealing with land was passed in 1911. By the Small Landholders (Scotland) Act, the Scottish Land Court and the Board of Agriculture for Scotland were constituted, and the provisions of the earlier Crofters Acts were extended to other small landholders, and were amended in various respects. A dignified status was given to the Land Court by a provision that its chairman should enjoy the same rank and tenure of office as a judge of the Court of Session. The powers of the Board of Agriculture and Fisheries, under previous statutes, were distributed between the Board of Agriculture and the Board of Fisheries, and an Agricultural (Scotland) Fund was created for the establishment, enlargement and improvement of small holdings. Disputes between landlords and the Board of Agriculture are settled in the Land Court, which also determines the amount payable to landowners as compensation for permanent improvements, fixes rents in certain cases and prescribes regulations for pasture, grazing and common rights. The decisions of the Land Court are not subject to review by other courts, though the Court of Session may be consulted by the Land Court on questions of law. The first Report of the Land Court, for the nine months ending Dec. 31 1912, showed that 2,434 applications for small holdings had been received, and that 256 had been decided, the total rents, in these cases, being reduced from £2,226 16s. to £1,568 2s. and arrears of rent amounting to £1,721 14s. being reduced to £771 19s. In 1919, "fair rents" were fixed for 170 holdings, the average reduction of rent being 10%, and 275 holdings were re-valued, at the expiry of seven years from the fixing of a "fair rent"; the original rents of these holdings amounted to £2,823, the first "fair rents" to £1,927, and the rents fixed in 1919 to £2,058, representing an increase of over 6½% on the previous decisions—an indication of the improvement in the value of land. Further provision for the acquisition of land for the purposes of small holdings was made by the Land Settlement (Scotland) Act of 1919 (9 & 10 Geo. V., C. 97), which also amended the Small Landowners Act of 1911. Fresh powers were given to the Board of Agriculture by the removal of restrictions as to total area to be acquired and as to methods of purchasing or taking land on lease or feu, and by widening the range of its activities. A large series of statutes for crofts and small holdings is now in operation, and the Land Court in its 1919 Report drew attention to the urgent necessity for their codification in order to remove ambiguities, inconsistencies, and difficulties of interpretation. Less important measures dealing with land were the Feudal Casualties Act of 1914, for providing for the redemption of duplicands and grassums (entry fees) and other sums payable by feuholders to their superiors at intervals of more than a year; the Entail (Scotland) Act of 1914 restricting the possibilities of future entails of land or property; and the Duplicands of Feuduties (Scotland) Act of 1920, passed to reverse the effect of a decision of the House of Lords in 1919 that a "duplicand" payment of a feuduty means, unless otherwise defined in a deed, the payment of double the regular feuduty in addition to the ordinary annual payment. The Act defines a duplicand, in accordance with what has been the traditional usage, as "one year's feuduty only over and above the feuduty for the year." The prevalence of the system of feus in Scotland rendered the legal decision a matter of considerable importance.

Liquor Licensing.—The Temperance Act (Scotland) 1913 provided that, on the Act's coming into force in June 1920, local authorities should, on the receipt of signed requisitions from electors in their areas, take a poll on three alternative resolutions dealing with the number of licenses in an area. The resolutions were (1) that there should be no change in the system of licensing, (2) that the licensing court should grant not more than 75% of the licenses previously in force and (3) that no license should be granted within the area, except, in special circumstances, to *bona fide* hotel and restaurant keepers, who might be allowed to sell drink in retail to residents in hotels or to persons taking meals at restaurants. The areas were defined as burghs of a pop. not exceeding 25,000; separate wards in larger burghs; and parishes in the counties. The voters were defined as electors to town councils in burghs and electors to parish councils in the counties. Each voter could vote for only one resolution, but, where a no-license resolution was not carried, the votes given for no-license were to be added to the votes given for limitation of licenses. A no-license resolution was to require 55% of the recorded votes in a poll of not less than 35% of the electors, in order to be carried; a limitation resolution required a bare majority vote in a poll of the same size. Polls were held in Nov. and Dec. 1920, in 580 out of 1,221 polling areas; of the remainder, about 300 were areas in which no license existed, and in the rest no requisitions were submitted for a poll. The polls took place in all the towns and in the more thickly populated rural districts. Five hundred and nine areas voted for no change, 35 for limitation of licenses, and 40 for no license. The total numbers of votes were:—708,727 (60%) for no change; 19,400 (1·6%) for limitation; and 453,728 (38·4%) for no license. In Glasgow, four wards (Camphill, Cathcart, Pollokshields and Whiteinch) voted for no license, and nine wards for limitation; in Edinburgh, Dundee and Aberdeen no change was carried in every ward. There were in Nov. 1920, 9,371 licensed premises in Scotland, of which 1,471 were hotels or inns, 4,847 were public-houses and 3,053 were grocers' shops. The reduction made in May 1921, in accordance with the result of the polls, involved the extinction of about 450 licenses, a majority being in urban areas, where middle-class residential districts voted for the abolition or reduction of licenses. Glasgow contributed 99 to the total number of withdrawals of licenses, but these were chiefly in the residential districts already named or in other residential districts like Govanhill, Kelvinside, Park and Pollokshaws, in which there was an unusually

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large proportion of grocers' licenses. Among the smaller towns which "went dry" were Buckie, Cullen, Kirkintilloch, Sanquhar, Lerwick, Stornoway, Stromness and Wick. The contest was fought by the Temperance party on a prohibition programme, and its influence was thrown against the limitation resolution; the result was, therefore, rather a repudiation of prohibition than an indication of satisfaction with existing licensing conditions. The Act of 1913 provided for further polls, on a requisition by electors, in Nov. and Dec. 1923, but the experience of the poll of 1920 made it clear that modifications were required in the Act, especially in the definition of an "area" as a single ward in the larger burghs, which must be treated as a whole in order to secure that any reduction of licenses shall be more equally distributed than was possible in 1920.

Education.—A large amount of attention has been devoted to education, with a corresponding increase in public expenditure, both national and local. The English Education Act of 1918, which marks an era in State provision for education, was accompanied by the Education (Scotland) Act of the same year. The Act swept away the system of school-boards, created in 1872, in favour of the principle of a larger area for educational administration than a parish. The new administrative body created by the Act is known by the awkward name of an Educational Authority. Five large burghs, Edinburgh, Glasgow, Aberdeen, Dundee and Leith, were made separate educational areas; the number has since been reduced to four by the amalgamation of Leith with Edinburgh. Elsewhere, the area is the county, including the burghs within its bounds, and the Secretary for Scotland was empowered to make, by order, electoral divisions within the areas, to define the number of members of each educational authority, and to apportion the representatives among the divisions of the area. Electors to educational authorities are the persons registered as local government electors under the Representation of the People Act (1918). Voting is conducted on the principle of proportional representation; each elector has one transferable vote. School management committees, acting under an education authority and including representatives of parents and of teachers, exercise general powers of supervision and management, but have no control over finance, or over the appointment or dismissal of teachers. Education authorities are empowered to expend public money not only on the maintenance of schools but also on the provision of food and of books for the children (including books for general reading), and they may make grants to pay travelling expenses of young persons resident at a distance from the nearest intermediary or secondary school, and may give assistance to a qualified person attending a university or training college. They are bound to provide free primary, intermediary and secondary education in all districts, but may maintain a limited number of fee-paying schools and may also make contributions to certain schools not under their jurisdiction. Religious instruction may be given in the schools, but no child whose parents object to such instruction is thereby to lose any other advantage of the school. Voluntary or denominational schools may be (and nearly all have been) transferred to educational authorities and managed as public schools, their teachers being appointed by the local authority and approved as to character and religious belief by representatives of the church or body by whom the school was conducted. In such transferred schools, the time devoted to religious instruction is not less than it was under the former management. Voluntary schools, not thus transferred, are not eligible for grants from the Education Fund; new voluntary schools may be established by educational authorities under conditions similar to those affecting transferred schools. An educational authority administers the Education Fund of the area, arising from Government grants or loans, supplemented by its own education rate, which is fixed by the authority and levied by the parish councils of the area. The Act also extended the school age to 15 years and severely limited the employment of children of school age, prohibiting the employment of children under 15 in factories, workshops, mines or quarries, and forbidding street trading by persons under seventeen. A system of continuation schools was also provided for. An attendance of 320 hours annually in a continuation school may be required from all young persons up to the age of 18, unless their education is otherwise provided for, and instruction in such schools is to include English and general education, instruction for special forms of employment, and physical culture; when the scheme comes into operation, employers will be bound to afford facilities for an attendance of 320 hours, exclusive of hours between 7 P.M. and 8 A.M., unless hours within these limits are sanctioned by the Scottish Education Department, the approval of which is also required for the exercise of a large number of the powers conferred by the Act.

The operation of the Act of 1918, contemporaneously with a large increase in the salaries of teachers, has resulted in a vast increase of expenditure. The estimate for ordinary public education in Scotland for the year ending March 31 1911, was £2,253,725, and for the year ending March 31 1921, £6,877,220, and to this increase have to be added the large sums raised by local rates, which have risen proportionally. The system of assessment, based on house rent, and divided, in almost equal proportions, between proprietor and tenant, is generally regarded as being no longer suitable to the circumstances, the value of the house occupied by a ratepayer not affording a satisfactory test of his ability to pay, and a demand has been made for the substitution of a local income tax; some reform of the system of local rates has been promised by the Secretary for Scotland. In addition to State grants for elementary and secondary education, financial assistance to the Scottish universities has been increased from an estimate of £93,000 in the year ending March 31 1911 to an estimate of £195,000 for the year ending March 31 1921, besides a share of a non-recurring grant to universities and other institutions adversely affected by the war. Private benefactions, including grants from the Carnegie Trustees, have provided funds for the institution of new chairs and lectureships in all the universities, including chairs of Scottish History and Literature, French, German, Bacteriology, Organic Chemistry, Physiological Chemistry, Mercantile Law and Engineering at Glasgow; chairs of Agriculture and Political Economy at Aberdeen; and chairs of French, German, Accounting and Business Method, Chemistry in relation to Medicine, Zoölogy, Forestry, Clinical Medicine, Bacteriology, Tuberculosis, Therapeutics and Psychiatry at Edinburgh.

Evidence as to social conditions is available in reports of Government departments. The Mental Deficiency and Lunacy (Scotland) Act of 1913 reconstituted the existing Commissioners of Lunacy as a General Board of Control and amended the Lunacy Laws. The Board's first Annual Report (for 1914) showed that there were 19,557 insane persons in Scotland, of whom 16,870 were paupers. In 1919 the total was 17,580, of whom 14,562 were paupers. The latest Report of the Board draws attention to the decrease, pointing out that the average total for the five years from 1911 to 1915 was 18,537, and for the five years 1916–20, 18,132, and remarks that "it may be assumed that but for the influence of the war the numbers in the last quinquennium would have been at least 19,883 instead of 18,132." The Prison Commissioners, in their Report for 1919, state that the influence of war conditions was ceasing to operate at the end of that year. The total number of persons committed to prison in 1918 was 9,773 as compared with 14,505 in 1917 and 43,535 in 1914. The figures for 1918 are the lowest on record; there was a continued decrease in the first four months of 1919, but the total number of commitments for that year was 11,725: similarly, the judicial statistics for 1919 show an increase of 26·9% in the number of persons dealt with in criminal courts, as compared with the previous year, the numbers being 80,152 in 1918 and 101,687 in 1919. The total for 1911 was 155,537. The most satisfactory feature of the year 1919 was a decrease (from 10,772 to 9,176) in the number of persons dealt with in juvenile courts, as compared with 1918; the numbers of such persons had risen during the war from 10,761 in 1911 to 11,851 in 1915 and 12,180 in 1917, a result attributed to the absence of paternal control during the war years.

Shipbuilding.—The figures of production in Scottish shipbuilding for 1911 represented a considerable increase over 1909 and 1910, the number of vessels being 557 in 1911 against 450 in 1910, and the tonnage 671,624 against 420,250. These numbers exceeded the previous record of production—757 vessels with a tonnage of 675,173 in 1907—because the I.H.P. (indicated horse power) figures were 742,299 in 1907 and 837,668 in 1911. The output for 1911 consisted chiefly of vessels of moderate size, and the types of vessels were very varied. The main increase was, naturally, in the Clyde area; the E. coast shipbuilding areas (the Forth, the Tay, the Dee and the Moray Firth) produced 144 vessels with a tonnage of 41,041 and I.H.P. 47,739—an increase of 13,183 tons and 17,311 I.H.P. upon 1910. In 1912, a fresh record was created, the total Scottish tonnage being 688,188, with I.H.P. 914,741, and in 1913 the figures rose to a tonnage of 809,711 and I.H.P. 1,148,225. The Clyde output for 1913 was more than double that of any other British shipbuilding area, except the Tyne, and it exceeded the output of the Tyne by 317,000 tons; the advance since 1910 was the most remarkable in the whole history of Clyde shipbuilding, for the tonnage of 1910 had been nearly doubled in 1913; but the increasing cost of production caused some anxiety about the future. Among the larger vessels built before the outbreak of war were H.M.S. "Conqueror," the largest battleship yet built on the Clyde, which was launched in 1911, and the liner "Aquitania," the largest vessel then built for the merchant service (tonnage 45,600, speed 23 knots), which was launched in 1913. In the seven months of 1914 which preceded the outbreak of war, the output showed a continuous decrease, and a period of depression was believed to be at hand, and from Aug. three of the largest yards had to devote practically their whole attention to naval construction. The total tonnage as published for 1914 was 460,258 with I.H.P. 496,120, but these figures are exclusive of the construction of warships and must be compared with the 1913 figures for mercantile construction, viz.: 692,601 tons with I.H.P. 649,240—a decrease of 232,343 tons and 153,120 I.H.P. The naval figures, now available, show that the outbreak of war had not merely checked the depression but had produced a fresh "boom" in Scottish shipbuilding. In 1915 mercantile construction amounted to a tonnage of 233,501, with I.H.P. 205,288—figures not far below the U.S.A. construction for the year—although the yards were almost entirely controlled by Government, and merchant work was neglected. No separate Scottish figures for 1916 were published until after the close of the war, and, in 1917, the mercantile tonnage for the United Kingdom was a state secret. Mercantile construction had been, to a large extent, in abeyance until the end of 1916, but great activity was shown in this

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department in 1917 and 1918. The totals (including naval construction) for the five war years were:—

	Vessels	Tonnage	I.H.P.
1914	481	591,396	1,192,347
1915	386	331,410	1,231,043
1916	477	541,527	1,898,044
1917	517	502,875	1,628,950
1918	585	613,709	1,958,944

In no one of the war years did the tonnage approach that of 1913, but this is explained by the circumstance that the proportion of tonnage to I.H.P. is much smaller in naval than in mercantile construction, and the 1913 I.H.P. figures were exceeded in every year of the war. In the war years, the volume of naval repairs was also very great.

In 1919 the tonnage figures of Scottish yards rose to 729,490 with I.H.P. 1,590,894, and in 1920 to 778,914, with I.H.P. 673,040; the figures relate entirely to mercantile shipping, as naval construction was stopped. The increase of tonnage over 1918 was in the building of many cargo steamers, the average size of which was greater than before the war, and the decrease in new machinery indicated in the I.H.P. figures is explained by the circumstances that such steamers are of comparatively low power. Judged by the test of tonnage, the output for 1920 was not far below that of 1913, although the machinery installed was not much more than half; compared with the purely mercantile output of 1913, both the tonnage and the I.H.P. figures were larger in 1920, and the year ranked as second only to 1913, but the prospects for the future were very poor.

Shipping.—The year 1911 was marked by a rise in freights which continued throughout 1912 and the first half of 1913, but in the end of that year there was something like a collapse, and the "slump" continued until the outbreak of war, when a temporary suspension of chartering was followed by a very sharp rise in freights which continued, progressively until Government control began, in 1917. A further rise took place at the beginning of 1918 in order to cover Government liability for losses in tonnage through sinkings. The reorganization of Scottish shipping, after the interruption of the war, did not make much progress until the latter half of 1919, owing to the necessities of demobilization; and the process of reorganization was hampered in 1920 by labour troubles and especially by the uncertainty of the export coal trade. Freights continued to be high in the early part of the year, but even high rates proved to be unprofitable in view of the cost of coal and of labour and rises in harbour tolls, stevedoring, and insurance premiums; and in the end of the year there was a "slump" in freights. The effect of the war may be traced in the decrease in the total number of vessels registered in Scottish ports. In 1914 there were 494 sailing vessels, with net tonnage 153,323 and 3,441 steam vessels with net tonnage 2,675,720—a total of 3,935 vessels with net tonnage 2,829,043. In 1918 there were 354 sailing vessels with net tonnage 82,181 and 2,759 steam vessels with net tonnage 1,797,907—a total of 3,113 vessels with net tonnage 1,880,088, the decrease in tonnage being constant and progressive until 1918, in which year there was a check to the rate of the downward movement. The decrease in net tonnage registered in Scottish ports was 172,134 in 1915, 232,994 in 1916, 389,183 in 1917 and 154,644 in 1918, the figures in each case representing the decrease on those of the previous year. Statistics showing the recovery in 1919 and 1920 were not available in Feb. 1921. The following table shows the effects of the war and of the first year of peace upon the imports and exports of merchandise at Scottish ports:—

	1911	1915	1917	1918	1919
Imports in £	46,937,758	58,442,334	76,970,468	109,343,866	112,631,887
British and Irish Exports	46,683,953	38,242,899	44,048,744	32,333,700	69,661,877
Foreign and Colonial Exports	677,301	1,442,711	1,025,380	526,349	6,146,906
Total in £	94,299,012	98,127,944	122,044,592	142,203,915	188,440,670

Coal.—The table at the foot of the page shows the output of Scottish coal in the decade.

The export trade before the war amounted in round numbers to 16,000,000 tons per annum, of which 6,500,000 represented bunker coal and coal shipped to home ports. The outbreak of war at once closed markets in Germany, Austria, Russia, and Turkey, and interrupted trade with other countries. The effect was specially felt in the E. of Scotland, which is largely dependent on overseas trade. Exports further decreased from 1915 to 1917. In 1918 they amounted to 7,460,000 tons, or about 45% of the pre-war average, but, in the end of that year, shipments to foreign countries were almost entirely suspended, owing to the demand for bunker coal and for coal for Admiralty and home use. Exports were specially low in the Forth area because the ports of Bo'ness, Grangemouth, Granton, and Burntisland were largely or entirely requisitioned by the Admiralty. In 1920 the coal controller, to safeguard an expanding home demand, placed very severe restrictions upon exports; and Scottish exports, in the first ten months of that year, amounted to 1,156,475 tons as compared with 2,129,059 tons in the first ten months of 1919; these figures are exclusive of bunker coal. Total output was reduced by strikes in 1912 and in 1920, and, during the war, by shortage of labour. Prices were low at the beginning of 1911 and fell in the first half of the year, but, by the beginning of 1912, they showed an advance of from 1s. to 2s. per ton in all classes of fuel. Prices remained high in 1912 and rose in 1913; they varied at different periods in 1914, and the advance of recent years began in 1915, although there were remarkable fluctuations in 1916. Maximum retail prices were fixed for home consumption in 1917. After the Armistice, prices advanced rapidly in the second half of 1919, and the supply was unequal to the demand. Export prices reached an unprecedented level in 1920, but the beginning of 1921 witnessed a "slump" in exports. Before the war, the Scottish coal trade had to face German competition. At one time, Germany was an important market for Scottish coal, but exports to Germany had fallen to under 3,000,000 tons, and German coal was competing with Scottish coal in foreign markets. New markets were, however, being opened up, and from 1911–4 Fife coal was developing large exports to S. America. A new dock at Methil, built principally for this trade by the North British Railway Co. (at a cost of nearly £1,000,000), was opened in 1913.

Iron and Steel.—In spite of a temporary decline in the price of hematite pig-iron and steel scrap in 1911, the decade opened well for the steel and iron trades. There was an increase in steel exports in 1911 and it was maintained, in spite of the coal strike, in 1912, and in the first half of 1913; but German competition was severely felt both in home and in Japanese, Canadian and Indian markets. In 1914 both the pig-iron trade and the steel trade were inactive, but a rapid improvement followed the outbreak of war, and steel and malleable iron continued to be in great demand throughout the war. The pig-iron market, on the other hand, suffered in 1915 from an unprecedented advance in the price of ore and from freight difficulties. Early in 1916 all the works in which pig-iron was produced were placed under the Ministry of Munitions, and there was a steady demand in spite of reduced exports. The pressure of work in the steel and iron trades continued after the decontrol of steel in Jan. 1919 and of iron in the following April, and prices were high. In the end of the year steel ship-plates were £19 15s., boiler ship-plates £24 10s., and angles £19 5s., net per ton delivered on the Clyde, as compared with £7 2s. 6d., £7 17s. 6d., and £6 15s., respectively, the highest prices in 1911. Hematite iron rose to 210s. per ton as compared with 72s., the highest price in 1911. Prices reached still higher levels in 1920, demand far exceeding supply in the earlier part of the year, but prices proved to be too high for remunerative trade, and reductions were made in November. Imports of pig-iron from France and Belgium were begun, but in quantities so small that competition with Scottish production had not yet become serious.

Mineral Oil.—The Scottish mineral oil trade, the centre of which is W. Lothian, was suffering severely from foreign competition in the years immediately preceding the war. Low prices and decreased dividends marked the year 1911; there was a revival in 1912, due partly to the general "boom" in trade and partly to the opening up of wider markets, and 1913 was also prosperous in spite of the growing competition of the Mexican oilfields. Production remained about the average of over 3,000,000 tons of shale in 1914, but prices fluctuated, and exports decreased from 324,704 tons of oil in 1913 to

	No. of mines at work under Coal Mines Act	No. of persons employed	No. of tons of coal produced
1911	518	138,377	41,718,163
1912	520	143,302	39,518,629
1913	542	147,549	42,456,516
1914	547	146,168	38,847,362
1915	535	121,854	35,596,856
1916	537	127,104	36,193,000
1917	522	130,027	38,569,964
1918	522	124,475	31,890,218
1919	512	144,286	32,457,864

The estimated output for 1920 was 31,000,000 tons

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311,000 tons. Prices were maintained at a high level throughout the war, and the demand was steady, but, at the beginning of 1919, the largely increased cost of production rendered it very doubtful if the industry (which was estimated to employ directly about 10,000 workpeople and indirectly probably about 50,000) could be continued on a remunerative basis. The problem was solved by an offer from the Anglo-Persian Oil Co. to form a new consolidated company known as Scottish Oils Ltd.; its acceptance by the shareholders of the Scottish companies allied the Scottish oil trade with a strong group of oil interests under one central management, and the result has been satisfactory, although demand decreased in the end of 1920 owing to the general uncertainty of trade conditions.

Textiles.—The woollen trade in the Borders had a year of great prosperity in 1911, the output and the export trade (especially with Germany) being very great. Thread and yarn makers had also a prosperous year, and the linen trade of Dunfermline was steady, though not brisk, but the jute trade of Dundee passed through one of its worst years, with unprecedented curtailment of production, due chiefly to over-production in Calcutta. The following year saw a remarkable revival in the jute industry, which enjoyed a period of unparalleled success, the woollen trade continued to be prosperous and conditions in the linen trade were normal. Prosperity in textile industries continued through 1913 and was not checked until the outbreak of war, when the export of tweeds and linen came suddenly to an end, and the textile industries as a whole suffered from a decrease in the purchase of luxuries and from the cessation of imports of raw material. Jute, which had been prosperous in the early part of the year, became unremunerative towards its close. New outlets were found in the manufacture of khaki cloths, flannel shirtings, and military blankets, but reorganization took time and was delayed by lack of dyes and by the circumstance that Scottish flannel was largely made from Belgian raw materials. Throughout the war, the Dunfermline linen trade suffered more severely than other textiles, the looms being unsuitable for the goods which were required. The jute trade recovered in 1915, largely owing to Government orders. These conditions continued to the end of the war; prices, in spite of Government control, were very high, and rose after the Armistice. The year 1919 was very prosperous for the jute trade, and linen made a considerable recovery, in spite of difficulties about raw material, but the woollen trade suffered from a poor clip after a severe winter and a late spring. The general prosperity in textile trades continued into the first quarter of 1920, but was followed by an almost complete cessation of demand for woollen and linen goods, and similar conditions prevailed in the jute trade. All over, prices, as determined by cost of production, were too high for the consumer.

Agriculture.—Agricultural conditions have undergone a large number of changes. In 1910, agriculture was an unprofitable occupation for the tenant, and rents were low—on the average, about half what they were in the 'eighties. Agricultural wages were also comparatively low, although they had recently advanced, and the average weekly earnings for all classes of agricultural labourers were higher in Scotland than in England. Farmers were feeling the burden of foreign competition and of the expense of the machinery necessary for scientific farming. The food problem during the war gave a new impetus to agriculture, the effect of which may be seen from the following table:—

	Area under:—			
	Crops and grass acres	Arable land acres	Permanent grass acres	Corn crops acres
1911	4,845,835	3,348,568	1,497,267	1,218,055
1914	4,786,179	3,295,040	1,491,139	1,186,432
1915	4,781,416	3,290,543	1,490,873	1,220,307
1916	4,775,525	3,303,180	1,472,345	1,234,748
1917	4,776,200	3,360,342	1,415,858	1,273,549
1918	4,761,101	3,453,494	1,307,607	1,493,169
1919	4,751,475	3,408,479	1,342,996	1,378,318

The largest increase in production was in the years 1917 and 1918. In 1917, the total produce of wheat was 304,169 quarters (an increase of 21,000 quarters over 1916) and in 1918 it rose to 402,000 quarters. The figures for barley and bere are 704,788 quarters in 1917 (an increase of 57,600 quarters over 1916) and 677,000 in 1918; and for oats 5,446,931 quarters in 1917 and 6,457,000 in 1918. The total produce of the potato crop was 1,110,085 tons in 1917 (an increase of 579,000 tons on 1916) and 1,151,000 tons in 1918. Live stock showed similar variations; the number of horses rose from 206,474 in 1911 and 198,704 in 1915 to 207,113 in 1916 and 210,048 in 1917, falling slightly in 1918. Numbers of sheep and pigs declined slightly in the war years—sheep from 7,164,342 in 1911 to 6,878,198 in 1918, and pigs from 171,115 in 1911 to 128,007 in 1918, but cattle rose from 1,200,017 in 1911 to 1,225,330 in 1916 (1,209,842 in 1918).

The increases in corn crops and potatoes were the result not only of economic conditions, such as rising prices, but also of administrative and legislative measures. In the summer of 1915 the Secretary for Scotland appointed a departmental committee to report on the measures necessary to increase the production of food during the war; in 1916, the attention of military tribunals was directed to agricultural necessities, and the army lent military labour at certain seasons of the year. The Corn Production Act of 1917 led to the division of Scotland into districts with District Wages Committees to fix wages. The general prosperity of agriculture is shown by the rise in Fiars Prices—average prices ascertained annually by an inquiry held by the sheriff of a county in order to fix the amounts payable to parish ministers for each kind of grain. The prices vary considerably in different counties, but the value of all sorts of grain and of oatmeal was doubled or trebled between 1911 and 1918, and remained at its high level through 1919 with a slight decline in 1920. The wages of agricultural labourers increased proportionally, and their standard of living rose, giving impetus to a tendency notable before the war, to abandon the traditional brose and porridge in favor of more expensive foods and especially butcher's meat. A result of agricultural prosperity was a very large number of sales of land in 1919 and 1920. Scotland, to a large extent, ceased to be a country of huge estates, and the number of farmers who farm their own lands greatly increased.

Forestry.—Before the war, there was a revival of interest in forestry, due to the exertions of several Scottish landlords, and to the action of the Board of Agriculture and the Development Commission. In 1912, a departmental committee, appointed to select a suitable locality for a demonstration forest area, issued an elaborate report on steps for the promotion of sylviculture, some of their suggestions being adopted by the Development Commission in 1913. These developments were interrupted by the war, for scarcity of labour put an end to afforestation, and the extensive demand for timber brought about a depletion of woodland areas from 1915 onwards. It was estimated in 1916 that more than half of a home production of 40,000,000 cubic ft. of timber had come from Scottish forests. The depletion of woodlands was continued owing to the demand for timber for purposes of reconstruction in 1919 and 1920, and in June of the latter year there was a series of destructive forest fires in Ross-shire, Inverness-shire and Aberdeenshire. In 1919, a Forestry Act, passed for the United Kingdom, transferred to the Forestry Commission the powers in this respect of the Board of Agriculture for Scotland. The Commission had acquired, by the end of 1920, about 60,000 ac., of which about half was plantable.

Fisheries.—The character of the Scottish fishing industry was already undergoing an important development by the year 1910. It was ceasing to be conducted by small fishing boats, owned by the fishermen who used them, and was passing into the hands of large companies whose capital provided the necessary fleets of steam drifters. The capitalization of the industry was extending to salmon fisheries, which were being bought up by wealthy companies. These conditions have persisted even in the Highlands and Islands, where the combination of fishing with the cultivation of crofts became much less common. In 1910, the Scottish fishing fleet consisted of 9,724 vessels, valued at £4,409,027, of which 1,073 (valued at £2,457,586) were propelled by steam; in 1919, there were 6,534 fishing vessels, valued at £7,198,431, of which 3,722 were sailing or rowing boats; the remainder consisted of 294 steam trawlers (valued at £3,342,255), 767 steam drifters, and 1,751 auxiliary motors. The number of boats which possessed auxiliary motors in 1910 was 156. Between 1910 and 1919, the number of sailing and rowing boats decreased from 8,175 to 3,722, and the estimated value from £642,902 to £122,823. The sailing and rowing boats were manned by 25,985 men and boys in 1910, and by 9,830 in 1919; the total number of men and boys employed as crews decreased from 38,941 in 1910 to 27,408 in 1919. The increase of motor vessels in the western area was a notable feature of the period. In 1910, 40 motor vessels belonged to Campbeltown and 11 to Ballantrae, and 23 to other W. coast fishing ports; in 1919, the numbers at Campbeltown and Ballantrae had increased to 78 and 88 respectively and there were 209 belonging to other ports, of which Loch Carron and Skye possessed 80 (as compared with 4 in 1910) and Inverary 70 (as compared with 8 in 1910). Stornoway, where there were no mechanically propelled vessels in 1910, had 18 steam liners and drifters and 13 motor-boats in 1919. The steam trawlers were still, in 1919, confined to Leith, Montrose, Aberdeen (which possessed 193 out of 294), and Peterhead, except for 8 belonging to Greenock. The large use of motor-boats was partly a result of the diversion of steam drifters to other purposes during the war, and the demand for them decreased in 1919, when steam drifters again became available. In the course of the war, 302 trawlers, 829 drifters, and 133 motor-boats (a total of 1,264 fishing vessels) were requisitioned by the Admiralty, chiefly as naval auxiliaries. Of these, about 100 were lost while on war service; of the remainder, all except 131 were released in 1919 and most of them had been reconditioned and were again engaged in the fishing industry by the end of that year. The number of Scottish fishing vessels sunk while engaged in fishing in the course of the war was 96, of which 51 were trawlers. In June 1915, no fewer than 34 vessels were lost, and the experience of that month led to the enforcement of very severe restrictions upon the fishing industry. The effect of war restrictions is evident from the total quantities of fish (exclusive of shell-fish) landed in Scotland in successive years by Scottish vessels:—1913, 7,267,328 cwts.; 1914, 6,926,241 cwts.; 1915, 2,319,390 cwts.; 1916, 3,412,030 cwts.; 1917, 3,079,768 cwts.; and 1918, 3,313,228 cwts. In 1919, the quantity rose to 5,968,866 cwts. The value of the catch naturally rose in proportion to scarcity; the value of over 7½ million

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cwts. in 1913 was £3,733,379; of about 2½ million cwts. in 1915, £2,051,171; and of over 3 million cwts. in 1917, £3,645,015. The most remarkable rise occurred in 1918, when about 3¼ million cwts. were valued at £5,991,693. In a week of Jan. of that year, the average price of all white fish sold in Aberdeen was £7 9s. 2d. per cwt. Maximum prices were fixed, but they had necessarily to be fixed at a high level in view of scarcity of labour and the special dangers attaching to fishing industry. In 1919, the increase in quantity over 1918 was 80%, but the value was £6,063,739—an increase of only a little above 1%, as compared with 1918; but the average price in 1919 was about double that of 1910, and prices remained high through 1920. The stress of the outbreak of war was felt specially heavily by the herring industry, for the chief markets for cured herrings were in continental Europe and communication was cut off. There was a large existing stock of unsold herrings, and great quantities had been sent to German ports. As the war progressed, decreased production and increased home demand led to a great improvement, and exports were resumed—in 1916, 366,682 barrels of herring were exported (as compared with 1,385,323 barrels in 1913), and 113,284 barrels in 1917—so that 1914 was the only disastrous war year. Increased production in 1919 brought about a difficult situation, for political and economic conditions in Russia and in Central Europe prevented the resumption of trade, and the industry was saved from disaster by a Government guarantee, which was renewed for 1920, but was refused for 1921, which opened with very gloomy prospects for the herring fishing industry. A committee of the Fishery Board recommended in 1919 that whaling operations should be prohibited in any part of Shetland, on the ground that the decline of the herring fishing in Shetland is directly connected with the introduction and development of whaling, an industry carried on almost entirely by foreigners.

Railways and Transport.—No new railways have been constructed since 1911, and the whole railway conditions have been abnormal since 1914. Serious railway accidents during the decade include a collision at Burntisland on April 14 1914, in which two railway employees were killed; collapse of a culvert near Carrbridge on June 18 1914, involving a disaster to a train and the deaths of five passengers by drowning; and an accident at Ratho on Jan. 3 1917 resulting in 12 deaths. The gravest railway disaster occurred to a troop train at Quintin's Hill, near Gretna, on May 22 1915, when 227 of the 7th Royal Scots were killed and 246 were injured. The accident occurred through the carelessness of two signalmen, both of whom received sentences of imprisonment. There has been a large increase in motor transport, but agriculture, fishing, mining and commerce are still handicapped by the lack of transport facilities. The proportion of mileage of railway to pop. is much smaller in Scotland than in such a small maritime country as Sweden, the number of miles of railway per 10,000 pop. being 16·2 in Sweden and 8·2 in Scotland. Transport conditions compare even more unfavourably with Belgium, which has a great system of canals, in addition to an elaborate system of railways, light railways and steam tramways. A committee on Rural Transport, appointed by the Secretary for Scotland, reported in 1919 that the construction of a considerable number of railways and light railways is essential for the development of the country, especially of inland straths and glens in various regions and of the W. coast and the islands. They gave illustrations of the results of lack of transport—the impossibility of growing early potatoes on soil specially suitable, the continued use of land for sheep farming which could be turned into good meadow land, the closing of a lead mine and the impracticability of working iron stone. In many districts, land could carry more stock and would be capable of closer settlement if better transport were available. The system of water transport could also be extended with advantage. Scottish canals fell largely into disuse after the introduction of railways, and some of them were acquired for the construction of their permanent way by railway companies. The total mileage of canals in Scotland is 183. There has been much discussion of the project of a reconstruction of the Forth and Clyde Canal, but without any result. The question of transport is closely associated with the utilization of water-power, several schemes for which are under consideration, the most important being schemes for the utilization of water-power in the districts of Lochaber and Fort William. In the large towns, there has been a great development of systems of electric tramways and motor omnibuses, and motor vehicles running in rural districts have proved formidable competitors to the railways.

Highlands and Islands.—The Board of Agriculture issued in 1913 a report on home industries in the Highlands and Islands by Prof. R. W. Scott, who pointed out that most of the existing home industries depend upon raw materials derived from the land—the hosiery and tweed industry using wool, and the basket industry, osiers, and that the encouragenemt of these industries must be closely connected with general agricultural policy. Shetland industries depend upon an improvement of the wool of Shetland sheep; in the Hebrides a deterioration in the quality of home-grown wool has led to large imports for Harris tweeds, while in Skye little has been done to encourage the cultivation of osiers. The report recommended the creation of local committees, under the authority of the Board, to supervise cottage industries, but the outbreak of war prevented the carrying out of the suggestions made. The home industries in existence in the Highlands and Islands in 1911 were hosiery, wool and worsted manufacture, basket-making, lace-making, silk-spinning, shirt-making, umbrella manufacture, straw hats and bonnets manufacture, small ware and fancy goods, but only one person was reported as engaged in lace-making. The total number of workers in home industries was 5,649, about 500 of whom were males. An attempt by Lord Leverhulme to establish in Stornoway a large fish-curing and packing industry and to develop the whole resources of the island has been hampered by the seizure of land by returned soldiers, and the future of the project was in 1921 still uncertain. Lord Leverhulme's proposals included the construction at Stornoway of a fishing harbour superior to any existing harbour on the W. coast or in the western islands and the completion of a canning factory and of carding and spinning mills, the building of which was begun before the interruption of the execution of the scheme by the "raiding" of farms in the spring of 1920. The organization not only of the fishing industry but also of the Lewis and Harris hand-woven tweed industry was thus contemplated, along with the opening up of the common grazing lands in Lewis and Harris and the provision of some 3,000 allotments of a quarter of an acre in size, selected so as not to interfere with existing dairy or other farms.

The effects of the World War can readily be traced in Scotland of the present day. The efforts made, alike for the recruiting of the fighting armies, for the production of ships and munitions, and for the maintenance of food supplies, and generally, of the social and national organization, rendered those years the most strenuous period in the whole history of the country, and constitute a record of courage and endurance which cannot but leave its mark upon the national character. Like other portions of the Empire, Scotland has, since the end of 1918, suffered from the weariness produced by stupendous effort and from a consequent restlessness and impatience which has found vent in industrial disputes and in an eager adoption, by some of the youth, of new social ideals, in which the influence of Russian Bolshevik experiments and propaganda has been conspicuous. Such manifestations can be paralleled from other periods following the end of a great military struggle, and there is already evidence that the disturbances in organization and habit produced by the experiences of the war have reached their climax, and, with the restoration of commercial and industrial prosperity, will cease to operate adversely upon the peace of the country.

(R. S. R.)

SCOTT, CYRIL (1879–), English musical composer, pianist and author, born at Oxton, Birkenhead, Sept. 27 1879, was musically educated at the Hoch conservatorium, Frankfurt A/M, chiefly under Ivan Knorr. While still in the pupil stage Scott heard his first symphony performed at Darmstadt in 1899. On Scott's return to England Hans Richter produced an orchestra suite by him at Liverpool. Subsequently Scott produced a vast amount of music, more especially of songs, most of which are on the same high level as that of the *Schumacherlieder* of his student days. Violin and pianoforte music also poured from his pen. A series of early overtures written for plays by Maeterlinck seem to have been suppressed, but there remain a Christmas overture, the two fine Passacaglias, the *Ballad of Fair Helen*, *La Belle Dame sans Merci*, and a pianoforte concerto and also two quintets, a piano quartet and a violin sonata. Scott also published several volumes of poems, including *The Voice of the Ancient* (1910); *The Vales of Unity* (1912); *The Celestial Aftermath* (1915) and the prose book *The Philosophy of Modernism* (1917). In 1920 his *Nativity Hymn* was accepted for publication by the Carnegie Trust, and in 1921 he paid a visit to the United States.

SCOTT, SIR JOHN EDWARD ARTHUR MURRAY, BART. (1847–1912), English art collector, was born at Boulogne Feb. 23 1847. The son of an English doctor at Boulogne, he became secretary to Sir Richard Wallace, heir of the 4th Marquess of Hertford. He helped Sir Richard to organize relief for the sufferers of the siege of Paris in 1870, and after the siege, to transport the treasures of the Hertford art collection from Paris to Bethnal Green museum. It was largely through his influence that Sir Richard Wallace's widow left the collection *en bloc* to the British nation, together with Hertford house, and he acted as chairman of the trustees' committee until his death. He became a trustee of the National Gallery in 1897, was created a baronet in 1899, and a K.C.B. in 1908. He died in London Jan. 17 1912.

SCOTT, ROBERT FALCON (1868–1912), English sailor and explorer, was born at Devonport June 6 1868, the son of John Edward Scott of Outlands, Devonport, and entered the navy in 1882. He was promoted lieutenant and appointed to the "Amphion" in 1889, and torpedo-lieutenant to the "Majestic," flagship of the Channel Squadron, 1898, becoming commander 1900. He commanded the National Antarctic expedition of 1901-4 (*see* 21.966) and in 1905 published his account of it in *The Voyage of the "Discovery."*

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On his return he was promoted captain and commanded first the "Victorious," flagship of the Channel Squadron, and subsequently the "Essex" and the "Bulwark." He was awarded the gold medals of the Royal Geographical Society and of the Royal Scottish Geographical Society, and received medals from the geographical societies of many foreign countries, and an hon. degree from Cambridge. During part of 1909 he was naval assistant to the Second Sea Lord of the Admiralty, and in June 1910 he again set out for the Antarctic in the "Terra Nova" in command of a new expedition, financed partly by private individuals but aided by a Government grant. He arrived at Lyttelton, N.Z., in Oct. and reached McMurdo Sound at the end of the year. On Nov. 2 1911 he started on his journey of 850 m. to the Pole, accompanied all the way by Dr. E. A. Wilson, Capt. L. E. G. Oates, Lt. H. R. Bowers, and Petty-Officer Edgar Evans. He reached the Beardmore glacier on Dec. 10 and on Jan. 4 1913 left behind him his last supporting party in lat. 87° 32′ S. When last heard of he was about 150 m. from the Pole, which his record shows that he reached Jan. 17 only to find Amundsen's tent and records left there one month earlier. On the return journey Evans fell (Feb. 17) in descending the Beardmore glacier and died shortly after. Blizzards were encountered and progress was slow. Food ran short, and on March 17 Oates went out alone to die. Three days later a fresh blizzard checked the survivors, whose supply of oil-fuel was exhausted and their food-supply very low. Scott's last entry in his diary was made on March 24. He was then only 11 m. from One Ton depot and a supply of food; but he was unable to reach it and died, with Wilson and Bowers, on or about March 27 1912.

A search party, sent out from the base in March 1912, had been driven back from One Ton depot by the weather, and it was recognized that there was no chance of Scott's party surviving the winter. Nothing further could be attempted until Oct., when search parties went out, and on Nov. 12 Dr. Atkinson and Mr. Wright found Scott's tent with the bodies of Scott, Bowers and Wilson and the valuable scientific records. Capt. Scott had a warm sympathy for scientific research and a good knowledge of many branches of science qualifying him for the leadership of an expedition, the main results of which were obtained by the labours of his scientific colleagues. The news of the disaster did not reach England until the survivors landed in N.Z. Feb. 10 1913. A memorial service, held in St. Paul's cathedral, London, Feb. 14, was attended by King George, and by royal warrant the rank and precedence of the wife of a K.C.B. were conferred on Capt. Scott's widow. A fund was raised as a memorial of Capt. Scott, from which ample provision was made for the surviving relatives of the lost explorers, and the balance was devoted to the promotion of polar research, a substantial amount being granted in 1921 towards the endowment of the Polar Research Institute of the Geographical department of the university of Cambridge.

On Sept. 2 1908, Scott had married Miss E. A. Kathleen Bruce, daughter of Canon Lloyd Bruce. Lady Scott had attained some reputation as a sculptor, and, later, executed statues of her husband, which have been erected in Waterloo Place, London, and at Portsmouth. Her other works include a statue of his companion, Dr. Wilson, at Cheltenham, one of Capt. Smith of the "Titanic" at Litchfield, and portrait busts of Mr. Asquith, Lord Knutsford, John Galsworthy, Granville Barker, and other well-known contemporaries. She was one of the first women to undertake munition making, and in 1916 she became private secretary to the secretary of the Ministry of Pensions. In Jan. 1922 her engagement to Lt.-Comm. Edward Hilton Young, D.S.O., M.P. (b. 1879), financial secretary to the Treasury, was announced.

SCOTT-GATTY, SIR ALFRED SCOTT (1847–1918), British herald and genealogist, was born at Ecclesfield, Yorks, April 26 1847, the son of the Rev. Alfred Gatty, vicar of Ecclesfield and sub-dean of York, by his wife Margaret Scott (*see* 11.530), a popular writer. One of his sisters was Juliana Horatia Orr-Ewing (*see* 10.40), the writer of children's books. The additional name of Scott was assumed by him by royal licence in 1892. He was educated at Marlborough and Christ's College, Cambridge. In 1880 he entered the Heralds' College and became Rouge Dragon pursuivant, and in 1886 was appointed York herald. In 1899 he became registrar of the college, and in 1904 was made Garter principal king-at-arms and knighted. Sir Alfred Scott-Gatty was an authority on heraldry and genealogy, and presented many copies of records to the Heralds' College. He was also an accomplished musician, many of whose songs became popular. In 1911 he was created K.C.V.O. He died in London Dec. 18 1918.

SCRIABIN, ALEXANDER NICHOLAEVICH (1871–1915), Russian composer, was born at Moscow on Christmas day 1871 (O.S.). His father was a lawyer; his mother, a good pianist and pupil of Leschetitsky, died when he was one year of age. His schooling was received in the Moscow Cadet Corps, but he never showed any liking for the military career for which he was intended, and at 18 entered the Moscow Conservatory of Music where he was a pupil of Safanov and Tanier. On leaving the conservatory Scriabin was greatly helped by the patriotic music publisher Belayef, who brought out his earlier works and arranged a European piano recital tour for him. At 20 he returned to Moscow and joined the conservatory staff. Later he again travelled, this time for six years, visiting the United States amongst other countries. He then settled in Brussels for some time, and in 1910 returned to Moscow. In 1914 Scriabin visited England, giving two piano recitals, playing his own Concerto and appearing as pianist in his *Prometheus*. He was then suffering from a tumour of the lip, from which, soon after his return, he died, April 14, 1915.

As a composer Scriabin represents what may be called the classical school carried forward to its most advanced point. The form of his sonata and symphony movements he derives from Mozart, through Beethoven; however bewildering these may at first sound, they will be found, on a second or third hearing, to be laid out on essentially the Mozart-Beethoven lines. In his pianistic idiom and general pianistic qualities of style, Scriabin derives largely from Chopin, of whose work he was a great admirer. All this then indicates a conservative side to his composition, but he was more radical in his harmonies, and it was, probably, largely the novelty of these that retarded appreciation of his later works. Gradually he evolved what may be called a new scale or, from another point of view, a new chord. It consists of the upper partials of the fourth octave from the fundamental note, less two (taking C as the fundamental note—C, D, E, F♯, A, B♭ or, arranged as a superposition of fourths, as Scriabin most frequently uses them, C, F♯, B♭, E, A, D). The hint of this new harmonic scheme may be seen in the earliest compositions, and its development was fairly regular and consistent, until it came to dominate his later output. In his later works he discards entirely the old key signatures. In his orchestration Scriabin calls for a large force, and uses it very freely: his scores are excessively contrapuntal in texture, the various instruments moving very independently and weaving together their respective themes: muted brass plays a large part in his orchestral colour scheme. In the First Symphony a chorus is used in the finale; the "Poem of Fire" also uses a chorus, but in an orchestral way, no words being supplied. For the last-named work the composer also wrote an optional part for a "Tastiera per luce," or keyboard of light, the intention being that varying colours should play upon a screen as the work was being performed. The composer was greatly interested in theories as to a correspondence between the musical scale and the scale of colours. In his great *Mystery* (left unfinished at his death) music, dance, speech, perfume and colour were to be combined; this work was to be rather a work of ritual than of art, and was to express its author's idealistic mysticism through the medium of 2,000 participants.

It is usual to look upon Scriabin's musical work as largely the expression of theosophical views, and undoubtedly much of his inspiration was drawn from the works of Blavatsky and others. He was not, however, a close reader, or a careful thinker. Seizing the main idea of a book or a creed, he would neglect the details, and his imagination would quickly develop a huge scheme of thought having little relation to what he had read. The titles of many of his works and of their separate parts, and the marks of expression affixed to particular passages, indicate plainly the existence of a spiritual "programme." The emancipation of the human soul through ceaseless striving, and its achievement of self-expression, may be said, very roughly, to represent the general sense of the spiritual basis of Scriabin's musical works.

The works of Scriabin have been variously classed into periods. A logical classification is into four periods as follows: 1st period, with a strong Chopin influence; the dividing line between this and the 2nd period runs through the First Symphony, and the 2nd period shows some Wagner and Liszt influences; the dividing line between this and the 3rd period runs through the Fifth Sonata, and a 4th period begins with the "Poem of Fire."

Works.—Orchestral: Revery (*op.* 24); Symph. I. (26); Symph. II. (29); Symph. III., or Divine Poem (43); Symph. IV. (54); *Prometheus*, or "Poem of Fire" (60). Piano: Sonatas I. (*op.* 6);

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II. (19); III. (23); IV. (30); V. (53); VI. (62); VII. (64); VIII. (66); IX. (68); X. (70). A very large number of preludes, études, impromptus, mazurkas, poems, etc., including the great "Vers la Flamme" poem and the much-discussed last work, the Five Preludes (*op.* 74). Piano and Orchestra: Concerto (*op.* 20). No songs or chamber music are included in Scriabin's output. (P. A. S.)

SCULPTURE (*see* 24.488).—The state of coma which, so far as public interest is concerned, had afflicted European, and particularly British, sculpture up to the neighbourhood of 1910, yielded at about that date to a long-sustained treatment of shocks administered by the exhibitors of what has been regarded as "freak" sculpture. These shocks, sporadic but startling and lingering in their effect, had persisted throughout the preceding decade, and the so-called "rebels," authors of these frequently unintelligible sculptural efforts, found their ranks considerably swelled by converts to a system that seemed both easy of adoption and financially profitable. Hitherto, indeed, British sculpture had been well-nigh moribund, and only on occasion had the public evinced an interest in the case by crowding the bedside of the invalid to witness in some London gallery the delirium of the dying art as represented by the works of some new "rebel."

The attention of the public was caught and their mind entertained to an unusual degree in the closing years of the last century when Rodin, the great French master, startled the world by his originality of thought and won admiration by the freshness and vigour of his work. The interest thus awakened was, however, ill sustained in England, until the breach with academicism which Rodin inaugurated by his originality and independence was reflected and rendered wider in the work of the artistic "rebels" in Great Britain. The wave of revulsion from academicism and realism reached perhaps its high-water mark in 1910, and in 1921 had shown no sign of ebbing.

It would be difficult to classify these revolutionaries or to apply to their work any generic term, yet this movement has something in common with the post-impressionism of the painters. It had reached England from the Continent, where it was far more widely spread and had rooted more deeply. In France it received smaller encouragement than in Germany and Austria, where its influence is revealed in much of the recent monumental sculpture. The gospel of the movement forbids in chief any show of anatomical detail, and allows but little of true construction or of natural forms.

There can be little doubt that to this movement, in part at least, was due the awakening of public interest in sculpture about the year 1910. It was during the following year that considerable efforts were made to collect for public exhibition the works of that foremost of British sculptors, Alfred Stevens. That these efforts were successful was plain from the space devoted to the exhibition in the Tate Gallery during Nov. and Dec. 1911 and Jan. following. This exhibition constituted in the case of the majority of visitors a first introduction to the finest sculptor Great Britain had produced. The interest it provoked encouraged a scheme for a further and more permanent collection and preservation of the scattered works of this great master. Public interest in Stevens was promoted to a very large extent by the labours of the Stevens Memorial Committee, and by the enthusiasm and solicitude of Prof. Legros, and it was on behalf of this Committee that in 1911 the late Sir William Richmond presented to the trustees of the gallery an interesting bust of Stevens by Edouard Lantéri. Since then the collection at the Tate Gallery has been enriched by a cast of Stevens's remarkably fine chimney piece at Dorchester House.

Foremost of European sculptural works raised in 1911 were, in Rome, the large memorial to King Victor Emmanuel, and, in London, the great memorial to Queen Victoria at Buckingham Palace. The Victor Emmanuel monument reveals no individualism or inspiration in its design or modelling. The Victoria Memorial, largest of sculptural monuments in London, is imposing in its effect and is magnificently situated at the head of the Mall and before the Palace. In 1912 the great bronze quadriga by Adrian Jones was placed upon Decimus Burton's arch at the top of Constitution Hill, London.

The revival of sculpture which marked this period was not evident alone in parochial and civic patronage; it was found—not for the first time—a suitable and convenient, and certainly an effective, channel, through which might be expressed international courtesies adaptable to various occasions. Three such works, which might be regarded as political, were erected in London during the year 1920–1, to which reference will be made later. During 1912 two such monuments were unveiled in France, both of which were in the form of courtesies between that country and Great Britain. On April 12 M. Poincaré unveiled at Nice the Queen Victoria Memorial, and on April 13 a memorial to King Edward was presented to the public at Cannes.

In the meantime one of the most important events of 1912 in England was the completion of Alfred Stevens's monument to the Duke of Wellington in St. Paul's Cathedral by the addition of the bronze equestrian statue of the duke which was designed to surmount the monument. Alfred Stevens, the designer of this splendid work, had died leaving the memorial incomplete, and it must for ever remain a matter for regret that many important architectural features in Stevens's original design were modified with results destructive to the purity of the style and the elasticity of the structure. It was not until 45 years after Stevens's untimely death that the screens were removed and the completed monument revealed to the public gaze. Fortunately the great sculptor had left behind him a small model which he had designed for the equestrian group, and John Tweed, who was finally commissioned to carry out this portion of the work, followed and developed with no mean intelligence the ideas conveyed in the small original model. The result is not, however, as happy as could have been desired. The horse is in the Renaissance style as intended by Stevens, and is in keeping with the rest of the design; the light is quite inadequate to illuminate the upper parts of the monument, which is far too high for its position, the bronze group barely clearing the overhead structure of the building and consequently suffering some obscurity.

The Tate Gallery, in London, latterly more fittingly known as the National Gallery of British Art, was enriched by the addition of Havard Thomas's bronze statue "Lycidas," the gift of Mr. and Mrs. E. Sadler, while perhaps the most interesting work in the Royal Academy exhibition of 1912 was the same sculptor's statue "Thyrsis," which was acquired by the Felton Bequest Committee for the National Gallery of Melbourne.

The outbreak of the World War had no immediately noticeable effect on British sculpture. The work shown at the Royal Academy exhibition just then concluded had been of an unusually high standard, Sir Thomas Brock's statue of Capt. Cook had been set up in the Mall, London, and a very large number of works of some importance were well on the way to completion in the autumn of 1914. These did much to cover any paucity which might have been apparent in the exhibition of the following year. Nevertheless, upon the outbreak of hostilities a vast number of contracts for important architectural sculpture were at once cancelled or their execution postponed. This, it is hardly necessary to say, resulted in a period of distress and stagnation which terminated only with the demand for war memorials after the signing of the Armistice.

While general attention was focussed upon the war, British sculpture suffered a severe blow by the death of Prof. Edouard Lantéri, of the Royal College of Art. As a sculptor his output amounted to little, but, as he himself would have had it, the fruits of his teaching will long survive him, and those sound constructive principles of sculpture which he taught will remain an influence in that distinctively British school of sculpture which he endeavoured to promote.

Two works of outstanding beauty and remarkable workmanship in the Academy exhibition of 1914 should be mentioned: Havard Thomas's bronze cast of his "Thyrsis," which had appeared in wax two years previously, and Derwent Wood's bronze bust of Mr. Henry James.

No sculpture of importance was made public during 1915 beyond Rodin's "Burghers of Calais," Lady Scott's statue of Capt. Scott, and such works as were exhibited at the Royal

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Academy. Mr. Toft's figure, "The Bather," was a notable exhibit, and it was bought by the Trustees of the Chantrey Bequest for the national collection. A large work in marble which attracted much attention was the statue "Premier Matin" by the Belgian sculptor Egide Rombeaux. Political interest in Serbia, arising out of the war, was in part responsible for the exhibition this year in London of the work of Mestrovic, the Serbian sculptor; his work, though showing an extreme revolt against academicism, is undoubtedly powerful and full of individualism. Rodin's already well-known bronze group, "The Burghers of Calais," purchased in 1912 by the National Arts Collection fund, was erected in Victoria Tower Gardens, London, and the memorial statue of Capt. Scott was set up in Waterloo Place, London.

Derwent Wood won further honour with his child's head (a portrait of Master Charles Haviland Hillman) in the Academy in 1917. This year was specially marked, however, by the death of that greatest of modern sculptors, Auguste Rodin, a master who has exercised probably a greater influence upon the sculpture of his day than has any before him. His works had long since found their way into every important public and private collection of modern art in Europe and America; a triumph of extraordinary significance, because it was not until comparatively late in his career that he won official recognition.

In Aug. 1919 a picturesque figure was removed from sculpture circles by the death of Walter Winans. Never a sculptor of more than technical ability, Winans worked to please himself and for the entertainment of his friends. Horses and shooting were perhaps as great a passion with him, and, though in sculpture he was a gifted dilettante and no more, he had some successes and was widely known.

Save for the few exceptions of those men who were physically unable to render war-service, almost every British sculptor had now been for some time with the fighting forces or engaged in the hospitals or munition works at home. Metals—particularly those of which bronze is constituted—were controlled by Government in order to safeguard the supply necessary to the manufacture of war munitions. This supply, though sufficient for those needs, did not very far exceed them; it is worthy of note, therefore, that the Government, in the interests of sculpture, ascertained the average amount of bronze used by those sculptors who were still at work, and assigned to each such quantity of metal as was in fair proportion to his previous needs. Beyond this, however, the British Government did little or nothing to encourage or to make use of sculpture, though Germany, in the meantime, found a valuable weapon in the production of war medals, which were designed as propaganda to serve the double purpose of heartening the German people by commemorating real or supposed victories and of disseminating in neutral countries evidence of Albion's perfidy and of the success of German arms. These medals, of which some hundred or more were designed, are in very many cases works of a high artistic order, and several museums in Great Britain have secured fairly representative collections of them.

During 1920–1 no fewer than three public statues which may well fall under the category of "International Courtesies" were erected in London: the monument of "Gratitude" (a bronze group by Victor Rousseau)—the gift of Belgium—erected on the Thames Embankment in Canning Enclosure, Westminster; the statue of Abraham Lincoln by Saint-Gaudens—a gift of the United States; and the bronze replica of Houdon's George Washington, presented by the state of Virginia and set up in Trafalgar Square.

The London memorial to Nurse Cavell by Sir George Frampton, erected near St. Martin's church, Trafalgar Square, caused something like a sensation in 1920 by the evidence it gave of this well-known academic sculptor's conversion to simple and severe forms of archaicism. This was particularly noticeable in the treatment of the architectural forms. Some remarkable sculpture was exhibited in June 1921 by Paul Manship, a sculptor of great individuality and strength of modelling. In July 1921 Bertram MacKennal's equestrian statue of King Edward VII. was unveiled in Waterloo Place by King George. The sculptor was knighted after the ceremony. In Scotland Mr. Pettendrigh MacGillivry was made "King's Sculptor," a title that has no counterpart in England. (C. Po.)

UNITED STATES.—Although the period 1910–20 brought to light no new master in American sculpture, it showed an increase in the number of sculptors, and much good work was done. D. C. French, who in 1920 had reached the age of 70, was still indefatigable; conspicuous among his later works were the "Melvin Memorial" and the statue of Emerson, both at Concord, Mass.; "Lincoln," at Lincoln, Neb.; the Longfellow and Lafayette reliefs; the exquisite Spencer Trask Memorial at Saratoga Springs, N.Y.; and the imposing "Lincoln" for Washington, D.C., besides a score of architectural groups of high value. F. W. MacMonnies erected a "Pioneer Fountain" at Denver and a Washington group at Princeton, N.J. G. G. Barnard was as always original; his gigantic processionals in Harrisburg, like his rugged "Lincoln" in Cincinnati, compelled attention and discussion. Paul Bartlett devoted years to his equestrian "Lafayette" for Paris, following this with the pedimental group for the capitol, Washington, D.C. Henry Shrady's monument to General Grant (Washington, D.C.) was a work of sincerity. H. A. MacNeil embellished Ohio's capitol with his "McKinley Memorial" and Albany with a soldiers' monument. St. Paul and Springfield, Ill., and Worcester, Mass., gained new works by Andrew O'Connor. A. A. Weinman's Baltimore group, C. Keck's "Republic" in Pittsburgh, and H. A. Lukeman's various monuments were important contributions. Karl Bitter's untimely death in 1915 was a great loss; among his last works were the admirable East pediment of the Wisconsin state capitol, the austere "Carl Schurz" (New York), and the "Lowry Memorial" in Minneapolis. Another good pediment was that of the Kentucky capitol by Charles Niehaus. Miss Anna Hyatt's "Joan of Arc" (New York) was completely successful. Cyrus E. Dallin continued his mounted Indians; "The Appeal to the Great Spirit" was perhaps the finest. J. E. Fraser's "End of the Trail" was a notable achievement. Among portrait statues were Weinman's seated "Lincoln" (Hodgensville, Ky.); Edmund T. Quinn's "Edwin Booth" (New York); R. Tait McKenzie's "Whitefield" (Philadelphia); and Leonard Crunelle's "Governor Oglesby" (Chicago). Herbert Adams produced his "Bryant" (New York), as also his graceful MacMillan Fountain in Washington, D.C. In portrait busts Charles Grafly continued to lead, with his former pupil, Albin Polasek, a close second. Atillio Piccirilli's "Outcast" and "A Soul" were sculpture "by first intention." McCartan's graceful fauns and Rudolf Evans' beautiful "Golden Hour" were of this period. Chester Beach and Paul Manship continued their successful work. Sherry Fry's fountain for St. George, Staten Island, revealed skill of a high order. Evelyn Longman was well represented by her Allison Memorial (Des Moines, Ia.), and the Illinois Centennial Monument, Logan Square, Chicago. Nellie V. Walker had important works in many western cities—for example, her heroic "Keokuk." Lorado Taft's "Black Hawk" and several fountains were also of this period. Doubtless the most stimulating event of the decade was the Panama-Pacific Exposition of 1915 in San Francisco. Among the many sculptors who made valuable contribution to its display of decorative art were Calder, Aitken, Roth, MacNeil, Jaegers, and Konti.

(L. T.)

SEAMAN, SIR OWEN (1861–), English poet and editor of *Punch* (*see* 24.543), was knighted in 1914. His later volumes include *War Time* (1915); *Made in England* (1916) and *From the Home Front* (1918), mainly reprints of verses contributed to *Punch*. At the beginning of the World War he joined the "Veterans" corps of the former Inns of Court Volunteers, later known as the Inns of Court Reserve Corps (2nd batt. of the County of London Volunteer Regt.). He was gazetted lieutenant in 1916.

SEDGWICK, ADAM (1856–1913), English biologist, was born at Norwich Sept. 28 1856. Educated at Marlborough, King's College, London, and Trinity College, Cambridge, he became fellow and tutor of his college and assisted F. M. Balfour, the first

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professor of animal morphology at Cambridge. From 1890 to 1907 he held a readership in that subject himself, and in 1907 became professor of zoölogy in Cambridge University. Two years later he was transferred to the Imperial College of Science and Technology in the same capacity. Details of his work in cytology and embryology are to be found in 7.720, 9.320 and 328. He died in London Feb. 27 1913.

SEEBOHM, FREDERIC (1833–1912), English historian, was a native of Bradford and came of a Quaker family. His interest in problems of modern life, social and religious, led him to study the conditions of English rural life in the past and the religious movements of the Reformation. In his *English Village Community* (1853) he dwelt on the survival of Roman influences in agricultural life; and in his *Tribal Systems in Wales* (1895) he reconstituted a Celtic society from 14th century evidence. He died at Hitchin Feb. 6 1912.

SEELY, SIR CHARLES, 1ST BART. (1833–1915), British politician was born at Lincoln Aug. 11 1833. He came of a family which held large property, including coal-mines, in the Midlands, and also in the Isle of Wight. In 1869 he entered the House of Commons as Liberal member for Nottingham, but lost his seat at the general election of 1874. He was reëlected in 1880, but seceded from the Liberal party on Irish Home Rule, and in 1885 lost his seat. He was once more elected in 1892, and held the seat until 1895. In 1896 he was created a baronet. Sir Charles Seely was a warm supporter of the Volunteer movement. He died suddenly at Brooke House, Isle of Wight, April 16 1915.

His youngest son, JOHN EDWARD BERNARD SEELY (1868–), British politician, was born at Brooke Hill Hall, Derbyshire, May 31 1868. Educated at Harrow and Trinity College, Cambridge, he was called to the bar in 1897, and from 1900 to 1901 served with the yeomanry during the South African War. In 1900 he entered the House of Commons as Liberal member for the Isle of Wight, but was defeated at the 1906 election. He was, however, elected the same year for the Abercromby division of Liverpool. In 1908 he entered the Asquith Government as Under-Secretary for the Colonies, but in 1910 lost his seat, although in the second general election of that year he stood successfully for the Ilkeston division of Derbyshire. In 1911 he was made Under-Secretary for War, and in 1912 became War Minister. Owing, however, to the events attending the Curragh incident of 1914, he resigned in the summer. He served in the army with distinction in the World War, rising to the rank of general in 1918, and on his return to official life became parliamentary under-secretary to the Ministry of Munitions and deputy-Minister of Munitions (1918). In Jan. 1919 he became Under-Secretary for Air, and president of the Air Council, but resigned in Nov. of the same year.

SÉGUR, PIERRE M. M. H., MARQUIS DE (1853–1916), French author (*see* 24.584), died at Poissy Aug. 13 1916.

SEISMOLOGY (*see* 8.817 and 24.589).—Strictly speaking, seismology is that department of knowledge which is concerned with the study of earthquakes, and such was its meaning up to the end of the 19th century, the older seismology being exclusively concerned with the earthquake which could be felt. In the early nineties it was discovered that suitably designed and sufficiently sensitive seismometers recorded disturbances which were evidently connected with great earthquakes, and, as it was known that the intensity of disturbance decreased with an increase of distance from the central region of greatest violence, it was natural to conclude that the very small disturbances, registered at great distances, were due to the same cause that gave rise to the destructive earthquake. With the accumulation of observations difficulties began to arise; it was found that neither the magnitude of the disturbance, nor the distance at which record could be obtained, bore any constant relation to the magnitude of the earthquake. Some shocks of great violence gave small records, not very extensively distributed, while others of much less severity at the place of origin gave much larger records and were registered all over the earth. The distant records, however, continued to be regarded as records of the earthquake itself, and are still generally described as such. In 1900 R. D. Oldham, when examining the circumstances of the Californian earthquake of 1906, arrived at the conclusion that the fractures and dislocations of the surface rocks, which gave rise to the destructive earthquakes, were but a secondary consequence of a deep-seated disturbance, to which he gave the name of *bathyseism*, and suggested that this, and not the earthquake, was the origin of the disturbance which, propagated through the interior of the earth, gave rise to the long-distance records, commonly known as seismograms. Subsequent consideration of other earthquakes confirmed his belief in the correctness of the conclusion, and from this it results that the word "seismology" is at present being used to cover two distinct and independent departments of study, which may be distinguished as *teleseismology* (τῆλε, distant) or the study of the long-distance records, and *engysseismology* (ἐγγύς, near) or the study of the earthquake proper, each being distinct and independent offshoots of the bathyseism, or deep-seated disturbance. It is the first of these which, at the present day, is more especially meant by seismology, and it is an instance of the way in which words gradually depart from their original meaning, that the term should have come to imply something which has no direct connexion with earthquakes.

Nothing is known at present of the origin of the bathyseism, and very little of the depth at which it originates. The latter probably varies considerably, those disturbances which give rise to well-marked teleseisms and moderate surface earthquakes taking place at greater depths than others which are accompanied by violent and destructive earthquakes. The only suggestion which has yet appeared of the depth of origin is by Dr. G. W. Walker, who has followed up certain investigations, started by Prince Boris Galitzin, of the angle of emergencies of the wave-paths, and finds that in many cases they indicate an origin at a considerable depth (it may be as much as 1,200 km.) below the surface. These investigations require following up before they can be accepted as conclusive, but the suggestion is of interest; there is no inherent impossibility, and it seems to offer a possible explanation of some difficulties which have arisen in the interpretation of the long-distance seismograms.

Since 1910 many improvements in detail have been made in the instruments used for obtaining the long-distance records of the newer, or tele-, seismology, and an entirely new principle was introduced by the late Prince Boris Galitzin for a direct measurement of the acceleration of the true motion of the ground. This instrument is based on the fact that, if a plate of quartz is subjected to pressure between two sheets of metal, a free electric charge appears in those sheets, the amount of which is proportioned to the pressure. An instrument was actually constructed on this principle and subjected to experimental tests, but has not been applied to the recording of natural disturbances, owing to the death of the inventor and the effects of the political revolution in Russia.

The rate of propagation of wave-motion through the earth, as registered by long-distance seismographs, has been investigated by Dr. C. G. Knott, who has succeeded in solving the mathematical difficulties of the problem. He finds that the rate of transmission of both the first phase, condensational, and of the second phase, distortional, waves increases continuously till the wave-path attains a depth of about three-tenths of the earth's radius, the wave-paths reaching lesser depths than this having a continuously curved form, convex towards the centre of the earth. Beyond this the rate of propagation is nearly constant, even decreasing at certain depths so that some of the wave paths are concave towards the centre in part of their course. Below six-tenths of the radius the distortional wave is killed out, and is not registered at distances greater than 120° from the epicentre. The rate of propagation of the two forms of wave-motion is about 7·2 and 4·0 km. per second respectively, near the surface of the earth, and about 12·8 and 6·8 at depths of over 1,500 kilometres.

For the older seismology or study of earthquakes proper, *see* GEOLOGY (section *Dynamical Geology*).

AUTHORITIES.—The best general introduction to the newer seismology is Dr. G. W. Walker, *Modern Seismology* (1913). The most complete is by Prince B. Galitzin, original in Russian; a German translation, *Vorlesungen in Seismometrie*, appeared in 1912. G. W.

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Walker, "Focal depth and the Time Curve," *Brit. Assn. Rep.* (1917, p. 13). C. G. Knott, "The Propagation of Earthquake Waves Through the Earth, and Connected Problems," *Proc. Roy. Soc. Edinburgh* (1919, p. 157). (R. D. O.)

SEITZ, KARL (1869–), Austrian politician, was born at Vienna on Sept. 4 1869, the son of a wood merchant. Left without parents at an early age, he grew up in an orphanage, and, after completing his course in the public elementary school, began to learn the tailoring trade, until through the medium of patrons he was provided with a place in the teachers' seminary at St. Pölten. In this way he became an elementary school teacher. Originally inclined to the German National party, he joined in 1888 the Social Democratic party. He organized the Social Democratic teachers of Vienna, and in the Diet of Lower Austria waged a fierce fight against Burgomaster Lueger and the dominant Christian Socialist party. Elected to the Austrian *Reichsrat* in 1901, he became, after the death of Pernerstorfer, its vice-president down to its dissolution. After the revolution of 1918 he was president of the German-Austrian National Assembly, and subsequently of the national parliament (*Nationalrat*) until the new elections in Oct. 1920, and federal president until Nov. 1920. He was in 1921 chairman of the committee of the Social Democratic party and of the parliamentary party, and vice-president of the *Nationalrat*.

SELBORNE, WILLIAM WALDEGRAVE PALMER, 2ND EARL OF (1859–), English politician (*see* 24.599), on his return from the governorship of South Africa resumed his prominent position in the House of Lords. He took an active share in defending the House against Liberal attack, and was one of the leading "Die-hards" who maintained an uncompromising resistance to the Parliament bill. In regard to Irish Home Rule, he constantly pressed for a referendum to the people. As a former First Lord of the Admiralty, he contributed decisively to the condemnation passed by the House on the Declaration of London. When the World War came he was largely occupied with his military duties with the 3rd Battalion of the Hampshire Regiment; but he joined the first Coalition Ministry as Minister of Agriculture and Fisheries. As minister he appointed a committee of technical experts and practical agriculturists, under the chairmanship of Lord Milner, to report on the means of maintaining and increasing food production in England and Wales; but, fortified by the opinion of a Scottish committee appointed for the same purpose, he and the Government rejected the English committee's recommendation to guarantee farmers a minimum price of 45s. a quarter for the four years following the harvest of 1916. He preferred a plan for organization and coöperation through the county councils and the Board of Agriculture. In June of the following year he resigned his office because he disapproved of the Irish policy accepted by Mr. Asquith's Government as a result of Mr. Lloyd George's negotiations with Irish leaders. He did not join Mr. Lloyd George's Ministry, and after the war he was mainly conspicuous in ecclesiastical matters; he was forward in promoting the movement for self-government in the Church which culminated in the Church Enabling Act of 1919. His elder son, ROUNDELL, CECIL, VISCT. WOLMER (b. 1887), entered Parliament in 1910, and proved an active member of the Unionist party. A younger son was killed in the war.

SELF-DETERMINATION.—This phrase, defined in the Oxford *New English Dictionary* as "the determination of one's mind or will by itself towards an object," was used exclusively, from the 17th century to within quite recent years, as a synonym for "free will" in the individual person, as opposed to the determination of this will by God's predestination—the doctrine of Determinism. Thus John Scott, in his *Christian Life* (1683–6), speaks of "necessary agents, that have no Free-will or Principle of Self-determination," and Bishop Stillingfleet, in his *Origines Sacrae* (1662), of giving man "the freedom of his actions, and a self-determining power." The *New English Dictionary* fails to show any use of the phrase in earlier days in the sense in which it became widespread and familiar at the close of the World War, and it has been commonly assumed that it was a new word coined, or rather adapted from the Russian *Samo-obrazhenie*, to give convenient expression to the political principle for which the nations of the Entente were then supposed to be fighting, that is to say, the right of nations to determine their own allegiance and form of government. It had, however, been used in this sense even before the war. Thus in his article on ROME in the earlier volumes (11th edition) of this Encyclopaedia (a recension of the 9th edition article by Prof. H. F. Pelham) Prof. H. Stuart Jones, writing of the Roman provincial government, says that "nothing could compensate for the lack of self-determination" (*see* 23.653).

It was after the Revolution of March 1917 in Russia that "self-determination" as a political catch-word came into sudden prominence. On April 10 the Russian Government, then dominated by the Radical element under Kerensky, issued a statement which said, among other things, that "Free Russia does not aim at dominating other nations; . . . . its object is to establish a durable peace on the basis of the rights of nations to decide their own destiny." The substance of this proclamation was at once condensed into the formula "self-determination, no annexations, no indemnities," which was to produce so profound, and in some ways so disastrous, an influence on the world-settlement which followed the war. The principle of self-determination had, indeed, already been laid down by President Wilson in his address to Congress of Jan. 22 1917. "No peace can last," he said, "or ought to last, which does not recognize and accept the principle that Governments derive all their just powers from the consent of the governed." The principle, and the words in which it is defined, are those of the American Declaration of Independence; it was not till a year later that President Wilson himself crystallized this principle in the word "self-determination" in the address to Congress of Feb. 11 1918, in which he defined the Fourteen Points; and on this occasion the phrase is still marked as a neologism by being printed between inverted commas. "'Self-determination' is not a mere phrase," he said; "it is an imperative principle of action which statesmen will henceforth ignore at their peril." Two months later, in his speech of April 6, the phrase had become, as it were, naturalized; he speaks of "the free self-determination of nations upon which all the modern world insists." The inverted commas no longer appear.

President Wilson has been blamed in certain quarters for his failure at the Peace Conference in 1919 to make the principle of self-determination the only basis of the ultimate settlement, for allowing the old diplomatic Adam too much say in the adjustment of national boundaries. In this respect the blame is not deserved; for he had early pointed out that the application of the principle must be conditional; the fourth of the "Four Principles" laid down in his speech of Feb. 11 1918 was "that all well-defined national aspirations shall be accorded the utmost satisfaction that can be accorded them without introducing new or perpetuating old elements of discord and antagonism that would be likely to break the peace of Europe and consequently the world." This is, of course, a serious limitation of the principle of self-determination in its practical application, since it involves a check upon this determination by an outside authority, which authority President Wilson defined as "the organized force of mankind"—embodied in the League of Nations—but which in effect has been, and always must be, those nations that are in a position to make their will prevail, whether inside or outside the League. In practice, then, self-determination has proved largely illusory. The Treaty of Versailles made advances towards the application of the principle, but these advances were tentative and timid. No transferences of territory of the first importance—such as those of Alsace-Lorraine to France or of Posen and West Prussia to Poland—were made subject to plebiscites. In the treaty with Germany plebiscites were prescribed in the cases of the districts of Allenstein and Marienwerder, of Upper Silesia and of North Schleswig, and negative plebiscites in the case of Eupen and Malmédy. In the Austrian treaty plebiscites were prescribed in the cases of Klagenfurt and Teschen, but it was only in the former case that a popular vote was actually taken. A plebiscite was refused in the case of Western Hungary, transferred to the Republic of Austria under

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the name of Burgenland. The case of East Galicia was left open, and so remained in 1921. Experience in the case of Upper Silesia abundantly proved the wisdom of thus limiting the right of self-determination. Plebiscites had worked smoothly enough in the case of fairly homogeneous areas defined by ancient boundaries, as in Avignon in 1791 and Savoy and Nice in 1860; they are altogether another matter in districts inhabited by mixed populations divided by bitter national jealousies. The method proved in any case to be costly and dilatory. In large areas it involved an extensive military control which the victorious Allies were unable to provide, while it was impossible to set up provisional governments to supervise the partition of areas over which they exercised control.

The experience of the diplomatists at Versailles has then, if properly studied, great value as a corrective to the dreams of idealists who persist in building theories for an imaginary world. But, apart from this experience, it is certain that the principle of self-determination could not be universally applied without overthrowing all that remains of the world's order. Yet the principle remains, in spite of disillusionment, a powerful solvent of established bodies politic, and it is therefore still important to understand its implications. The phrase "the self-determination of nations" is widely accepted as the expression of a principle as clear as it is just. So far as the meaning of self-determination is concerned, it is indeed clear enough. What is not so clear is what is meant by a "nation." This is a subject round which interminable discussions have centred, and which must be examined if the full implications of the principle of self-determination are to be realized.

Definition of Nation and Nationality.—Legally defined, a nation is the aggregate of the subjects or citizens of a particular sovereign state, and nationality is the quality of such subjection or citizenship. But the word "nation" has also a wider meaning, which the *New English Dictionary* embodies in the following inclusive definition:—"A nation is an extensive aggregate of persons closely associated with each other by common descent, language, or history, so as to form a distinct race or people, usually organized as a separate political State and occupying a definite territory." This definition is open to criticism, as involving some confusion of thought: and this confusion is not made less confounded by the definition of "nationality" as primarily synonymous with "nation" but "frequently a people potentially but not actually a nation," while a "people" is defined as "a body of persons composing a community, tribe, race, or nation."

The truth is that the vagueness of our terms reflects the vagueness of our ideas about a problem the intricacies of which we have only recently been called upon to unravel. No satisfactory definition of the word "nation" is possible because, save in its legal sense, it conveys no definite idea; and the same is true of the word "nationality." Yet a clear definition is the essential preliminary to any fruitful discussion. It is proposed then, for the purposes of the present argument, to use the word "nation" in the sense of "the sum of people constituting a sovereign and independent body politic," the Latin *populus* as distinguished from *natio*. The word "nationality" it is proposed to deprive of its legal connotation, and to define a nationality as "an extensive aggregate of persons conscious of a community of sentiments, experiences, or qualities which make them feel themselves a distinct people." The various elements that produce this consciousness will be discussed later. They have an important bearing on the practical problem which was only very imperfectly solved by the Treaty of Versailles, namely, the problem raised by the claim of nationalities, thus defined, to become nations. The complexity and perils of the issues involved in this claim may be illuminated by the fact that, even now, in the actual polities of the world, nationalities and nations nowhere coincide. It remains, therefore, of great importance to determine what are the essential qualities of nationality and what are its necessary relations to the conception of the state.

Theories of Nationality.—On few subjects has there been so great a difference of opinion as on the question of what constitutes nationality. Fichte explained it, in terms of his transcendental philosophy, as a thing divine and spiritual, a manifestation of the mind of God revealing itself in the national soul. So, too, for Mazzini, the prophet of the Italian *risorgimento*, nationality was a thing sacred, not to be profaned by a cold analysis of its elements, but believed in and suffered for as a prime article of faith—the "faith in liberty"; for him the map of Europe would have to be redrawn on national lines as the necessary first step towards "the universal association of the human race."[1] No student of the history of the rise of nationalities during the last hundred years will underrate the part played by such prophets as these. Yet their enthusiasm by itself explains nothing and would have achieved nothing; it is like fire, itself a subtle and mysterious element, which yet needs very material fuel to feed its destructive and creative force. The explanation of the phenomena of nationality, as other thinkers have realized, must be sought, not in the region of metaphysics, but in that of observed facts.

If we analyze the composition of the several nationalities, we find these elements: race, language, religion, common habitat, common conditions, mode of life and manners, political association. These elements are, however, never all present at the same time, and none of them is essential. Community of race, even where this is put in the forefront of the claim of nationality, is mainly a politic fiction, at least in countries of European civilization, in which the races are inextricably mixed up. Language, again, is as little as race the criterion of nationality. It may be, as Bluntschli says, the expression of a common spirit and of intellectual intercourse, and as such it may be brought powerfully to the aid of nationality, as in the case of the Czech language in Bohemia, or, still more strikingly, of the English language in the United States. But nationality and inherited community of speech are not identical. The Swiss are a distinct nationality, though they speak four different languages. Community of language, on the other hand, has not prevented the British and the Americans from developing different nationalities. Religion, too, has clearly no necessary connexion with nationality, though it has played a great part in creating and stereotyping nationalities, notably in countries of backward civilization, as in the Balkan peninsula or in Ireland. A common habitat and common conditions are doubtless powerful influences at times in determining nationality; but people have thus lived together for centuries without developing a national consciousness, and in many cases—notably in the east of Europe—they have evolved separate national consciousnesses in spite of a common habitat and common conditions. As for manners and mode of life, these are apt to raise stronger barriers between classes than between nationalities. Lastly, political association, though—as in the case of the Swiss—it sometimes encourages the spirit of nationality, is more often its result than its cause.

All these elements, then, may or may not contribute towards the formation of a nationality, but when we have summed them up we are no nearer to a solution of the problem of its formation. Some theorists seek this solution in a psychological process. "A nationality," says Bluntschli, "only comes into being slowly, by a psychological process which gradually produces in a mass of men a distinctive form of existence and community of life, and stereotypes these as the inheritance of the race."[2] For him time, and a tradition of many generations, are the essential conditions. This may be true of the evolution of new nationalities; it is not true of the creation of a new sentiment of nationality in even large masses of persons. It is, for instance,

[1] *Scritti* (18 vols., Milan-Rome, 1861–91), viii., 205; xi., 181, 243; xii., 245. Mazzini avoided the practical problem involved in the reconstruction of Europe on national lines by saying that it was sufficient to indicate the "large lines" and "to leave details to the future and to the votes of the peoples" (x., 137). His own plan of reconstruction included the restoration to Poland of the frontiers of 1772, and the setting up of a Bohemian-Moravian-Hungarian federation. As Signor Salvemini (*Mazzini*, 1920) points out, "the 'design of God' was not quite so clear as Mazzini believed."

[2] *Lehre vom modernen Staat* (5th ed. *of Allgemeines Staatsrecht*, 1875), i., p. 92.

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the boast of the United States that they have been able to absorb annually some million of alien immigrants, and that one generation has usually sufficed to give them not only the name but the full sense of American nationality. The "psychological" element, indeed, may be admitted, but it does not explain the whole of the phenomena nor the ultimate driving force, so to speak, of nationality.

The German historian Karl Lamprecht came nearer the truth when he added another element, the economic, as the creative force in the evolution of nationality. Like Bluntschli, he found a general law for this evolution in the development of the *Volksgeist*, but he explains this development by changes in economic conditions. Nationality, that is to say, is but a manifestation of the instinct of men to group themselves for the defence of their common interests, and it follows that the groups thus formed tend to shift and change with the ebb and flow of the economic struggle for existence. This view, which—if it be sound—obviously conflicts with the belief that the triumph of the principle of self-determination would bring permanent peace to the world, was elaborated by the Austrian Socialist Otto Bauer, in his *Nationalitätenfrage*, with special reference to the nationality question in the former Habsburg Monarchy. "It is," he said, "the battles of the economic classes, everywhere active, the changes in the means and the conditions of work which determine the strength and weakness, the death and rebirth of nationalities." The determining factors of nationality in Austria-Hungary—which for the purpose of this study might be considered the laboratory of Europe—he declared to be not cultural but economic. The mass of men, the peasants and the labourers, are incapable of that consciousness of a widespread, common, inherited culture which is supposed to be the hallmark of nationality; but they are dissatisfied with their lot, resentful of the dominant powers whom they hold responsible, and ready therefore to group themselves against them.

This revolutionary tendency, which among the lower classes of the dominant races is anti-national and cosmopolitan, is apt among subject races to express itself in *nationalism*. The process was strikingly exemplified in Bohemia, where the flood of Czech nationality followed the channels opened up by industrial change, and German nationality succumbed not so much to cultural as to economic pressure. Before the World War the same process was taking place in all the eastern marches of Germany—in Silesia, in Posen, and in East and West Prussia, in which for years past the German element had been succumbing to the irresistible flood of Polish nationality, of which the unifying force was the economic opposition of the Slav proletariat and peasantry to the German capitalist and governing classes. The same phenomenon is apparent in the case of Ireland. The idealists of Sinn Fein never succeeded in inspiring the shrewd peasantry with their own enthusiasm for their "Milesian past"; the use of the renovated Gaelic language remained a conceit of the "intellectuals" of the cities; and the labourers and peasants were won to the Republican cause by a frank appeal to their economic interests—the promise of small holdings and of freedom from war taxation and the burden of the national debt.

It is then clear that there is an economic basis for nationality, and that, whatever other elements may enter into it, a sense of community of material interests is always present. It may be added that this sense is the strongest and most essential factor, and that without it nothing else will serve to maintain the common sentiment. Common origin, common language and a common tradition of culture and laws will not preserve the unity of a nationality when the material interests of its parts come into violent conflict. This truth received its most momentous illustration in the secession of the southern states of the American Union in 1860–1 and the bitter struggle that followed. The principle of state sovereignty and independence on the one side, and that of American national union on the other, did but disguise the true causes of the struggle, which were less political than economic; the agricultural south was determined to preserve its economic system, based on negro slavery; the industrial north was primarily inspired, not by any abstract love of coloured humanity, but by the economic objection of the labouring masses to the slave system.

Relation of Nationality to the Nation or State.—In considering the relation between the idea of nationality and that of the state we are apt to be confused by the romantic and idealistic tinge given to the idea of nationality by the poets and philosophers of the struggles for freedom. A nationality, conceived as something divinely inspired, is believed to have not only the capacity but the right to become a nation, and its legitimate growth to be necessarily stunted if it be prevented from doing so. Bluntschli, for instance, described a nationality as an incomplete organism which could only become completed as an effective "personality" by political organization as a nation or state, and some such idea underlay the Liberal enthusiasm for that "principle of nationalities" which during the last hundred years has so profoundly changed the map of the world. But when we come to examine this principle, as stated by its most conspicuous champions, we find no clear conception of what it ultimately involves, while the main question—of what constitutes a nationality—is consistently begged. The late M. Émile Ollivier, for instance, defines the principle of nationality (and incidentally of self-determination) as follows:—

> This principle is that every association of men called a people is an independent individuality; free, sovereign, enjoying the imprescriptible right of self-determination (*de disposer d'elle-même*) both in internal and external affairs.[1]

If the word "people" be taken in its usual non-political sense, this statement was, and remains, obviously untrue, or represents at most an aspiration; if it means a *nation*, then the principle as here defined is merely that of the sovereign independence of nations, *i.e.* states, which has always been a fundamental doctrine of international law; it is, that is to say, a conservative, not a revolutionary principle. But this is not what M. Ollivier meant by it. For him, as the apologist of the Liberal Empire, the principle of nationality was dynamic, not static; it involved a regrouping of the nations, not—as Alexander I. of Russia had once proposed—by the formation from above of homogeneous populations fenced off by their natural boundaries, but by the free vote of the people concerned—the Napoleonic plebiscite. This principle of nationalities, he says in his *L'Empire libéral*, is to be carefully distinguished from the theory of great agglomerations, the natural limits of the race, for race has nothing to do with it:—

> In the politics of nationality there are no natural frontiers. The true frontiers are those fixed by the will of the populations. The idea of race is barbarous, exclusive, retrograde, having nothing in common with the large, holy, civilizing idea of country (*patrie*).

Renan, in his *Qu'est-ce qu'une nation?* comes to much the same conclusion. A *Zollverein*, he says, is not a *patrie;* a nation is a grand aggregation of men with a moral conscience which causes them to sacrifice their individual interests to those of the community; wherever the existence of such a moral conscience is proved a nation exists as of right. "If there is any doubt as to its frontiers, consult the populations in dispute."

This solution of a difficult problem would be admirably easy were the rivalries of nationalities confined to the frontiers of states, which we have the best reason to know they are not, and were these frontiers themselves a mere question of marks on the map. But in any case, as Herr Bauer points out, this "psychological-voluntarist" theory begs the whole question of nationality, for it does not explain the factors that determine the will of populations to form a nation or to attach themselves to a nation already formed—supposing they are conscious of possessing a choice. It does not, that is to say, give us the real connecting link between nationality and the state, nor does it explain why in the 19th century, for the first time, nationality was erected into a *Staatsprinzip*.

Historically it seems clear that the explanation is at least largely economic. It may be true that a *Zollverein* does not constitute a *patrie*, but the experience of Germany proved that it may be a powerful element in the constitution of one. It was

[1] *L'Empire libéral*, i., p. 164.

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not enthusiasm for the abstract rights of man which bound together the old provinces of France in a sense of common nationality; it was the economic gains of the Revolution, the creation of a prosperous nation of *bourgeois* and of peasant proprietors, that made the *patrie*. It needed the passion of Mazzini and Garibaldi for an ideal Italy to rouse the Italians to throw off the yoke of an oppressive and alien system, but it was the long prosaic labours of Cavour that laid firmly the economic basis of Italian unity. Instances, indeed, might be multiplied to show that, whatever may be the constituent elements of nationality, it is only a strong sense of common material interests that can create and maintain a nation. It is certainly no mere coincidence that the development of the principle of nationality during the 19th century kept pace with the vast economic changes produced by the industrial revolution.

The factor of sentiment is not, of course, excluded; but the sentiment of nationality is not a thing apart, or especially holy. It is, as Mr. A. J. Balfour has pointed out, but one of a group of such sentiments for which there is no common name. Man is a gregarious animal; he has the group instinct; and this implies also the instinct of self-sacrifice for the sake of the group—*esprit de corps*, the civic sense, local or national patriotism. All human associations are directed to some common good, and from the point of view of the group sentiment it matters little how this good is conceived—whether as material or spiritual. A trade union is an association for a purely economic purpose; but it demands self-sacrifice on the part of its members, and it certainly develops a strong sense of *esprit de corps*. To say, then, that the strongest and most permanent bond of a nation is the sense of common interests is not to belittle the value of loyalty to a national cause.

The modern world has become so accustomed to hearing of nationality as the basis, or the only sound basis, of the state that it is apt to forget how very recent is this conception, which for many people is rooted in the very nature and justice of things. The sentiment of nationality is of course very ancient; it is indeed (as the Latin word *natio*, from *nasci*, "to be born," implies) a natural development of the sentiment of the family and the tribe. But this sentiment was, until comparatively recently, not consciously associated with any conception of the state as we understand the term. The ancient Greeks were strongly conscious of their common Hellenism, but their political unit was the city state; there was a Greek people, but no Greek nation. The Roman Empire, which, as it were, flattened out national differences throughout the civilized world, was in essence the expansion of the city state; it was in no sense "national," even from the point of view of the Romans. The Middle Ages, which inherited the Roman tradition, recognized nationality, but not as the constituent principle of bodies politic. The voting in general councils of the Church was by "nations," but these had so little to do with the conception of states that it was not until the Council of Constance, in 1414, that a fourth nation was added to the Italians, the French and the Germans—the English, who had hitherto been included among the Germans. Yet so early as the 11th century the poet of the *Chanson de Roland* celebrates "French" valour and puts into the mouths of his warriors praises of "sweet France," and in the next century the German minnesingers are denouncing "welsh" arrogance and exalting German nationality. Yet there was so such thing as a national state, the root reason being that the material basis of society was feudal, that is to say, determined by the ownership of land—the only stable form of wealth then existing—and by an elaborate system of reciprocal services and obligations which took no account whatever of the frontiers of nationality. With the growth of the fenced cities, and of the commerce of which they were the centres, the feudal system gradually decayed. But the monarchies which rose upon its ruins had still for the most part a purely territorial basis, and so continued as long as landownership gave the strongest title to wealth and power, that is to say, until the beginning of the 19th century. The industrial revolution, with the vast impetus it gave to international commerce and the new self-conscious classes it created, sapped their foundations. Artificial boundaries became a nuisance, and the German *Zollverein* was the beginning on a large scale of a process of economic concentration, segregation and exclusion which has continued ever since, and is likely still to continue. To say that it is economic pressure which has largely determined the formation of nations is not to pretend that the economic vision of peoples is always clear. The group instinct sometimes defeats its own ends. The disappearance in 1918, for instance, of the last of the great purely territorial monarchies, Austria-Hungary, destroyed an economic unit of the greatest importance to all its constituent countries. It used to be said that if Austria did not exist, Austria would have to be created. This was from the political point of view. From the economic it was true still.

National Expansion.—"If men had any strong sense of the community of nations," says Bertrand Russell, "nationalism would serve to define the boundaries of the various nations. But because men only feel community within their own nation, nothing but force is able to make them respect the rights of other nations, even when they are asserting similar rights on their own behalf" (*Principles of Social Reconstruction*, p. 33). The truth of this is revealed in the whole history of the last hundred years. The Magyars, after securing their own liberty by a gallant struggle, proceeded to force their own national ideals on the races subject to them. The Germans, welded into a great nation by "blood and iron," embarked on a policy of conquest beyond their own borders. The Italians, when they had liberated themselves from the Germans, aimed at recapturing the "national frontiers" of Italy, though this involved the attempt to absorb alien populations, and even began to dream of reëstablishing the Mediterranean empire of Rome. The Poles, reunited after a century and a half of agony, scarcely waited for the ink on the Treaty of Versailles to dry before starting on the great adventure of reconquering their frontiers of 1772. Even Bolshevist Russia, wicked fairy godmother of the bantling "self-determination," showed little disposition to allow her outlying provinces to determine themselves. The Sinn Feiners in Ireland passionately claimed self-determination for themselves, but equally passionately resented its application to the solid minority in Ireland concentrated in north-east Ulster when they too demanded it.

All this, though lamentable from the point of view of self-determination considered as an instrument of peace, is merely the natural outcome of this principle considered as the expression of group selfishness. If the national group is bound together by a vivid sense of common and exclusive interests, sooner or later it will seek to expand, if it is a healthy organism and thus subject to the ordinary laws of growth. German political theory before the World War conceived of the national group as such an organism, and as subject to the universal law of the struggle for existence and the survival of the fittest. "A cessation of growth," said Paul Rohrbach in his *Der Deutsche Gedanke*, "would be for us a catastrophe both internal and external, for under our present conditions it could not possibly be natural or voluntary, but would only happen when another people or combination of peoples should hurl us to the ground in such a way as to make us infirm for a long while to come." "In every great nation," he says again, "the instinct of self-preservation reveals itself in the form of a natural pressure to expand, which only finds its frontiers where it meets other national-political counteracting forces strong enough to resist it." From the ideal point of view this "doctrine of conquest" is, of course, wholly evil and misguided. From the strictly scientific point of view, judged that is to say by the experience of the past and even of the last few years, it must at least be treated with respect. To this world-old doctrine of conquest, reinforced by the new spirit of national exclusiveness, the new doctrine of democratic self-determination, combined with a new organized spirit of international good-will, is prescribed as an antidote. How far is it likely to prove effective?

Self-determination and Peace.—The advantage of the old unnational conception of the state was that it offered no rigid

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barriers to the economic expansion of the nationalities, in so far as these existed outside the political sphere, the overflow of a nationality in one state percolating, or occasionally flooding, into another without any sense of inconvenience to the state invaded, which merely received a very often welcome addition to the number of its subjects. In the days before the industrial revolution these transferences of population were, indeed, more often determined by other than economic causes. Thus in the 17th century some 30,000 Slav and Albanian families migrated into the Habsburg dominions, Slavonia and southern Hungary, in order to escape the fury of the Turks; Flemish and French Protestants fled in thousands to the British Islands; and the Electors of Brandenburg peopled their waste spaces with Huguenot refugees from France and Protestant refugees from southern Germany. In the industrial age the migrations took another form. German industrial expansion demanded a vast supply of cheap labour, and this was provided by a mass immigration of Slavs, which created misgiving even when the German Empire was supremely powerful.[1] Little misgiving was created, on the other hand, by the still vaster immigration of all the less developed nationalities of Europe into the United States and, later, into the British Dominions. The process, indeed, was in itself unobjectionable so long as the migrating masses carried with them no conscious sentiment of nationality in a political sense, and no claim to assert themselves as separate entities, *i.e.* so long as allegiance was conceived as due not to the nationality but to the state. It is quite another thing when, under the principle of self-determination, the balance of nationalities in any given state becomes a matter of vital importance to the state itself. The Emperor Leopold I. would hardly have given special privileges to the Slavs who sought refuge in his dominions had he foreseen that this migration would lead, some 200 years later, to the downfall of the Habsburg Empire and dynasty. The danger of similar consequences is increased when the constitution of the state itself is made dependent upon a popular vote, and all the signs point to the fact that self-contained nations will no longer permit promiscuous immigration—the United States has set the example by "tightening up" its immigration laws—and will be increasingly intolerant of national divergencies within their own borders. The effect of the principle of self-determination, logically applied, would therefore be to establish the nationalities as jealously segregated nations, probably surrounded by tariff walls, certainly defended against dangerous infiltration of alien elements from without by rigid rules as to naturalization, and earnestly bent on reducing all within their borders to the same national model. The danger to peace of attempting to confine the expansive forces of nationalism within such artificial limits is obvious, and the danger will not be avoided by the creation of an international force, such as the League of Nations, charged with the duty of preserving the *status quo* or of readjusting it according to the ebb and flow of the national life of the several communities; for the pressure of the forces of expansion of vigorous nationalities, artificially restrained, would blow the League to pieces.

It may be that the economic development of the world, by increasingly demonstrating the interdependence of nations, will reduce the sentiment of nationality to the position it occupied during the long ages when it was not the basis of the state, still less an intolerant crusading power. But the World War at least proved that the international movement associated with labour, disfigured as it was by its insistence on the necessity of a new form of war—that of class against class—was powerless against the passion of nationality. The true hope of peace for the future lies in the recovery by the world of the idea of the state, whatever form it may take, as a thing apart from and above the idea of nationality and infinitely tolerant of national divergencies. It is the ideal towards which the British Empire has been consistently tending. The ideal League of Nations will be some such loose confederation, embracing all the world, of which each constituent state, while guarding its own interests, will realize that these interests are bound up with those of the totality of states. For such a universal union, however, the world is not ripe; for there are peoples who are not yet capable of self-government, and will only become so, if ever, by a long process of education. To talk of self-determination for such peoples is a mockery. It is also a wrong; for, as Senator Elihu Root wisely said with reference to the Philippines, "the right to government is prior to the right to self-government."

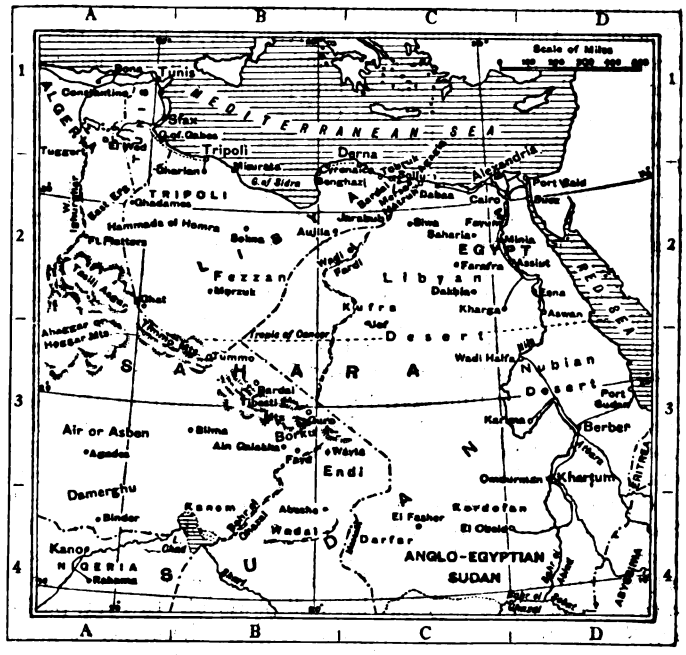
[1] See a remarkable series in the *Frankfurter Zeitung* in 1911.

See W. Alison Phillips, "Europe and the Problem of Nationality," *Edinburgh Rev.* for Jan. 1915, of which parts are incorporated in the above article; J. W. Headlam-Morley, "Plebiscites," *Quarterly Rev.* for July 1921 (No. 468); Sarah Wambaugh, *A Monograph on Plebiscites, with a collection of Official Documents* (1921); *Plebiscites*, vol. xxv. of the Peace Handbooks issued by the Historical Section of the Foreign Office (1920); *A History of the Peace Conference of Paris*, edited by H. W. V. Temperley (3 vols., 1920). Among more modern foreign works on the subject are Schallmeyer, *Vererbung und Auslese im Lebenslaufe der Völker* (1903); Kirchhoff, *Zur Verständigung über die Begriffe "Nation" und "Nationalität"* (1905); Otto Bauer, *Nationalitätenfrage und die Sozialdemokratie* (1907). (W. A. P.)

SELOUS, FREDERICK COURTNEY (1851–1917), English explorer (*see* 24.614), in 1909 organized Mr. Roosevelt's hunting expedition in East Africa, and in 1910 represented Britain at the Congress of Field Sports held at Vienna. In Aug. 1914 he offered his services to the War Office, but they were declined on account of his age (he was over 62). Persistence, however, gained him a subaltern's commission (Feb. 1915) in the Legion of Frontiersmen (25th Fusiliers) and he reached Mombasa in May following. Selous took part in many engagements in the East African campaign, was promoted captain and (Sept. 1916) given the D.S.O. He was killed in action at Beho Beho on Jan. 4 1917 (a year after his eldest son had been killed on the western front). His private collection of trophies was given by his widow (Mary Maddy, whom he married in 1894) to the Natural History Museum, London, where in June 1920 a national memorial to him was unveiled—a bronze half-figure by W. R. Colton—a Selous scholarship being also founded at his old school, Rugby.

See J. G. Millar's Life of *Frederick Courtney Selous* (London 1918), and *Geog. Jnl.*, vol. xlix. (1917).

SENUSSI AND SENUSSITES (*see* 24.649).—The military activity of the Senussi from 1900 to 1910 had been directed against the advance of the French in the regions bordering the Sahara between Lake Chad and the Nile basin. There was evidence of an



THE SENUSSI COUNTRY

increase of adherents to the sect in Egypt and in Arabia; in N.W. Africa and in the Anglo-Egyptian Sudan Senussiism made practically no headway.

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Activity in Cyrenaica.—While continuing hostilities against the French, the Senussi sheikh Sayed (Sidi) Ahmad esh Sherif in 1911 aided the Turks in Cyrenaica, then commanded by Enver Bey (later Pasha) in the campaign against Italy. The traditional policy of the Senussites was one of suspicion in regard to the Turks but they had been won over by Pan-Islamic propaganda. By the Treaty of Lausanne, Oct. 1912, the Turks agreed to evacuate Tripoli and Cyrenaica. At that time the Italians held only the chief seaports of Cyrenaica, the rest of the country being in the military occupation of the Senussites and their allies. Sidi Ahmad continued the war with Italy, aided by a body of Turkish troops, which, contrary to treaty engagements, remained in Cyrenaica. The Italians devoted their attention to the occupation of the hinterland of Tripoli (including Fezzan), a process completed in Aug. 1914. In Cyrenaica they remained mainly on the defensive. General Ameglio, appointed governor of Cyrenaica towards the end of 1913, had however begun a vigorous campaign against the Senussites, when in Feb. 1914, in consequence of the threatening situation in the Balkans, orders were issued from Rome to suspend operations.

When the World War began, and while Italy still remained neutral, Turkish agents, with German support, sought to make Cyrenaica and Tripoli bases of action against the French and British. To the tribes which rose in revolt in Tripoli and its hinterland the Senussites gave some support, but Sidi Ahmad, through the intermediary of chiefs friendly to Italy, was conducting unofficial negotiations, and had the Italians been willing to acknowledge his independence an accommodation with them might have been reached. He refused however to accept the position of "a protected Bey." By the spring of 1915 he was again attacking Italian posts. Strong efforts had been made for some time by the Turks and their German advisers to induce the Senussites to invade western Egypt; a special Turkish mission now visited Sidi Ahmad and endeavoured to get him to proclaim a *jihad*. The Senussi sheikh was disinclined to take the advice offered him. The Senussites had always maintained good relations with Egypt—for much of their trade they were dependent upon the good-will of the Egyptian authorities. It was the demonstration that the Turco-Germans could give him substantial military and financial aid which finally changed Sidi Ahmad's views. A large number of Turkish officers and some Arabic-speaking German officers from the German garrison at Constantinople were smuggled into Cyrenaica, a matter of little difficulty. Among the arrivals was Nuri Bey, a half brother of Enver Pasha who exercised much influence. Nuri was joined in April 1915 by Ga'far Pasha, an Europeanized Arab of considerable ability, and with and after Ga'far came arms, ammunition and other stores, including wireless and telephonic apparatus.[1] By Aug. 1915 the Germans were using the landing places between Sollum and Tobruk as submarine bases. The time for putting the Turco-German plans into operation was approaching. These plans were, mainly through Senussite instrumentality, to threaten at once French north and central Africa, Nigeria, Egypt and the Anglo-Egyptian Sudan. It was also designed to penetrate to Cameroon and establish land communication between the Mediterranean and the Gulf of Guinea. The German Emperor, as "Islam's Protector," exhorted Sidi Ahmad to "expel infidels from territory which belonged to true believers." But besides the Senussi sheikh the only important chief won over to the cause was 'Ali Dinar, Sultan of Darfur, a tributary state of the Anglo-Egyptian Sudan, and the plan failed.

French determination to secure their position in the central Sudan contributed largely to the localization of the conflict. In 1909–10 the French had conquered Wadai (*see* 28.225), which adjoins Darfur, thereby withdrawing from the Senussite sphere a country in which they had been all powerful. In 1913, pushing N. from Kanem into the Saharan borderland, Colonel Largeau conquered Borku, capturing 'Ain Galakka, the Senussite southern base, in November, of that year. In the middle of 1914 Bardai, the chief settlement in the Tibesti highlands, was occupied.[2] These newly conquered regions on the southern fringe of the Libyan Desert were placed under the control of Lt.-Col. J. Tilho. Though risings against their authority by chiefs acting on Senussite instructions, and raids by nomads continued up to the early months of 1917, the French posts formed an effective barrier against any Senussite advance into central Africa.

Campaign in Western Egypt.—Since May 1915 the danger of a Senussite invasion of western Egypt had existed. It was due to the great tact with which Lt.-Col. C. L. Snow,[3] who commanded the small force stationed in western Egypt, handled a very delicate situation that the rupture with the Senussites was delayed till Nov. 1915. At the last moment, early in November, a final effort was made to avoid a break, Sidi Mohammed el Idris, Senussite envoy in Egypt, being sent to Cyrenaica to arrange for the Senussi sheikh "to get rid of his Turkish advisers in return for a sum of money." It was too late; Sidi Ahmad was already well supplied with German gold as well as arms.

The enemy plan of campaign was to advance in parallel lines with two forces, one across the Libyan plateau,—a great limestone tableland—the other farther S. along the string of oases leading from Siwa to the Nile. Simultaneously the Sultan of Darfur was to rise in revolt, invade Kordofan and advance on Khartum. The plan was boldly conceived, but the danger to Egypt and the Sudan was not chiefly in the military force at the command of the Senussi sheikh and his allies. That danger lay in the spiritual authority exercised by Sidi Ahmad and the high prestige he enjoyed in Egypt. Many if not most of the 200,000 Bedouins of western Egypt were adherents of the Senussi sect and should the Senussi forces gain any striking success it "might lead to serious religious and internal disorders." So wrote Gen. Sir John Maxwell, then commanding the forces in Egypt, who added that the Senussi peril was his principal source of anxiety—not the Turkish attack on the Suez Canal.

The opening of the campaign was accompanied by great activity by German submarines off the Cyrenaican coast and in the Gulf of Sollum; among the boats sunk were the British auxiliary cruiser "Tara" and the horse transport "Moorina." Survivors of the crews were handed over to the Senussi and suffered great privations (Cyrenaica is a very desolate country and the Senussites themselves were often short of food). Land hostilities began on Nov. 15 but in view of the isolation and smallness of the Egyptian garrisons at Sollum and other advanced posts they were withdrawn, and a stretch of country 200 m. or more in length was at once overrun by the Senussites. They advanced as far as Dabya (90 m. W. of Alexandria and the terminus of the railway along the coast), sweeping past, but not attacking Mersa Matruh, the chief port of western Egypt and reached by boat from Alexandria in 12 hours. This port was made the base for the British operations.

General Maxwell's endeavour, in view of the internal situation, was to avoid anything in the nature of a reverse, to keep the enemy as far as possible from the Nile valley, and, as soon as possible, to strike a decisive blow at the Senussi and by his defeat to diminish his influence as a spiritual potentate. These aims were achieved, but at the outset the difficulty was to get together a force strong enough to undertake operation. In Aug. 1915, when the situation on the western Egyptian frontier became critical, the Gallipoli campaign was being vigorously prosecuted, while the Turks had again advanced towards the Suez Canal. When the Senussi invasion occurred the decision to evacuate Gallipoli had not yet been taken, while the British Government had just committed itself to the Salonika campaign. In these circumstances Sir John Maxwell had to content himself with collecting a "scratch" force to oppose the Senussi. The strength

[1] The German political agent was a certain Mannismann, who after the defeat of Sidi Ahmad endeavoured to persuade the Senussites to continue the war. He was attacked and killed in the desert by tribesmen hostile to Ahmad.

[2] Turkish troops had occupied Tibesti in 1910 and Borku in 1911. They were recalled at the outbreak of the war with Italy.

[3] Col. Snow was killed in the first action (Dec. 11 1915) by an Arab whom he was endeavouring to persuade to surrender. He had served over 20 years in the Egyptian coastguard and was intimately acquainted with the desert tribes.

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of the Senussi is conjectural. The Turkish troops with them may have numbered 1,000; the *Muhafizia* or Senussite regulars were perhaps 5,000 strong. In addition there was an irregular body of tribesmen, Arabs and Arabized Berbers, probably numbering 20,000, all well armed and accustomed to desert warfare, but undisciplined and untrustworthy. The Senussites were well supplied with rifles and small-arms munitions; they had field guns and machine-guns; they had an ample camel transport and many of their troops were well mounted. With them were about 100 Europeans; Ga'far Pasha was commander-in-chief, and was accompanied by Sidi Ahmad and Nuri Bey.

Through bad leadership, or from other causes not explained, the Senussi offensive was not carried out as planned. When the advance across the Libyan plateau was made, Siwa oasis was also occupied; but no further progress towards the Nile by that route was then attempted. Moreover, 'Ali Dinar of Darfur, who had formally renounced his allegiance to the Sudan Government in April 1915, while preaching a *jihad* and indulging in abusive letter writing,[1] did not carry out his threat of invasion. Thus at the outset the British had to deal only with the enemy advance along the Mediterranean coast.

Orders for the formation of a Western Frontier Force were issued on Nov. 20. Maj.-Gen. A. Wallace, who was given the command, took up his headquarters at Matruh on Dec. 7. His troops consisted of Yeomanry, Territorials, Australians, New Zealanders, Indians and Egyptians, with a squadron of armoured cars and a squadron of aeroplanes. The striking force was a composite mounted brigade under Brig.-Gen. J. D. T. Tyndale Biscoe and a composite infantry brigade under Brig.-Gen. the Earl of Lucan. "Regiments and staff had been collected," wrote Sir John Maxwell, "somewhat hastily. . . . The composite yeomanry brigade contained men from 20 or more different regiments. . . . It was not until the middle of Feb. (1916) that the condition of the Western Frontier Force could be considered really satisfactory."

The Senussites were engaged on Dec. 11 and 13 in the neighbourhood of Matruh with indecisive result. Having received reinforcements, General Wallace again engaged the enemy, on Christmas Day, at Gebel Medwa, a few miles from the coast. The Senussites, severely handled, retreated to Halazin (officially misspelt Hazalin), 25 m. S.W. of Matruh. Torrential rains now interrupted operations; in any case General Wallace was too weak to resume the offensive until further reinforced. The first of these new reinforcements consisted of the 2nd Regt. of the 1st South African Infantry Brigade, which disembarked at Matruh on Jan. 20 and 21 1916. They were the first S. Africans from the Union to take part in the war outside the limits of S. Africa.[2] On. Jan. 23 the Senussites were attacked at Halazin and after an eight-hours' stubborn engagement were defeated and fled. The country had been turned by the rains into a quagmire and mud played an important and unfortunate part throughout. General Wallace's successes now induced many of the Egyptian Bedouin (mostly the Walad 'Ali tribesmen) to desert the Senussi cause. Wallace had been tied to his base at Matruh by lack of sufficient camel transport, but by February this difficulty was overcome and the force had been further strengthened, partly by more South African infantry. The time for a real offensive had come. At this period General Wallace resigned and was succeeded by Maj.-Gen. W. E. Peyton (Feb. 9 1916).

On Feb. 20 General Peyton sent forward a force under Brig.-Gen. H. T. Lukin (commander of the 1st S. African Inf. Brig.) with orders to take Barrini, 50 m. E. of Sollum. On the 26th an engagement was fought at Agagia, in which Ga'far Pasha attempted to carry out his favourite manœuvre—an enveloping movement. This movement was checked, the infantry pressed forward and after a two-hours' struggle the Senussites were compelled to evacuate their position. The yeomanry were then sent in pursuit, and the Dorset Regiment (under Col. H. M. Souter) in a fine charge broke into the enemy lines and captured Ga'far Pasha.[3] Nuri Bey took over the command of the Senussi forces, which offered little further resistance. Two British columns advanced on Sollum, which was reoccupied on March 14. Sollum is close to the Cyrenaican frontier and into Cyrenaica, that is into Italian territory, Nuri Bey and his forces retreated after blowing up their main ammunition dump. General Peyton did not further pursue Nuri, but on March 17 a squadron of armoured cars, under Major the Duke of Westminster, raced 120 m. across the desert and rescued the survivors—some 90 in number—of the "Tara" and "Moorina." Shortly afterwards General Peyton's force was reduced, the S. Africans leaving in April for France.

Sidi Ahmad had been with Ga'far Pasha until the end of Jan. 1916. He then went to Siwa and began the advance along the oases that lead to the Nile. The advance came too late to be effective, but on Feb. 11 Senussites occupied Baharia oasis, some 100 m. from the fertile and densely peopled districts of Fayum and Minia. Before the end of February the Senussites had also occupied the more southerly oases of Farafra and Dakhla. Thereupon the Egyptian officials were withdrawn from Kharga (the Great Oasis), which is connected by railway with the Nile valley, and the Senussites proceeded to occupy it. The strategical importance of the oases is great, but having no troops available for an offensive in S.W. Egypt, General Maxwell took defensive measures only. A command under Maj.-Gen. J. Adye patrolled the region from the Fayum to Assiut and Esna. The oases were kept under constant observation by aeroplanes, and the Senussites did not emerge from them. After the complete defeat of their northern force they abandoned Kharga, which was reoccupied by the British on April 15 1916. Gen. Sir Archibald Murray had meanwhile (March 19) succeeded General Maxwell in the Egyptian command.

Darfur Campaign.—At this period, in the Sudan, the Sirdar, Gen. Sir Reginald Wingate, was dealing with 'Ali Dinar of Darfur. For over a year the Sultan had been openly defiant and since Dec. 1915 had been making arrangements to invade Kordofan. As the Sudan Government had not in 1915 any force available for action in Darfur, negotiations were entered into with him, but without result, and the belief grew in the Sudan that the Government was too weak to deal with so powerful a sultan ('Ali Dinar had a regular "slave" army some 10,000 in number, for the most part well armed). Early in 1916 it had become imperative to clear up the situation if the general peace of the Sudan was to be preserved. Though it was the worst season of the year for military operations the Sirdar determined to anticipate 'Ali Dinar's offensive. An expeditionary force, 3,000 strong, was organized under command of Maj. (temporary Lt.-Col.) P. V. Kelly. Except for a detachment of the R.F.C. the troops consisted entirely of units of the Egyptian army—this being the first time since the *Mahdia* that Egyptian troops had fought Sudanese Arabs. The expedition was highly successful. It was remarkable for the manner in which transport difficulties were overcome. Khartum, the base, is 500 m. by rail from the nearest seaport: El Obeid, railhead, is 428 m. from Khartum; and from El Obeid the force had to advance nearly 400 m. across a desolate roadless country. It then had to engage a numerically superior enemy of indomitable valour. Battle was given by the Darfurians on May 22 (1916) at Beringa, near El Fasher, 'Ali Dinar's capital. A body of 2,000 riflemen, supported by a large mounted force, attacked the Egyptians with all the accustomed bravery of the Dervish warrior. They were beaten back, counter-charged and completely defeated, losing

[1] He addressed one letter to "The Governor of Hell in Kordofan and the Inspector of Flames in Nahud."

[2] A volunteer force raised in Rhodesia (the 2nd Rhodesian Regt.) had gone to E. Africa in 1915.

[3] Like many other Arab officers and men in the Turkish army who fell into the hands of the British, Ga'far Pasha joined the Arab forces under the Emir Faisal and took part in the Syrian campaign against the Turks. After his capture at Agagia he had been confined in the citadel at Cairo. He tried to escape by means of a rope. Ga'far being a very heavy man, the rope broke; he fell, injured himself, and was removed to hospital. While there, he learned of the Sherif of Mecca's revolt and resolved to join his forces. In 1920 he became Minister of Defence in the Provisional Arab Government of Mesopotamia. He was a delegate at the Near East Conference held in Cairo in March 1921.

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over 50% of their number in killed alone. 'Ali Dinar and a considerable following of horsemen fled from the field. The party was chased and bombed by airmen, but the Sultan made good his escape. He retired to the confines of French central Africa. In Oct. 1916 a column was sent against him; he again fled, was pursued and killed in action on Nov. 6.

The Siwa Defeat.—In the oases west of the Nile (where Maj.-Gen. W. A. Watson had taken over the command) there was little change between April and Oct. 1916. The patrolling of the desert front, over 800 m. in length, was done by light motor-cars, the Imperial Camel Corps and aeroplanes. In October, the British, with slight opposition, reoccupied Dakhla oasis, where Sidi Ahmad had a farm and where he had been living for some months. From Dakhla a daring attempt was made by a party of British, in motor-cars, to reconnoitre Kufra, but it was found impossible to cross the belt of sand dunes west of the oasis.

Sidi Ahmad now retired by way of Farfara and Baharia oases to Siwa. As long as he remained there he was not utterly discredited in the eyes of the Egyptians. It was therefore decided to attack Siwa with a force sent in motor-cars from Matruh. The distance to be covered was 150 m., but the ground was for the most part hard. Leaving Matruh on Feb. 1 1917, the armoured-car force, under Brig.-Gen. H. W. Hodgson, reached the escarpment, below which lies Siwa oasis, the next afternoon, and was in action the whole of Feb. 3. The Senussites were about 1,000 strong, including 800 riflemen, and had mountain and machine-guns. An attempt to rush the cars was frustrated, but the action appeared to be indecisive. However, at daybreak the next morning the Senussites, having blown up their ammunition, retreated west. The head of their column was ambushed, but the main body got away. Sidi Ahmad, with Mohammed Salih (ex-commander of the Egyptian coastguard, who had deserted at the beginning of the campaign), had already fled to Jarabub (the oasis in which is the mosque-tomb of the founder of the Senussite fraternity). Thither he was not pursued, and in the Kufra oases he had a practically inaccessible place of refuge.

Nevertheless, with the defeat of Siwa the danger to Egypt from the Senussi movement disappeared and though raids were made on the Darfur border they did not seriously affect the Sudan. In Cyrenaica, too, the situation was altered. An Anglo-Italian agreement had been concluded in July 1916 for common action against the Senussi and it was in contemplation to transfer from the Egyptian to the Italian sphere Jarabub and that part of the Libyan Desert containing Kufra.

An Understanding with Italy.—During 1917 and 1918 Turkish and German influence among the Senussites steadily declined while strong efforts were made by the Italians to come to an understanding with the sect. They secured the release of 700 Italian soldiers, prisoners of war. Sidi Mohammed el Idris, the former envoy to Egypt, and the eldest son of Senussi el Mahdi, had disapproved his cousin's action and had taken no part in the invasion of Egypt. He had an influential following and was desirous of peace with both Italy and Great Britain. After the fight at Siwa he entered into an agreement with both Powers. Sidi Ahmad himself was deeply committed to his Turkish and German counsellors. Many of these, including Nuri Bey, had left Cyrenaica. In the summer of 1918 the Idrisi party gained the mastery in the Senussite ranks. Sidi Ahmad's position was undermined and he found it convenient to quit Cyrenaica. In August of that year he was conveyed by a German submarine from Misurata to Polo, whence he went to Turkey, still claiming to be the head of the brotherhood. In 1919 he "girded the Sultan with the sword of 'Othman" but in 1920 had turned Nationalist and aided Mustafa Kemal.

The Senussi chiefs in Libya had chosen Sidi Mohammed el Idris as Grand Senussi, and the new head of the order in Jan. 1919 sent a mission to Rome, when Italian sovereignty was implicitly recognized. Neither Italy, France or Great Britain had challenged the right of the Senussi sheikh to exercise spiritual authority over the members of the brotherhood; Italy in 1917 had gone further and had acknowledged Sidi Mohammed's temporal authority in what may be called his hereditary dominions. By the accord of Regima concluded Nov. 1920 the 1917 agreement was ratified and Sidi Mohammed, to whom the Italians gave the title of emir (prince), himself visited Rome to pay homage to the King of Italy. An indication of Sidi Mohammed's attitude was the permission he granted at this time to an English woman to visit Kufra, though in the guise of a Moslem. The lady in question, Mrs. Rosita Forbes, testified to the desire of the Senussi chiefs to resume trade with Egypt.

AUTHORITIES.—See the despatches of Sir John Maxwell, Sir Archibald Murray and Sir Reginald Wingate (*London Gazette* supplements June 21, Sept. 25, Oct. 25 and Dec. 1 1916 and May 27 1919); *The Times History of the War*, vol. ix., chap. cxlv.; Lt.-Col. J. Tilho, "The Exploration of Tibesti . . . in 1912–7," *Geog. Jnl.*, vol. lvi. (1920); Capt. Gwatkin Williams, R.N., *In the Hands of the Senussi* (1916); Rosita Forbes, *The Secret of the Sahara: Kufra* (1921); W. T. Massey, *The Desert Campaigns* (1918).

(F. R. C.)

SERBIA (*see* 24.686) had in 1910 an area of 48,303 sq. km., which after the Balkan wars was increased to 87,358 sq. kilometres. The pop., according to the census taken on Dec. 31 1910, was 2,911,701, showing an increase of 417,931 over that of 1900. The country was divided into 18 districts, as follows, (the pop. is shown in brackets):—Belgrade[1] (155,815), Belgrade City (89,876), Valjevo (157,648), Vranja (252,937), Kragujevac (189,025), Krajina (112,142), Kruševac (167,371), Morava (203,638), Niš (198,768), Pirot (112,314), Podrina (238,275), Požarevac (259,906), Rudnik (85,340), Smederevo (143,216), Timok (149,538), Toplica (110,216), Užice (146,763), Čačak (138,911). Of this total pop. 2,528,819 lived in the country, and only 382,882 in towns. Of these the most populous were Belgrade (89,876), Niš (24,949), Kragujevac (18,452), Leskovac (14,236), Požarevac (13,411), Šabac (12,100), Vranja (11,439), Pirot (10,737). In 1900 the density of population was 51.6 per sq. kilometre.

The territory acquired by Serbia in the wars of 1912–3 contained (according to not very reliable statistics) a pop. of 1,481,614, divided among the following 12 districts:—Prijepolje (49,315), Raša (81,214), Zvečane (81,643), Kosovo (193,337), Prizren (124,101), Tetovo (146,803), Skoplje (Uskub, 157,078), Kumanovo (144,983), Bregalnisa (101,442), Tikveš (84,657), Bitolj (Monastir, 252,646), Okhrida (84,395).

Thus Serbia on the eve of the World War had a pop. of roughly 4,500,000. The births, deaths, and marriages in Serbia amounted in 1911 and 1912 to 107,219 and 114,257, to 64,369 and 63,358, and to 30,420 and 13,289 respectively.

Agriculture.—Serbia is a land of small holdings, the former Turkish proprietors having been expropriated in 1833 and 1880: in 1900, out of a total of 401,093 families, no less than 91·5% were owners of land. Of these only 86 persons owned over 100 hectares of land, and only three persons over 300, while there were 98,253 properties (33·4%) of under three hectares. There has been a very rapid development of coöperative societies since 1895 (900 in 1909, with 35,000 members; 1,200 in 1913, with 40,000 members).

Of a total area of 2,045,176 hectares there was in 1905 (*a*) cultivated land 1,223,671 (arable land 1,027,815, gardens 25,815, vineyards 33,101, orchards 136,939); (*b*) grazing land 418,391; (*c*) commons and uncultivated land 110,101. In 1908 the chief products of the harvest were (in tons) maize 533,691, cereals 457,734, hay and clover 226,858, straw 777,728, plums 530,061, potatoes 54,946. In 1905 (latest statistics available) the live stock was distributed as follows: horses 174,363, cattle 969,953, pigs 908,580, sheep 3,160,166, goats 510,063.

Forests.—Over one-third of Serbia's total area (3,750,000 ac.) is forest land, all but 750,000 ac. of this belonging to the State or the various communes. The chief varieties of tree are beech (750,000 ac.), oak and conifers.

Mines.—The mining industry of Serbia has a great future, but has hitherto been but little developed, owing to lack of capital and means of transport. Table I gives the export of ores (in metric tons) according to the last statistics available. That these are merely the first primitive beginnings is best shown by the fact that in the year

[1] The phonetic spellings of the names of the districts and towns, following the system adopted by the Committee of the Royal Geographical Society, are: Belgrade, Valyevo, Vranya, Kraguyevats, Krajina, Krushevats, Morava, Nish, Pirot, Podrina, Pozharevats, Rudnik, Smederevo, Timok, Toplitsa, Uzhitse, Chachak, Leskovats, Shabats, Priyepolye, Rasha, Zvechane, Kosovo, Prizram, Tetovo, Skoplye, Kumanovo, Bregalnitsa, Tikvesh, Okhrida. The spellings given above follow the Croatian form or its equivalent.

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TABLE 1.—Exports of Ores.

	1904	1906	1908
Coal and Lignite	2,631,810	2,375,067	296,125
Gold (in kilogrammes)	89	139	191
Silver " "	48	3	823
Black copper	1,641	7,613	2,198
Lead	245	213	1,552
Antimony	4,725	3,200	261
Pyrites			32,726
Cement	52,500	92,357	11,074

1910 a single copper mine (Bor) exported ore to the value of over 8,000,000 francs, thus exceeding the total result of all the mines given above.

Foreign Trade.—The progress of Serbian trade may best be gathered from the following Tables 2 and 3. In 1910 maize to the value

TABLE 2.—Imports and Exports.

	1905–7 (triennial)	1908–10 (triennial)	1909	1910	1911
Imports	6,821,000	9,196,000	2,941,403	3,387,826	(?)
Exports	9,004,000	10,626,000	3,719,270	3,935,521	4,676,640

TABLE 3.—Distribution of Trade.

	Imports from		Exports to	
	1909.	1910.	1909.	1910.
Germany	£1,154,068	£1,399,033	£ 623,791	£876,594
Austria-Hungary	711,894	645,930	1,163,866	712,875
U.K. and British Colonies	303,409	456,997	5,696	66,892
Turkey	194,224	237,382	878,967	938,837
France	141,460	144,144	97,172	47,644
Italy	93,800	145,798	121,864	42,786
Russia	77,294	72,925	815	541

of over 21,400,000 francs was exported. The famous plum industry (known to the west only through German intermediaries) accounted in 1908 for the export of 49,042 tons of prunes (value 10,350,721 francs) and of 14,398 tons of plum jam (value 3,251,093 francs). The pig trade, upon which Serbia's prosperity very largely depended, having been injured by Austria-Hungary's tariff policy, a new system of slaughter-houses was established in Belgrade, and in 1911 the chief of these exported 9,751 tons of pork (68,047 head). By 1913 the amount exported had risen to 12,913 tons (100,776 head).

Finance.—On Jan. 1 1913 the public debt amounted to £26,362,240. Table 4 shows how the budget balanced in the years before the war. In 1915 the budget was fixed at the same figure. From 1915 to 1918, owing to the conquest of the country, no proper budget was possible, the Government and army subsisting upon the subsidies of the Allied Powers.

TABLE 4.—Finance.

	Revenue	Expenditure	Surplus
1909	£4,145,764	£4,132,945	£12,818
1910	4,611,109	4,602,913	8,198
1911	4,805,458	4,803,272	2,186
1912	4,972,758		
1913	5,230,588		
1914	8,572,826		

Education.—In 1909 there were only 1,296 elementary schools in Serbia with 2,584 teachers and 138,434 pupils, and 20 secondary schools with 393 teachers and 7,317 pupils. In 1910–11 the university of Belgrade had 1,025 students. Only 27% of the pop. could read and write.

Army.—After 1908 great efforts were made to increase the efficiency of the army. Organized under a system of obligatory service, the war strength in 1914 was estimated at 350,000 men, which, with the addition of the Landsturm, could be raised to about 400,000. (*See* ARMY: *Balkan Armies.*)

POLITICAL HISTORY, 1909–18

The annexation of Bosnia by Austria-Hungary in 1908 marked a turning point in the history of Serbia. Henceforth public opinion, supported by prominent statesmen in every party, was practically unanimous in regarding a conflict with Austria-Hungary as sooner or later inevitable. This belief had at once a national and an economic basis: for Count Aehrenthal not merely supported the Hungarian policy of repressing Yugoslav national aspirations inside the Dual Monarchy, but obstructed Serbia's commercial development by tariff and frontier restrictions, by a veto upon either direct access to the sea or a common frontier with Montenegro, and by opposition to all idea of Balkan coöperation. Those Serbs who feared so unequal a conflict and would have preferred a more conciliatory attitude towards Austria-Hungary, were reduced to silence by Aehrenthal's refusal to admit the international aspect of the problem or to consider the Serbian proposals for arbitration before the Hague Tribunal. Isolated in Europe and jealously shut off from her natural outlets on the Adriatic, Serbia was driven to seek new political and economic ties in the east and south. The policy of Aehrenthal inevitably strengthened the tendencies towards the creation of a Balkan League, and these were accelerated by the political unrest evoked throughout the Balkan Peninsula by the Young Turk Revolution.

The Balkan League.—The idea of a Balkan League was by no means new. It had been advocated as early as 1844 by the Serbian statesman Garašanin, and formed the subject of serious negotiations between Prince Michael Obrenović and the Bulgarian exiles of his day, and also between Kossuth, Prince Michael, and Prince Cuza of Rumania. The last serious overtures had been made in 1891 by the Greek premier Tricoupis, and after their betrayal to the Porte by Stambulov the idea remained dormant for nearly 20 years. The speech of the Russian Foreign Minister Isvolski on Christmas Day 1908, advocating a league between Turkey and the three Balkan Slav States, inaugurated a new era of Russian activity in the Balkans, under the active direction of Tcharikov, the ambassador at Constantinople, and Hartwig, who rapidly acquired great influence as minister at Belgrade. In the spring of 1910 the kings of Bulgaria and Serbia paid successive visits to St. Petersburg and Constantinople, and Dr. Milovanović, the Serbian Foreign Minister, was especially active in his endeavours to secure the adhesion of Turkey to a general Balkan League. His views were also shared by Venizelos, who came into power in Greece in October of the same year, and even to a lesser degree by Gešov, a Russophil, who became Bulgarian premier in March 1911. In view, however, of the increasingly chauvinistic attitude of the Young Turk regime in Macedonia and Albania, Venizelos considered it advisable to make overtures to Bulgaria, with a view to common defensive action against a possible Turkish attack. His initiative led to important secret negotiations, in which Mr. J. D. Bourchier, *The Times* correspondent, acted as intermediary. These preceded by at least five months the first conversations between Serbia and Bulgaria, which appear to have originated from an overture made by Rizov in Belgrade at the instance of King Ferdinand.[1] On Oct. 11 1911 Gešov, on his return from the west, had a long discussion with Milovanović in the train between Belgrade and Nish, and secret negotiations continued throughout the winter. The coming of age of Prince Boris of Bulgaria in Feb. 1912 was attended by the crown princes of Serbia, Montenegro, Greece and Rumania, and this demonstration was widely regarded as a symbol of increasing coöperation between the Christian States of the peninsula. On March 13 1912 a secret treaty of alliance was concluded between Serbia and Bulgaria, and was supplemented on May 12 by a military convention. On May 29 a similar treaty was concluded between Bulgaria and Greece. There was no actual treaty binding Serbia and Greece, while the Serbo-Montenegrin treaty, concluded as late as Sept. 1912, was less political than military and provided for separate though parallel action.

The Treaties.—By the terms of the Serbo-Bulgarian agreement each State was bound to assist the other with all its forces, in the event of an attack by one or more States unspecified, and in particular in the event of any Great Power trying to annex any portion of Turkey's Balkan possessions. If internal troubles should arise in Turkey, either ally might initiate proposals for military action, and any point upon which agreement was not reached, should then be referred to Russia for decision. Special provision was made for possible conquests, Serbia recognizing Bulgaria's rights over the territory lying east of the Rhodope Mountains and the Struma river, and Bulgaria similarly recognizing Serbia's rights north and west of the Šar (Shar) Mountains. The districts lying between these limits,

[1] See *Samouprava*, Oct. 28 1913.

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the Aegean and the Lake of Okhrida, were to form "a distinct autonomous province"; but should their partition prove inevitable, then Serbia undertook to make no claim beyond a line drawn from the Lake of Okhrida to near Kriva Palanka on the old Turco-Bulgarian frontier and including Skoplje, but not Monastir, Prilep or Veles. In the event of a dispute, the Tsar was to act as arbitrator, and Bulgaria undertook to accept the more southerly line as its new frontier with Serbia, if the Tsar should decide in favour of the latter. In the event of war, Bulgaria undertook to place at least 200,000, Serbia at least 150,000, men in the field against Turkey. If either Turkey or Rumania attacked Bulgaria, Serbia was to send 100,000 men to her aid; while Bulgaria on her part must provide 200,000 men in support of Serbia, in the event of an attack by Austria-Hungary.[1] The treaty between Bulgaria and Greece was much more indefinite, though it provided for mutual aid against Turkey, not merely in case of direct military aggression, but also of the infringement of treaty rights and of the principles of international law—a phrase which was of course intended to cover the championship of co-nationals in Macedonia or Thrace against Ottoman misrule.

No attempt was made to define the territorial claims of the two countries in the event of a successful war, and the division of the spoils was thus left to the chance of a future agreement. The military convention was not concluded till Sept. 22, when events were already moving rapidly. By it Greece undertook to provide at least 120,000 men against Turkey, while Bulgaria increased the contingent already promised in her agreement with Serbia to 300,000 men. Special clauses provided for a blockade of the Aegean by the Greek fleet, and forbade the conclusion of peace or even of an armistice without the consent of all the allies.

The League, Turkey and the Powers.—Internal disorder had spread rapidly throughout Turkey in Europe in the year following Italy's invasion of Tripoli: and the ferocious policy of suppression adopted by the Committee of Union and Progress towards all the non-Turkish nationalities culminated in a reign of terror at the parliamentary elections of 1912, in a recrudescence of Komitaji activities, and in an Albanian rising even more widespread and more determined than in the two previous summers. The premature death of Milovanović on July 1 not merely deprived Serbia of her ablest modern statesman, but removed one of the few restraining influences in any Balkan capital. He was succeeded as premier by Trifković, and in the conduct of foreign affairs by the Old Radical leader Pašić, who placed almost unreserved reliance on Russian support and worked in the closest accord with Hartwig. On Sept. 12 Pašić became premier at the head of a purely Old Radical Cabinet.

By this time not even the most pacific statesmanship could have arrested the growing anarchy in Turkey. Public opinion in Belgrade and Sofia was roused by a massacre of Bulgarians at Kočana (Kochana) on Aug. 1, and by the report of similar outrages in the Sanjak. By the middle of the month, Uskub, and the entire district recognized by the secret treaty as Serbian, were in the hands of the insurgent Albanians; and the concessions granted by the Porte, while failing to arrest the movement, only served as an incentive to swift action on the part of the neighbouring States.

The somewhat vague proposals for decentralization and administrative reform put forward by Count Berchtold on Aug. 20 prompted the Balkan allies to hasten their preparations. While the slow-moving concert of Europe was discussing alternative proposals for Turkish reform, the Porte suddenly held up Serbian war material at Salonika and began to mass troops round Adrianople. Before any collective step had been taken by the Powers, the situation was gravely compromised by the almost simultaneous mobilization of the Bulgarian, Serbian, Greek and Turkish armies (Oct. 1). At the last moment the Porte announced its intention to enforce the Vilayet Law of 1880, which had been allowed to remain on paper for a whole generation. But this was very naturally regarded by the Balkan allies merely as a fresh attempt at evasion, and the Powers still further alarmed them by a note which, in its endeavours to soothe Turkish susceptibilities, laid far more stress upon Turkish territorial integrity and sovereign rights than upon the cause of reform. Simultaneously the Powers warned the four Balkan States against warlike action and assured them that even in the event of victory no change in the territorial *status quo* would be tolerated. The further announcement of their intention—after a lapse of 34 years—to enforce the Treaty of Berlin, decided the four allies to precipitate events, and before the impending note could be formally communicated, the King of Montenegro, by an act of undoubted collusion, declared war upon Turkey. On Oct. 13 the other three Balkan Governments presented to the Porte a series of far-reaching demands, culminating in racial autonomy for all the nationalities of the Ottoman Empire, and four days later the Turks, without deigning to answer, declared war on Serbia and Bulgaria. (For the military events, *see* BALKAN WARS.) All the Great Powers, though for quite divergent reasons, genuinely attempted to prevent war. This is equally true of Russia, who, though privy to most of the designs of the Balkan allies, disapproved because she could not wholly control the time and method of action, and of Austria-Hungary, to whom the existence of an anti-Austrian clause in the treaty had been betrayed, but who already reckoned confidently upon setting the allies at variance before it could come into operation. That the Powers, having failed to prevent war, adopted a passive attitude during its early stages, was due to the almost universal assumption in official circles that the Turks would be victorious, and that the refractory Balkan States would soon be only too glad to accept a settlement dictated from without.

The First Balkan War.—The rapid and overwhelming success of the allies radically transformed the situation. By the end of November Turkish rule in Europe was restricted to the Chatalja lines, the Gallipoli Peninsula, and the three fortresses of Adrianople, Janina (Yannina) and Scutari. The Serbs in particular, after the victories of Kumanovo and Monastir, were in actual occupation of all Macedonia west of the Vardar, and had reached the Adriatic at Durazzo and Medua. They were thus able to go far beyond their obligations under the military convention, by help to the Bulgarians investing Adrianople.

Kumanovo was much more than an ordinary victory. It restored to Serbia that self-confidence which had been so gravely shaken by the rebuffs and scandals of the previous 30 years: and throughout the Yugoslav provinces of Austria-Hungary it was hailed as an atonement for Serbia's downfall on the field of Kosovo, and as a pledge of her new mission as the Southern Slav Piedmont. In Croatia especially, where the Hungarian Government had suspended the constitution and established Cuvaj as dictator, there were continual demonstrations in favour of the Balkan allies, even on the part of sections of the population hitherto regarded as Serbophobe. Austria-Hungary at first adopted a waiting attitude, but as the Serbs approached the Adriatic, she suddenly ordered a general mobilization, and suppressed all public expressions of feeling, while the official press of Vienna and Budapest adopted a menacing tone towards Serbia. Great prominence was given to the alleged insults offered to Herr Prochaska, Austro-Hungarian consul at Prizren, and for some days public opinion was allowed to believe that he had been shamefully mutilated by Serbian officers. It only transpired at a much later date that Prochaska, known to be in touch with the open enemies of Serbia in the Sanjak, had been entirely unmolested by the invaders, but that on the other hand he had received definite instructions from Vienna to create an "incident" such as might provide a pretext for action. The Austro-Hungarian chief-of-staff and War Minister, Gens. Conrad and Auffenberg, are known to have favoured a radical solution of the Southern Slav question by

[1] Gešov in his *Memoirs* asserts that King Ferdinand in signing this was decided by his knowledge of the text of a secret Austro-Rumanian military convention, permitting Rumania in the event of war with Russia, to annex not only Bessarabia, but also Silistra, and even Ruščuk (Ruschuk), Šumla (Shumla) and Varna.

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immediate war with Serbia (*see* under AUSTRIAN EMPIRE: *Foreign Policy*): and Count Forgács, who as minister in Belgrade, had supervised the anti-Serbian forgeries exposed at the Friedjung trial, was now permanent under-secretary at the Ballplatz and using all his influence with Count Berchtold in favour of war. There is practical certainty, however, that the Archduke Francis Ferdinand on this occasion supported Francis Joseph's aversion to war, and that the decisive factor was Italy's opposition to any "forward" policy from Vienna. As negotiations were already proceeding between Berlin, Vienna and Rome for a fifth renewal of the Triple Alliance (actually signed on Dec. 5 1912 for six years), Italy was able to use as a lever the special Austro-Italian agreement of 1909, by which Austria-Hungary had pledged herself to make no change in the Balkan *status quo*, "without a previous agreement with Italy, based on the principle of compensation." Moreover, Berlin, concerned for the Alliance, insisted strongly in Vienna upon the need for reassuring Rome by a more moderate attitude towards Serbia. The march of events had taken Vienna altogether by surprise, and in complying with its ally's wishes, it was influenced by the altered outlook of the Great Powers. On Oct. 8, in a last effort to avert war, they had warned the Balkan States that no territorial changes would be tolerated. But the success of the campaign and the general relief with which public opinion hailed the downfall of Turkish rule in Europe, soon led to a change in their attitude. On Oct. 30 M. Poincaré proposed a general declaration of *désintéressement* in territorial questions: and though this was rejected by Vienna, its moral effect was only increased when Mr. Asquith spoke in favour of recognizing the accomplished fact and remaking the map of eastern Europe. On Nov. 2 this view was strongly endorsed by M. Sazonov. For the moment all that Count Berchtold could do was to encourage Bulgarian designs on Constantinople and attempt to sow dissensions among the allies. The Turks, seeing themselves isolated in Europe, made overtures of peace as early as the 11th to King Ferdinand, who was not willing to consider them until his troops had been checked before Chatalja. On the 25th, however, negotiations were opened and resulted, not in peace, but in an armistice (Dec. 3) pending a general peace conference in London. When this opened at St. James's Palace on Dec. 16, Serbia was represented by the ex-premier and historian Novaković, the president of the Skupština Nikolić, and the minister in Paris, Vesnić. The wisdom of the allies in excluding Greece from the armistice soon became apparent: for her command of the sea limited the Turks to the Anatolian railway as the sole channel of reinforcement. In London Turkey pursued a policy of dilatory diplomatic intrigue and only receded inch by inch before the very drastic demands of the allies. After a month had been wasted, the Powers, with unexpected unanimity, presented a joint note to the Porte, advising the cession of Adrianople to Bulgaria and hinting at the loss of Constantinople as a possible consequence of renewed hostilities (Jan. 18 1913). Kiamil Pasha laid the proposals of the Powers before a specially convoked council of notables, and was on the point of yielding when the extremists of the Committee of Union and Progress overthrew his Cabinet and murdered the commander-in-chief, Nazim Pasha (Jan. 23). In view of the united front presented by the Powers, there can be little doubt that the new Cabinet would soon have been driven to the necessary concessions. But the Balkan delegates, rightly or wrongly, took the protestations of the Young Turks at their face value, and broke off the negotiations on Jan. 28. The council of ambassadors initiated by Sir Edward Grey continued to sit in London, and devoted especial attention to the Albanian problem and to the friction produced between Albanians and Serbs by the latter's presence on the Adriatic. Since the commandant of Scutari, Hasan Riza, declined to recognize the armistice, hostilities before the town had continued throughout Dec. and Jan., and Serbia sent repeated reinforcements to the aid of the Montenegrins.

Resumed Hostilities.—When war was resumed on Feb. 3 the brunt fell upon Bulgaria, and the Serbs, being complete masters of Macedonia, were free to contribute 47,000 men and a siege train of 38 guns to the operations against Adrianople, which held out until March 26. The dispute which arose as to whether Shukri Pasha had surrendered to the Bulgarians or to the Serbs, was in itself quite unprofitable, but was a symptom of the friction which was daily increasing between the two allies. Gen. Stepanović, who commanded the Serbian contingent, was allowed to pass through Sofia with his staff, without a single greeting, and on April 16 Bulgaria renewed the armistice with Turkey, without waiting for her allies. The final phase of the war concentrated round Scutari, which Montenegro and Serbia made desperate efforts to reduce. Even the announcement that the council of ambassadors, in fixing the frontiers of the new Albanian State, had definitely included Scutari (while leaving Dibra, Prizren, Peć [Ipek] and Djakovo to the two Serb kingdoms) only served as an incentive to create if possible a fresh *fait accompli*. But Austria-Hungary upheld her veto, and on March 20 addressed a severe note to Montenegro, reproaching her for the murder of a Bosnian Franciscan and other incidents, and at the same time dispatched a strong naval squadron to the southern Adriatic. Her next step was to urge upon the Powers a collective demand for the cessation of hostilities and the withdrawal of the Montenegrin and Serbian forces from the territory assigned to Albania, and to threaten the use of force unless at least the civil population of Scutari were allowed to leave the town (March 23). This demand was supported by Britain, partly in order to avert a conflict, and was conceded: but the close support of Cetinje by Belgrade rendered the danger of Austro-Hungarian intervention increasingly acute. On March 31 the Powers ordered Montenegro to cease hostilities, and on her refusal established a naval blockade of her strip of coast. This seemingly illusory measure at least had the effect of restraining Austria-Hungary, who could not act separately so long as the Powers held together. It was, however, simply defied by King Nicholas, who gained time by consenting to the withdrawal of the Serbian troops and meanwhile closed the frontier and conducted secret negotiations with Essad Pasha, commandant of the town since the assassination of Hasan Riza on March 30. On April 23 Scutari surrendered to the Montenegrins, and the Powers had difficulty in restraining Austria-Hungary from immediate action. What finally decided her appears to have been the knowledge that her seizure of Mount Lovčen (Lovchen), the key to Cetinje, would be followed by Italy's occupation of Valona, with its control of the entrance to the Adriatic.

Amid the countless rival intrigues the Powers presented in public a unanimous front, and on May 14 the Montenegrins found themselves obliged to surrender Scutari to Adml. Burney, as commander of the international fleet. Negotiations could now be resumed in London for a general peace (May 20), and the Powers found it easier to take a strong line. Before the delegates could be brought to business, it was necessary for Sir E. Grey to inform them, with quite undiplomatic bluntness, that unless they were prepared to conclude peace without further delay they had better leave London altogether. By the Treaty of London, which was signed on May 30 1913, and only contained seven brief articles, Turkey ceded to the four allies conjointly the island of Crete and all territory lying to the west of the Enos–Midia line, and all the contracting parties agreed to refer the settlement of Albania and the Aegean Islands to the five European Great Powers, and all financial questions to the International Commission convoked in Paris.

The Dispute between the Allies.—The Balkan allies were now faced by the thorny problem of dividing the spoils. Macedonian autonomy, which the treaty had laid down as the ideal solution, was from the first abandoned by all parties. Their success, as it had far exceeded their expectations, also increased their appetites and encouraged them to extend their claims. Thus while Serbia found herself in effective possession of most of Macedonia, and remembered the imperial traditions of Stephen Dušan, Bulgaria saw the possibility of acquiring Adrianople and Thrace, and not content with the "Big Bulgaria" of the

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Treaty of San Stefano, dreamed of "the four seas" (the Adriatic as well as the Black, Aegean and Marmora). The four Governments seemed each bent upon annexing a maximum of territory, and thus too often became the tools of Powers whose ambitious plans of political and military equilibrium they had unconsciously upset. Above all, the long delays in restoring peace stabilized the various regimes of occupation and proved fatal to mutual understanding. Between Bulgaria and Greece there was no territorial bargain, and no obvious means of reaching one, while Serbia as early as Jan. 23 formally raised the question of a revision of the Serbo-Bulgarian treaty. This rested on the argument that Serbia was entitled to compensation for four reasons—(1) that she had furnished her ally with military support far in excess of her bargain, (2) that she had absolved Bulgaria from her military obligations in Macedonia, (3) that she had loyally continued the war three months after her own work was done, and (4) that the acquisition of Adrianople by Bulgaria radically modified the basis upon which the bargain rested. But if Serbia's attitude is to be justified, it must be on the broader ground that events had transformed the situation still further to her disadvantage in another direction. Her two parallel aims in the war had been the political liberation of her kinsmen under Turkish rule, and her own economic emancipation by means of free access to the sea; and from the practical rather than the sentimental standpoint the second was much the more vital. Her whole calculation centred upon securing the Sanjak, Kosovo and a link with Montenegro, and a port in northern Albania (as the best substitute for access through Herzegovina); and when Austria-Hungary imposed her veto upon the latter, the Vardar valley became Serbia's only possible alternative outlet, and this involved her retention of Veles, Prilep, Monastir and Okhrida as well as the "disputed zone." That Vienna deliberately aimed at thus embroiling Serbia and Bulgaria is shown by the fact that during the earlier Albanian negotiations Count Berchtold had offered to Serbia the whole of the Vardar valley with Salonika itself, if she would renounce her Adriatic claims. Bulgaria, on her side, insisted on the literal interpretation of the treaty and showed herself indifferent to Serbia's difficulties on the west.

Meanwhile Russia had made every effort to avert a conflict, Sazonov going so far as to express regret at the Serbo-Greek negotiations (April 17), while warning Bulgaria of possible danger from Rumania, in the event of aggression against Serbia (April 28). On April 30 the Russian ministers in Sofia and Belgrade simultaneously reminded the two allies of their obligation to submit disputes to Russian arbitration. But Sazonov's success in settling a Bulgaro-Rumanian frontier dispute had only served to render Sofia more unyielding, and on May 19 the Bulgarian commander-in-chief wrote to the premier, assuming war with Serbia and Greece to be inevitable, and urging concentration against the former. The pressure very rightly brought to bear by Sir E. Grey upon the peace delegates in favour of the Treaty of London was misinterpreted by the Bulgarians (who alone had any motive for haste) as a guarantee of that Treaty against Turkey, and as dispensing them from the need of guarding their eastern frontier. They were still further encouraged by the openly Serbophobe tone of the official press in Vienna and Budapest: and King Ferdinand had already ordered Gen. Savov to hasten the transference of the army from the Thracian to the Macedonian front, when on May 27 Pašić, under pressure from the Serbian opposition, publicly committed his Government to the demand for treaty revision. This hastened the resignation of the pacific Gešov, behind whose back King Ferdinand was already concerting aggressive action. Before he went, Gešov, under strong Russian pressure, met Pašić at Tsaribrod (June 1) and agreed to Russia's proposal for a meeting of Balkan premiers at St. Petersburg; but a further proposal for the immediate reduction of the allied armies to a third, though accepted by Serbia and Greece, failed owing to the impossible conditions put forward by Gen. Savov. Gešov's successor, Dr. Danev, opposed the meeting of the premiers, contended that Russia had already prejudged the case by even considering revision, and relied increasingly upon Austria-Hungary. That his confidence was not ungrounded is shown by Count Berchtold's assurance to Rumania in May that the Dual Monarchy was ready to defend Bulgaria "even by force of arms."[1] Serbia and Greece on their part were fully alive to the danger; there had been informal talks between Venizelos and Novaković in London, and between Prince Alexander of Serbia and Prince Nicholas of Greece in January and March at Salonika. After the accession of King Constantine, a less conciliatory mood prevailed in Athens and Belgrade, each of whom in turn made secret overtures to Rumania for a defensive alliance, but without success (April 19, June 8). Their own agreement was hastened by the common danger, and the Serbo-Greek military convention of May 14 was revised on June 1 and supplemented by a definite treaty of alliance for 10 years. While the first of these provided for mutual military support in case of a Bulgarian attack upon either ally, the second extended the *casus foederis* to an attack by a third Power, "in circumstances envisaged by the Treaty of Alliance between Greece and Serbia." Both the wording and the events of the moment make it clear that the intention was to guard against an Austro-Hungarian attack upon Serbia; in 1913 King Constantine took this risk, but in 1915 he was to deny its application.

On June 8 the Russian Government made its supreme effort for peace, by inducing the Tsar to address a personal appeal to the kings of Serbia and Bulgaria, which closed with the warning that "the first to make war would be responsible before the Slav cause." King Peter's courteous though somewhat ambiguous answer was never published; but that of King Ferdinand, which threw the entire blame upon Serbia and argued that the Bulgarian claim had long been admitted by Russia, was a fresh blow to the cause of peace. On June 13 the Powers made a joint *démarche* at Sofia and Belgrade in favour of demobilization, but Bulgaria imposed the impossible condition of a preliminary joint occupation of the disputed territory. Her attitude stiffened still further after the speech of the new Hungarian premier, Count Tisza, who emphasized the right of the Balkan States to settle differences in their own way—*even by war*—and declared that Austria-Hungary could not allow any other Power to acquire special prerogatives in the peninsula (June 19). As a natural result, Russia's fresh proposals for a conference of Balkan premiers in St. Petersburg, while promptly accepted by Belgrade and Athens, were met by Dr. Danev with a reiterated demand for joint occupation, and a virtual ultimatum giving Russia a week in which to pronounce as arbiter and 48 hours to announce compliance with the request. With Sazonov's sharp reply bidding Bulgaria to expect nothing more from Russia, St. Petersburg's influence over Sofia may be said to have ended. Count Tarnowski, the Austro-Hungarian minister in Sofia, was supreme in the counsels of King Ferdinand during the critical fortnight that followed. The deadlock was complete, when on June 22 the Serbian Cabinet was driven to resign, owing to the resentment of the military party at its alleged moderation. The most it could do was to place itself unreservedly in Russia's hands, and when this was endorsed by the Skupština after a stormy secret session Pašić resumed office (June 26). But Russia was by this time powerless to avert the catastrophe.

The Second Balkan War.—On the night of June 29, without previous declaration of war, the Bulgarian armies made an almost simultaneous attack upon the Serbs and Greeks. Their extended order and lack of proper reserves showed how greatly they had underestimated their enemy, and Gen. Savov is credibly reported to have declared that he could cut through the Serbs like "a knife through rotten cheese." But the Serbian generalissimo, Gen. Putnik, was fully alive to the Bulgarian preparations, and in confidential orders to his commanding officers had warned them that the Bulgars would "use their amicable relations with us" for a surprise attack. In point of fact, on certain sectors those who carried out this "stab in the back" had been dining only a few hours earlier

[1] Prince Fürstenberg to Take Jonescu, who published the facts in *La Roumanie*, Dec. 15 1914.

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with their Serbian comrades across the lines. It is probable that Savov did not aim at regular war, but hoped by a sudden shock to drive a wedge between Serbs and Greeks, seize the coveted districts of Macedonia and then hold them until the foreign intervention which he believed to be imminent should settle the dispute on a basis of "*beati possidentes*." This is borne out, not merely by captured despatches, but by the amazing fact that when Putnik's forces everywhere held their own, Savov on July 1 telegraphed the order to stop hostilities. But the war so lightly begun could no longer be stopped. That afternoon the Serbian counter-offensive opened, and a proclamation of King Peter, prepared some weeks previously in Belgrade, with a blank space for insertion of the date, was issued to the troops. The desperate struggle which continued almost uninterruptedly from July 1 to 9 is known as the battle of the Bregalnica (Bregalnitsa), though it actually extended over a much wider front. At its close the Bulgarians found themselves cut into two by the inaccessible Plaskovica Mts., and were obliged not merely to relax their hold upon the Vardar valley at Krivolak, but to abandon the whole Ovčepolje (Ovche Polye) district, the strategic key to central Macedonia.

It appears certain that the original attack took place without the knowledge of the Danev Cabinet and contrary to its unanimous decision.[1] But that the premier was contemplating war at an early date is shown by his request that Vienna should ascertain whether the Turtucaia–Balčik (Balchik) line would buy Rumania's neutrality (June 28) and by his warning to the Rumanian minister that Serbian resistance would be over before Rumania could complete her mobilization (July 1). That there were two parallel policies in Sofia is further shown by the fact that on the very day of the request to Vienna the Rumanian Government officially informed Bulgaria that it would not remain neutral in the event of war. During the mutual recriminations that followed defeat, Dr. Danev publicly asserted (1) that Count Tarnowsky had already given assurances to King Ferdinand that Austro-Hungarian troops would re-occupy the Sanjak in the event of a Serbo-Bulgarian war, and (2) that on June 26 a treaty was signed between Austria-Hungary and Bulgaria, by which the latter bound herself, in the event of an Austro-Serbian or an Austro-Russian war, to mobilize enough troops to paralyse Serbia's action, while Austria-Hungary in her turn undertook to prevent, either by diplomatic or military action, any attack of Rumania upon Bulgaria in the event of the latter becoming involved in war with the allies, and even to intervene herself, should the war take a turn unfavourable to Bulgaria. These assertions have never been contradicted: the first coincides with the known facts, but for the second documentary evidence is as yet lacking. The memorandum addressed by Radoslavov and Genadiev to King Ferdinand on July 6—advocating a close accord with Austria-Hungary as the sole hope of averting disaster—neither proves nor disproves the existence of an alliance, for they may well have written in ignorance of a secret compact; but it should have served as an index to the attitude of those statesmen in 1915.

The Treaty of Bucharest.—By July 17 the Serbs had forced back the Bulgarians at all points to the frontier of 1912, and could henceforth adopt a mainly defensive attitude; but on July 16 Rumania declared war and began to throw troops across the Danube, while on July 15 the Porte repudiated the provisions of the Treaty of London and ordered Enver Pasha to advance upon Adrianople.

The frantic appeals of Sofia to the Powers to enforce upon Turkey respect for a treaty concluded under their auspices were disregarded, and Western public opinion was not inclined to save Bulgaria from the consequences of her own act. At the same time the entry of two new combatants greatly complicated Austria-Hungary's designs of intervention. She was held back by both her allies—Italy, who viewed with alarm the Balkan activities of any outside power and was determined to insist upon compensation, and Germany, who feared the loss of Rumania for the Triple Alliance, and the consequent derangement of the military balance in Europe. William II. was further influenced by a triple personal motive—the appeal of his brother-in-law King Constantine, old friendship for King Charles, and active dislike for King Ferdinand. This momentary divergence of view between Vienna and Berlin sealed Bulgaria's fate: though Vienna and St. Petersburg united to hold back Rumania from occupying Sofia or claiming the Ruščuk (Ruschuk)–Varna line. Bulgaria had no course left but to sign an armistice on July 31 and to open peace negotiations at Bucharest with her four Christian neighbours. This apparent emancipation of the smaller Powers from the European concert's control decided Austria-Hungary in favour of belated action against Serbia. But on Aug. 9 the Italian Government made it clear to Vienna that it would not recognize the *casus foederis* of the Triple Alliance as applicable to such a case;[2] and the combined pressure of Rome and Berlin, coupled with the certainty of Russian aid to Serbia, again averted war at the last moment.

The Treaty of Bucharest, signed on Aug. 10, gave to Rumania the Turtucaia–Balčik line, deprived Bulgaria of almost all her conquests in Macedonia and left her to settle the fate of Thrace as best she could with Turkey. Serbia acquired all Macedonia to the W. of the Vardar, and to the E. the districts of Štip (Istib or Shtip) and Kočana; but at the last moment Bulgaria was left in possession of a dangerous salient at Strumnica (Strumitsa), which enabled her to threaten Serbia's only railway connexion with the Aegean. The new Serbo-Greek frontier had already been fixed by mutual agreement, and ran from Gjevgjeli (Gyevgyeli or Gevgeli) (30 m. N. of Salonika) to the S.E. corner of the Lake of Okhrida, leaving Florina and most of the Monastir–Salonika railway to the Greeks. The Treaty of Constantinople, which was concluded between Bulgaria and Turkey on Sept. 29 and deprived the former of the greater part of Thrace, did not directly concern Serbia; but the indifference shown by her and her new allies, and still more by Britain and Russia, to Turkey's violation of a treaty which was their joint work and indeed was morally binding upon them, was to be dearly paid for by Bulgaria's attitude in the World War.

The treaties marked a new orientation in the Near East. Slav coöperation was replaced by mutual hatred, which promptly threw defeated Bulgaria into the arms of Turkey and predisposed both for an alliance with Berlin; Rumania's ties with the Triple Alliance were sensibly loosened, while Greece was drawn in two directions by dynastic attractions and party rancours. The military balance had undoubtedly been altered to the disadvantage of the Triple Alliance, yet it was to William II. that King Charles addressed a cordial telegram on the conclusion of peace, "which thanks to you remains definitive," and it was to the joint efforts of France and Germany that Greece owed Kavalla.

The Albanian Conflict.—Austria-Hungary now concentrated her attention upon Albania, and thereby rendered still more acute the relations between Serbs and Albanians. In the past three decades the latter had been rapidly ousting the former from the historic territories of Kosovo, Prizren and Decani (Dechani), and now tried to justify present possession by a claim as autochthonous owners of the soil. The mountainous and inaccessible character of these borderlands and the extreme backwardness of their population made a guerrilla warfare almost inevitable; and the summons addressed to Belgrade by the Great Powers for the withdrawal of the Serbian troops (Aug. 19) was a signal for further trouble. Late in Sept. there was a formidable Albanian rising, and the insurgents, aided by numerous bands from beyond the frontier and armed with foreign rifles, seized Dibra and even Okhrida, and forced Serbia to remobilize the Morava division and many of her reserves. In order to prevent fresh raids, the Serbs occupied certain strategic points in Albania, and this gave Austria-Hungary excuse for a sharp warning. Thus for the first fortnight of October there was once more acute friction between Vienna and Belgrade. At last Serbia accepted the inevitable and with-

[1] Gesov, *The Balkan League*, p. 92.

[2] The essential facts were first revealed by Signor Giolitti in the Italian Parliament in Dec. 1914.

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drew her troops, but covered her retreat by a note to the Great Powers, begging them to enjoin upon their Albanian protégés a respect for the frontiers created for their benefit (1804). Even after this crisis was over, Count Berchtold made further trouble for Serbia by steadily opposing her Government's very natural desire to take over, so far as Serbian territory was concerned, the shares of the Orient railway hitherto owned by Austrian subjects. Vienna's permanent ill-will was further revealed by attempts to block the conclusion of a concordat between Serbia and the Vatican.[1]

By Christmas 1913 the situation in Old Serbia[2] was rapidly becoming normal, but the administration in the new territory left much to be desired, and the closing of Bulgarian schools, the expulsion of Exarchist clergy and occasional excesses against the Moslem population caused serious unrest and discontent. The Pašić administration became absorbed in defending itself against the increasingly violent onslaughts of the Opposition. In Dec. 1913 and again on June 2 1914 it resigned, but eventually remained in office. On March 4 the Opposition had withdrawn from the Chamber as a protest against alleged unconstitutional action of the Government in budget matters. But though the tension was increased by the activities of a powerful military clique known as "The Black Hand" and by the sudden and arbitrary seizure of its club premises by the masterful Minister of the Interior, Protic, the Government was still in office in the summer. The visit of Crown Prince Alexander and Pašić to St. Petersburg early in February had given rise to rumours of a new Balkan League under Russian auspices; but the advent of Radoslavov to power in Sofia had really made any such plan impracticable, and King Charles of Rumania, though bent upon coöperation with Serbia and receiving the Tsar with special honours at Constanta (Constantsa), had no idea of breaking his connexion with the Triple Alliance.

The Assassination of the Archduke.—On June 24 King Peter, incapacitated by ill-health, appointed Prince Alexander as Regent, and simultaneously dissolved Parliament, Pašić having in April pledged himself to the election as for a "Great Skupština" for constitutional changes. Only four days later the assassination of the Archduke Francis Ferdinand and his wife at Sarajevo revived the latent Austro-Serbian conflict in a more acute form than ever. The authors of the crime, Princip and Čabrinovič, belonged to a group of Bosnian Serb students, mostly under the age of 20, who gave terrorist expression to the universal discontent aroused by Austro-Hungarian repression throughout her Yugoslav provinces. The victories of Serbia during the Balkan Wars and the openly hostile policy pursued towards her by Vienna and Budapest had assured to her in the eyes of public opinion the position of the Yugoslav Piedmont. Thus no external incentive to the crime was needed: and the young hotheads were further swayed by sentimental considerations. The motive of the Archduke's visit was to conduct manœuvres which had no meaning save as a rehearsal for a future campaign against Serbia: while the selection of "Vidovdan" (St. Vitus's Day—the anniversary of Kosovo) for his public reception in Sarajevo was regarded as a deliberate challenge to the Serb idea. It was, however, proved that the assassins had been in Belgrade and had been secretly smuggled across the Drina into Bosnia, after receiving hand grenades and revolvers from the Serbian Komitajis Major Tankosić and Ciganović. On these facts the Ballplatz sought to establish the complicity of the Serbian Government, but for this no evidence has ever been produced. Indeed presumption overwhelmingly favours the opposite theory. The country was exhausted by two wars; the Albanian campaign in the previous autumn had shown the reluctance of the peasant soldiers to return to the colours, and it was now the eve of harvest. Military stocks were alarmingly low, as the next winter was to show. The young Prince had only just assumed the reins of Government; the position of the Cabinet was shaky, and a fierce electoral campaign was opening. The Concordat with the Vatican had only just been signed, and delicate negotiations with Montenegro for a customs and military union and perhaps even a dynastic arrangement, were still pending. Serbia had every conceivable motive for avoiding aggressive action. After the tragedy, it is difficult to see what other course her Government could have pursued; its one omission was to offer a thorough inquiry, without waiting for any suggestion from Vienna. The situation was from the first envenomed by the press of Belgrade, Vienna and Budapest; but it is to be noted that while the former had always had an irresponsible and highly scurrilous section, which the Government was unable to restrain owing to the lack of any proper press or libel laws, the two latter had always been extremely sensitive to the directive of the Ballplatz, and the worst offences were committed by journals with the strongest official ties.

Austria-Hungary and Serbia.—The ominous silence preserved by Austria-Hungary for nearly three weeks after the murder has been very largely explained by the documents published since the war by the Austrian and German republican Governments. From memoranda on Balkan policy prepared for Count Berchtold during May 1914, and re-drafted by him personally both before and after the murder, it is evident that Austria-Hungary was pressing upon Germany the need for clearing up the situation with Rumania, and for attaching Bulgaria to the Triple Alliance, and that Germany wished to use Bucharest as a bridge between Vienna and Belgrade, but dropped this idea after the tragedy. On July 2 Francis Joseph wrote to William II. that the main basis of Austro-Hungarian policy must be the isolation of Serbia, and "her elimination as a political factor in the Balkans," again advocated alliance with Bulgaria and proposed that Rumania should be warned that the friends of Serbia cannot be the friends of Austria-Hungary and Germany.[3] On reading the letter the Emperor William said that he must be prepared for European complications and must therefore talk with his Chancellor; but he at once authorized Count Szögyény to inform Francis Joseph that he might reckon upon Germany's full support "even in this case," and he urged that if there was to be an advance into Serbia, it should be at once, especially as Russia was certain to be hostile, though unprepared for war (July 5).[4] Next day Herr von Bethmann Hollweg instructed the German minister in Sofia to coöperate with his Austro-Hungarian colleague in favour of the Bulgarian alliance, and the German minister in Bucharest to announce Germany's abandonment of all idea of agreement with Serbia. That Germany gave *carte blanche* to Austria-Hungary has been vehemently denied by Bethmann Hollweg in his *Memoirs*, but is admitted in so many words in the preface to the official German White Book,[5] and is proved by Herr von Tschirschky's assurances to Francis Joseph on July 2, by the instructions which he received from William II. and Bethmann Hollweg, and by William's letter of July 14 to Francis Joseph.[6] As early as July 8, Tschirschky reported to Berlin Berchtold's intention of drafting an ultimatum in such a form that "its acceptance seems out of the question,"[7] and not merely is there no trace of Berlin rebuking this tendency, but there are repeated signs of impatience in Berlin at Vienna's delays. Not merely was the full initiative left to Vienna,[8] but on July 12 there was a joint decision between Vienna and Berlin not to inform Italy of their intentions, but to place her before "an irretrievable situation."[9] In Vienna the only counsels of moderation came from the Hungarian premier, Count Tisza, who at the Crown

[1] This statesmanlike measure was negotiated by Vesnic, the Serbian minister in Paris, and Gavrilovic (afterwards Yugoslav minister in London), aided by Bakutic, a Croat expert in canon law, from Sebenico.

[2] Since 1912 this name was transferred to the original kingdom and the "Old Serbia" of Turkish times became "New Serbia."

[3] Goos, *Das Wiener Kabinett und die Entstehung des Weltkrieges*, p. 29.

[4] *Ibid.*, p. 31.

[5] P. 5 (Authorized English Edition).

[6] *Die Deutschen Dokumente*, Nos. 11, 15, 26.

[7] *Ibid.*, No. 19.

[8] Goos, op. cit., p. 44.

[9] *Diplomatische Aktenstücke* (Republik Oesterreich) i., p. 51 (No. 16).

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Council of July 7 opposed Count Berchtold and declined to admit war to be inevitable. He deprecated a surprise attack, without previous diplomatic action, as likely to place Austria-Hungary in a bad light before Europe and rally the Balkan States against her; he favoured harsh, but not impossible (*unerfüllbar*) demands upon Serbia, and even if their refusal should lead to war, he would not favour Serbia's complete annihilation, partly because Russia would then be forced to intervene, and partly because as Hungarian premier he could not sanction annexations at Serbia's expense. (Here he was following the traditional Hungarian view that the inclusion of further Slavs in the Dual Monarchy was a menace to Magyar supremacy in Hungary.) All the other ministers present—viz. the three joint ministers, Berchtold, Bilinski, and Krobatin, the Austrian premier Count Stürgkh and the chief-of-staff Baron Conrad—were agreed that a mere diplomatic success, even if it led to the public humiliation of Serbia, would be worthless, and that demands must be addressed to her such as would render rejection, and consequent military action, probable. By threatening to resign, Count Tisza carried his point that there should be no mobilization until the ultimatum had been rejected.[1] His attitude is clearly revealed by two memoranda which he addressed to Francis Joseph on July 1 and 8. In the first he condemns Berchtold's idea of using Sarajevo as an excuse for the final reckoning with Serbia as "a fatal blunder," but begs Francis Joseph to make every effort to overcome William's "prejudice in favour of Serbia." From the second it transpires that it was "the satisfactory assurances" of Berlin which had decided all Tisza's colleagues in favour of war with Serbia. He himself dissents, and insists that Serbia must be given a chance of escape, though only through severe diplomatic defeat. This is necessary in order to avoid complications with Italy, to ensure Britain's sympathy and to enable Russia to remain inactive.[2] On July 14, however, after full discussion with Berchtold, Tisza called upon Tschirschky and announced that "he had abandoned his original doubts and is quite in accord with energetic action,"[3] and that "the note will be so drafted that its acceptance may be virtually ruled out."[4] Berchtold on his side informed Tschirschky that Tisza had not merely come round to his view, but had "in certain points introduced a stiffening." On July 15, in answering an interpellation, Tisza denied that war was inevitable, but significantly added that a State which does not regard war as *ultima ratio* cannot maintain itself as a State. Thus while Tisza must be credited with statesmanship such as was signally lacking in his colleagues, his final decision and his subsequent zeal in the conduct of war make it impossible to claim him or his Government as unwilling actors in the great struggle, just as it is beyond dispute that the Magyar policy towards Croatia and the nationalities was a foremost factor in provoking the Austro-Serbian conflict which actually fired that train.

The Ultimatum to Serbia.—A further proof of Germany's failure to exercise a restraining influence on her ally is afforded by the detailed note presented on July 20 by the Serbian chargé d'affaires in Berlin to Herr von Jagow, expressing the strongest detestation of the murder, the desire for friendly relations with Austria-Hungary and a readiness to meet all such demands as might be compatible with State independence.[5] Jagow, however, deliberately refrained from taking up the note's concluding appeal for friendly intervention in Vienna, and there is no evidence to show that he even reported to Count Berchtold the Serbian appeal, while on the contrary he ignored King Charles's offer of mediation on July 10. The secret of the ultimatum was jealously guarded, and the long delay, created, as was intended, a false sense of security in some quarters. Its delivery at Belgrade, which took place at 6 P.M. on July 23, was carefully timed for the moment after President Poincaré's departure from St. Petersburg after his State visit, the object being to eliminate the chances of French mediation. The ultimatum, after reminding the Serbian Government of its formal undertakings of March 31 1909, charged it with "culpable tolerance" of terrorist propaganda directed against Austria-Hungary and blamed Serbian officers and functionaries with planning the Sarajevo murders. It therefore demanded that the "Narodna Odbrana" (League of National Defence) and any similar society guilty of anti-Austrian propaganda should be dissolved, that objectionable passages should be expunged from Serbian educational works, that all officers or officials whom Austria-Hungary might name as guilty of propaganda should be dismissed, and that the Belgrade Government should not merely arrest certain specified persons charged with complicity, but should order the trial of others, allow Austro-Hungarian delegates to take part in the inquiry and accept the collaboration of Austro-Hungarian officials "in the suppression of the subversive movement."

The general impression produced by this document upon European opinion is best summarized in the words of Sir E. Grey, who telegraphed the next day to Sir M. de Bunsen, that he "had never before seen one State address to another independent State a document of so formidable a character." The fifth demand in particular (that of collaboration), he pointed out, "would be hardly consistent with the maintenance of Serbia's independent sovereignty."[6] None the less, Serbia in her reply actually consented to "such collaboration as agrees with the principle of international law, with criminal procedure and with good neighbourly relations." Only on one point did she reply in the negative; the share of Austro-Hungarian officials in the actual inquiry would, it was argued, be a violation of the constitution and the criminal code, but even this could be met by "communications in concrete cases." On all other points there was unqualified submission, and in certain respects, such as the offer to introduce legislation for fuller control of the press and to stiffen frontier regulations regarding weapons, the answer went much further than had been demanded. As a final proof of sincerity, Serbia offered to submit any outstanding points to the decision of the Hague Tribunal or even to the Great Powers which had imposed upon her the declaration of March 31 1909.[7] Thus Serbia is found for the third time in six years offering to submit herself to the verdict of the Hague—the two previous occasions being the Bosnian crisis and the Friedjung trial—and each time it is Austria-Hungary who rejects the proposal. Three days later, as a last resort, the Serbian Government informed the Italian Foreign Minister that it was even prepared to swallow the whole note, "if only some explanation were given regarding the mode in which Austrian agents would require to intervene," and went so far as to offer to accept these explanations from a third party, if Austria-Hungary was not disposed to give them to Serbia direct.[8]

Austria-Hungary had demanded an answer to her note by 6 P.M. on July 25, thus leaving a period of 48 hours for either reply or mediation. The official documents published in Berlin and Vienna since the war make it abundantly clear that the Ballplatz deliberately couched the note in such terms as to be unacceptable; but even in 1914 this was obvious from its tenor and from the significant fact that Baron Giesl, who received the Serbian answer from Pašić a quarter of an hour before the expiry of the time limit, instantly handed him a fresh note announcing the rupture of diplomatic relations and the immediate departure of himself and his staff. Moreover the text of the answer was kept secret in Vienna for several days, until a sarcastic commentary could be added; and Belgrade, presumably owing to the confusion which prevailed there, appears to have taken no steps to bring it promptly to the notice of the other Powers.[9] This is the more regrettable, since even William II. (to judge from his marginal notes on

[1] Goos, op. cit., pp. 53–62.
[2] Goos, pp. 62–70.
[3] *Diplomatische Aktenstücke* 1, No. 23.
[4] *Die Deutschen Dokumente*, No. 49.
[5] *Die Deutschen Dokumente*, No. 86.
[6] *British Diplomatic Correspondence*, No. 5.
[7] *British Diplomatic Correspondence*, No. 39.
[8] *British Diplomatic Correspondence*, No. 64.
[9] *e.g.* it was communicated to Sir E. Grey by the Serbian minister on the same day on which it reached London through the Austrian embassy with Count Berchtold's comments.

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diplomatic documents, as published since the Revolution) was impressed by the moderation of the Serbs, regarded Vienna's essential wishes as fulfilled and expressed the view that Giesl ought to have remained in Belgrade. His ministers, however, had failed to support Sir E. Grey's proposal for a prolongation of the time limit, and were thus responsible for bringing Russia into action. On July 27 the Tsar replied to a despairing appeal of the Prince Regent for assistance to Serbia, by a telegram strongly urging him to "neglect no step which might lead to a settlement," but conveying the assurance that "Russia will in no case disinterest herself in the fate of Serbia."[1] On July 28 Austria-Hungary formally declared war upon Serbia, and on the same day rejected the Russian proposal for a friendly exchange of views between Vienna and St. Petersburg.[2]

Henceforward the Austro-Serbian quarrel is merged in the larger diplomatic conflict between Alliance and Entente. Due stress ought, however, to be laid upon one of Sir Edward Grey's many efforts to avert war even at the last moment. On July 29 he received Count Mensdorff's assurance that Austria-Hungary "had no idea of territorial aggrandisement," and when he hinted that there were other means of turning Serbia "into a sort of vassal state," received the rejoinder "that before the Balkan War Serbia had always been regarded as being in the Austrian sphere of influence."[3] Undeterred by this ominous attitude, Sir Edward on July 30 put forward the proposal that Austria-Hungary, after occupying Belgrade, should cease her advance and consent to discussions with Russia, who otherwise could not be expected to "suspend military preparations."[4] In other words, Belgrade would become a kind of pledge in Vienna's hands for the attainment of a satisfactory settlement. The elaborate dispute regarding the Russian and German mobilizations has hitherto obscured the essential fact that on July 31 Francis Joseph definitely, almost petulantly, refused the British proposal as transmitted through Berlin,[5] thereby rendering the military action of St. Petersburg inevitable.

The Outbreak of War.—When Baron Giesl presented the ultimatum, Pašić had been absent electioneering in the provinces; but he at once returned to Belgrade, and on July 25 mobilization was ordered, and the seat of Government and the archives were hastily transferred to Nish. In view of so grave a crisis elections became impossible, and as parliamentary sanction was more than ever necessary, the Government had no other course than to ignore the fact of dissolution and to call the previous Skupština once more into existence. At its first meeting in Nish on Aug. 1, the entire Opposition endorsed the Government's action, and for the moment party life was in abeyance. Parliament also ratified the Concordat with the Vatican and a law ensuring to Catholicism full freedom of worship in Serbia. There was an unexpected delay in the invasion of Serbia, and it was not till Aug. 12 that the first Austro-Hungarian troops crossed the Drina and the Save. After 12 days of desperate fighting (known as the battle of the Jader) the invaders were thrown back across the frontier, this being the first definite Allied victory. Unduly elated by this success and by the news of Russia's rapid advance in Galicia, the Serbs were now led to underestimate Austria-Hungary's resources, and encouraged by the Allies, passed to the offensive early in September. Their rash invasion of Syrmia—a necessary preliminary to any successful penetration of Bosnia from the east—soon proved beyond their strength and had to be abandoned by Sept. 13; and the joyous welcome everywhere accorded to them by the population merely brought down a cruel vengeance on its head when the Austro-Hungarian army returned. A further mistake was made in attempting to hold the rich but strategically indefensible Mačva (Machva) district, doubtless owing to the horrid excesses committed there by the enemy during their first inroad. None the less the Serbs were able to check a second Austrian advance across the Drina in mid-September. But on Nov. 6 General Potiorek began a third invasion in great force, and during the next month steadily pressed back the Serbian forces into the heart of their country. The danger was aggravated by shortage of ammunition, and when at last the necessary supplies began to arrive, a large force of Bulgarians armed with machine-guns and acting with the connivance of Sofia, raided the Vardar railway from the Strumnica salient and destroyed an important bridge on the only line by which the new guns could be moved up to the front. The enforced evacuation of Belgrade on Nov. 29 revealed the extremity of the danger, and brought the latent political crisis to a head. On Dec. 5 the purely Radical Cabinet resigned and was succeeded on Dec. 13 by a Coalition Government, in which Pašić remained premier, but the leaders of all parties save the Liberals received portfolios. It was however in this blackest week that the Skupština unanimously endorsed the Government's declaration that its foremost war aim was "the liberation and union of all our Serb, Croat and Slovene brethren not yet set free." This was the first public step of Serbia in favour of Yugoslav unity.

Serbia after the Austrian Rout.—With the arrival of munitions from the West the army's flagging spirits revived, and the brilliant offensive initiated on Dec. 2 by Gen. Mišić and the 1st Army resulted, after a twelve days' battle along the whole front, in the complete rout of Potiorek. By Dec. 14 Serbian soil was for the third time entirely free from invaders, and an enormous booty was captured. But the enemy left deadly infection behind him, and by the early spring of 1915 exhausted Serbia was immobilized by a typhus epidemic which is estimated to have caused about 300,000 deaths among the civil population. A notable part in checking its ravages was played by Lady Paget as head of the Serbian Relief Fund units in Skoplje, and by Col. Hunter and a R.A.M.C. detachment, who organized a scheme of disinfection on the whole Serbian railway system. The latter step appears to have been taken in view of the possibility of Allied troops being employed upon the Danube, an idea which receded from the general design, in proportion as the Austro-German recovery in Galicia became more marked. Serbia's negative role during 1915 was due not only to exhaustion but to considerations of high policy. The attitude of Bulgaria was from the first extremely equivocal, and Serbia, had she listened to certain ill-considered pleas for a fresh offensive into Hungary, would have been at any moment liable to an attack from the rear, unless she could rely upon Greece or the Allies to hold Bulgaria in check. Meanwhile the Entente was eagerly working for the intervention of Italy and of Bulgaria, neither of whom could receive adequate satisfaction save at the expense of Serbian aspirations. During the winter pressure was repeatedly brought to bear upon Nish to make territorial concessions to Bulgaria in Macedonia; but the one and only condition upon which Serbia could safely have considered this—namely, that the Allies should guarantee Yugoslav unity in the event of victory—was precluded by their parallel negotiations with Italy, whose official policy it was to prevent, not to further, Yugoslav unity, and to whom by the Treaty of London, concluded on April 26 1915, no less than 700,000 Yugoslavs were assigned. The fact that this treaty's concealment from Serbia was made an absolute condition by Rome, did not tend to diminish the reserve of the Nish Government, who almost immediately learned the essential facts through Mr. Supilo's discoveries in official circles at Petrograd. The Serbs, who were not formally recognized as Allies by the Western Powers, were more conscious than ever of the value to them of the Vardar valley, which would form part of any serious concessions to Bulgaria; and they were from the first sceptical as to the possibility of winning over Bulgaria, whom they believed to be tied to Vienna and Berlin by a secret compact. They were further handicapped by the attitude of Greece, who in the autumn of 1914 exercised her right of veto, under the Serbo-Greek Treaty, upon any cession of territory to Bulgaria and was prepared to demand Monastir as compensation. This attitude could not be ignored at a period when Greece was still ready to intervene on the side

[1] *Serbian Blue Book, Nos. 37 and 43.*
[2] *Russian Orange Book, No. 25,* and *British Diplomatic Correspondence, No. 93.*
[3] *British Diplomatic Correspondence, No. 91.*
[4] *Ibid., Nos. 103 and 110.*
[5] *Die Deutschen Dokumente, No. 482.*

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of the Allies, and when even King Constantine had firmly rejected William II.'s suggestion that he should fall upon Serbia and tear up the Treaty of Bucharest. What changed the views of both Athens and Sofia was simply the unfavourable turn in the military fortunes of the Allies. As long as the Bulgarians thought that the Dardanelles would be forced, their help could probably have been secured in return for the promise of Macedonia and the guarantee of an Allied occupation: what was lacking was the corresponding pledge to Serbia. The conclusion of a Bulgarian loan in Berlin in Feb. was the first sign of a change, and after March neutrality was the best that the Allies could hope for from Bulgaria, though she showed great skill in furthering Bulgarophil illusions in the West. Thus the concrete proposals addressed to Sofia by the Entente on May 29, over Serbia's head, came two months too late. The Radoslavov Cabinet now played for time, and while asking on June 15 for further details, concluded parallel negotiations with Turkey regarding the Thracian railway. On July 18 the official *Narodni Prava* spoke of the impossibility of Bulgaria keeping out of the war, and public opinion freely discussed the rival alternatives. The final reply of the Entente (Aug. 3) offered Bulgaria the "whole uncontested zone" of the treaty of 1913, with immediate occupation as far as the Vardar; discussion even of Skoplje and of the "contested zone" after peace; Seres at once and Kavalla in the future; and the Enos-Midia line in Thrace. The price was to be war upon Turkey. Greece at once protested, and the Emperor William urged his brother-in-law on no account to cede Kavalla. But the decisive factor was the fall of Warsaw on Aug. 8; not only public opinion, but the general staff now regarded Germany's triumph as inevitable. The Turco-Bulgarian agreement was initialed on the very day after the Allied note, and completed at the end of the month, and on Aug. 20 its negotiator, the Germanophil Žekov, replaced Fičco as War Minister. Meanwhile the position of the Pašić Cabinet was extremely delicate. It loyally declined to discuss the indirect overtures made to it from Vienna, and stood officially for the programme of unity: but during the summer, yielding to pressure from the reactionaries in Petrograd, it showed a readiness to limit its claims to the territory generally regarded as purely Orthodox—viz. Banat, Syrmia, Bosnia-Herzegovina and South Dalmatia—and to leave the Catholic Croats and Slovenes to their fate. This scheme would have fitted in with Italian designs and with the Treaty of London, which envisaged three separate Slav States, an enlarged Serbia, an enlarged Montenegro and a reduced Croatia. Its weakness lay in the ignorance of its promoters; for even such a division would have left well over a million Catholics in "Orthodox" Serbia. Its failure, however, was above all due to the vigilance of Mr. Supilo and his colleagues of the Yugoslav committee.

The Conquest of Serbia.—In the late summer the Serbian Government was unduly optimistic as to Greek and Rumanian intervention, and its disbelief in a German invasion was encouraged by Allied military opinion. Only three weeks before Mackensen crossed the Danube, Lord Kitchener, in conversation with a Serbian representative, gave his opinion that any action from the north was mere bluff. Hence though the Skupština on Sept. 5 authorized the Government to make territorial concessions, Pašić adopted a waiting attitude. Bulgaria's mobilization, two days after the opening of the Austro-German bombardment along the river front, proved his calculations to have been correct. Yet even at this moment Allied opinion hoped that Bulgaria might enter on the Entente side, and therefore a veto was imposed upon the Serbian general staff's plan for an immediate attack upon Sofia before the Bulgarian army was ready (Sept. 27). Next day Sir Edward Grey in the House of Commons announced that in the event of Bulgaria's aggression "we are prepared to give to our friends in the Balkans all the support in our power, in the manner that would be most welcome to them, in concert with our Allies, without reserve and without qualification." Relying on the fulfilment of this pledge, the Serbs devoted their main effort to checking the Austro-German advance and remained on the defensive towards Bulgaria. The danger was increased by King Constantine's repudiation of Greece's treaty obligations towards Serbia and the overthrow of Venizelos. That statesman, however, had enquired of the Allies as early as Sept. 23, whether, if Bulgaria declared war on Serbia, and if Greece asked Serbia to supply the 150,000 men stipulated by the Serbo-Greek Treaty for such a contingency, France and Britain would assume Serbia's obligation for her; and an affirmative answer was received within 48 hours. On Oct. 6, the rupture with Bulgaria was complete. The fatal delays in sending the promised troops, coupled with Allied insistence that the Serbs should hold back Mackensen to the last moment, belong to military history; but their results were eminently political. At the critical moment of the Bulgarian menace to the Nish-Salonika railway there were at Salonika not 150,000 Allied troops ready for action, but 35,000 French, and 13,000 British, the latter under strict injunctions from London not to cross the frontier into Serbia.[1] Nish was decorated to welcome Allies who never came. The whole Serbian plan of campaign collapsed, and the armies, losing control of the railway southwards, retired precipitately through the passes leading to the plain of Kosovo. General Sarrail, informed that he must not expect reinforcements, was forced to arrest his belated offensive northwards (Nov. 12) and soon to withdraw to the west of the Vardar. The Serbs were thus cut off from Allied help, lost Skoplje and only just escaped envelopment by the converging Austro-German and Bulgarian armies. The final retreat of the Serbian army and Government took place in the dead of winter across the inhospitable snow mountains of Albania and Montenegro to Scutari, Medua and Durazzo, a smaller section escaping southwards from Prizren and augmenting the Serbian forces south of Monastir. Fortunately, the general exodus of the civilian population was checked before it had gone too far; but the retreat stands out as one of the great tragedies of the war, and the loss of life which it involved must have far exceeded 100,000 and is estimated at twice that number by very sober authorities.[2] After dreadful sufferings the fugitives were conveyed by Allied transports to Corfu, which for the remainder of the war became the seat of the Serbian Government and a base for the convalescence and reorganization of the army. Notable assistance was rendered by British voluntary units, and some idea of the generous response of the British public to Serbia's need may be gathered from the fact that the Serbian Relief Fund from first to last collected over £1,000,000 in money and material, and employed over 700 workers in Serbia, Albania, Corfu, Salonika, Corsica, Biserta and France, while the Scottish Women's Hospitals under Dr. Elsie Inglis performed notable services for the Serbs both on the Balkan and the Russian fronts. The deaths of Mrs. Dearmer, Mrs. Harley (Lord French's sister), Mrs. Haverfield, Dr. Inglis herself and many others set a seal on the new-found friendship of the two nations.

Conquered Serbia was divided for administrative purposes between Austria-Hungary and Bulgaria, the latter holding the Timok, Nish, Skoplje and Macedonia: all that remained to the Serbs was a fragment of territory south of Monastir. Bulgaria now threw off the mask and officially declared the Serbian State to have ceased to exist. It therefore enrolled all men of military age throughout the occupied territory and in Feb. 1917 extended this to include the whole male population. It refused to recognize the Serbian Red Cross and took possession of the Serbian Legation in Sofia. All "ownerless" land was confiscated, all Serbian schools, law courts, and inscriptions were Bulgarized, libraries and collections were either destroyed or removed to Bulgaria, the Serbian clergy were evicted, and there were wholesale deportations. A formidable rising in the mountains behind Kuršumlje (Kurshumlye) was brutally repressed, with over 2,000 executions (March 1917). The war aims now repeatedly avowed by Sofia were the annexation not only of Macedonia, but of Kosovo and Prizren, and the whole upper Morava and Timok valleys: a common frontier with Hungary: the prevention

[1] See Gen. Sarrail, *Mon commandement en Orient*, p. 27.
[2] G. Djurić, in *Royal Statistical Journal*, May 1919.

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of Yugoslav unity and of Russia's acquisition of Constantinople: and (after Rumania's entry) the retention of the whole Dobruja. Dr. Radoslavov more than once proclaimed Bulgaria's resolve to keep all her conquests,[1] and his official organs declared that Serbia's reconstitution, "no matter under what form, would be a perpetual menace to Balkan peace" and will never be permitted.[2] Austria-Hungary showed much greater reserve, airing from time to time various alternative schemes for a vassal Southern Slav State under the Habsburgs, keeping Prince Mirko of Montenegro as a possible candidate for its throne and employing agents in Switzerland to sow dissension among the exiles.

The Serbs in Exile.—Soon after the establishment of the Serbian Government at Corfu party rivalries began to revive. The deputies were scattered, living mostly on the Riviera, an independent press was impossible, and regular Allied subsidies made the Government virtually immune from serious democratic control. The supersession of the Voivode Putnik and almost all his staff caused great indignation, and though the whole Serbian Coalition must bear the responsibility, it was known to be the work of Pašić, and his masterful colleague in the Radical party, Protić, then still out of office. In Aug. 1916 an attempt is alleged to have been made upon the life of the Prince Regent at the front, and the Government, after vainly urging the Skupština to institute a new form of courts-martial, proceeded in the winter—while the joint advance under Sarrail was crowned by the capture of Monastir from the Bulgarians—to order numerous arrests on a charge of conspiracy and murder. Among those implicated were the late governor of Macedonia, Gen. Popović, the ex-War Minister Gen. Bojanović, and several distinguished staff officers: many line officers known for their gallantry were placed on the retired list or confined to the island at Corfu.

The Conspiracy Trial which opened in Salonika in Jan. 1917 and was conducted behind the shelter of a strict military censorship, resulted in a death sentence upon nine Serbian officers, and notably of Col. Dimitrijević, the head of a secret society known as "Union or Death," or more colloquially the Black Hand, whose chief aim had been to fan nationalist sentiments in the army. There is no doubt that "Apis," as Dimitrijević was called throughout the Slavonic South, interfered unwarrantably in politics, and it is probable that he had his hand in the Sarajevo murder; but the lack of convincing evidence for the alleged conspiracy makes it probable that he was the victim of rival military and political cliques. Strong pressure of the Old Radical leaders forced the Prince Regent to sign three death warrants and to disregard appeals for mercy from the Western capitals. This trial revived all the old party dissensions: the reactionaries had triumphed on the very eve of the collapse of their chief support, the Tsarist Government. Pašić found himself between two fires—the need for a more democratic restatement of foreign policy, and the demand of the young Radical and Progressive parties for a revision of the Salonika trial. Refusal led to their withdrawal from the Cabinet, and its reconstruction on a purely Old Radical basis under Pašić and Protić. The last occasion when all parties coöperated was on July 20 1917, when the Declaration of Corfu, drawn up between Dr. Trumbić for the Yugoslav committee and Pašić for the Serbian Government, met with unanimous approval. Pašić, having strengthened his position abroad by a visit to Paris and London, declined to convoke Parliament for four months after the legal period had expired. At last, as the result of a direct appeal of its President to the Crown, it met in Corfu on Feb. 12 1918; and the Government resigned, but after weeks of fruitless negotiation for a coalition ministry, was allowed to resume office. The Opposition, which numbered 60 as against 64 Old Radicals, still insisted on the revision of the trial and the transference of foreign affairs from Pašić to their own candidate Drašković; and in April, when the budget was introduced, they withdrew in a body from the Chamber, thus leaving the Government without the quorum of 84 required by the Serbian Constitution. Serbian public opinion was too scattered and disorganized to be effective, and the Corfu Government tried to discredit its opponents' action before the uninformed West, as defeatist or even Austrophil. Thus throughout the spring and summer of 1918 there was acute and growing tension among the rival Serbian groups, and the real initiative in the Yugoslav question and in the political campaign against Austria-Hungary, had passed to Trumbić, Beneš, Lansing and the Allies and to the leaders of the movement inside the Dual Monarchy. Pašić had reverted to his Pan-Serb attitude, opposed inclusion of Dr. Trumbić in a Yugoslav and no longer purely Serb Cabinet, and steadily obstructed the Yugoslav committee's work. There was, moreover, a certain section in the army which aimed at Serbia's military occupation and annexation of Habsburg territory, rather than a free union on equal terms. Fortunately all such ideas were absent from the mind of Voivode Mišić, whose comprehension of the issues at stake was illustrated by his special encouragement of the Yugoslav volunteers and by his signal tact in dealing with the newly constituted Government in Zagreb. Events, moreover, favoured union on terms of full equality; for Austria-Hungary had ceased to exist and her authority had been shaken off by all her Yugoslav subjects long before the Serbian army in its northward advance had even reached Belgrade. Any slight possibilities of initial friction were averted by Italy's action in advancing beyond the Armistice line; the whole Croat and Slovene population thus clamoured for the arrival of the Serbian army and received it everywhere as their liberator from Habsburg rule and their champion in the complications which then seemed imminent. (For the completion of national unity, *see* YUGOSLAVIA.)

[1] *e.g.* in *Vossiche Zeitung*, Oct. 10 1916.
[2] *e.g.* *Narodni Prava*, May 19, *Kambana*, Oct. 9 1916.

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SERBIAN CAMPAIGNS.—Although the Balkan area developed into one of the side-shows of the World War, it was there that it started in 1914 with the ultimatum of Austria-Hungary to Serbia. The 1914 operations and the conquest of Serbia in 1915 are narrated in separate sections below. Under SALONIKA CAMPAIGNS an account is given separately of the Allied operations on the southern Serbian front, 1915–8.

I. OPERATIONS IN 1914

The Austro-Hungarian military problem in starting a campaign against Serbia was complicated by the prospect of a Russian intervention in Galicia. The alternatives were: to defeat Serbia completely before the Russian threat became deadly, or to stand on the defensive against Serbia till after a great battle had decided the issue in Galicia.

The strategic geography of Serbia was, in its broad lines, simple. On the N. side there is the formidable obstacle of the

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Danube and Sava, on the W. the line of the Drina, a river not very broad, but rapid and difficult to bridge, these rivers forming the actual frontier.[1] Initially then the assailant must begin by forcing a river barrier, whatever the direction of his advance, and his power to do so depended: (*a*) on the communications on his own side of the river, which would enable him to collect the troops and material for forcing the passage; (*b*) on the barrier itself; and (*c*) on the defensive positions available for the Serbs inside the barrier. Taking all these factors together, an attack on the northern barrier offered the best chances of success. It was the course chosen by Prince Eugene in 1717 and by Mackensen in 1916, and it was that which the Serbs themselves regarded as most likely to be taken in August 1914. The reasons which led the Austrian commander to choose differently will be considered presently. More important than the choice of a point at which the barriers could most easily be forced was the choice of a direction for the subsequent advance. The objectives were plain enough, the defeat of the Serbian field army and the occupation of the most important part of the country. Without the attainment of these objectives, Austria could not pretend to have conquered, or even to have defeated, Serbia. Both, however, were attainable by an invasion of the Belgrade–Pozharevats–Kraguyevats–Krushevats region, conventionally called the Morava valley. This was the richest part of the country, and the centre of all its communications. Here and here only could the Serbian army be definitely brought to action under conditions in which the Austrian superiority of numbers would be effective.

This region could be approached from the N. (Belgrade or Danube–Pozharevats front), from the N.W. (Sava and Lower Drina front), from the W. (Middle Drina front) or from the S.W. (Upper Drina front).[2] The first named was the most direct route. For the forcing of the Danube[3] five railheads on the Hungarian side were available, for the prosecution of the advance the Orient railway (Belgrade–Constantinople) and various branches of it. The country was rich in local supplies, populous, and relatively well provided with roads, and the general trend of the natural features, governing that of the lines of communication, was from N. to S. On the other hand, the defender would of course be best prepared for attack on this front, and the Danube obstacle was here most difficult to overcome, in spite of the command of the water ensured by the Austrian monitors.[4] Next in importance were the lines of advance from the Sava and Lower Drina, and especially those from the Sava, since the Drina valley was totally destitute of railway approaches on the Hungarian side. In the angle of the Sava and Drina lies the fertile plain of the Machva; many favourable points exist on the Sava for the forcing of a crossing, and the town of Shabats in particular offers a choice of tolerable roads leading S. to the slopes of the Tser (Cer) range S.W. to Valyevo, and W. to Arangyelovats, the last-named route conducting an invader to either Palanka or Kraguyevats in the Morava region. In conjunction with such an advance, an operation on the left, over the Lower Kolubara, supplied from the Sava, would lead to the rear of Belgrade, while on the other flank a successful operation by troops organized for mountain warfare by Valyevo over the Kolubara and Rudnik ranges to Gorni Milanovats and Chachak would threaten the rear of the whole Morava region. As a way of turning the great obstacle of the Danube front, the lines of advance grouped on the axis Shabats–Arangyelovats possessed tempting advantages. But, considered from the point of view of supply, the disadvantages were very serious. Not only was this the longest route between the railheads of deployment and the final objective, but it was destitute of railways[5] E. of the Kolubara. West of that river, indeed, the line Valyevo–Arangyelovats–Palanka lay in the very axis of the march, and a branch-line connected this with Obrenovats on the Sava, where water-borne supplies could be unloaded. But the barrier of the Kolubara and the ridge behind it had to be mastered before this branch could be used, and it was certain that the Serbs could assemble in time to fight on the Kolubara line if not W. of it. That is, from deployment to the first great battle the campaign would have to be carried out with road transport, and in the case of the rightmost routes (axis Valyevo–Chachak) pack transport only.

From the Middle Drina (Lyeshnitsa–Lyuboviya front) all routes converge on Valyevo, at the head of the Kolubara. Thence operations towards Arangyelovats, Gorni Milanovats and Chachak would take the course already discussed. But up to Valyevo operations would lie wholly in mountainous country[6] and would depend for supply almost entirely on pack transport from distant railheads—for in Bosnia the railways come to an end 25–27 m. W. of the Drina, and from that river to Valyevo is a further 32 miles. All arguments against the choice of the Shabats route therefore applied with far greater force to the Valyevo route. Farther S., in the region of Vishegrad, operations into Old Serbia by way of Uzhitse might gain a footing, or help a Valyevo force to gain a footing, at Chachak. But such operations would be mountain warfare pure and simple. Although in this part the railway runs right up to the frontier, no body of troops large enough to deal with the Serbian army could be collected and fed in the upper valley of the western Morava, either by way of Uzhitse or by way of Valyevo. As a threat to the flank and rear of a beaten Serbian army retreating up the Morava valley, such manœuvres might be effective; but to the beating of that army they could contribute practically nothing. Operations from Vishegrad into New Serbia would be too eccentric to have the slightest influence upon the conflict of armies in the Morava valley, and the same would apply to operations from Focha or from the Herzegovina against Montenegro, supposing that state to join Serbia in resisting the Austrian advance. Operations in this quarter would be scarcely more than guerrilla.

On a review of the conditions, then, the most logical plan of campaign from the Austrian point of view would be a frontal operation S. from the Danube front, coupled with an enveloping movement from the Sava (or Sava–Lower Drina) front directed on Arangyelovats, the latter either preceding the other by some days and seeking to surprise possession of the Kolubara ridge, or following it and directed to the flank and rear of an ascertained position of the enemy. Loosely connected with these main operations an advance from the Middle Drina or Vishegrad or both on Chachak and the western Morava had advantages for the exploitation of victory, but not for the winning of it. Such a plan was proposed before the war in the Austrian staff, and practically the same plan was assumed by the Serbians as the basis of their defensive deployment. Whether any or all of these operations could be carried through before the Russians intervened, or before their intervention became dangerous, would depend on available time. If no time at all were available, a pure defensive was the only course. If time for a thorough conquest, all the operations above mentioned with proper proportioning of strength would contribute something to a decisive success. In any intermediate conditions, one or more of the subsidiary operations would be omitted from the plan, and, especially, if a minimum time were available only the direct S. attack from the Danube front would be admissible, with or without a collateral attempt by light forces from Shabats or Obrenovats to seize the Kolubara ridge.

The calculation of this available time depended principally upon the arrangements made between the Austrian and the German staffs for initial operations in Poland, Galicia and E. Prussia. For this a plan had been drawn up by Conrad von Hötzendorf and Moltke in consultation; and, on the basis of this plan,

[1] In its upper course the Drina passes inside the Austrian frontier, and direct advance into Serbia is therefore possible from the region of Vishegrad. But this roadless, mountainous region is quite unfitted for the movements of large forces.

[2] Attack from the stretch of the Danube front lying in the mountains between Welsskirchen and the Iron Gates was regarded by both sides as outside the limits of probability.

[3] The lowest reaches of the Sava are usually considered as belonging to this front.

[4] Six in number, armed with 4·7-in. guns, and armoured.

[5] The small line connecting Shabats with Loznitsa was of no importance except in the case of stabilized trench warfare in the Machva.

[6] Even the Yadar valley road was in many places unsuitable for wheeled transport.

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the scheme of operations adopted against Serbia was apparently the full scheme outlined above; concentric advance from all the fronts in varying strengths and at various dates. Nearly half the army was placed in position for this advance, and the Austrian supreme headquarters intended to conduct the campaign itself. But at the last moment, it is asserted, the Germans, rightly or wrongly, changed their minds, the allies' scheme for Poland and Galicia fell to pieces, and, in trying to adapt their plans to the new conditions, the Austrians threw their S.E. forces into confusion before they had even deployed. The responsibility for a grave initial blunder, then, lies ultimately with Moltke, if he failed to keep his promise, or with Conrad, if he interpreted a mere interchange of views as a binding engagement. In any case the effect was to withdraw the forces on the San–Danube front to another theatre amid the battle for the river crossings.

The Yadar Campaign.—The deployment, carried out according to the original scheme,[1] in spite of the fact that, at some date not yet known, it had been decided to make a radical alteration, was as follows:—

II. Army.—General of Cavalry Böhm-Ermolli on the Danube–Sava front from Weisskirchen to Mitrowitz (Mitrovicza). Left to right—VII. Corps (34th and 17th Divs.); 7th Div.; IV. Corps (32nd and 31st Divs.); IX. Corps (29th Div. only); 10th Cavalry Division. In reserve 23rd Honved Division. Total: 131 battalions, 42 squadrons, 56 batteries.

V. Army.—General of Infantry Liborius von Frank. On the Lower Drina from mouth to Lyuboviya, and left to right—VIII. Corps (9th Div., 21st Landwehr Div. and combined brigade); XIII. Corps (36th Div., 42nd Honved Div., one brigade, one mountain brigade). Total: 79 battalions, 15 squadrons, 39 batteries.

VI. Army.—Feldzeugmeister Potiorek. Vishegrad-Focha region, left to right—XV. Corps (1st and 48th Div. staffs with 4 mountain brigades); XIV. Corps (18th Div. staff and 6 mountain brigades); in reserve 40th Honved Division. Detached, facing Montenegro, 47th Div. and 3rd Mountain Brigade. Total: 74 battalions, 5 squadrons, 40 batteries.

Each army had in addition one Landsturm brigade and the V. and II. one to three "march" (*i.e.*, reinforcement) brigades.

Of these forces the II. Army was withdrawn on Aug. 14,[2] leaving the others in full battle on the Drina. That this battle was in being, however, was due not to Conrad, who—naturally, under the changed conditions—ordered the "Balkan Forces" to stand on the defensive, but to "*Feldzeugmeister*" Potiorek, commander-in-chief as well as commander of the VI. Army. This officer, high in favour at Court, had been for some years viceroy in Bosnia-Herzegovina, and regarded the problem from the standpoint of the Sarajevo residency rather than from that of a military headquarters faced with a military problem. He saw above everything else the possibility of the Serbians advancing over the Drina to excite insurrection among their brothers and cousins, although there was nothing in the layout of the Serbian deployment to suggest this, and he not only kept the centre of gravity of the forces on the Drina, but, on his own responsibility, launched a "preventive" offensive on this unfavourable front.

On the Serbian side, general mobilization had been ordered on July 25, months since the demobilization that marked the end of the Balkan Wars. Of a population of about 3,100,000 in Old Serbia and about 1,800,000 in New Serbia (where there had been no time to set up the administrative machinery of conscription), 489,500 men were mobilized at the outset and some 43,000 more between August and September.

On Aug. 5 1914 Montenegro declared war on Austria-Hungary. Her forces amounted to about 50,000 militia with very little artillery, and were of no direct assistance to Serbia. But they occupied the attention of three mountain brigades of the enemy's army and, what was perhaps more important, they added considerably to Potiorek's politico-military anxieties.

Strategically, there were three possible courses open to the Serbs: the defensive in their own country, the offensive W. into Bosnia, Herzegovina and Croatia, and the offensive N. into Hungary; but the first course was the only one practicable. An offensive into Bosnia, even with Montenegrin aid, could only have succeeded if the populations there had been ready to rise at the first signal, which they were not. Politically, it would have played into the hands of the enemy by showing the world that Austria's fear of Serbian ambitions had been justifiable. Militarily, an offensive over the Drina presented the same supply difficulties in either direction. An offensive into Hungary, whether to the right or left of the Danube, must begin with the forcing of the Danube or the Sava, and in view of the disproportion between the opposed forces had no chance of success unless the bulk of the Austro-Hungarian army were at the same time closely engaged in Galicia and Poland. In the initial stages of the operations at any rate, therefore, such a movement was out of the question.

The strategy adopted was, therefore, purely defensive, in spite of the offensive victories of 1912–3 and the mania for the offensive at all costs and in all conditions which then pervaded almost every army in Europe.

The order of battle was as follows, the Crown Prince Alexander being commander-in-chief, and Voivode R. Putnik chief-of-staff, with headquarters at Kraguyevats:—

I. Army.—General Boyovich. Divisions Timok I., Timok II., Morava II., Danube II., 52 battalions, 7 squadrons, 26 batteries: approximate strength 55,000, grouped about Palanka and Racha and Topola.

II. Army.—General Stepanovich. Divisions Shumaja I., Morava I., Danube I., and "Combined Division." 64 battalions, 10 squadrons, 33 batteries, about 71,000 men. Grouped about Arangyelovats, Lazarevats, Belgrade.

III. Army.—General Yurichich-Stürm. Divisions Drina I., Drina II., 28 battalions, 5 squadrons, 16 batteries, about 32,000. Grouped around Valyevo.

Uzhitse Army.—General Boyanovich. Division Shumaja II., Uzhitse Brigade, 24 battalions, 2 squadrons, 11 batteries, about 26,000. Grouped at Uzhitse and Bainabashta.

Independent Cavalry Division.—Sixteen squadrons, one battery, about 3,000 concentrated at Ub.

Belgrade Group.—About 9 battalions, 2 squadrons, 10 batteries.

Obrenovats Group.—About 11 battalions, 5½ batteries.

Other frontier troops, in all about 25 battalions, 13 batteries.

In infantry, therefore, the Serbians had about 213 battalions to pit against the 272 of the enemy's II., V. and VI. Armies. On the other hand, nine out of ten of the men in these 213 battalions had fought in the wars of 1912–3. In artillery the opposed forces were nearly equal, about 110 Serbian to about 130 Austro-Hungarian; three-quarters of the Serbian guns were of a better model than the Austrian, and some heavy artillery was available. On the other hand, the equipment of the Austrians and their resources in ammunition and stores were much superior, for Serbia was nearly isolated, the one available arsenal was small, and stocks depleted in the Balkan Wars had not been made good.

In sum, then, it would appear that the Austrian expeditionary force—even counting the II. Army which appeared only to be withdrawn, and the III. Corps which did not appear at all—was none too strong for the defeat of the Serbian field army, let alone its destruction. And as soon as it had been decided to withdraw the II. Army, replacing it by a mere screen along the Danube, it was or should have been obvious that the 141 battalions, 17 squadrons and 70 batteries of the V. and VI. Armies were far too weak a force to attempt an offensive into difficult country held by superior numbers of well-trained and war-experienced troops. Potiorek, however, decided otherwise.

From July 26 to August 11 only minor incidents took place—bombardments of Belgrade and other places by the monitors, raids over the river for reconnaissance purposes. Then, on the night of August 11–12, the Austrian main bodies began to cross on a wide front at Drenovats (near Shabats) on the Sava, several points between Lyeshnitsa and Loznitsa on the Lower Drina, and Zvornik and Lyuboviya on the Middle Drina. On the 12th the frontier troops of the Drina defence were pushed back concentrically in the general direction of Valyevo, those of the Sava defence driven out of Shabats. E. of that point the II. Army, under orders for Galicia, remained inactive except for the seizure of Gipsy Island (Ostrovo Tsiganlya) close above Belgrade, while in and S. of the Vishegrad region the XV. and XVI. Austrian

[1] The III. Corps (6th and 28th Divs., 22nd Landwehr Div.), however, which mobilized with the other seven corps, did not proceed to the Serbian front, but was dispatched to the Dniester at once

[2] It arrived in Galicia too late for the crisis there.

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corps were preoccupied by the activity of the Uzhitse army,[1] and the Montenegrins.[2]

During the 12th and following days the Serbian headquarters became convinced that nothing was likely to come from the Danube front, and shifted the centre of gravity of their forces towards the Upper Kolubara. The calvary division at Ub was ordered to reconnoitre towards Shabats and to separate the Shabats column of the enemy from the Drina columns. The II. Army was to push the right wing (Shumaja I.) against Shabats, and its centre and left along the Tser and Iverak ridges and the Yadar valley in conjunction with the III. Army, which concentrated forward from Valyevo to Zavlaka and Krupany to support its retiring outposts. The I. Army was to take over the whole northern front as far as Obrenovats. The Danube 1st Div. was transferred to it, the II. Army receiving Timok I. in exchange.[3] These movements, in spite of forced marching, took time, and but for the difficulties which at once arose in the Austrian army—the V. Army had only wheeled transport—so forward a concentration would have been impossible. As it was, the dispositions were practically realized by the night of Aug. 15–16, when the battle proper opened with the Austrians on the front Shabats–Slepcevish (elements of IV. Corps, and 29th Div., X. Corps, both of II. Army); Bela Reka–Tser plateau and Lyeshnitsa valley (VIII. Corps); Iverak ridge and Yadar valley W. of Yarebitse (36th Div., XIII. Corps); W. of Krupany and N.E. of Lyuboviya (remainder of XIII. Corps).

During the night and the day following there was heavy fighting on this line. The Serbian cavalry division, supported by Shumaja I. of the II. Army, pushed up to and towards the left of the positions of the Austrians about Shabats. The II. Army arrived in sufficient strength to hold a line on Tser, in the Lyeshnitsa valley, and on Iverak, in touch with the right of the III. Army W. of Yarebitse. But the centre and especially the left of that army retired under severe pressure from the Austrians (right of XIII. Corps) who, in this case equipped for mountain warfare, were able to capture Krupany and enforce the swinging-back of the whole Serbian left wing. Yarebitse was given up and, pivoting on the right of the II. Army, the remainder of that army and the III. took up new positions in an arc about Zavlaka (night of 16–17th).

On the 17th the Serbian cavalry spread over the Machva, intercepting communications between the Austrian Shabats force and the columns working along Tser plateau.[4] But Shumaja I., advancing from the S. on Shabats, was arrested by entrenched infantry some 3 m. short of its objective. The II. Army on Tser and Iverak and the right of the III. Army in the Yadar valley maintained an unbroken front, and on Tser in particular carried out counter-attacks, but the continued pressure from the S.W. on the centre and left of the III. Army compelled a further retreat. Here the situation was becoming critical, the Austrian 42nd Div. threatening to seize the Valyevo road to Osechina behind the Serbian positions, while farther to the S.E. only third-ban troops stood between the Austrian mountain brigades and the Petska–Valyevo road.[5]

On the 18th the fighting continued in front of Shabats, and Shumaja I. drew back to Slatina, while the cavalry division, meeting the Austrian 21st Landwehr Div. about Lipolist, fell back to concentrate in line between Shumaja I. and the Tser ridge. On Tser and Iverak the day was a repetition of the 17th, with more pronounced counter-attacks on the front of the defence. On the right of the II. Army the strong position of Kozaningrad on Tser was stormed and held, in spite of the fact that reserves had been given up to strengthen the III. Army. On the critical wing of that army also the day was rather more favourable,—thanks to the arrival of the II. Army reserves alluded to above, which by counter-attacks prevented an imminent breach in the centre of the III. Army, now E. of Zavlaka, in the Yadar valley. Farther to the S.W., little ground was gained by the Austrian mountain troops, the Serbians still holding Rozan and Proslop at night.

The 19th was destined to be the critical day. On the Serbian right, the Austrian Shabats force, now superior in numbers to Shumaja I., took the offensive and drove back the Serbs to the river Dobrava, while the 21st Landwehr Div. from Lipolist pressed back the cavalry division a short distance. On the left of the general front, the III. Army and the left of the II. lost ground, both in the Yadar valley and on the extreme left where Rozan and Proslop and even Petska fell into the enemy's hands.

But in the centre, on Tser and Iverak, a definite change in the situation set in. Freed by the capture of Kozaningrad on the previous day, the Serbian "Combined" division on Tser pushed ahead rapidly along the ridge, although with every advance it was more and more ahead of the troops on either flank. This success not only imposed caution on the assailants of the cavalry division on the Machva plain, but, what was of decisive importance, brought them into positions overlooking the Lyeshnitsa valley. Threatened in rear, and with their wheeled transport exposed to capture, the Austrians began to fall back not only in that valley but also on Iverak before Morava I., and General Stepanovich decided to ignore the grave position of affairs on his left and force victory in the Yadar valley. The "Combined" division and Morava I., therefore, always echeloned from right to left, drove along Tser and Iverak, Timok I. in the Yadar valley conforming. The battle of the Yadar was decided.

On the 20th the drive along the ridges was accentuated more and more, and the Austrians fought no longer for victory, but for escape. So vigorous was the pursuit on Tser that a part of the "Combined" division outran all support and barely escaped destruction in the rear of the enemy's lines. Both along Tser and along Iverak, artillery was, with great efforts, pushed up behind the advancing infantry to shell the valleys below. In the Yadar valley Yarebitse was captured by 10 A.M. and the general pursuit ended near the Drina the same evening. The right wing of the Austrians, less hard pressed and better organized for movement in rough country, retired in good order. Morava II., from Valyevo, only reached Krupany on the 21st. No attempt was made, however, by the Austrians either on the Lower or the

[1] On Aug. 2–4, Serbian forces captured Uvats, Rudo and Ustivar, and raided the Drina immediately below Vishegrad. Other raids were pushed, with Montenegrin coöperation, over the Metalka Saddle on Chaynicha (Čajniče), and towards Focha. On the 7th an Austrian advance from Vishegrad on Gradishte was checked by the Serbians. On the 16th a Serbian attempt to capture Vishegrad by forces from Uvats, Gradishte and the hills to the N.E. was repulsed. The Austrian XV. and XVI. Corps at the same time took the offensive on the front Vishegrad–Chaynicha. While the left flank was being cleared by sharp mountain fighting (19th) about Chelebish (S.E. of Focha), the Chaynicha force crossed the Metalka Saddle and moved on Plevlye, Priyepolye, while the Rudo troops on the left forced the Serbian positions on the Lim at Uvats and Priboy (20th–22nd) and the Vishegrad troops repulsed a second attack on their stronghold (20th–21st). But at this moment the collapse of the main offensive on the Drina compelled the Austrians to retreat to Vishegrad and Focha, whither they were followed by the Uzhitse army and the Montenegrin Plevlye group.

[2] On Aug. 7–11 Montenegrin forces raided Artovatz on the Gatsko road and Klobuchi on the Trbinye road. Cattaro was intermittently bombarded, and Budua raided, from Mount Lovchen. These raids were repelled by the Austrian 3rd Mountain Brigade and 47th Division. But on Aug. 15 the main body of the Montenegrins appeared before Bilek (Bileva) which they blockaded for some time. On the 25th–26th, however, a northward sortie of the garrison, coupled with a southward advance of the 3rd Mountain Brigade from Gatsko, caused the Montenegrins to give up the blockade, and on Aug. 30–Sept. 2, forces from Trbinye coöperating, the 3rd Mountain Brigade and the Bilek force drove back the invaders into their own territory. A threat to the Montenegrin rear by part of the 3rd Mountain Brigade which advanced from Gatsko S.E. to Visznitsa Do largely contributed to the result.

[3] This distant division seems to have reached the front on the 18th.

[4] The Austro-Hungarian force at Shabats was limited to pure self-defence by orders of the army command which was preparing for the move to Galicia. After crossing on the 12th, it was actually withdrawn again on the 14th, leaving only outposts on the hostile bank. At Potiorek's request, however, the 29th Div. was again sent over the river on or about the 17th.

[5] So serious was the situation that already on the 16th G.H.Q. had ordered Morava II. of the I. Army, hitherto posted about Lazarevats to meet a possible attack by Obrenovats, to move by forced marches to a position astride the Petska–Valyevo road. The division reached this position on the 18th.

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Middle Drina to keep a foothold on the right hand, and on the 22nd the whole river front was again occupied by the Serbians.

Meanwhile the troops of the Austrian II. Army had ceased to press Shumaja I. on the line of the Dobrava, and begun to fall back on Shabats, and the 21st Landwehr Div. in the plain likewise retreated on the Drina, followed by the Serbian cavalry division which gleaned prisoners, guns and vehicles. On Aug. 21–22, Shumaja I., reinforced by troops from Tser on its left, and also by Timok II. from the I. Army, advanced from the S.E., S., and S.W. on Shabats, held by elements of the IV. Corps and by the 29th Div., under the command of General Tersztyanski. On the 23rd sharp counter-strokes were made by the Austrians to hold off pressure on their river flank. Only rear-guards remained in Shabats when the Serbs attacked on the 24th.

So ended the first invasion of Serbia. The principal reason for its failure was the Austrian commander-in-chief's undervaluation of the military, and overvaluation of the political, factors with which he had to deal. Neither on the part of the Higher Command nor on the part of the Court was pressure brought to bear on him. Nor, after the event, did he attempt to find scapegoats among his subordinates. What he did, he did in the exercise of unfettered judgment. But history will not regard this judgment as of a high order. To hurry[1] on an offensive in mountainous country, from a starting-point at a maximum distance from the strategically decisive point, with three armies equipped in the main for warfare in the plains, of which one was under orders for another theatre, is so astonishing a proceeding that it can only be assumed that the campaign was never intended to be more than a demonstration of activity, analogous to a punitive march up some valley of the Indian frontier region. And indeed, Potiorek's position as civil and military commander of a rough frontier region has been very aptly compared to that of an Indian viceroy. Regarded from this standpoint, the advance over the Drina is an operation differing in degree only from the advance of the XV. and XVI. Corps on the Lim or that of the 3rd Mountain Brigade into the fastnesses S.E. of Gatsko. And in such an operation the assistance of the II. Army might no doubt be dispensed with. But if the ground of justification be thus shifted, the basis of criticism is shifted also, and in that case what is to be said of a modern European commander-in-chief who thought that an organized army of 11 strong divisions, recently victorious in two campaigns over other organized armies, could be treated as though it were on the military-technical level of a frontier tribe? Actually, it appears that the astonishment and dismay of the commanders, from army down to and below division commanders, at the incomprehensible sequence of events was no small factor in the issue.

Of the conduct of operations on the Serbian side it need only be said that Putnik's management of his forces in space and time, and the choice of the moment and place of counter-attack, were masterly. To gain great results, the risks of a forward concentration were accepted, but always under such conditions that the chances and profits of success were greater than the chances and losses of defeat. The object was limited, but its attainment complete without remainder.

At the same time, in this as in many other instances, the idea of a limitation of objective has been criticised *per se*. Only a detailed reconstruction of the conditions at the moment of the counter-offensive would make a final judgment to be formed on the question in the present case; and for that the materials not only have not been published but are probably not even in existence, since the bulk of the Serbian archives were destroyed in the autumn of 1915. But this much may be said, that the Serbians were, in point of ammunition and transport, ill-equipped for a great strategic pursuit either into Bosnia or into Hungary, that the great battle in Galicia was only just opening, and its consequences could scarcely be foreseen, and that the strain of the forced marches imposed by the forward concentration, followed by that of hill fighting, had told heavily on the victors.

The Syrmian Operation and the Massed Austro-Hungarian Attack.—The Yadar and Shabats operations closed, then, on the river line, but meanwhile no events had taken place on the front E. of Obrenovats, and the Austro-Hungarians were palpably withdrawing forces by all railheads between Weisskirchen and Mitrovitsa, and after a short rest the Serbian command decided to push an offensive over the Sava into Syrmia (Srem), the subdistrict of Hungary lying in the angle between the Sava and Danube. In this region were three of the six railheads at the enemy's disposal and an important lateral line. Its occupation would therefore thrust back the line of deployment of any future attack from the N., and the new front to be held defensively at the further limit of the occupied area would lie in and across the Fruska mountain range (the Mitrovitsa–Peterwardein), and thence along a part of the Danube which was exceptionally strong as an obstacle—owing to the marshes and channels at the confluence of the Theiss—to Semlin and the old Danube front. This gained, it would be possible to embark upon an invasion of Bosnia without fear of a sudden attack in flank and rear.

As early as the 26th, two days after the reconquest of Shabats, Putnik issued general instructions regrouping the army for the new project. The II. Army (now to consist of Morava I., Timok I., Timok II., and "Combined" divisions) was to occupy and defend the Lower Drina to Lyeshnitsa exclusive. The III. Army (Drina I., Drina II., Morava II.) was to hold from Lyeshnitsa inclusive to Zvornik. A special detachment, reporting directly to G.H.Q., was to hold the crossings below and at Lyuboviya. The I. Army (Shumaja I., Danube I., cavalry division) was to assemble towards Shabats and prepare to force a passage into Syrmia. The Belgrade and Pozharevats groups were to continue in their defensive missions, the former to be prepared to coöperate with the I. Army in the capture of Semlin, the latter to dispatch its principal formation, Danube II., to Obrenovats for Sept. 9. The Uzhitse Army was to continue its mountain offensive towards Vishegrad, in concert with the Montenegrin Plevlye group. The date of the Sava crossing was to be ordered by G.H.Q., and meanwhile the II. and IV. Armies were instructed to reconnoitre crossing places on the Drina line, and to obtain all possible intelligence as to the condition of the enemy in their front.

A pause followed, while the preliminary work was being carried out and the I. Army being marched over from the Morava valley. The enemy was occupied with reorganization, and with the reliefs and takings-over consequent on the withdrawal of the II. Army. On the whole northern front there remained one post-line division only, the 29th; along the rivers themselves were Landsturm formations. Yet Potiorek was in fact contemplating a new thrust on the Drina; and the 29th Div. was ordered to be ready to coöperate by forcing a passage of the Sava at Yarak. Thus it befell that the division was grouped between Huma, Yarak and Nikinci when the Serbian offensive was launched. Apart from it, there were no formations in Syrmia other than the regiments holding the thin surveillance line.

On Sept. 3 General Krauss, commanding the 29th A.H. Div., received word that the Serbs intended to force the passage of the Sava below Mitrovitsa. This report he more than half-disbelieved, and in any case, regarding Mitrovitsa–Yarak as the centre of gravity of the Serbian offensive into Syrmia, he was content to leave his forces grouped as they were for Potiorek's intended advance. This was to take place on the 7th, and for it the 7th Inf. Div. was added to Krauss's command, henceforward known as the "Combined Corps Krauss."

On the night of Sept. 5–6, the Serbian preparations being complete, the passage was forced in two places, between Mitrovitsa and Yarak by Timok I. of the II. Army, and at the Kupinovo loop by the I. Army. The former, intended more as a demonstration than an operative crossing, was successfully achieved, but the eager troops pressed on without making a bridgehead, fell into the midst of Krauss's troops and, driven back on the river, were overwhelmed in the attempt to recross, five battalions being completely destroyed.

The Kupinovo division, on the other hand, secured their position with a bridgehead line before pushing on. Fortune favoured them, too, for the defence here consisted of Landsturm forces

[1] The Commander of the V. Army, von Frank, protested against this hurry, and only submitted to a formal order.

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directed by a headquarters at Peterwardein, and Krauss, bound to Yarak by his orders to coöperate in Potiorek's Drina offensive which had not been cancelled, only sent his newly arriving 7th Div., piecemeal, to assist the Landsturm in holding the Syrmian plain. This was, of course, unknown to the Serbian I. Army, which developed its advance cautiously across the plain and by the night of the 8th occupied a front from Platicheno near Klenak by Brestac round to Progar. In the next days, the left stood almost fast while the right pushed out, cleared a passage for the troops at Obrenovats, and by a threat to the rear of Semlin forced the enemy to give up that place to the Belgrade forces. Lastly, the right of the line swung up with its flank on the Danube and its centre on Gorubintsi; the intention was to bring this right wing by a wheel into the W. part of the Fruska range and so to make good the line across that range from river to river which was the objective, without losing men in a frontal battle against the enemy's strong forces about Huma and Mitrovitsa. For three more days it was persisted in, then on the evening of Sept. 11, owing to the situation of affairs on the Drina front, it was given up. On the 12th, 13th and 14th a methodical retreat, with which Krauss's 29th Div., though released at last from Mitrovitsa–Yarak, was unable to interfere seriously, brought the Serbian I. Army and Belgrade and Obrenovats forces back to their original positions whence the field divisions were hurried with all speed to take part in the new battle of the Drina.

Potiorek's second offensive had opened on the night of Sept. 7–8. The VIII. Corps (with which originally the 29th Div. was to have coöperated) bordered the Lower Drina as far up as Biyelyina. the XIII. from that point to Kozluk, the XV. thence to Zvornik, and finally the major part of the XVI. corps opposite Lyuboviya, the remainder, as in the previous phase, facing the Uzhitse Army and the Montenegrins. The Serbs were, as the result of the Yadar operations and the proposed offensive into Bosnia, deployed in strength, and this, on the one hand, increased the probability of repulsing any given attempt, but on the other made it more difficult to deal with any break-through that might actually occur, as the defence system lacked depth.

The attack began with the VIII. Corps. Here it only succeeded in establishing a bridgehead in the N.W. corner of the Machva, covering temporary bridges at Parashnitsa; and the expected coöperative attempt of the 29th Div. at Yarak was not made, as, by the date fixed for this coöperation (the 9th), Krauss had concluded that the failure of the VIII. Corps was too clear, and the situation in Syrmia too critical to allow it.

But farther S., on the front of the XV. Austrian Corps and the right of the XIII., the Serbians' III. Army had more difficult conditions for defence, and on the night of Sept. 8–9 the passage was forced first at Brasinski Han and then at Zvornik. Crossings followed at other points farther up as far as Lyuboviya. The Serbs were forced back to the Guchevo–Boranya–Yagodnya ridge.

By the 11th the situation on this wing was serious enough for the Serbian command to order the cessation of the Syrmian offensive and the transfer of the I. Army with all possible speed to the region of Valyevo–Petska.

Meanwhile, local reserves gathered from behind the centre had been dispatched to establish a front Yagodnya–Brankovac–Rozani–Proslop. Behind this line, the reassembly of the I. Army about Valyevo was to take place. Its headquarters were ordered to Valyevo, its forces to the same point as a preliminary to concentrating about Petska, whence the enemy was to be attacked in flank and rear towards Krupany, Zavlaka or Osechitsa, according to the amplitude of his presumed sweep. The definite line of resistance on which battle was to be accepted if the Austrian pressure was maintained, was from the Dobrava S. of Shabats to Brestovats and Tser ridge (II. Army), thence in the hills about Zavlaka or about Osechitsa (III. Army), according to circumstances, to whatever point on the Petska–Valyevo road the concentrating I. Army[1] was able to reach in time.

[1] To aid in this concentration, only the Danube I. Div. was to be disengaged at once in Syrmia, and the army was to be reconstituted by this division's picking up *en route* Danube II. from Obrenovats and a division of the II. Army from Tekerish. This latter did not join, becoming absorbed in the lower Yadar fighting.

Two days later the situation was suddenly modified again. On the night of 12–13th parts of the Austro-Hungarian XIII. Corps began to cross the Drina at Kuriachista, midway between Lyeshnitsa and Loznitsa, opposite the left of the II. Serbian Army, which was by now weakened through giving up local reserves and taking over an extended front for the benefit of the III. Army. This new move threatened not only to cut the Serbian line in two, but to roll up the whole Guchevo–Yagodnya position by a drive along the Yadar valley behind it.

With this, the battle becomes too tangled for brief description. Though the particular threat from Kuriachista was soon ended, the left of the Austro-Hungarian XV. Corps developed strong attacks on Loznitsa. The struggle for the W. end of Guchevo ridge and the lower part of the Yadar valley was fed from day to day by successive reinforcements arriving on each side. Here, minor contests for the possession of minor ground features, attempts to hold a hill long enough for it to be crossed with guns, or to storm it before it could be crowned, went on for days collaterally with the pressure exercised by the Austrian mountain troops of the XVI. Corps on the left of the Serbian III. Army, until the forces of the Serbian I. Army began to appear on Sept. 15. Next day, with a considerable force in hand, the I. Army staff mounted a counter-attack which bore back the Austrians from the line W. of Kostaynik–Sanats (pt. 835)–Sokoloka Planina–Petska, to one which on the evening of the 18th ran from W. of Kostaynik–Sanats–Veles–Karashitsa–Lyuboviya. Then, with further Serbian gains to the right of Sanats, fighting died away all along the line and trench warfare set in on the front from Karashista to Lyuboviya, the Austrians and Serbs facing one another on the line Guchevo–Boranya–Yagodnya–spur S. of Yagodnya.

On the Machva front, meanwhile, the offensive of the VIII. Corps, which had at first obtained only a bridgehead at Parashnitsa, was resumed in combination with a crossing at Yarak by Krauss's corps, when Syrmia had been evacuated by the Serbs. Here also, after violent but narrow-fronted attacks, trench warfare set in on the line of the two bridgeheads (N. of Shabats–Glushtsi, and Ravnye–Serbian Racha) which on Oct. 31 were united in one by a successful advance of the VIII. Corps from Ravnye to Glushtsi.

The second phase had been very different from the first. The Austrian staff had taken their opponent seriously, and laid their plans carefully, and it was only after the greatest exertions and very heavy losses that the Serbs had succeeded in pushing back the invaders. Even so, the latter had mastered the greatest part of the river obstacles, and in the absence of aircraft on the side of the defence, could carry on all preparations for a fresh offensive, unseen behind their firmly held trench-line.

Meanwhile, the Uzhitse Army and the Montenegrins, who at the close of the first phase were following up the retreating Austrians towards Vishegrad, had developed a series of operations which, like the expedition into Syrmia, were designed to prepare the way for a serious offensive of the II. and III. Armies over the Drina. This being forestalled by the Austrian offensive, the operations of the Uzhitse Army and its allies were without practical effect. They were, however, vigorously conducted.[2]

[2] On Sept. 4 Goles Height, S.E. of Vishegrad, was stormed by Shumaja II., while farther up the Dwina, other Serbian and Montenegrin forces attacked at Ustipratsa, Gorazda and Focha. At the latter place the Montenegrins broke through on Sept. 11, and a raid was pushed deep into the enemy's country, while a number of simultaneous attacks at Gorazda, Ustipratsa, Vishegrad and Bainabashta caused the Austrian 8th Mountain Brigade to draw back to Han Pesak and Srebenitsa, when it crossed the rear of its Corps (XVI.) fighting N. of Lyuboviya. This and the other Austrian mountain brigades, however, maintained an active war of raids and expeditions in the mountains. The Montenegrin main body, from Focha, moved E. to Kalinovik, which it captured and then evacuated. Other Montenegrins from Focha and Serbs from the Vishegrad and Rogatitsa region threatened Sarajevo for some time, though periodically cleared away by expeditions of the mountain brigade from Sarajevo and the 8th Mountain Brigade from Srebenitsa and Han Pesak. Meanwhile, the bulk of the Serbian Uzhitse forces (Shumaja II.) advanced by Han Pesak on Vlasenitsa, and also to Srebenitsa. Indecisive fighting took place at the former during the last of September and the first of October, but at Srebenitsa the threat to the rear of the Austrian XVI. Corps was dissi-

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The Kolubara Campaign.—The course of the war during September and October had not been favourable to Austria-Hungary. Galicia had been lost, and the line of battle had receded W. until it lay in the region of Lodz–Cracow–the Dunajec and the Carpathians. In November, the campaign in the western theatres had ended in deadlock. Falkenhayn had succeeded to the control of German operations, and his doctrine of wearing-down strategy was taking shape. Winter was at hand.

Nevertheless, Potiorek meant to resume active operations. No binding order prevented him from doing so. Conrad's instructions were that he was to prevent an irruption of the Serbs into Austro-Hungarian territory, but it was left to him to decide whether that defence should be passive or conducted offensively by partial attacks. The Emperor expressed the wish that Potiorek would succeed in defending the monarchy, to which the *Feldzeugmeister* replied that he "hoped to do a good deal better than that." Falkenhayn, with his wider outlook, suggested a sudden seizure of the N.E. corner of Serbia with the view of opening up a line of munitions transport to Turkey, but this project aroused no interest at the headquarters of the "viceroy" of Bosnia, who was resolved to drive another offensive into Serbia with all his might, at the first favourable opportunity.

The Serbians meanwhile had suffered severely from the unfamiliar conditions of trench warfare, notably in the Machva, and at the end of October Putnik had decided to evacuate the line in that quarter. The Austrian attack of Oct. 31, therefore, met with only outpost resistance, and Shabats was occupied two days later, while monitor activity continued on the rivers.[1]

The advance of Krauss and the VIII. Corps in the Machva was the first stage of the new general offensive. On the night of the 4–5th it was developed by a frontal attack from Shabats combined with a fresh crossing at Mishar, the Serbians continuing their retreat to the line N. Dobrava–Dobrits–Tser ridge. On the next night (Nov. 5–6) a heavy bombardment opened along the whole Austrian front, especially on that of the Guchevo range. On the 6th, infantry pressure began along the mountains from the W. end of Guchevo as far as Yagodnya. Once more, evidently, Potiorek intended the centre of gravity of his attack to be on the right and right centre, the front of his own army composed of mountain troops long familiar to him, and well equipped for the work. On the 6th, from the slopes of Guchevo itself he issued a proclamation, stirring his troops to the highest efforts by promising them this time the "annihilation" of the "exhausted" enemy. Nor were these empty words, for the condition of the Serbian *moral* at this time and their shortage of ammunition were evident.

At this opening moment, the dispositions and order of battle on both sides were as follows:—

Serbian II. Army (Vidoyevitsa–Dobrava): Morava I., Timok II., Shumaja I., Timok II., Cav. div. and details; 63 battalions, 27 squadrons, 34 batteries.

III. Army (Yadar–Kostaynik): Drina I., Drina II., Combined Division; 40 battalions, 6 squadrons, 18 batteries.

I. Army, under Boyovish (Kostaynik–Uzovnitsa stream and Drina): Morava III., Danube I., Danube II. (temporarily detached to II. Army); Lyuboviya detachment; 44 battalions, 9 squadrons, 24½ batteries.

Uzhitse Army, under Aratich (along Upper Drina from Tiryeshnitsa stream to the Lim, front continued thence by Montenegrins): Shumaja II., Lim detachments, Uzhitse Brigade; 34 battalions, 2 squadrons, 12 batteries.

Belgrade Detachment, under Zhivkovich (Brestovik–Pechani): 17 battalions, one squadron, 9 field and some medium batteries.

Obrenovats Detachment (Pechani–Vukodrazh R.): 6 battalions, 3 batteries.

Branicevo Group and Kraina Group (Brestovik–Kladovo): 12 battalions, 4 batteries.

(The three last-mentioned forces were on the river front.)

Serbian total: 226 battalions of all categories, 41 squadrons, 113 batteries, modern and B.L.

The Austro-Hungarian forces and dispositions, as established by the Serbians, were as follows:—

River front from Shabats E.: 55 battalions, almost entirely Landsturm.

Shabats–Machva–Loznitsa front (V. Army, in order from left to right Krauss, VIII., XIII.): 87 battalions.

Loznitsa–Lyuboviya (VI. Army, XV., XVI. Corps, 40 Honved Divs., and other troops): 110 battalions.

South-west of Lyuboviya: mountain troops (1–2 brigades).

On the 7th, the VI. Army attacked and pushed the Serbian III. Army off the entire Guchevo ridge, and bore back the I. Army[2] and the right of the Uzhitse Army till the latter, marking the extreme left of the battlefronts, stood on Trsvena Stena.

On the 8th the retrograde movement of the III. and I. Armies continued to the line Kozaningrad (pt. 706) on Tser–Strasha (1424)–Zavlaka–Petrina Stena–Proslop. Meanwhile, the Serbs on the Machva retiring to the line Kozaningrad–the Dobrava were under strong pressure. Next day, in the midst of general activity on the water, an Austrian regiment forced the passage of the Danube at Semendria, threatening an inroad in the Morava valley itself, and part of the Belgrade force was hurried E. to deal with this threat, which it did successfully.

The reports from the front had already decided Putnik to withdraw to a line covering Valyevo, viz. Obrenovats group, Kolubara mouth to Skela; II. Army, Ub–Blizonzhski heights; III. Army, Yantina–Kamenitsa; I. Army, Yolina Breza–Sovachki Kik; Uzhitse Army, right Trsvena Stena–centre and left Vishegrad to river Lim. But it soon became apparent that a stand could not be made on this line. *Moral* was low, with mixture of units considerable. In the two Drina divisions of the II. Army in particular men feared for their families and considerable numbers left the ranks and made their way home, while accompanying the retreat were hundreds of refugee families with their carts and beasts, fugitive or requisitioned. From the interior, new drafts came up in thousands and congested Valyevo.

Though the army was by no means in dissolution, it was undisguisedly in full retreat. By order of G.H.Q. communications were destroyed in the retirement.

The line now to be taken up was the so-called "Kolubara line," which from the rear followed that river to the confluence of the tributary Lig, then, by the Lig to Gukosi and thence by height 700 to the Malyen ridge at Malyen (point 997). The Kolubara part of the line (with a defensive flank along the Sava) was to be held by the Obrenovats group; from just below Lazarevats to Malyen inclusive was allotted to the II., III. and I. Armies west. The Uzhitse Army was to leave one brigade at Kadinyacha on the ridge between Rogatitsa and Uzhitse, the remainder astride the Vishegrad–Uzhitse road at Shargan.

By the evening of Nov. 14, the Obrenovats detachment had taken up its positions behind the Kolubara, the II. Army had fallen back from Kotsielevo towards Lazarevats and the Middle Kolubara, the III. Army, always manœuvring so as to extricate its right before its left could be turned, was astride the Yadar-Valyevo road at the water parting about Kamenitsa, and the I. Army continued the line S. to Velovitsa, with its Rogatitsa detachment (somewhat out of touch) pushing the left in the

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pated by a counter-attack of the 8th Mountain Brigade when that formation returned from an expedition in relief of Sarajevo. The Serbian column retreated whence it had come, to Bainabashta. Finally, when on the main front much warfare set in, the Serbians and Montenegrins began slowly to retire to their respective frontiers, while on the other side a systematic drive was carried out by large forces of the XV. and XVI. Corps. One Austrian group advanced from Sarajevo E. on Rogatitsa, and won a severe engagement on Romanja Planina on Oct. 21–22. While another following up the retirement of the Serbs from Vlasenitsa advanced on Rogatitsa from the N. The Montenegrins between Focha and Katinovik did not give way without inflicting severe losses on the group opposed to them. But by the end of October all the allied forces had withdrawn behind the Drina. Farther S., the region of Artovats was again the scene of some irregular fighting in October.

[1] During October, there had been many local engagements on the Danube–Sava front. Belgrade was frequently bombarded. The defence was very active, and minefields were placed at several points, to one of which, near Shabats, the monitor "Temes" fell victim on Oct. 23. In the main, however, the Austrians kept the upper hand.

[2] The I. Army was short of Danube II., which had been taken to strengthen the II. Army N. of Tser. Habitual disregard of the order of battle, *i.e.* an unnecessary regrouping, has been criticised as a peculiar failing in the Serbian method of conducting operations. Often, of course, there was no alternative. But there seems some justification for the criticism, nevertheless.

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higher mountains. By the evening of the 16th, the positions were:—Obrenovats group, Obrenovats–Konatitsa; Cavalry division, Konatitsa–S.W. of Stepoyevats; II. Army, Voluyak–Lazarevats–Chavka; III. Army, Chibutkovitsa–Ivanovatsa; I. Army, Gukoshi–Mednik–Bachinovats–Ruda–Malyen; Uzhitse Army, right S.E. of Yasenovats–Yelova Gai, and left Shargan and Leshka Gora.

The weather was terrible, but Potiorek, sure of success, drove on his troops to new efforts, although communications became worse and longer day by day. On the 17th the cavalry at Konatitsa was threatened, and had to be reinforced, while the mountain troops of the XVI. Corps, pushing along the ridge of Malyen, reached Strazara (pt. 1000). On the 18th the position of Choka on the front of the II. Army was attacked. But the main bodies of the invaders' columns were not yet up to the front. The Serbs thus enjoyed a relative respite, and their left, at Malyen, was able to reëstablish patrol communication with the Uzhitse Army.

On the 19th the Austro-Hungarian main bodies began to exercise general pressure, their efforts being specially directed on the angle of the Kolubara and the Lig, and on the point where the line crossed the Yadar river (Gukoshi and Mednik heights). On the 20th the battle followed the same course, and Putnik ordered an offensive to be resumed on both flanks. But the time was not ripe, and the army and divisional generals reported themselves unable to carry it out.

On the 21st the Austrian XVI. Corps broke the Gukoshi–Malyen line in its centre and the defence was brought back to Gukoshi–552–Rayats–Suvobor–Malyen, and on the 23rd the Malyen position was evacuated and touch with the Uzhitse Army again lost. Nothing now intervened between the XVI. Corps and the head of the western Morava valley, but the weather and the distance of its supply sources, and the liability of the convoys to be cut off by descents of the Uzhitse Army, imposed caution, and for some days only minor fighting occurred here.

In reality, it was not here that Potiorek intended to win his victory, but farther north. The initial phase of the operations was complete when Valyevo was in his hands, and secured against attack from the S. by a sufficient foreground. The next was to be the driving back of the Serbs from the Lower Kolubara, the cutting off of Belgrade, the opening of the Obrenovats–Valyevo railway for supply, and finally the advance in the dry and not too hilly country N. of Lazarevats into the Morava valley, accompanied in its last stages by a descent upon Chachak and Gorni Milanovats in the enemy's rear.

The weather had, however, converted the poor roads of the Ub country into deep mud, and the regulation military transport foundered in this mud, so that the intended rapid advance by Krauss and the VIII. Corps to the Kolubara had been impossible. The mountain troops had outpaced the scheme, and it was not till the 22nd that the Austrian V. Army was able to open a real attack on the Kolubara. By the 25th it had made good the passage, but progress was slow, and at that date only Chopka and Konatitsa had fallen. Obrenovats still held.

Putnik had now resolved to give up Belgrade. Ammunition was expected, but had not arrived. *Moral* was becoming lower and lower, and only ruthless concentration on essentials would enable the army to last till the day when, with pouches and wagons refilled, counter-offensives could be launched. Meanwhile, his policy was to fight for time, so as to evacuate Belgrade as thoroughly as possible.[1] Then the Belgrade and Obrenovats forces were combined and posted on the line Varovnitsa–Kosmai–Sibnitsa (night of 29–30th), in touch on the right with the Pozharevats (or Branicevo) force, which held the Danube front astride the Morava. The Austrians entered Belgrade on Dec. 1.

On Dec. 2 the Serbian positions were as follows:—

Belgrade-Obrenovats force, Varovnitsa–520–313–Rogacko Brdo–281.

II. Army (4 divisions and cavalry division), Sibnitsa–Olbrezak–Ravani (318)–Medvyednik (365)–Vayan (490).

III. Army (3 divisions), Mramor (398)–Kalanyevitse–489–520–Motika (603).

I. Army (4 divisions), (now commanded by Mishich), Nakuchani–Vrnchani–Sinoshevtsi–Galich (703)–Vuskova Glavitsa.

Uzhitse Army (equivalent of 2 divisions) Kita–Kablar–Ovchar–Markovitsa.

On the Austro-Hungarian side they were:—

V. Army: Combined Corps and VIII. Corps, area E. of Lower Kolubara and S. of Belgrade; XIII. Corps, Arapovats–Trbushnitsa–Parlog–Liplye.

VI. Army: XV. Corps, Vrlaya–Golubats; XVI. Corps, Vranovitsa–Lesusitsi–Ruyevitsa (583), detachments Godun, Pozhega, Arilye.

Both opponents were by now almost worn out. Suffering from their exertions, their losses, and the absence of food, shelter and ammunition, they were held together only by the inertia of the system. In this condition victory would fall to that side which first found a stimulus. This came to the defenders in two forms, the example of the old King, who took a rifle and fought in the ranks, and the arrival of the long-expected ammunition.

On the night of the 2nd, while Potiorek was slowly regrouping his forces to develop the attack on his left, Putnik issued orders for a general offensive S. of Sibnitsa "in order to profit by the enemy's present weakness and raise the *moral* of our troops."

The II. Army was to drive the enemy over the Kolubara; the III. (Drina II. and "Combined" division) to push towards the old line on the Lig; the I. to make good the line Krivareka–Lozany–Teochin (in order from right to left, Timok II., Morava II., Danube I., Danube II.); of the Uzhitse Army the available portion of Shumaja II. to attack N. and N.W. along Pranyani and Goina Gora; the Lim detachment to attack between the Lushnitsa and Venchaska streams by Breziak N.; the remainder of this undispersed army standing fast or forming a defensive flank for the advancing centre.

The counter-offensive was delivered or launched on the morning of Dec. 3, and was quite unexpected by the Austrians. The Uzhitse Army's offensive wing reached a line astride its assigned ridges marked by Ruyevitsa and Godun. The I. Army drove the XVI. Corps back to the line Byezna–Ozrem–Kriva Reka. The III. Army reached the line Vrlaya–Lipet, the I. Okressak–Barosevats–295–347, while on its right the cavalry maintained contact, at Slatina, with the defensive right flank, the Belgrade-Obrenovats force.

Next day the Uzhitse Army's advance was sharply arrested, and it only maintained its ground on the line 370–Ruyevitsa–Godun–Oruyewitsa–Krstata. But the I. Army drove a deep wedge, and by nightfall occupied Golubats–Prostruga–Rayets–Suvobor–Babina Glava. The III. and II. Armies met with stiff resistance. The III. made no progress, and the southern wing of the II. was hung up by the unshaken resistance of Kremenitsa; the N. wing reached Arapovats and Sakulya. No serious fighting occurred on the part of the cavalry or on that of the Belgrade-Obrenovats force, and the commander of the latter, fearing that an envelopment was in progress, extended his right to the heights E. of Grotska. Next day Putnik, conscious also of the danger of allowing the regrouped Austrians to break through into the Morava region and envelop his right, caused the II. Army to extend its right (Timok II.) past Vitnitsa to Kosmay heights, behind the cavalry. The attack of the centre was in fact at a standstill, and it was evident that it was impossible to defeat the enemy's leftward regrouping of flank attack.

On this day (Dec. 5) the Uzhitse Army's attack, numerically weak and divided amongst several directions, came to a standstill. But the success of the I. Army on the ridge of Prostruga was made definitive, the Austrian XVI. Corps brigades retiring N. towards the Kolubara with heavy losses.

On the 6th the I. Army pursued its opponents N. and downhill towards Valyevo, while on the left of its flank the Uzhitse Army made advances N., N.W. and W. against weakening opposition, and on the right the III. Army reached the line of the Lig. But simultaneously, the storm broke on the extreme right, where the slowly prepared attack of Krauss and the VIII. Corps was launched at last. The line of defence held, but Timok I. from the II. Army was set in motion for the extreme right.

[1] Some French naval guns had to be blown up, as they could not be removed. Before destruction they fired all their ammunition into Bezania.

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On the 7th, while the I. and Uzhitse Armies continued their advance to Valyevo and Uzhitse respectively—their opponents withdrawing divergently on the Loznitsa and Shabats routes—the III. turned the flank of the defenders of Kremenika and thus enabled the II. Army, weak as it now was, to make progress towards Lazarevats and Voluyak height. But on the right the Austrian attack made real progress and approached the advanced line of the Kosmay position. On the 8th and again on the 9th the Kosmay line itself was taken and retaken. On the evening of the 9th the alignment of the Serbian defensive flank was from the Danube E. of Grotska, by Umchari, Varovnitsa, and Kosmay to the Kolubara valley near Sakallia. Lazarevats was reoccupied by troops of the II. Army on the 9th, and the III. Army, coming up into line with the I., bordered the Kolubara as far as Valyevo, these two armies beginning the pursuit of those Austrian forces which had taken the Shabats direction in their retreat.

The 9th was in fact the turning-point of the battle, as the 3rd had been that of the campaign. On the evening of that day Potiorek, ill informed of the state of affairs in the N., and deeply impressed with the defeat of the mountain troops (VI. Army) which he had himself accompanied and directed, gave orders for a general retreat on Belgrade, Shabats and Loznitsa. On that day also Putnik issued general directions for the continuance of an offensive which was evidently yielding much greater results than those aimed at in the instructions of Dec. 2.

The position of affairs on which the new scheme was based was: heavy and apparently increasing pressure on the Kosmay front (VIII. and Krauss), indicating an attempt to break through into the Morava region; stiff resistance of the enemy (XIII. Corps of II. Army) between that front and the Kolubara, and on that river astride the Ub routes; and full retreat of the Austro-Hungarian XV. and XVI. Corps in the divergent directions of Shabats, Loznitsa and Vishegrad.

Putnik's objects were two: to follow up the retreating XV. and XVI. Corps quickly so as to regain possession of the national territory and rescue the inhabitants, and to attack the enemy northern forces frontally and in flank before they could prepare a winter position on the Belgrade loop. Attacked all along the front and threatened on their right, he hoped that the Austrians would evacuate the capital without ruinous street-fighting. Some hopes were no doubt cherished of cutting off the retreat of the two corps (VIII. and Krauss) but they were slight. The physical conditions were adverse. "Our national mud," hitherto Putnik's ally, became now a hindrance.

On the 10th, therefore, the Uzhitse Army continued to pursue in the direction of Bainabashta and Rogatitsa, part of the I. Army pushed along the Loznitsa road, part towards Shabats, while the III. Army, with its left already over the Kolubara S. of Ub, began to wheel to the N., pivoting on Lazarevats, with the outer flank following the direction of Ub–Obrenovats.

But already on that day, the battle at Kosmay diminished instead of increasing in intensity. The Austrians began to draw back. Hopes of completing the wheel of the III. Army vanished. The Austro-Hungarian XIII. Corps gave ground only slowly. The renewed *moral* of the Serbs had sufficed to give them victory, but it could not force them through the phase of exploitation, when it was evident that the enemy was evacuating the country of his own accord and also that he would not be hustled. Had the Ub–Obrenovats direction been assigned to troops of the I. Army, which alone of the five larger formations had really experienced the sensation of clear victory, it is possible, though by no means certain, that the envelopment might have succeeded. As it was, the last phase of the battle was practically a frontal drive E. of the Kolubara, with heavy local fighting and the gleaning of prisoners and spoil, but no *débâcle*. When on the 13th the left division of the III. Army seized Obrenovats, the Austrians had already withdrawn clear of the flanking threat. They had, owing to the state of the VIII. Corps, decided not to make a stand on the Belgrade loop, and after one day's further fighting, they evacuated Belgrade which the Serbian patrols reoccupied at 10 A.M. on the 15th. Meanwhile, Shabats, Loznitsa and Bainabashta had been reached and reoccupied by the pursuing columns of the I. and Uzhitse Armies.[1]

The recovery of the country and the capital intact, and the capture of 41,000 prisoners and 133 guns, with large quantities of stores, even though no Sedan had been achieved, constituted a victory that was both decisive and—after a crisis of *moral* such as that of the end of November—wonderful. It gave Serbia peace in the midst of World War for a few months to come. But her losses had been very heavy. In the three battle periods of 1914, 69,000 Serbian soldiers had been killed or had died of sickness, perhaps 15,000 had been taken prisoners, and probably 180,000 had been wounded, out of a mobilized force which at the outset numbered 490,00.

II. The Conquest of Serbia, 1915

When the third punitive expedition ended in failure, Potiorek was relieved of the command, and the V. and VI. Armies were fused in one called the "Balkan Forces," to which the Archduke Eugene was appointed as commander, with Krauss as his chief-of-staff. Under cover of outposts along the rivers, the corps were reorganized and disposed for the defence of Hungary. Soon the VIII. and XIII. Corps were withdrawn for service in other theatres, and on Italy's entry into the war the Archduke and Krauss were transferred to Laibach to command the new front, General Tersztyanski being left with a much weakened force opposite the Serbs. The latter indeed were not fitted for the offensive. Not only were their numbers greatly reduced by the battles of 1914, but an epidemic of typhus devastated their ranks still further.

Meanwhile, Falkenhayn, reasoning not in the spirit of a Bosnian viceroy who wished to teach a lesson, but in that of a modern war-manager, had become convinced of the necessity of opening a road to Turkey for the transit of munitions and expert personnel. The desire to reserve or to recoup forces for this purpose went so far, indeed, that he constantly imposed a brake on Hindenburg's and Conrad's proposals for decisive operations in the Russian theatre. At one time in the spring, the beginnings of a German army were assembled in Hungary, though the scheme—at that period only one of clipping off the N.E. corner of Serbia—was abandoned before effect had been given to it. Later, when the first fear of the Italians had died away, and the Russian campaign was nearing its end, it was taken up again.

Throughout the spring and summer negotiations had been in progress for winning, or buying, Bulgaria's active support. Falkenhayn exercised all his influence to keep these alive, even under difficult circumstances, for though Bulgaria's price was high, without Bulgarian aid no forces that could be spared from other fronts would suffice for the clearance of the Orient railway, while the nature of Bulgaria's reward imposed the conquest of Macedonia in addition to the military occupation of N. Serbia. There were, further, internal difficulties between the two allies on the question of command. Bulgaria insisted on a German commander as chief, and found in this matter, naturally, Falkenhayn's entire support, but Conrad, ever jealous of the prestige of the Austro-Hungarian army and hostile to German control, long refused his consent. It was not, indeed, until the verge of the offensive that a formula acceptable to all these states was discovered.

The plan of operations adopted was the reverse of Potiorek's, and was substantially that proposed by Krauss and by Tersztyanski successively, viz., direct attack over the Sava and Danube, coupled with a coöperative attack from the Machva, for the securing of the Kolubara line and its railway. But it had the further element of Bulgarian intervention on the right rear of the defence which, if energetic and controlled as to timing and direction by the same commander-in-chief as the frontal offensive, would be decisive. The appointed commander-in-chief of the group of armies was Mackensen. He was to have under him the reconstituted XI. German Army (Gallwitz), the reconstituted

[1] During the period of the Kolubara campaign, there was a certain amount of minor fighting between the Montenegrins and the Austrian forces of Bosnia and Herzegovina, on the Drina, about Artovats, and about Trbinye. No results of importance were achieved on either side.

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Austro-Hungarian III. Army (Kövess), and one Bulgarian army, the I. Another, smaller, Bulgarian army (the II., Todorov), not under Mackensen's command, was assembled for the seizure of Macedonia. The political treaty of alliance was ratified on Sept. 4, at Sofia, the military arrangements embodied in a convention at Pless on the 6th. According to the latter, within a period of 30–35 days, Germany and Austro-Hungary were to engage 6 divisions each and Bulgaria 4 (each equivalent in infantry strength to 2 normal divisions).[1] Another Bulgarian division was to operate, as above mentioned, into New Serbia (Macedonia).

Accordingly, Kövess's army, consisting of the Austro-Hungarian VIII. and XIX., and the German XXII. Res. Corps (seven divisions), was assembled in Syrmia, and Gallwitz's III., IV. Res. and X. Res. Corps (also seven divisions) in the Banat.

The Bulgarian I. Army (Boyadiev) (1st, 5th, 6th and 8th Divs.) was disposed in the region of Vidin, Kula, Belogradchik and Tsaribrod. The small Austrian forces still available in Bosnia after meeting the demand of the Italian front, were to operate in the Upper Drina region, to hold the Montenegrins in check.

On the Serbian side, there was a definite and perhaps a decisive inferiority in numbers. Battle in 1914 and typhus in 1915 had cost the little country 125,864 dead by Oct. 1 1915, without counting permanently disabled men and prisoners. Gaps had been made good by calling up two new conscript classes, and the ration strength had increased to 572,171 in August. But this figure was far in excess of that available for fighting service—indeed, the German intelligence staff estimated the latter at not more than 200,000.

The Serbian dispositions were generally as follows:—Drina front from the Lim to Bainabashta, Montenegrin forces; Middle and Lower Drina, Machva to Kolubara (exclusive), III. Army (Yurichich-Stürm), 3 divisions; Kolubara to Grotska, Belgrade force (Zhivkovich); the Lower Morava, II. Army (Mishich), 3 divisions; general reserve, Palanka, 2 divisions and cavalry division; in the N.E. angle were the Branicevo and Kraína groups.

On the Zayechar–Knzajchevats front, the Timok army (Goykovich), on the Nish–Pirot route and to the S. as far as Vranya, the II. Army (Stepanovich), and on the routes into Bulgaria, E. of Uskub, Boyovich's group, comprised 4 divisions and 3 Ban formations.

These dispositions, which at first sight seem to dispose in cordon, weak everywhere, at least five-sixths of the available force, indicate not only a sense of the danger impending on the E. side, which the Western Powers had forbidden Serbia to meet by a preventive offensive, but also the hope of assistance from Salonika. The help of Greece was invoked under the terms of the treaty of alliance of 1913, that of the Western Powers had been promised, if tardily and with reservations. To deploy, facing N., with three-fifths of her forces, and to guard the route to Salonika with the remainder, was, in sum, Putnik's plan.

As against an attack supported by artillery on the 1914 scale, there would have been no reason to suppose that this type of defence would be less successful than it had been in the Kolubara campaign. One line after another could be defended, and when the dead point of the offensive was reached, the reinforced defenders would deliver the counter-stroke of reconquest.

But tactics, unhappily for Serbia, had advanced since 1914, notably German tactics. Discreet reconnaissances, under the direction of the German Lt.-Col. Hentsch, chief-of-staff of Mackensen's group of armies—the same who had borne so grave a responsibility at the Marne—had been carried out for weeks past, for the purpose of fixing of battery positions and working out technical details of the Sava and Danube passages. Searchlights were assembled, large troop barges constructed, and for the protection of the main crossings heavy artillery was massed.[2]

Oct. 6 was fixed as the initial day for Kövess[3] and Gallwitz, the 11th for the Bulgarians.

The bombardment opened on the 5th, laying towns and villages in ruin all along the line; but on the Serbian side only outposts held the river lines, local reserves being kept under cover.

Kövess's main crossing place was to be Belgrade, opposite which place technical preparations had been multiplied and two corps out of three assembled. The third (XIX. Austro-Hungarian) was to pass the Drina at Byelyina, and the Sava at Shabats, Kupinovo, Progar and Zabrezh, in order to create bridgeheads and to prevent the defenders from concentrating to the eastward

Gallwitz's crossings were to take place at Ram and at Semendria, on each side of the Morava mouth, opposite which points lay the railheads, and at the island of Temes Sziget between them; the attack was to be accompanied by a demonstration from Orsova and a Bulgarian threat towards Negotin.

On Kövess's front the secondary crossings, especially in the Machva, secured footholds on the S. side of the water, but all attempts to advance out of the waterlogged river valleys themselves were checked (Oct. 7). Opposite Belgrade, in the early morning hours of the 7th, the first boatloads of troops of the VIII. Corps pushed off into the stream under cover of innumerable searchlights, heavy artillery fire, and monitor activity, while a little way up the Sava the XXII. Res. Corps put over its advanced troops into Ostrovo Tsiganliya (Gipsy Island). Zhivkovich had 16 battalions and nearly all the Serbian heavy artillery, including French and British 6-in. guns, to oppose to them. The landing—the only operation in the World War analogous in form and spirit to that of the Gallipoli Peninsula—succeeded, but only after the fiercest fighting was the foothold really made good and room secured on the front of both attacking corps for the passage and deployment of large forces. On the night of 9–10th, Zhivkovich abandoned the attempt to hold the town, and fell back a little way S., on the line Zarkovo–(249)–Visznitsa.

Simultaneously, Gallwitz's 3 corps had been launched, on both sides of the Morava. Preceded by a demonstration at Orsova on the 6th, the left corps (X. Res.) forced the passage at Ram on the night of 6–7th, and drove inland, over the Anatema heights to Kuryatse, threatening Pozharevats from the north-east. The IV. Res. Corps (3 divisions) seized Temes Sziget Island with little difficulty and reached Brezhani (Brežani). But the front from Semendria to Gatsko defied the III. Corps, and not only protected the right rear of Zhivkovich, but gave time to Putnik to bring troops from the Machva.[4]

Nevertheless, it was clear by the 11th that the river barrier was lost and Putnik began a steady policy of fighting successive delaying actions on the N. front, while at all costs keeping back the Bulgarians on the right and rear, in order to gain time for the arrival of French and British aid, the first elements of which had already reached Salonika.

On the 12th Mackensen opened the general advance, in the midst of a gale which, known as the *Kossova*, descends seasonally upon the country from the south-east. Kövess made slow progress till the 16th, when the Serbians evacuated under pressure the Petrov Grob–Avala–Velika Kamen line, and fell back to Melyak–Ripany–line of R. Ralya.

Gallwitz by that date had enforced the evacuation of Pozharevats, cleared the way for his III. Corps to advance on the Semendria front, and brought his left flank to Bozevats. To the E. of Kövess, the Austrian offensive was a simple follow-up of the retiring Serbs, who now attempted no real defence W. of the Kolubara, though small forces with local riflemen delayed the Austrians long enough for the families and the live stock to be evacuated on Valyevo. The Montenegrins, and with them some Serbs, were maintaining a particularly independent struggle between the Yadar and the Lim.

By this time the Bulgarian advance on the right flank had begun, though some days later than had been intended. In the south, Todorov's II. Army (7th Div. with improvised formations)

[1] An interesting sidelight is thrown on the relations of the allies by the fact that Germany thought it necessary to require from Bulgaria a written guarantee of unimpeded transport freedom through Bulgarian territory.

[2] In the case of the Belgrade crossing, no fewer than 20 batteries of heavy and superheavy artillery were collected, nearly half of which consisted in 30·5 and 42-cm. howitzers, and 18-cm. long guns. In addition, about 90 field guns and howitzers were engaged.

[3] The Drina portion of Kövess's army was, however, behind time.

[4] All Austrian forces in Bosnia were late in their preparations and took no effective part in the offensive.

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prepared to threaten the flank of the Salonika railway from Strumitsa, the Ovchepolye from Kyustendil, and Vranya from Trn. The I. Army advanced on the various routes to attack Zayechar, Knyazhevats and Pirot; on these the Serbs had advanced to meet them, always with the idea of gaining time, and by the 16th very little progress had been made by the invaders, except by one regiment which by a daring mountain march seized Vranya and cut the railway there. This success weakened the position of the Serbian forces on the Egri Palanka road at Stratsin, and when, farther S., Todorov turned their right by Kochana and pushed cavalry to Veles, they evacuated the Ovchepolye (Oct. 18–19). On the 21st Uskub itself fell into the hands of the Bulgarians and the Salonika line was lost, though a counter-attack recovered Veles from the Bulgarian cavalry two days later.

At that moment for the first time, the French from Salonika came into action, threatening Strumitsa and Todorov's left. It was too late.

On the northern wing of the Bulgarian army, Boyadiev's central columns cut the road between Zayechar and Knyazhevats on the 21st, and farther to the Bulgarian right, Negotin was occupied by the invaders, who there made contact with the Orsova detachment of the XI. Army. The Serbs in this quarter offered little resistance, their rear being already threatened by Gallwitz's progress in the Morava valley.

In that region the fighting had been heavy, the weather severe, and it was not till the 19th that Mackensen's two armies mastered the Ralya line. On the 21st, the date on which the Bulgarians seized Uskub and the French came on the scene at Strumitsa station, Mackensen's N. front was marked by the line Shapina–Selevats–S. of Kosmay. On the 23rd it lay on the line Lazarevats–N. of Arangyelovats–N. of Palanka–Petrovats, and the Serbian eastern fronts began to be in difficulties, though some days were still to elapse before Goykovich's force finally disappeared and junction was effected between Boyadiev's right and Gallwitz's left. In W. Serbia the Austrians from Bosnia were beginning to be active, and the country-side was being evacuated by men, women and children, with their animals and belongings. From Uzhitse as well as from Valyevo, the emigration had set in towards Novipazar.

Putnik's left armies were now falling back concentrically towards Kralyevo–Krushevats, in proportion as his E. front caved in. On Oct. 30, after no light efforts, the XIX. Austro-Hungarian and XXII. Res. Corps of Kövess's army were S. of Gorni Milanovats, the VIII. Austro-Hungarian Corps S. of Raibrovats, Gallwitz's army to the S. of Lapovo–Petrovats. The Serbs had evacuated Zayechar on the 25th, Knyazhevats on the 27th, and after a fierce resistance and repeated counter-strokes from Pirot, Stepanovich had retired on Bela Palanka on the 29th. Farther to the S., Todorov's attention had been thoroughly attracted to the Strumitsa side, and the position at Uskub and on the Upper Vardar had scarcely changed.

From Nov. 1 onwards, the final desperate effort was made by the Serbians to gain time for the arrival of the French and British by holding the arc Chachak–Kraguyevats–Yagodnya–Nish–Leskovats. Still the Bulgarians were held back in this phase, but the Germans and Austrians steadily advanced. Kraguyevats fell, with its arsenal, on Nov. 1; Yagodnya on the 3rd, Kralyevo on the same day, Paratyin on the 5th. For some days longer the defence continued stubborn on the S. side of the W. Morava and about Varvarin in the Morava valley, where a salient was held to enable the last elements of the Serbian IV. Army (Goykovich) to extricate itself from the closing vice. But by the 9th the defence on this line was at an end, and Mackensen was preparing the dispatch of the XXII. Res. Corps to another theatre, having received the Alpine Corps (division) in lieu.

On the E. front meantime, Stepanovich's counter-attacks had completely held up the Bulgarians at Bela Palanka, while a great part of the population flowed away through Nish into Kossovo. It was not until Nov. 4, when Boyadiev had received a fresh division (the 9th) and Paratyin had fallen, that orders were given to evacuate Nish, and that centre was held by rear-guards till the 5th. Leskovats resisted till the 7th.

The Orient railway, the objective for which Falkenhayn had planned the campaign, was now clear from Germany to Constantinople, and with his usual economy he was already thinking of withdrawing the German forces to other theatres.[1] The Serbian army, plainly in dissolution, had ceased to be a menace to the Danube monarchy. But new problems were arising—the Albanian question, the problem of Greece and the Allied Salonika army, the question of a submarine base on the Aegean. In all these, each of the three victors had a different standpoint, and fresh difficulties set in between the three Governments. Belonging as they do to the Salonika phase of the Balkan campaigns, these problems will not be dealt with here, and it only remains to describe, briefly, the last stages of the Serbian tragedy.

Substantially, the results of the Bulgarian coöperation had fallen considerably short of what was expected. The tough resistance of Stepanovich, and even of the small IV. Army in the N.E. corner, had kept back the eastern danger until it was too late for an envelopment. Indeed, considerable portions of Boyadiev's army—those oriented on Negotin and Zayechar, if not also that on the Knyazhevats route—were already crowded out of the closing front. For effective envelopment of the Serbian right, there only remained the N. portion of Todorov's II. Army, and, with the increasing arrival of French and British in the region of Rahovo and Doiran, this Bulgarian general was obliged to be cautious, while encircling attack upon the Serbian left was practically excluded by the fact that the Bosnian forces had made a late start and were traversing very difficult country. Supply and weather conditions, moreover, were becoming serious for the invaders. Practically, nothing could now prevent the remnant of the Serbian army from escaping into Albania, should it choose to do so.

But for this desperate measure, which would involve the loss of all war material and of many thousands of lives in the roadless, snow-bound interior of Albania, the Serbian command was not yet prepared. It seemed preferable to attempt to break through towards the S., where the long-expected Allied army was now advancing and Todorov was in difficulties.

The II. Bulgarian Army had, after seizing Uskub and taking, losing and retaking Veles, moved out fan-wise against the mountains N.W. and W. of Vranya, Kachanik, Kalkandelen, and the Babuna pass, while its extreme left was on the defensive against Sarrail's Rahovo group, and its left centre column was moving down from Shtip on Krivolak and Kavadar, where also Sarrail was collecting a considerable force. In the existing conditions it was evidently more important, from Todorov's point of view, to bar the Vardar valley against Sarrail than to attempt to force the mountain barrier of the Kara Dagh and the Shar Dagh. He therefore placed his centre of gravity well to the S., leaving his N. flank covered by a mixed force drawn partly from the I., partly from the II. Army.

Against this force, Putnik assembled the remnants of 5 divisions E. of Prishtina, and with them assumed the offensive with all the violence of which his troops were still capable, on Nov. 9.

This began on the 9th, driving the Bulgarian group of General Ribarov back to Vranya in the one direction and towards Kumanovo in the other. By the 15th Ribarov's right was in extreme difficulties. But the arrival of part of the I. Bulgarian Army from Leskovats on the left rear of the attacking wedge rescued it. By now the general front of the Austrian and German pursuit had reached Uvats, the line of the Ibar, Yaver (Javor), Kurshumlye. Pressure on the rear was too close to allow of persistence in the southward break-through. The moral rally which had permitted that attempt was dying away on all the defended avenues, and Putnik made up his mind to escape through Albania with what could be saved of the army and the people. Between Nov. 20–25, the historic Kossovopolye witnessed another last effort of the Serbian people, then everything flowed away towards Ipek (Pech), Dyakovo and Prizren.

At these points the pursuit ceased in the first week of December. It had practically become Bulgarian alone. Such German

[1] As above mentioned, Mackensen was given orders almost on the battlefield to send away the XXII. Res. Corps.

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troops as remained in the theatre when Falkenhayn's orders had been carried out were sent down the Vardar, into the midst of the Bulgarian II. Army. The Austrians diverged into Montenegro, which was completely occupied, with some severe local fighting and much secret negotiation, by the third week in Jan. 1916. But the end of pursuit did not mean rest and reorganization for the poor remnant of the Serbian army. It was impossible to live at the halt; and a midwinter march through the Albanian mountains, brought those whom its rigours left alive to the coast of the Adriatic. Thence, after some delay, they were transferred to Corfu, where the Western Powers provided food, equipment, clothing and stores, so mitigating a disaster that they might have prevented. (C. F. A.)

SERVIA: *see* SERBIA.

SETON-KARR, SIR HENRY (1853–1914), British big-game hunter, was born in India Feb. 5 1853. Educated at Harrow and Corpus Christi College, Oxford, he was called to the bar in 1879, but developed a taste for travel and big-game hunting which carried him all over the world. He also interested himself in state colonization and was a member of the Royal Commission on Food Supplies in Time of War. He published *The Call to Arms* (1900–1) and *My Sporting Holidays* (1904). He represented S.W. Lancs. (St. Helens) in the House of Commons from 1885 to 1906 and was knighted in 1902. He lost his life when the "Empress of Ireland" sank in the river St. Lawrence May 29 1914.

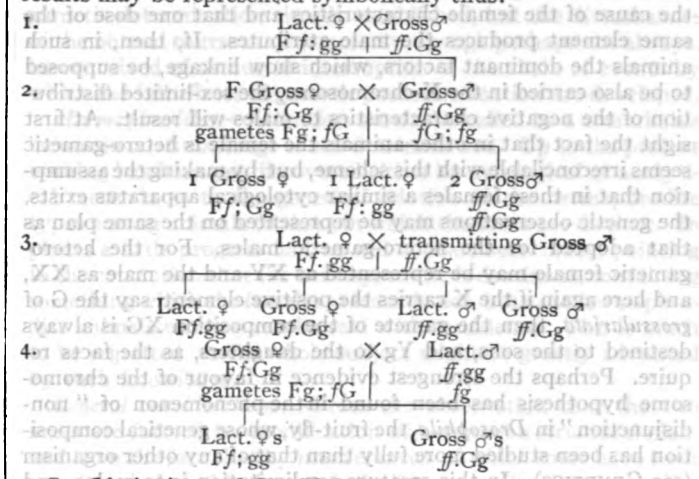
SEX (*see* 24.745*).—The problem of the determination of sex has in recent years been greatly elucidated. Knowledge has come from several sources. Both breeding experiments and cytological observation have severally led, as will be seen, to concordant conclusions, proving that the sex of the offspring is generally decided by one or other of the germ-cells which unite in fertilization. But though in ordinary circumstances the mode of determination is now known, there are nevertheless indications that in special cases the normal course may be altered or at least disturbed by various influences, the operation of which is not understood. The reconciliation of this latter class of evidence with the former has not yet been satisfactorily effected.

Sex Determined by Spermatozoa.—Knowledge of sex-determination began with the observation of Henking (1891) that in certain insects the spermatozoa were of two kinds, (1) those which contained a supernumerary, unpaired, or accessory chromosome (*see* CYTOLOGY), now generally called the X-chromosome, and (2) those without this body. McClung (1902) first suggested that this chromosome might be a determiner of sex, and took it to be the peculiarity of the male, but Miss Stevens (1905) and E. B. Wilson (1905), to whom the development of this part of the subject is chiefly due, proved that the spermatozoa bearing the X-chromosome are in these animals destined to form females. The eggs are alike in each possessing an X, and thus the somatic or diploid cells of the daughters come to have 2 X, one received from their mother and one from their father, whereas the diploid cells of the sons have one only, received from their mother. Since the gametes of the male are of two kinds, that sex is said to be *hetero-gametic*, the female being *homo-gametic*. Further observation, however, showed that the organization of even nearly allied genera of insects is by no means uniform in respect of the sex-chromosomes. Though unpaired in the males of some genera, the X may in others have a pair or "mate" of smaller size, known as the Y-chromosome. Between these and other genera in which the male has a pair of sex-chromosomes not visibly different from each other there are several transitional conditions. In a considerable number of forms also, the X is represented by a group of separate chromosomes, regarded as collectively the mates of the Y.

The X-chromosome has been seen in several orders of insects, especially Hemiptera, Orthoptera and Coleoptera, in spiders, myriapods and some nematodes. In man it is said (Guyer) to be represented by a pair corresponding to a single Y-chromosome.

Sex Determined by Ova.—Naturally this discovery that the male is hetero-gametic was at first supposed to be of universal application, but the next advance, which resulted from experimental breeding, showed that this simple view could not be entertained. The Currant Moth (*Abraxas grossulariata*) has a variety *lacticolor*, characterized by a deficiency of black pigment, till then known only in the female. Doncaster, instituting experiments with this variety, found that by breeding such females with normal males the F_1 family consisted of males and females, all normal.[1] Interbred, these gave F_2 composed of two normal males: one normal female: one *lacticolor* female. But *lacticolor* ♀ × F_1♂ produced families containing normal ♂, normal ♀, *lacticolor* ♂ and *lacticolor* ♀, all in equal numbers. On breeding any normal *grossulariata* ♀ with the *lacticolor* ♂ now produced, the sons were all *grossulariata* and the daughters all *lacticolor*.

Other interpretations have been proposed, but it is evident that the eggs of the *grossulariata* ♀ are of two kinds, (1) those which are destined to be females, and do not carry the *grossulariata* factor, (2) those which do carry this factor, and are destined to be males (Bateson and Punnett). Taking the factors G, grossulariata: *g*, its absence; F, femaleness: *f*, its absence, the results may be represented symbolically thus:—



Sex-Limitation and Sex-Linkage.—Such a system of heredity is sometimes called "sex-limited," and the descent of the character so limited serves as an indication of the mode by which the factor determining sex is transmitted from parent to offspring. The proof that in these moths sex is determined by the eggs, or in other words that the female is the hetero-gametic sex, is thus complete. The same has been shown to be true of birds. In fowls, several conditions have been shown to be sex-limited to females; *e.g. black* as against the *cuckoo-markings* of the Plymouth Rock; *golden* (as in Sebrights or Hamburgs) as against *silver*; the *black pigment* of Silky fowls is suppressed by a sex-limited *factor which inhibits* this development, etc. In canaries the peculiar form of albinism known as *Cinnamon*, and in doves the pale albinotic variety shows a similar behaviour. We have thus to recognize that, paradoxical as it may appear, sex is in some animals determined by the sperm, and in others by the eggs. Man belongs to the former class. Apart from the cytological evidence, as yet unconfirmed, the descent of sex-limited conditions, notably colour-blindness, demonstrates this. Substituting male for female, colour-blindness, is transmitted in man exactly as the *lacticolor* character is in the moths. A colour-blind man mated with a normal woman has sons and daughters with normal colour-vision. The sons cannot transmit the colour-blindness, but the daughters transmit it to *half* their sons who are therefore colour-blind. Moreover, when the transmitting female is mated with the colour-blind man, the *colour-blind female* is produced, just as in the corresponding mating (3) in the *grossulariata* experiment, the *lacticolor* male was formed. Finally when the colour-blind woman mates with a normal man the sons are all colour-blind and the daughters are all transmitters. Following Doncaster's notation in the *grossulariata* scheme, if M, maleness, be substituted for F, and N, normal colour-vision, for G, the same analysis represents the observed facts: the transmit-

[1] In genetics the following symbols are frequently used: ♀ = female; ♂ = male; × = mated with; F_1, F_2, etc. = the first filial family, the second, etc.

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ting female (Nnmm) in man, for example, corresponds with the male Ggff, etc.—in *grossulariata*.

There is thus no doubt that just as in the bird and the moth the female produces two kinds of eggs destined respectively to form females and males, so in man the male produces two kinds of sperms destined to form respectively males and females.

Cytological Interpretation.—The notation given above provides the simplest representation of the empirically observed facts without any attempt to refer them to cytological phenomena. This attractive branch of Genetics has been actively developed by T. H. Morgan and his colleagues with remarkable success; and though serious difficulties remain, the incidence of the sex-limited characteristics can so readily be interpreted as depending on the distribution of sex-chromosomes, observed or hypothetical, that a causative influence has with great plausibility been attributed to them. Starting from the now familiar fact that in certain animals the XY male has visibly one X-chromosome and the XX female two, it is argued that the "double dose" of X is the cause of the female characteristics and that one dose of the same element produces the male attributes. If, then, in such animals the dominant factors, which show linkage, be supposed to be also carried in the X-chromosome, the sex-limited distribution of the negative characteristics to males will result. At first sight the fact that in other animals the female is hetero-gametic seems irreconcilable with this scheme, but, by making the assumption that in these females a similar cytological apparatus exists, the genetic observations may be represented on the same plan as that adopted for the hetero-gametic males. For the hetero-gametic female may be represented as XY and the male as XX, and here again if the X carries the positive element, say the G of *grossulariata*, then the gamete of the composition XG is always destined to the sons, and Yg to the daughters, as the facts require. Perhaps the strongest evidence in favour of the chromosome hypothesis has been found in the phenomenon of "non-disjunction" in *Drosophila*, the fruit-fly, whose genetical composition has been studied more fully than that of any other organism (see GENETICS). In this creature sex-limitation is to males, and the male is hetero-gametic; but, exceptionally, unexpected forms appear, as, for instance, red-eyed males in the mating where white-eyed alone should normally be produced. Bridges found that in such individuals and among the families containing these abnormal members, irregularities in the occurrence of the chromosomes could be demonstrated. Apparently in some maturation division two X-chromosomes had passed to the same egg, others receiving none. From this a series of exceptionally constituted gametes are derived which could have brought about the observed exceptions. Another line of argument pointing to the same conclusion has been derived by Morgan and his associates from a study of gynandromorphs—the curious individuals composed of more or less irregular patchwork of male and female tissues, which are formed with some frequency especially among the various orders of insects. A number of these have occurred in the pedigreed families of *Drosophila*, and on analysis it was found possible in almost every case to refer the characters shown in the several parts to their parental origin.

A primary objection to these modes of interpretation is that the cytological conclusions rest on a still slender basis of observation. As regards the forms with hetero-gametic females an unpaired chromosome has been reported to exist in the females of two moths (*Phragmatobia* and a *Psychid*), but on the other hand, Guyer states that in certain birds the *male* has an unpaired chromosome. Commonly, moreover, no consistent cytological distinction between the two sexes can be observed. But a still more fundamental difficulty besets the conception of the characteristics of either sex as dependent on a merely quantitative distinction. From arguments which cannot be here developed the Y-chromosome is regarded as demonstrably empty, and containing no determining elements, and XY is therefore to be understood as in potentiality merely the half of XX. Chemical phenomena, vaguely analogous, have been appealed to as making this system of interpretation less inadmissible than it at first appears, but that it is beset by grave objections cannot be denied.

Cytology has been of great assistance in codifying the apparently contradictory records as to the intricate series of parthenogenetic or agamic and sexual forms of the Hymenoptera and Hemiptera. We have learnt for example that in Hemiptera (Morgan; von Baehr) when fertilization produces females only, the fact is due to the death of all the sperms, which do not bear the X-chromosome. But in these groups it not rarely happens (*Neuroterus*, Doncaster) that the fertilized females give rise parthenogenetically to other females of which, without fertilization, some produce females only and others males only, but no cytological distinction between these two types of females has been seen. Whatever be the true cytological account of sex-determination, we have nevertheless to recognize that femaleness and maleness respectively, though similar throughout the Metazoa both in outward manifestations and in deeper physiological features, are constructed upon at least two distinct genetic plans. To reconcile the infrequency of visible cytological distinctions between the sexes with the chromosome hypothesis it has been suggested that the critical bodies are in such cases attached to other chromosomes, but this, though undeniable as a possibility, is as an argument dangerously tinged with obscurantism, a comment which applies to many of the subordinate hypotheses supporting the chromosome theory of genetic causation.

The situation is one through which many scientific problems have passed before final solution has been obtained. By independent lines of evidence conclusions largely identical have been reached. The facts are not in dispute, but a consistent interpretation of the whole series has not at present been obtained.

Disturbance of Normal Sex-Ratios: the Production of Inter-Sexes.—Hybridization is not rarely followed by a disturbance of the normal sex-ratio. From canary females crossed with other finches and from domestic hens crossed with cock-pheasants *male* mules (sterile) are easily bred but female mules seldom if ever. Among Bovidae some crosses give fertile females but sterile males (S. v. Nathusius) and the same occurs in a cross between species of cavies (Detlefsen). Among Lepidoptera a series of such examples are known, the first having been observed by Standfuss, who called attention to the absence or scarcity of females in many species-crosses. Recently Goldschmidt, working with races or species of *Lymantria dispar* brought together from many countries, carried out a remarkable series of experiments. He found that a Japanese race used as ♀ × European ♂ gave normal males and females, but that in the reciprocal cross though the males came normal, the females were intersexes, exhibiting many transitional stages, approaching males in various degrees both in form, colour and instincts. When Japanese males of certain races were used, the whole of the female offspring are said to have been thus transformed into males. Goldschmidt states that the various races can be arranged in an ascending scale according to the completeness with which these effects are produced, but the phenomena showed many complications not as yet adequately represented, notably the appearance of partially transformed *male* intersexes in the F_2 generation raised by inter-breeding the normal offspring raised in the first experiment. It has been pointed out by J. B. S. Haldane (1920, unpublished) that, apart from certain exceptions, a general principle can be perceived in this group of phenomena. If in hybrid offspring either sex is consistently missing or defective, this will be the hetero-gametic sex, *e.g.* in birds and Lepidoptera the female, in mammals, the male.

Sex of Twins.—The facts hitherto dealt with all go to prove that sex is determined by the gametic contribution made by one or other of the parents and that this is the normal course is not open to question. In harmony with that conception of sex-determination, it is found that when, as in twinning of embryos and generally when the fertilized egg multiplies by division, the products are commonly all of the same sex. In the armadillo (*Tatusia novem-cincta*), studied in detail by Newman, four embryos, demonstrably arising by division of one blastodermic vesicle (developing ovum), are usually produced at a birth and are always of the same sex, the four being all males or all females. Patterson found an exception in the case of the parasitic

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Hymenopteron *Paracopidosomopsis*, which by polyembryonic division sometimes produces both males, females and intermediates. That something analogous to non-disjunction here occurs is an acceptable interpretation of this anomalous instance. But there is a remarkable group of incontrovertible facts which show that sometimes the normal course of sex-development may be disturbed. F. Lillie discovered a remarkable example. When in horned cattle twins of opposite sexes occur, the female is sometimes sterile, being called a free-martin. It might be thought that these twins arose by division of one fertilized ovum, but Lillie by study of material from the Chicago stock-yards proved that an ovum had dehisced from each ovary and that therefore the twins were originally distinct. He further showed that sometimes the twins had an actual anastomosis between their foetal circulations. The presence of a male embryo must therefore be regarded as having the power of inhibiting the development of the female embryo, poisoning it in so far as the formation of the reproductive organs is concerned.

Effects of External Conditions.—Disturbance of the normal sex-ratios as a consequence of various interferences, such as starvation, high or low temperature, etc., has several times been alleged to occur, especially in Amphibia, and the evidence of R. Hertwig that delay in fertilizing the eggs of the frogs causes the production of a preponderance of males has been fully confirmed. Circumstantial details preclude the obvious suggestion that this is a result of differential mortality. Hertwig thought that inasmuch as the polar bodies are excluded very late, after the eggs are laid, his result might perhaps be reconciled with the conception of cytological pre-determination if the conditions of the experiment could in some way have decided which elements should be retained in the egg and which ejected in the polar body. Recently Seiler has made an observation of this kind in regard to a Psychid moth, *Talaeporia*. He states that if the females are kept in a high temperature while the eggs are undergoing maturation, it can be seen on cytological examination that the accessory chromosome more frequently remains in the egg, and that as a matter of observation more males are produced, the converse occurring under cold conditions. Until we know definitely which sex in Amphibia is hetero-gametic the discussion can scarcely be carried further, but the frequency with which transitional forms are found in the Ichthyopsida raises a probability that the facts are of a higher order of complexity. As to the genetical composition of the Amphibian intersexes, an important observation has lately been made by Crew. From the eggs of a female fertilized by a male showing intersexual characters 774 tadpoles were reared, all females. According to Baltzer, sex in *Bonellia* is directly determined by the conditions of larval life. The female is of course an animal of considerable size, whereas the male is a minute creature parasitic on her. Larvae which find the proboscis of the female and attach themselves to it are said to develop into males, those which remain free-swimming becoming females. Larvae artificially detached from the proboscis become intersexes. Adequate controls, by which the hypothesis of predisposition may be excluded, would in such an instance be most difficult to institute.

Effects of Castration.—Collateral evidence bearing on the nature of the distinction between the sexes has been drawn from many sources, especially from the results of castration, but though the facts thus empirically observed are of much physiological interest, they have no very direct bearing on the primary problem. The reproductive glands, acting chiefly, if not entirely, by virtue of the secretions (hormones) of their interstitial components, have often a great influence on the development and maintenance of secondary sexual characters, but the part played by the hormones must obviously be of a secondary nature. Removal of the genital glands has divers effects in various animals. In good agreement with the discovery that in the bird the female is the hetero-gametic sex, it is found that both in the fowl and the duck (Goodale) the removal of the ovary induces the plumage and some other characteristics of the male. The female is thus an organism in which the male attributes are concealed or recessive, whereas a capon does not develop hen-feathering. Moreover, Morgan found that in the Sebright bantam, the males of which are "henny" in plumage (not in combs or wattles), after castration the cocks acquire ordinary male plumage, which may naturally be interpreted to mean that the hen-feathering of these cocks is due to their possession of part of the female complex which has been transferred to them. Morgan and Punnett also have shown that the henny character behaves as dominant in breeding, a fact which proves that the dominance proper to the whole female complex of the bird pertains also to that part of the complex which controls the plumage.

Castration performed on moths during the larval stage has not produced modification of secondary sexual characters (Oudemans). In crabs, however, the destruction of the testes by certain parasites produces very striking "feminization" of the abdomen and appendages (Geoffrey Smith), but we do not know which sex in Crustacea is hetero-gametic. We are without a satisfactory interpretation of this group of observations, some of which superficially considered seem to run counter to the facts of gametic determination already established, but the disturbances of the normal course may commonly, though perhaps not always, be conceived of as due to interruption of the chain of events by which the full effects of gametic predetermination are developed.

Hermaphrodites.—Attention should be called to a remarkable lacuna in our knowledge of sex-determination. Up to the present nothing has been yet discovered either by cytological or analytical methods as to the genetical relation of the hermaphrodite types among animals to those in which the sexes are distinct. In plants a little progress has, as will appear, been made, pointing to the conclusion that the hermaphrodite is dominant, containing something which the females at least do not, but as to hermaphrodite animals nothing can be said with confidence. This is much to be regretted, as the whole subject might be greatly advanced by such knowledge.

General considerations.—From the observation that the two sexes are formed by modification of a common structural plan, and from the fact that by interferences, of which some have been mentioned, individuals cytologically, or at least gametically, destined to be of one sex may be made to assume more or less of the characteristics of the other, the conclusion has often been announced that each sex contains the other latent in it. To this expression, in the light of modern knowledge, no precise meaning can be attached, and it probably conveys nothing of essential truth. The primary sexual distinctions evidently depend on factorial elements which follow more or less closely the familiar principles of Mendelian segregation. The determining factor for sex should probably be regarded as a complex, usually transmitted in its entirety, but capable by accidental errors of cell-division of being disintegrated, so that the elements responsible for special characteristics may become detached from the rest and may even be passed over to the sex which normally does not receive them. For example, the races of fowls which do not incubate have presumably thus lost a portion of the dominant sex-complex; the hen-like cocks of the Sebright bantam may be represented as having acquired that ingredient of the female sex-factor which in the normal female inhibits the formation of the sickle-feathers and hackles of the cock, and so on. A similar representation may be applied to those cases (*e.g.* Phalaropes) in which the cocks are hen-like and normally incubate the eggs. It is not unreasonable to suppose that the transference of an actual fragment of critical material, presumably a portion of a chromosome, is responsible for the physiological abnormality. The literature of obstetrics and of stock-breeding abounds with nostrums for the arbitrary regulation of sex in man and the domestic animals, but from what is accurately known of the mechanism of sex-determination, nothing favourable to these claims can yet be adduced. Nor can any explanation be offered of the fairly constant departures from equality which normally occur in man and various domesticated animals. In the pig, ox and rabbit the male births are said sensibly to exceed the female, but in the horse and sheep there is a small excess of female births. The races of man show definite differences in the proportions of the sexes at birth. Of living births, taking females at 1,000, the males for England and Wales

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were for some time slightly below 1,040, which, though about the same as the proportion in Japan, is somewhat low in comparison with Germany, several European countries, and the white population of the United States, in which the males are about 1,060. On the other hand for the coloured population of the United States the male births are still less in proportion (in the year 1890, 1,024) and occasionally fall actually below the female number (998 in 1900). In all countries for which data can be obtained the proportion of males among *still-births* is very largely in excess of the females. Such divergences usually point to differential mortality or to the action of lethal factors, but in view of the large excess of males among still-births this account is not readily applicable here. The excess of males (surviving infancy) is exceptionally large in certain, though not all, of the families affected with the tendency to bleed profusely from trifling injuries, known as haemophilia. This is one of the sex-linked abnormalities appearing in males which follow much the same system of descent as colour-blindness. Illegitimate births in most countries show a distinct diminution in the excess of males.

Since the publication of Düsing, the proposition which he (following earlier writers) developed, that war produces an increase in the proportion of male births, has been widely disseminated. S. Newcomb investigated data as to births in the United States during the Civil War but found no positive result, and other parts of the evidence have been declared to be fallacious. Nevertheless, statistics for Great Britain and also those for Germany during the World War show a progressive rise which can scarcely be deemed insignificant. It should be remarked, however, that this rise had begun in Prussia some years before the war. On the other hand, no similar change has taken place in the neutral countries. For an adequate consideration of the facts many concomitant phenomena must be taken into account; for example, the fact that the total birth-rate of Prussia fell in the war period to less than half. Whatever be the immediate cause of the rise in male births, it is likely that it should be referred to the incidence of a differential pre-natal mortality rather than to any more fundamental genetic process.

Sex in Plants.—The attempt to make a factorial analysis of sex in the higher plants has not led to clear conclusions. Dioecious plants suitable for experiment are few. Correns, from results obtained in reciprocal crosses made between *Bryonia dioica* and the monoecious *B. alba*, inferred that the male of *dioica* was heterogametic, but the argument did not amount to proof. Shull's experiments with *Lychnis dioica* and a variation having the elements of both sexes present together were also beset with many complications and obscurities. In dioecious mosses the Marchals proved that segregation, in respect of sex, normally occurs at spore-formation, but both their experiments and those of Collins gave indications of further complexities. *Sphaerocarpos*, a liverwort, produces spores in tetrads, and of the four, two became males and two females. C. E. Allen states that the female spores each receive an accessory chromosome larger than that which passes to the male spores. Blakeslee showed that Mucors consist of several strains which may be called + and −, and that conjugation only takes place when a + culture comes into contact with a − culture. These strains may with great probability be regarded as two sexes, but the results were complicated by the discovery of other strains which are indifferent. We meet here the same difficulty noted in the case of animals, that the factorial relations between hermaphrodite plants and the dioecious forms have not yet been successfully represented. Varieties having the stamens to a greater or less degree aborted are not uncommon among the species of flowering plants which are normally hermaphrodite. If the deficiency is extreme, the variety is not merely in function female, but it is in a condition morphologically not distinguishable from the females of plants dioecious in the strict sense such as *Lychnis dioica* or *vespertina*. When such female varieties are fertilized with pollen from the hermaphrodite type the resulting family may be a mixture of hermaphrodites and females, but not rarely females only are produced. As the hermaphrodite is a dominant this evidence demonstrates that the hermaphrodite factor must thus be relegated to the female side, the male side taking the recessive in which the anthers are aborted. Such "unilateral" distribution of the factors may exist in regard to colour, double flowers and probably many other factorial distinctions, and the conception of sex-linkage is in a special and limited sense applicable to them (C. Pellew). Otherwise nothing comparable with the sex-linkage of animals has yet been discovered in plants. It must always be remembered that, on account of the complications created by the existence of a syncopated alternation of generations in the higher plants, no direct parallel between sex, as manifested in them, and that of animals can be instituted.

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SGAMBATI, GIOVANNI (1843–1914), Italian composer (*see* 24.757), died at Rome Dec. 15 1914.

SHACKLETON, SIR ERNEST HENRY (1874–1922), British polar explorer, was born at Kilkee Feb. 15 1874. He was educated at Dulwich College, and afterwards entered the merchant service, subsequently becoming a lieutenant in the R.N.R. In 1901 he joined the Antarctic expedition of Capt. Scott in the "Discovery," but had to return home on account of ill health. In 1908 he organized his first Antarctic expedition, largely fitted out by himself, which started from New Zealand in the "Nimrod," and achieved important results, reaching a point on the Antarctic continent about 97 m. from the South Pole (*see* 21.968). For this he was knighted in 1909, also receiving the C.V.O., while the Government contributed £20,000 towards the expenses of the expedition. He equipped a second expedition which left England in the "Endurance," Aug. 1 1914, with the idea of approaching the Antarctic continent from Weddell Sea and ultimately joining hands with another party whose ship, the "Aurora," was to start from Australia and approach by way of Ross Sea. Owing largely to bad ice conditions, the expedition was almost uniformly unfortunate (*see* ANTARCTIC REGIONS). The story of this expedition was related by Sir Ernest Shackleton in *South* (1919). He received the King's

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Polar medal and many honours from learned societies. In addition to the work mentioned above, he published *The Heart of the Antarctic* (1909). In 1921, in the "Quest," he organized a third expedition, which set sail in September; but while it was still on its way he died from an attack of *angina pectoris*, on board, off Georgia I., Jan. 5 1922.

SHANGHAI, China (*see* 24.799).—During 1911–21 the population and trade of Shanghai expanded steadily, as the result of the development of the port's railway communications with the interior and of the increasing development of cotton-spinning, shipbuilding and other industrial enterprises. At the same time the wealth and importance of the foreign settlements rapidly increased, chiefly because of the large number of Chinese officials, capitalists and political refugees who sought there security from the civil strife and disorders prevalent throughout the interior after the revolution.

The city's rate of expansion is reflected in the maritime customs returns, which show that the gross value of the trade of the port in 1919 amounted to 768 million taels, which, at an average exchange of 5s. 8d., represents £217,000,000. In 1908 the sterling value of the trade was £40,400,000. The changed conditions of international commerce brought about by the World War were manifested in the fact that in 1919, for the first time, the United States took the first place in the list of Shanghai's foreign trade, with a margin of 28 million taels over that of Japan, thus reversing the position occupied by the two countries in 1918. The trade of Great Britain, which before the war headed the list, showed signs of recovering some of its lost ground, especially in the matter of Manchester cotton goods.

The total pop. of Shanghai, as estimated by the Imperial Maritime Customs, was 1,000,000 in 1916, an estimate which included the inhabitants of the native city as well as those of the international and French settlements; but the actual total to-day must be considerably higher, for the Chinese pop. of the international settlement alone was 620,401 in 1915, and was estimated at 673,000 in June 1919. No reliable statistics are forthcoming in regard to the population of the native city (which displays but little evidence of the reformers' activities) nor of that of the Chinese-controlled suburbs of the foreign settlements, but it may be assumed to be increasing, while that of the French municipality has grown very rapidly since its boundaries were enlarged and its area developed by a progressive scheme of road construction. The foreign pop. of the international settlement in 1919 was calculated to be 22,000; at the last census (Oct. 1913) the total was 18,519, of which number 7,169 were Japanese, 4,822 British, 1,323 Portuguese, 1,307 Americans and 1,155 Germans. After the conclusion of the Russo-Japanese War, the number of Japanese residents increased much more rapidly than that of any other nation, but as the franchise for the election of the Land-renters' Executive Council is limited by property-owning or tax-paying qualifications, the British community still retains its predominant influence in municipal affairs. The Land-renters' list at the beginning of 1920 showed 1,100 British voters, as against 300 Japanese, 230 Americans and 150 Germans. The steady expansion of the revenues collected by the self-governing Council of the International Settlement (in which the Chinese Government has no jurisdiction) affords evidence of the growth and prosperity of the city during the past decade. In 1911 the rates and taxes collected were 2,589,628 taels; in 1919 the total was 4,419,961. The street traffic returns are significant not only of rapid growth but of changing conditions. In 1911 the council licensed 11,111 jinrikishas, 1,277 carriages, 217 motor-cars, 5,310 wheelbarrows, 199 sedan-chairs and 958 carts; the corresponding figures for 1919 were 14,726 jinrikishas, 831 carriages, 1,378 motor-cars, 8,667 wheelbarrows, 18 sedan-chairs and 2,141 carts. Industrial enterprise during this period was greatly stimulated by the improved facilities for the transport of raw materials provided by railway construction in the interior; cotton-mills, in particular, increased rapidly, the number of these at Shanghai at the close of 1920 being 26, with a total of 901,898 spindles. Factories were also established for the making of flour, cigarettes, matches, etc., and, as in Japan, a new development of the retail trade was manifested by the establishment of large department stores, conducted on European and American lines.

The political importance of Shanghai, as the headquarters of Young China and a sanctuary for political refugees of all descriptions, naturally increased during and after the upheaval of the Chinese Revolution. Many wealthy and conservative officials of the old régime sought and found security for themselves and their property within the limits of the extra-territorialized Foreign Settlements; later, in 1913, the expulsion of the Kuo-Min-tang politicians from Peking by President Yuan led many of these southern Parliamentarians to make Shanghai their headquarters, and each succeeding year of civil strife added to the numbers of those who sought shelter from its widespread disorders under the shelter of the municipality. Nor were the political refugees all Chinese, for, after the revolt of the Koreans against the Japanese Government in 1919, "the Provisional Government of the Korean Republic" established itself at Shanghai. Thus the little spot originally set apart as a place of residence for foreign traders came by force of circumstances to be the birthplace and centre of political activities in China, the vernacular press at Shanghai (including several of the most influential newspapers in the country) being generally in opposition to the policy of Peking and in sympathy with the views of the student class. By common consent of the contending factions, the Peace Conference convened in 1919 to discuss the differences between the Peking Government and the southern "Constitutionalists" was held in the neutral territory of the international settlement. An interesting feature of Young China's political activities in 1919–20 of particular importance to the future of Shanghai lay in its increasing insistence, on the one hand, on the abolition of the foreigners' extra-territorial rights and, on the other, on the recognition of the Chinese taxpayers' claim to a share in the direct executive government of the settlement, a claim which (while morally undeniable) would, if successful, effectively put an end to the conditions by virtue of which the Foreign settlements have afforded security for life and property during periods of widespread disorder in China.

See George Lanning and Samuel Couling, *The History of Shanghai* (1920). (J. O. P. B.)

SHANNON, CHARLES HAZELWOOD (1865–), English painter (*see* 24.801), was elected A.R.A. in 1911, and in 1918 became vice-president of the International Society of Sculptors, Painters and Gravers. His more recent works include "The Amethyst Necklace" (1907), "The Morning Toilet" (1912), "The Embroidered Shawl" (1914), and "The Incoming Tide" (1918); while in 1918 he produced various portraits, including those of Princess Patricia of Connaught, Miss Lillah McCarthy, and Miss Hilda Moore ("The Lady in Black"). Among his lithographs may be mentioned "Playmates" (1908), "Ebb Tide" (1917), "The Tidal River," and "A Sharp Corner" (1919). In 1920 he was elected R.A.

SHAUGHNESSY, THOMAS GEORGE SHAUGHNESSY, 1ST BARON (1853–), Canadian railway president, was born at Milwaukee Oct. 6 1853, his parents being Irish. He was educated at St. Gall's academy, Wisconsin, and began his railway service at the age of sixteen. In 1882 he joined the staff of the Canadian Pacific as general purchasing agent, and by 1891 had risen to be its vice-president. From 1899 to 1918 he was president and chairman of the board of directors, as well as a director of all the allied lines. He was knighted in 1901, created K.C.V.O. in 1907, and raised to the peerage of the United Kingdom as Baron Shaughnessy of Montreal and of Ashford, co. Limerick, in 1916. His two sons, William James Shaughnessy (b. 1883) and Alfred Thomas Shaughnessy (b. 1887) served in the Canadian Expeditionary Force during the World War, and the younger was killed in action in 1916.

SHAW, ANNA HOWARD (1847–1919), American reformer, was born at Newcastle-upon-Tyne, England, Feb. 14 1847. When she was a small child her parents moved to Massachusetts, and soon afterwards to Michigan, where her father cleared a farm, 40 m. from the nearest post-office and 100 m. from the railway. From 1872 to 1875 she studied at Albion College, Mich., and in 1878 graduated from the Theological School of Boston University. The district conference of the Methodist Episcopal Church granted her a local preacher's licence, and she held pastorates at Hingham and East Dennis, Mass., remaining in the latter place seven years, until 1885. Meanwhile the New England Conference of the M.E. Church refused to ordain her because of her sex, and the refusal was upheld by the General Conference at Cincinnati in 1880. But the same year she was ordained in the Methodist Protestant Church. While preaching she had studied medicine and received the degree of M.D. from Boston University in 1885. She was then chosen lecturer for the Massachusetts Woman's Suffrage Association. The following year she was made national superintendent of franchise of the Women's

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Christian Temperance Union, serving for six years. She was also associated after 1886 with the National American Woman's Suffrage Association as lecturer, vice-president-at-large, and from 1904–15 as president, when she declined reëlection. She had spoken in every state, before many state Legislatures, and before Congressional committees. She was a member of the International Council of Women; the International Suffrage Alliance; the National Society for Broader Education and the League to Enforce Peace. In 1917 she was appointed chairman of the woman's committee of the Council of National Defense, and in 1918 edited for this committee a department in the *Ladies' Home Journal*. She died at Moylan, Pa., July 2 1919, shortly after the passage of the suffrage amendment to the Federal Constitution by Congress. Her last message was an appeal to women to use their influence for the ratification of the League of Nations. She was the author of *The Story of a Pioneer* (1915, with Elizabeth Jordan) and joint editor of *The Yellow Ribbon Speaker* (1891, with Alice Stone Blackwell and Lucy Elmira Anthony).

SHAW, GEORGE BERNARD (1856–), British dramatist (*see* 24.812), produced on the London stage subsequently to 1910 *Fanny's First Play* (1911), *Overruled* (1912), *Androcles and the Lion* and *Great Catherine* (1913) and *Pygmalion* and *The Music Cure* (1914). He also produced in Dublin, or at special performances in London, the one-act plays *O'Flaherty, V.C.* and *Augustus does his Bit* (both satires on problems of the World War), *The Inca of Jerusalem* and *Annajanska*, and published a three-act play *Heartbreak House* (1919), produced in New York, and also in a German version in Vienna in Nov. 1920. A few months after the outbreak of war he published, as a special supplement to *The New Statesman*, an outspoken deliverance on "Common Sense and the War," which occasioned much comment and earned him some unpopularity. In 1921 he published *Back to Methuselah*. (*See* ENGLISH LITERATURE.)

SHAW, JOHN BYAM (1872–1919), English painter, was born at Madras Nov. 13 1872, the son of John Shaw, registrar of the high court of Madras. He came to England in 1878, and his first art teaching was obtained at the St. John's Wood school of art. He entered the Royal Academy schools in 1889, and his picture "Rose Mary" was hung in 1893. One of his best-known works was "Love the Conqueror" (1899). He illustrated a great number of books, among them being Browning's *Poems* (1898); *Tales from Boccaccio* (1899); *Pilgrim's Progress* (1904); Edgar Allan Poe's *Tales* (1909), etc. In 1911 he established, with Rex Vicat Cole (b. 1870), a school of art at Kensington. He died in London Jan. 26 1919.

SHAW, RICHARD NORMAN (1831–1912), English architect (*see* 24.813), died at Hampstead Nov. 17 1912.

SHAW, SIR WILLIAM NAPIER (1854–), British meteorologist, was born at Birmingham, March 4 1854. He was educated at King Edward's school, Birmingham, Emmanuel College, Cambridge, of which he became a fellow in 1877, and the university of Berlin. From 1887–99 he was university lecturer in experimental physics at Cambridge, from 1898–9 assistant director of the Cavendish laboratory, and from 1899–9 senior tutor of Emmanuel College. In 1891 he was elected a fellow of the Royal Society. In 1897 he became a member of the Meteorological Council, and was from 1900 to 1905 its secretary, in the latter year being appointed director of the Meteorological Office. In 1907 he became reader in meteorology in the university of London. He was president of the mathematical and physical section of the British Association in 1908 and of the educational section in 1919, and in 1919 was president of the International Conference of Meteorologists held in Paris. He was knighted in 1915, and in 1920 retired from his position at the Meteorological Office. Sir Napier Shaw's works include *Life History of Surface Air Currents* (with R. G. K. Lempfert, 1906); *Air Currents and the Laws of Ventilation* (1907); *Forecasting Weather* (1911); *Manual of Meteorology* (1919); besides many papers in scientific journals and valuable reports of meteorological and other subjects. He received many honours and distinctions, including the Symons medal of the Royal Meteorological Society.

SHELL-SHOCK, the popular name given during the World War to an obscure form of nervous disease which became rife among the armies. The term "shell-shock" appears to have been officially adopted in Great Britain in 1916, although cases to which this term might have been equally applicable had occurred in the English and French armies from the beginning of the war and onwards. It is probable, although it is not recorded, that similar cases occurred in previous bloody wars; but never before have such vast numbers of men been subjected to such terrific strain, dangers and horrors from forces generated by explosives. In consequence thereof the term "shell-shock," applied to all forms of war psycho-neurosis, found ready acceptance by the press and public, but by neurologists it was generally regarded as a misnomer—unless it were strictly limited to cases of concussion or commotion of the brain directly caused by the violence of the forces generated by the explosion.

Early in the war, and subsequently, cases of sudden death of groups of men without visible external signs of injury were recorded. They were particularly noted when the explosive forces were generated in confined spaces, where percussion and repercussion would be intensified in their effects upon the cerebro-spinal fluid, which acts as a water-jacket to the central nervous system and especially protects the vital centres in the medulla from concussion. Carbon-monoxide poisoning was also considered a possible cause of such a death, and especially was this likely in the case of explosion of mines or the imperfect detonation of shells in closed spaces, such as dugouts, saps or ravines.

The great majority of cases diagnosed as "shell-shock" were not *commotional* in origin, but *emotional*, and due in most instances to the existence in the sufferer of an inborn timorous, neuropathic or psychopathic disposition; but in a certain number of cases an emotional instability was acquired by the prolonged strain and stress of war. Thus fatigue, insomnia, anxiety and infective disease frequently combined to cause a neuro-potentially sound individual, with an excellent record of service, to become emotive and to develop "shell-shock," the final breakdown having been precipitated by a shell bursting near to him. The present writer had the opportunity of examining post-mortem the brain in such a case, and it showed rupture of minute vessels and haemorrhages into the substance of the brain and cerebro-spinal fluid.

In the absence of objective signs during life, such as ruptured tympanum, and changes in the cerebro-spinal fluid—for example, the existence of blood—it would be impossible for the medical officers to decide whether such a case was primarily commotional or emotional. This is an important matter, for the former was classed as a battle casualty and entitled the sufferer to a gratuity. The large number of British cases claiming a gratuity for "shell-shock" led to the promulgation of Army Form W 3436, which required circumstantial evidence by an eye-witness of the proximity of the soldier to the bursting shell. Even then great difficulties were experienced in coming to a just decision, for a purely commotional case, if not severe, usually recovered more rapidly than an emotional one; consequently a record of service and the severity, character and persistence of symptons had to be taken into account.

The diagnosis of "shell-shock" was made at the Casualty Clearing and Field Ambulance stations, and when a barrage was opened prior to the attack of the enemy, or other intense shell-fire, medical officers at the front-line stations had little time to investigate the numbers of casualties coming in, and until the later period of the war cases of "shell-shock" were sent to the base hospitals. The wish in a great number of these cases was not to go back to an intolerable situation; and fear, associated with the instinct of self-preservation, arose as an unconscious defence mechanism, and persisted in maintaining such hysterical manifestations as amnesia, tremors, paralyses, contractures, convulsive tics, aphonia, mutism, blindness, deafness and other functional sensori-motor disabilities. Whereas hysterical manifestations were extremely common in the ranks, they were relatively rare among the officers, who suffered from neurasthenia and anxiety neurosis instead. These two forms of psycho-neurosis

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in no essential manner differed from those affecting civilians of either sex (*see* 14.211 and 19.432).

Among the causes which led to the prevalence of cases diagnosed "shell-shock" was the neurological and psychological inexperience of medical officers in the diagnosis and treatment of psycho-neurosis. Another was the degree of discipline, *moral* and *esprit de corps* in a regiment; this largely depended upon the personality of the commanding officer, the medical officer and the quartermaster, their efficiency in performing their duties and their endeavours to supervise the welfare of their men so far as the emergencies of war permitted. Thus confidence and will-power were inspired in the men to face with them any situation, and "shell-shock" cases were relatively few in such regiments as compared with the number of cases in a regiment with poor *moral* and discipline, where suggestion played an important part.

It is generally accepted by medical authorities in England and abroad that the stress and strain of war, including exposure to shell-fire, does not produce psychoses such as epilepsy, manic depressive insanity, dementia-praecox, obsessional psychasthenia, or an organic disease like general paralysis, but it may excite or reveal them. It is, however, admitted that exhaustion or toxic psychoses with mental confusion of a temporary character are often due solely to the stress and strain of war.

Relation of "Shell-shock" to Court-Martial Procedure.—As a result of questions in Parliament and a debate opened on April 28 1920 by Lord Southborough, a War Office committee, with Lord Southborough as president, was constituted July 1920 with the following terms of reference:—

"To consider the different types of hysteria and traumatic neurosis called 'shell-shock'; to collate the expert knowledge of the service medical authorities and the medical profession from the experience of the war, with a view of recording for future use the ascertained facts as to its crisis, nature and remedial treatment and to advise whether, by military training or education, some scientific method of guarding against its occurrence can be devised."

In the House of Lords debate, in which Lord Horne, Viscount Peel and Lord Haldane took part, a good deal of attention was devoted to court-martial procedure, and especially in relation to "shell-shock" and to death sentences in connexion with cowardice and desertion. From what was said it seems probable that in the early days of the war, before "shell-shock" was fully understood, a few men were shot who, in the light of further knowledge and experience, could not have been held responsible for their actions. The question arises, When is a man who has pleaded "shell-shock" (taken in its widest acceptance) to be held responsible for and conscious of the quality of his acts? The psychology of the emotion of fear in relation to the instinct of self-preservation and the will-power to control supplies a basis upon which to answer this question. The emotion of fear is associated with three instinctive reactions, as we see in animals: (1) flight; (2) immobility; (3) concealment. In war practically every man, even the bravest, before a battle may experience fear; but a soldier should, by suitable training and confidence in his superior officers, overcome this by will-power, and thus convert the primary reaction of fear into that of anger. How can a medical officer differentiate between cowardice and fear causing an irresponsible lack of will-power in a man to control his actions in the face of difficulties and dangers? The doctor should know the man's personality, his previous record and what his comrades thought of him. It is not so much what he says as what he did, or what he has done, which will help towards a decision. There are, however, certain signs in a man who refuses to go forward in action or who runs away, that show he cannot be held altogether responsible for his action. He may be dazed in consequence of "shell-shock" and be the subject of mental confusion; there may be physical signs of fear over which he has no voluntary control, namely rapid action of the heart, dilatation of the pupils, sweating, blueness and coldness of the hands, often protrusion of the eyeballs, and an expression on the face which is hard to simulate. These conditions, associated with trembling, are sufficient indications of true fear inhibiting the will.

Out of the psychology of fear arises the question whether *in recruiting* there is any test by which the unfitness for active service on account of a nervous disposition can be ascertained. And, if so, whether it would be desirable to eliminate from the army such a man without probation. It is a fact that many highly intelligent men with nervous instability may, if suitably trained, develop into most efficient officers and non-commissioned officers. Much depends upon the method of training and on those who undertake the training. A sensitive nature with self-esteem must not be broken by harshness or injustice, which produces a mental conflict ending in an anxiety-neurosis or neurasthenia. It is generally admitted that under no circumstances should an imbecile, an epileptic or an individual who has suffered with a previous attack of insanity be recruited.

For further information the reader is referred to *Parliamentary Debates, House of Lords*, Wed. April 28 1920, vol. xxxix., No. 29. See also Sir F. W. Mott, *Shell Shock and War Neurosis* (1919).

(F. W. Mo.)

SHERMAN, JAMES SCHOOLCRAFT (1855–1912), American politician, was born near Utica, N.Y., Oct. 24 1855. He graduated from Hamilton College in 1878, was admitted to the bar in 1880, and practised in Utica until 1907. In early manhood he left the Democratic party, became a Republican, and as such was elected mayor of Utica in 1884. In 1886 he was elected to the National House of Representatives and was returned continuously until 1908, excepting the term 1891–3. He was a delegate to the National Republican Convention in 1892; chairman of the Republican State Convention in 1895, 1900, and 1908; and chairman of the Republican National Committee in 1906. For 12 years he was chairman of the House Committee on Indian Affairs—a subject naturally of great interest to him, as he was a relative of Henry R. Schoolcraft (*see* 24.359)—and the Sherman Institute in California, an Indian school, bears his name. At the Republican National Convention of 1908 he was nominated vice-president on the first ballot and was elected on the ticket with William Howard Taft. Four years later he was renominated, but he died at Utica, Oct. 30 1912, shortly before the elections.

SHEVKET, MAHMUD (1858–1913), Turkish pasha, was born at Bagdad in 1858, and from early youth showed marked qualities of intellect and personality. He received his military training at the military college in Constantinople, 1875–80, and after a very brief period of service with the troops was given an appointment on the general staff. Von der Goltz, who at that time was reorganizing the Turkish army, thought very highly of the young Shevket, and it was through his agency that the latter was sent to Germany to manage the reëquipment of the Turkish army. As a result he remained from 1884 to 1894 in the small arms factory of Mauser Bros., at Oberndorf on the Neckar. He also studied armament problems in France for a short time, and in 1894, as the reward of his labours, was made inspector of military arsenals in Constantinople. From 1901 to 1903 he was military governor of the Hejaz, in Arabia, then in what amounted to a state of war. He next went in a like capacity to Kossovo (Uskub), and there came in contact with the Young Turk movement, which had its headquarters in Salonika. In 1908 Abdul Hamid averted the break-up of the old régime by summoning a National Assembly. This state of things, however, did not last long. In the spring of 1909 the Old and Young Turks were struggling for supremacy. A powerful Old Turk counter-revolution was prepared, but, in mid-April, the III. Army Corps, under Hussein Husni Pasha, marched from Salonika against Constantinople. At San Stefano Mahmud Shevket took over the command, and, after heavy fighting, forced his way on April 4 into Constantinople. Impressed by his victory the National Assembly no longer dared to oppose the will of the Young Turks, and on April 26 voted the deposition of Abdul Hamid. Mahmud Shevket was the hero of the day. But he did not care for politics, which he considered had been the ruin of the Turkish corps of officers, and preferred to confine his activities to purely military matters. The next few years afforded him plenty of opportunities. In 1910 and 1911 he put down a revolt of the Malissors with great energy, and in 1912 fought against the rebels in Albania. In the summer of 1912 he became Minister of War, and in Jan. 1913 succeeded Kiamil as Grand Vizier. He took a very

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active part in army reforms, but he came into conflict with the Union Libérale, which took its orders from Sherif Pasha in Paris, and he was murdered by one of its members on June 11 1913.

SHIP AND SHIPBUILDING (*see* 24.867).—The period from 1910–21 was marked by great progress in shipbuilding; that progress was in some ways interrupted, in others stimulated, by the World War, which overshadowed every phase of development both in commercial and naval enterprise. The naval strengths during ten years after 1921 of the chief nations were restricted as a result of the decisions summarized in the article WASHINGTON CONFERENCE.

The great object of the Allied belligerents during the war being to obtain the maximum output both of war material and of merchant ships on which their supplies depended, those responsible for the building of all types of ships naturally turned their attention to standardization. This had the effect of retarding the adoption of new inventions on the one hand; but on the other the novel circumstances and continued development of material by Germany during the war, and the ruthless use made of that war material, continually called for novel devices and new types of ships to meet and defeat the continually changing and ever-increasing intensity of the campaign. This, whilst it produced many new types of warships and countless devices for their improvement in offence and defence, in the case of many classes of warships, but more particularly in the design of merchant ships, had the effect of developing standardized types, both in Great Britain and later in America, in order to increase the numbers of ships for transport purposes of all kinds and so counter the enormous losses due to the German submarine campaign. After the Armistice, although at first there was an enormous demand for ships of all classes, the slump in trade in 1920–1 and the very high prices of ships had the effect of reducing the demand. In Great Britain many of the warships building after the Armistice were broken up and no new ships had in 1921 been started. The output of merchant ships was in 1921 steadily declining, so that it could not be said that shipbuilding had yet resumed that steady advance which was being made before the war.

The outstanding features which have affected the design of all classes of ships specially are the gradual adoption of oil in lieu of coal as a fuel, the further development of the steam turbine, and, for certain classes of vessels, the progress made with internal-combustion engines (*see* INTERNAL COMBUSTION ENGINES).

In the British navy, and to a great extent in other navies, during this period, oil most completely superseded coal for steam-raising. At first destroyers were the only type of vessel, apart from submarines, in which coal was altogether abolished as a fuel in the British navy. Then in 1912 light cruisers of the "Arethusa" class had oil only. A little later in that year, in the "Queen Elizabeth" class of battleships oil was decided upon as the only fuel for the first time in a capital ship. Subsequently to that, no British warship proper, with the exception of the "Raleigh" class of 10,000-ton light cruisers, which were destined for world-wide work, had anything but oil as a fuel, and in the "Raleighs" seven-eighths of the power was derived from oil. This change was a very momentous one to make, especially when it is considered that in Welsh coal Great Britain possessed the finest and then the cheapest steam coal in the world. In spite of this, however, the advantages of oil were so great that, when in use it had been found satisfactory, coal was relegated to be the fuel of none but special or auxiliary ships in the navy.

The advantages of oil may be summarized shortly as follows: For the same weight it has 50% more thermal value than coal. It occupies less space and can be stowed in spaces inconvenient for coal and other stores. Boilers with oil remain much cleaner for a long period, so that full power can be kept up indefinitely as long as the fuel lasts. Oil can be easily taken on board at any time, thus not calling upon the crew for the great exertion involved in coaling ship hurriedly, perhaps just before their energies are required for fighting an action. The exertion of stoking is entirely done away with and far fewer men are required in the stokehold, which is always clean and comfortable. With oil also much larger boilers can be used, which saves space in the boiler-rooms. Though there are other contingent advantages, those named are enough to show that the British Admiralty took a wise course in adopting oil for all fighting ships, and this was amply proved during the war.

Subsequently, owing to the very high price of coal and of wages for firemen, many of the advantages enumerated above induced merchant shipowners to adopt oil in place of coal for high-powered passenger vessels. In low-speed cargo-boats the great economy of internal-combustion engines as compared with steam-engines, makes the advantage of the adoption of oil still more paramount, and the number of these vessels has been largely increased. The comparatively low powers, however, which can be got with internal-combustion engines prevented their being adopted up to 1921 for fast merchant ships or for any warships, except submarines, which generally have comparatively low power and moderate speed. In submarines a much lighter internal-combustion engine than that used for cargo vessels has been developed, with a high number of revolutions.

Another very important advance in marine engines has been gained by the used of toothed gearing. This gear enabling the high number of revolutions in turbines to be reduced, so that large slow-running propellers can be used in conjunction with very quick-running efficient turbines, a much higher efficiency has been secured and increased speed of ship and economy of working has resulted. In its present form this gearing was first introduced in 1910 by Sir Charles Parsons in connexion with the turbine engines of a merchant vessel named the "Vespasian." The success of the trials of this ship led to the further adoption of gearing, and for the British navy it was first tried in destroyers, then in some light cruisers, and was in 1921 gradually coming into use for most war ships and many mercantile ships. The largest ship in which it had been adopted was H.M.S. "Hood."

I. BRITISH WARSHIPS

Taking the first most important type of British warship, namely capital ships, the naval actions in the Russo-Japanese war of 1904–5 had demonstrated the capital importance of the heavy long-range gun, while the turbine system of propulsion had been sufficiently tested in high-speed passenger vessels and small warships to justify its adoption, at any rate experimentally, in warships of a larger size. These changes were, no doubt, bold ones, both as regards guns and machinery; but the wisdom of their selection for the design of the first "Dreadnought," in 1905, was sufficiently vindicated by subsequent experience, and by the general acceptance of these two features by other naval Powers.

Laid down in Oct. 1905, the original "Dreadnought" proved so successful that from 1907 onwards the designs of British capital ships moved on progressive lines without departing from the essential principle of the "Dreadnought" type, viz. a ship carrying an all-big-gun armament, adequately protected for taking her place in the line of battle, and of a speed at least equal to that of any foreign ship of similar rank.

The next 10 years therefore saw a succession of post-"Dreadnought" battleships in which the primary armament passed from the ten 12-in. guns of the "Dreadnought" through the ten 13·5-in. guns of the "Orion" (all on the centre line of the ship) to the eight 15-in. guns of the "Queen Elizabeth," an increase, within that brief period, of over 126% in the heavy projectile weight of discharge. There was no secondary battery, properly speaking. The "Dreadnought" carried 24 12-pdrs. for repelling T.B.D. attack, but this armament was soon recognized as being too light for the ever-increasing size and power of destroyers, and in subsequent ships up to the "King George V." class (inclusive) batteries of 12 to 16 4-in. guns were mounted as high up as possible to repel the attack of destroyers. In the "Iron Duke" and "Queen Elizabeth" classes 6-in. Q.F. guns were substituted for the 4-in., as the latter weapon was then thought to be insufficient against destroyers and light cruisers.

The speed of these battleships was kept at the uniform level of 21 knots up to and including the "Iron Duke" class. The type of turbine machinery on four shafts, which had proved so satisfactory in the original "Dreadnought," became the standard,

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but the growth in displacement necessitated a corresponding increase in power to attain the requisite speed. The use of oil fuel in association with coal was maintained until the "Queen Elizabeth" class was reached, when the greater advantages of oil fuel and the improved methods of its combustion finally caused the abandonment of coal as fuel. A noteworthy feature of these remarkable vessels was the advance in speed to 25 knots, necessitating, on a slightly larger displacement than that of their predecessors, an increase of about 150% in the power.

Concurrently with the development of the battleship proper, that of the British battle cruiser may be followed with advantage. Up to the inception of the "Dreadnought" design nothing more ambitious than an armament consisting of 9·2-in. guns associated with 7·5-in. guns ("Warrior" and "Minotaur," 1903–4) had been attempted in armoured cruisers. But the same reasons which caused the evolution of the all-big-gun battleships from the mixed armament of the "King Edward VII." and "Lord Nelson" classes now called for a similar simplification in the armoured cruiser designs. The outcome of this policy was the production of the "Invincible" class of "cruiser battleships," now generally known as "battle cruisers."

In these vessels the additional power necessary for their 4 to 5 knots superiority of speed over the "Dreadnought" was obtained at the sacrifice of two 12-in. guns and some loss of armour protection. The value of speed, which in battleships had always been a debatable point, was, of course, incontestable for the battle cruisers, and the development of the type has, both before and since the outbreak of the war, kept pace with the insistent demands of the strategist for the highest speed obtainable. Within the 10-year period referred to above, the increase in speed and power from the "Invincible" (25 knots for 41,000 H.P.) to the "Renown" (32 knots for 120,000 H.P.) required an increase in displacement from 17,250 tons to 26,500 tons, the relative increase in power being over 190 per cent. Finally in the "Hood" a speed of 32 knots with 144,000 H.P. on a displacement of 41,200 tons, an increase of 235% in power was involved.

The wisdom of the policy which initiated this new era in naval construction, relegating temporarily into the background the former British supremacy in capital ships, was naturally the subject of much criticism. But evolution in warship construction is not the property of any one navy, and there is little doubt that, at the conclusion of the Japanese war, the world stood on the threshold of a new era in naval architecture. If British naval supremacy was to be maintained it had to be done by leading the world along the new path of warship design, without waiting for others to utilize the advantages that had been rendered possible by progress in armour, guns and machinery. How great an advance the "Dreadnought" represented on previous ships may be gauged from the particulars given in Table I.

TABLE I.—*Comparison between "Dreadnought" and the Best Previous Ships.*

	"Dreadnought" (as designed)	Best Previous Ship
Number of 12-in. guns carried.	10	4
Length of line of battle for equal number of 12-in. guns on the broadside	Ratio	1 to 2
Total muzzle energy per broadside of 12-in. guns	383,000 ft.-tons	145,000 ft.-tons
Length of line of battle for equal 12-in. broadside gun power	Ratio	1 to 2·6
Tons displacement per 12-in. gun	1,785	3,750
First cost per 12-in. gun in line of battle.	£175,000	£280,000
Annual upkeep of ship per 12-in. gun carried.[1]	£ 34,800	£ 62,300
Speed (knots)	21	19
Endurance:		
At economical speed (nautical m.)	5,800	5,790
At 16 knots (nautical m.)	4,000	3,000

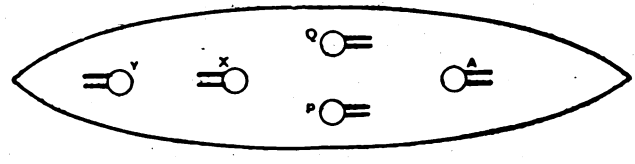
Other navies were not slow to follow the lead given by Great Britain. The veil of secrecy in which the new types were closely shrouded whetted the emulation as well as the curiosity of other nations. Germany, ever ready to reap where others have sown, set about preparing for the change, and two years later produced the "Nassau" class, with 12 11-in. guns as main armament and 12 6-in. guns as anti-destroyer armament. At the rate of three a year she continued to lay down ships of this type—improved in armament as time progressed—each batch being accompanied by a battle cruiser of corresponding power and speed. Other nations fell into step, and, during the five or six years preceding the outbreak of war, produced, with variants appropriate to their several necessities, all-big-gun ships carrying a main armament of 10 or 12 primary weapons grouped in turrets shielding two, three, or even four guns each.

While the German output of capital ships had, once it got under way, continued with methodical regularity, British naval construction had suffered from the vagaries inseparable from divergent political views and aspirations.

Under the "Cawdor Memorandum" of Nov. 30 1905 it had been laid down that the minimum British requirements would be four large armoured ships a year, and the "Dreadnought" with the three "Invincibles" fulfilled this condition, but in each of the two following years only three battleships (and no battle cruisers) were laid down, while the 1908–9 programme only provided for one battleship ("Neptune") and one armoured cruiser ("Indefatigable"). Efforts had been made to induce Germany to curtail her naval expansion—"a year's holiday in naval construction" being suggested—but such hopes as were based on this contingency gradually faded before the inexorable German determination to challenge British sea supremacy. In the 1909–10 estimates provision was therefore made for laying down four capital ships, two in July 1909 ("Colossus" and "Hercules") and two in Nov. ("Orion" and "Lion"), while four "contingent" ships ("Monarch," "Thunderer," "Conqueror" and "Princess Royal") were to be laid down in April 1910, if the German menace showed no signs of abating. So far from this latter being the case, there was an acceleration in the dates of laying down the German ships, and the programme outlined above was therefore punctually carried out. The 1909–10 programme, it will be seen, was a memorable one in the history of British naval construction, and its adoption enabled Great Britain to maintain her naval supremacy, which otherwise would have been jeopardized.

Notwithstanding the atmosphere of uncertainty created by the delays due to hopes of a reduction of armaments, the rate of progress on warships under construction was well maintained, and, with a few exceptions, Great Britain was able to complete the largest battleships within 24 to 30 months of laying down, a performance which compared favourably with the best achievements abroad, and which not even Germany with her methodical preparations was able to equal.

The disposition of the heavy guns in both battleships and battle cruisers had, during the first five years of this period, undergone several important modifications. In the "Dreadnought," "Bellerophon" and "St. Vincent" classes the five two-gun turrets were placed as in the diagram:—A being on the forecastle deck, the remaining turrets on the upper deck, giving eight guns on each broadside, six ahead and six astern.



The "Invincibles," which carried one turret (X) less, had the two middle turrets P and Q disposed *en échelon*, and the superstructure amidships was so arranged as to enable all eight guns to fire on either broadside. The middle turrets were, however, placed so near to one another that serious trouble was experienced from gun blast when firing across the deck. In the battle cruisers of the "Indefatigable" class, and the battleships of the "Neptune" and "Colossus" classes, therefore, where a similar arrangement was adopted, the centre pair of turrets were spaced wider apart. A further change in the arrangement of turrets was adopted for the first time in these

[1] This includes pay, victualling, repairs, coal, stores, etc., together with an addition of 15% per annum of first cost, for interest and depreciation, etc

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battleships, where the after-pair were disposed at different deck levels to enable X turret to fire over Y. This arrangement, which now became the standard practice, while it introduced some difficulty in providing for stability, was economical of space, and simplified many of the gunnery problems connected with the ship; it gave, moreover, a higher gun platform for some of the armament.

While the offensive qualities of the battleships had continued to increase in successive types, the need for improved defence, particularly against mine and torpedo attack, had not been overlooked.

The adoption of protective bulkheads against under-water attack as carried out in the "Dreadnought" and subsequent capital ships was the outcome of the naval engagements of the Russo-Japanese war. The Russian battleship "Tsarevitch," in particular, had been fitted with a protective deck which, instead of being continued to the side of the ship, was turned down in wake of the magazines, forming a heavy longitudinal bulkhead situated some distance from the ship's side. This protection had enabled her to resist successfully the explosion of several torpedoes. It was decided to incorporate in the "Dreadnought" design some under-water protection to the vitals. Within the limits of displacement available it was not possible to do more than protect the magazines and shell-rooms. These were given 2-in. protective bulkhead plating at the three centre-line turrets, and 4-in. protective bulkhead plating outside the two beam turrets, as the latter, being situated nearer the sides of the vessel, were consequently much more vulnerable.

In the subsequent "Bellerophon" and "St. Vincent" classes this side protection was developed in the form of a continuous longitudinal protective bulkhead terminated by protective transverse bulkheads completely boxing in the magazines and shell-rooms of the five turrets and the main machinery spaces enclosed between them. The thickness varies from 1½ in. to 3 in. according to the distance of the bulkhead from the outer shell of the ship. In a vertical direction the bulkhead ran from the outer bottom to just above the lower edge of the side armour. In the "Hercules" and "Orion" classes there was a reversion to the original "Dreadnought" system of isolated protection to the various compartments immediately below each of the three groups of turrets, the remainder of the ship's hull below water-line being unprotected. In the "King George V." and "Iron Duke" classes the under-water protection was extended by joining up the portions between the two foremost turrets to those below the centre turret, so that only the ends of the ship and something less than the middle third remained unprotected. Concurrently with the battleships this form of protection was also fitted in the battle cruisers, but limited to the magazines and shell-rooms.

Finally, in the "Queen Elizabeth" (the torpedo menace having increased) the continuous longitudinal protective bulkheads were once more incorporated, and with the transverse protective bulkheads at each end, girdling the ship throughout nearly her entire length, so that not only shell-rooms and magazines, but engine- and boiler-rooms had the protection of a bulkhead 2 in. thick some 10 ft. from the ship's side, with the addition of another longitudinal bulkhead of 17 lbs. plating placed (at a distance of 7 ft. amidships and at varying distances at the ends) on the inner side of the protective bulkhead, further minimizing the risk of damage to the vitals of the ship from the effects of an explosion.

The arrangement of the protective bulkheads in the "Royal Sovereign" class generally followed that of "Queen Elizabeth," but their thickness was 1½ inches.

The efficiency of this system of protection, which a series of experiments had established, was demonstrated at Jutland, and it was further improved upon by the later forms of bulge protection.

The construction of British battle cruisers had proceeded concurrently with that of the battleships, although in smaller numbers. The demands made upon the engineering staff to provide for the large increases of power already referred to involved many difficult problems, but the "Indefatigable" was nevertheless completed (in 1911) within two years of laying down, and the later ships, "Lion," "Princess Royal," "Queen Mary," and "Tiger," followed on in succeeding years, each marking some advance in power and speed. Two other battle cruisers of the "Indefatigable" type, viz. "New Zealand" and "Australia," built for the Dominions from whence they took their names, had also been completed and were available for reinforcing the battle cruiser squadrons.

When the World War broke out in Aug. 1914 there were, moreover, four capital ships building in England for foreign Powers—two for Turkey and two for the Chilean Government. The two Turkish ships had just been completed and commissioned, one at Armstrong's and the other at Vickers', and were on the eve of sailing when war was declared. As both vessels were subject to preëmption in the event of war, the Government promptly took them over and added them to the British fleet under the names of "Agincourt" and "Erin" respectively.

Of the two Chilean ships building in England at Armstrong's, the "Almirante Latorre" (10 14-in. guns and 16 6-in. guns) was the further advanced, and she was taken over and renamed "Canada." She was completed in Sept. 1915. The "Almirante Cochrane" was taken over in 1918 for conversion into an aircraft carrier, being renamed "Eagle."

There were thus at the outbreak of war the following completed capital ships on the offensive British list:—

"Erin" and "Agincourt" (purchased)	2
"Iron Duke" class	2[1]
"King George V." class	4
"Orion" class	4
"Colossus" class	2
"Neptune"	1
"St. Vincent" class	3
"Bellerophon" class	3
"Dreadnought"	1
Battleships	22
"Queen Mary"	1[2]
"Lion" and "Princess Royal"	2
"Indefatigable," "Australia," and "New Zealand"	3
"Invincible," "Inflexible," "Indomitable"	3
Battle cruisers	9

The total armament comprised in the above completed ships was as follows: 134 13·5-in. guns; 162 12-in.; 60 6-in.; 360 4-in., of which 18 were anti-aircraft[3]; 62 3-in. and 12-pdr., of which 38 were anti-aircraft; 46 6-pdr. and 3-pounder.

Of the older battleships, from the "Majestic" class (1895) onwards, the British navy possessed:—

"Lord Nelson" class	2
"King Edward VII." class	8
"Swiftsure" class	2
"Duncan" class	5
"Formidable" class	2
"Canopus" class	6
"Majestic" class	9

These older ships, whose speeds ranged from 17 knots to 19½ knots, comprised a total armament of 152 12-in.; 8 10-in.; 52 9·2-in.; 28 7·5-in.; 416 6-in.; 28 14-pdr., and 530 12-pounder. They were, of course, not in a position to meet modern "Dreadnoughts" on equal terms, but they compared favourably in offensive and defensive qualities with contemporary German warships, while being numerically in considerable superiority. They all rendered useful service during the war.

The old "Revenge," completed in 1894 (renamed "Redoubtable" in 1914), the last available vessel of the old "Royal Sovereign" class, was commissioned and rendered useful service in the Belgian coast bombardments of 1914 and 1915.

In addition to the "Tiger" and the two remaining ships of the "Iron Duke" class which were approaching completion, there were five "Queen Elizabeths" in a more or less advanced state of construction, and five "Royal Sovereigns" laid down eight to ten months previously. The "Queen Elizabeth," being the farthest advanced, was pushed on with all possible speed, and by Jan. 1915 she was sufficiently completed to be commissioned and sent out to the Mediterranean, where she took part in the bombardment of the Dardanelles forts.

With regard to the design of British capital ships in the past, a most serious limitation had been the restricted width of the graving-docks in Great Britain. This involved keeping the extreme beam of the ships within about 90 feet. Had wider docks been available, thus making it possible to have had a greater beam, the designs on the same length and draught could have embodied more fighting qualities, such as armour, armament, greater stability in case of damage, and improved under-water protection. This condition subsisted until the completion of the two big floating docks for Portsmouth[4] and the Medway, the two locks at Portsmouth, and the large graving-docks at Rosyth; but the shortage of wide docks was a serious handicap during the war, and it was necessary to make use of the Gladstone Dock at Liverpool and the dock at Avonmouth.

[1] Two more nearly complete.
[2] One more ("Tiger") nearly complete.
[3] The anti-aircraft armament was not provided until after the outbreak of war, when such provision became necessary.
[4] Portsmouth floating dock was transferred to Invergordon in 1914, and the Medway Lock to the Tyne in 1915.

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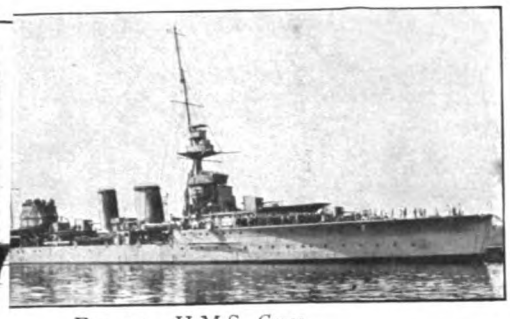

FIG. 14.—H.M.S. *Ceres*.

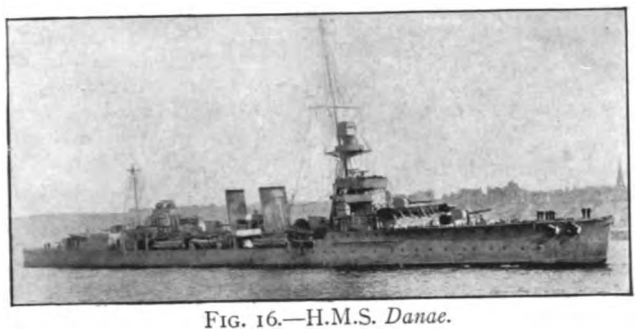

FIG. 16.—H.M.S. *Danae*.

FIG. 18.—H.M.S. *Hawkins*.

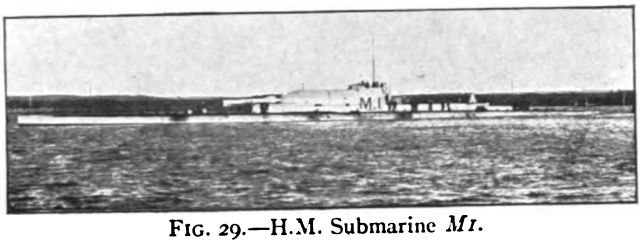

FIG. 29.—H.M. Submarine *M1*.

FIG. 22.—H.M.S. *Shakespeare*.

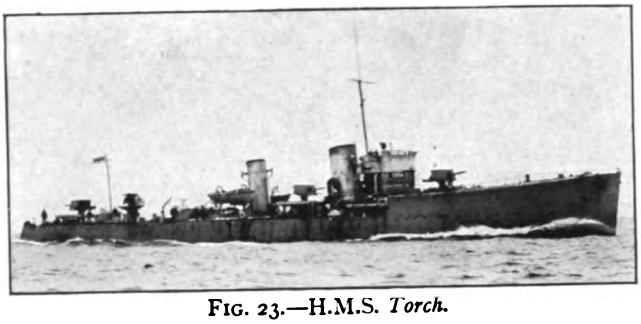

FIG. 23.—H.M.S. *Torch*.

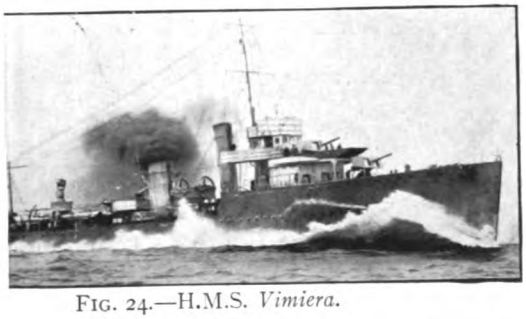

FIG. 24.—H.M.S. *Vimiera*.

FIG. 25.—H.M.S. *P32*.

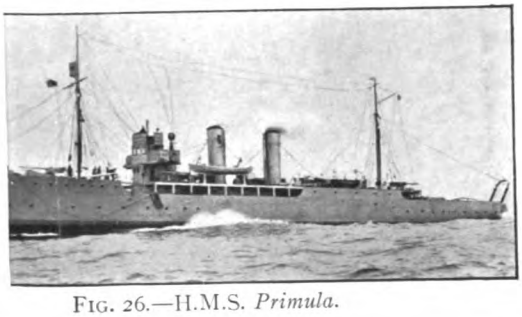

FIG. 26.—H.M.S. *Primula*.

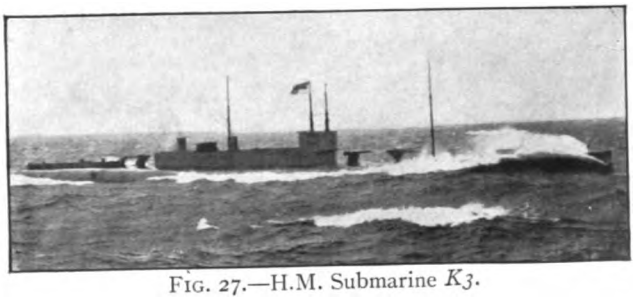

FIG. 27.—H.M. Submarine *K3*.

FIG. 28.—H.M. Submarine *L2*.

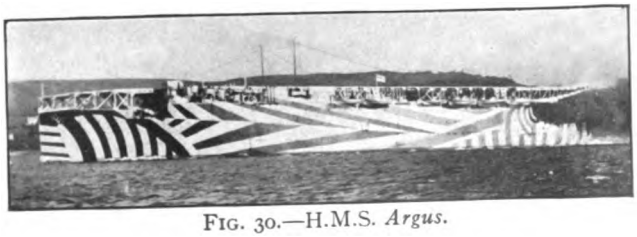

FIG. 30.—H.M.S. *Argus*.

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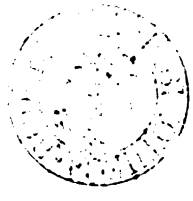

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Even in 1921 there was a great need for more British floating docks of the largest description. This was more especially apparent on the Clyde, where there was no dock, either floating or graving, which could take capital ships.

The German ships were not handicapped in this way, and most of their later capital ships had widths of between 90 and 100 ft., which enabled them to carry more armour, and as far as it is possible to judge, they stood a good deal of battering without showing any lack of stability, while they proved to be good gun platforms, at any rate for work in the North Sea.

Immediately after war was declared great pressure was exercised to complete the ships then building for the British navy, and to order such other vessels as could be designed and finished in the shortest possible time. The view held in the early days that the war would only last a year necessarily coloured all that was done in the way of naval design and construction. Generally speaking, therefore, the construction of new battleships was ruled out. With the acquisition of the "Agincourt," "Erin" and "Canada," which were building in England for foreign Governments in private yards, and in view of the certain early completion of the remaining two vessels of the "Iron Duke" class, shortly to be followed by the vessels of the "Queen Elizabeth" class, Great Britain had a great preponderance of heavier capital ships, or Dreadnoughts, over the enemy; and as this class of ship takes longer to design and construct than any other, it was obviously a prudent course to concentrate on such types as were specially needed and could be built more quickly.

It should also be remembered that the menace of the submarine, which was from the first beginning to loom as a vital factor in the war, pointed in the direction of large numbers of patrol boats, torpedo-boat destroyers, and smaller types of vessels to deal with this menace. No time, therefore, was lost in placing orders for additional British destroyers, submarines, light cruisers, sloops, mine-sweepers, patrol boats, etc.; and it very soon became clear that the Royal dockyards and the regular warship-building contractors would not be able to cope with the mass of new construction that was required. Accordingly, orders for many of the last-named classes were placed with builders who had hitherto only been accustomed to mercantile work. With the arrangements that were made, however, for superintending and overseeing the work by the Admiralty, with the assistance of the registration societies—Lloyd's and the British Corporation—very little difficulty was experienced in getting the work satisfactorily carried out by the firms new to this class of shipbuilding, and success attended the arrangements made.

Table II. gives the number and tonnage of vessels added to the British navy during the war. The total number (including other classes besides those in the table) was 1,513, of approximately 2,356,000 tons displacement.

TABLE II.—*British Warships Completed and Lost Between Aug. 4 1914 and Nov. 11 1918.*

	Completions		Losses	
	No.	Approx. Displacement	No.	Approx. Displacement
Battleships	15	395,000	13	201,000
Battle cruisers	3	81,500	3	63,000
Cruisers	3	56,500	13	158,500
Light cruisers	36	143,000	12	46,000
Monitors	40	126,000	6	14,000
Aircraft-carriers	8	67,500	3	27,500
Flotilla leaders	28	45,500	3	5,000
Torpedo-boat destroyers	255	273,000	64	52,000
Submarines	146	151,500	54	43,500
P. and P. C. boats	63	40,000	2	1,000
Sloops	124	155,500	18	22,500
Paddle mine-sweepers	34	27,500		
Twin screw mine-sweepers	55	43,000		
Patrol gunboats	30	27,000		
Oilers and petrol carriers	67	436,000		
Whalers, trawlers and drifters	382	173,500		

Battleships.—To take ships added to the British navy during the war in the proper order, it is necessary to begin with battleships of the "Iron Duke" class. The particulars of Dreadnoughts built after the "Hercules" are given in Table III.

The "Iron Duke" class (see fig. 1), of which there were four, followed the "King George V." class, both in sequence of time and in general characteristics. The same main armament, similarly arranged, with the five turrets all on the centre line of the ship, was adhered to, the chief difference in the "Iron Dukes" being that instead of the 4-in. guns forming the secondary armament, a battery of 12 6-in. guns protected by 6-in. armour was finally decided upon. The protection also was somewhat increased over that of the "King George V.," involving an increase in dimensions over any previous British battleships. Two of the class were laid down in Jan. 1912 and two in May, the four vessels being completed in March, June, Oct. and Nov. 1914, so that two were ready just

TABLE III.—*Particulars of British Battleships.*

Vessel	Date of Launch	Length between perpendiculars; (length over all)	Breadth	Mean Draught	Load Displacement: Tons	Speed: Knots	Horse Power	Armament	Thickest side of Armour
"Orion"	1910								
"Thunderer"	1911	545 ft. (581 ft.)	88 ft. 6 in.	27 ft. 6 in.	22,500	21	27,000	10—13·5-in. 16— 4-in. 3—21-in. T. T.	12 in.
"Conqueror"	1911								
"Monarch"	1911								
"King George V."	1911								
"Centurion"	1911	555 ft. (597 ft. 6 in.)	89 ft.	27 ft. 6 in.	23,000	21	27,000	10—13·5-in. 16— 4-in. 3—21-in. T. T.	12 in.
"Ajax"	1912								
"Audacious"	1912								
"Iron Duke"	1912								
"Marlborough"	1912	580 ft. (622 ft. 9 in.)	90 ft.	28 ft.	25,000	21	29,000	10—13·5-in. 12— 6-in. 4—21-in. T. T.	12 in.
"Emperor of India"	1913								
"Benbow"	1913								
"Queen Elizabeth"	1913								
"Warspite"	1913								
"Barham"	1914	600 ft. (643 ft. 9 in.)	90 ft. 6 in.	28 ft. 9 in.	27,500	25	75,000	8—15-in. 12— 6-in. 4—21-in. T. T.	13 in.
"Valiant"	1914								
"Malaya"	1915								
"Royal Sovereign"	1915								
"Royal Oak"	1914								
"Revenge"	1915	580 ft. (624 ft. 3 in.)	88 ft. 6 in. 102 ft. with bulge.	28 ft. 6 in.	25,750	23	40,000	8—15-in. 14— 6-in. 4—21-in. T. T.	13 in.
"Resolution"	1915								
"Ramillies"	1916								
"Agincourt"	1913	632 ft. (671 ft. 6 in.)	89 ft.	27 ft.	27,500	22	34,000	14—12-in. 20—6-in 3—21-in. T. T.	9 in.
"Erin"	1913	525 ft. (559 ft. 6 in.)	91 ft. 7 in.	28 ft. 6 in.	23,000	21	26,000	10—13·5-in. 16—6-in 4—21-in. T. T.	12 in.
"Canada"	1913	625 ft. (661 ft.)	92 ft.	28 ft. 6 in.	28,000	22½	37,000	10—14-in. 16—6-in 4—21-in. T. T.	9 in.

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before, and two shortly after, the declaration of war. Four torpedo-tubes were carried in lieu of three in the previous ships, and after the battle of Jutland a considerable amount of additional protection was added over the magazines—a course which was practically adopted in all British ships at that time as a precautionary measure. Only in one case was any portion of a shell found to have penetrated below the protective deck; but with the ever-increasing range at which actions were fought, and the increasing penetration of improved shell, the danger of the decks being inadequate had to be considered. Special interest is attached to this class, as the "Iron Duke" was the fleet flagship during the whole time of Adml. Jellicoe's appointment as commander-in-chief, and she was in action at Jutland with her sister ships.

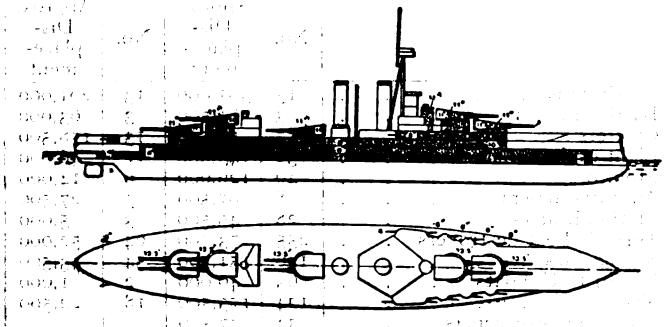

FIG. 1.

The "Marlborough," it should be specially noted, was the only British battleship of the post-"Dreadnought" type struck by a torpedo during the whole war, and the value of the longitudinal protective bulkhead and of the subdivision and arrangements adopted was clearly shown, as the ship was able to remain in the line, no vital damage being done. She was afterwards safely docked in the Tyne and repaired. This is specially interesting, as many of the older ships, some with centre-line bulkheads and with other arrangements not so good for dealing with under-water damage, were sunk in the Dardanelles and elsewhere by enemy torpedoes.

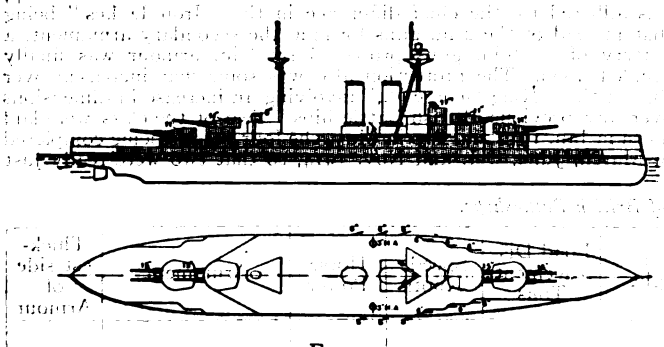

FIG. 2.

The next type to note is the "Queen Elizabeth" class of the 1912–3 programme (see figs. 2 and 3). Three of these vessels, after taking a little more than two years to build, were completed in Jan., March and Oct. 1915. The other two were completed in Feb. 1916. A very considerable departure was made in the "Queen Elizabeth" from any previous "Dreadnoughts," the 15-in. gun taking the place of the 13·5-in., and the designed speed being increased by 4 knots over previous "Dreadnoughts," whilst the secondary armament was similar to that of the "Iron Dukes," consisting of 6-in. guns. Their very great increase of speed involved more than doubling the H.P. of the "Iron Duke" to give the 25 knots desired, and the great increase in the weight of the 15-in. guns and mountings over the 13.5-in. meant accepting only four turrets with eight 15-in. guns, as against five turrets with 10 13·5-in. guns in the previous ships; and even so the armament was considerably heavier. The further great departure from previous practice in battleships was the adoption of oil only as the fuel. This necessitated special arrangements of the oil bunkers, many of which were 30 ft. in height, and required special construction to withstand the head of oil. The armour and protection were fully maintained as compared with previous ships, but all these additions involved increasing the displacement to 27,500 tons.

In the battle of Jutland the Fifth Battle Squadron, consisting of four vessels of this class, were heavily engaged for several hours, and although they inflicted and sustained heavy punishment, especially in the case of "Warspite," all the vessels gave a splendid account of themselves and were not seriously damaged or put out of action. After the battle of Jutland additional protection was added to the magazines. The oil fuel proved a complete success in the stress of war conditions, it being found easier to keep up a high sustained speed, with the smaller complement carried.

It should be noted that Sir Philip Watts was responsible as Director of Naval Construction for the design of the "Iron Duke" and "Queen Elizabeth" classes, thus completing a series of 27 battleships of the "Dreadnought" type designed and built during his tenure of office at the Admiralty—in addition to the large number of battle cruisers, light cruisers, destroyers and other vessels built during that period—truly a great record.

Following the "Queen Elizabeths" came the "Royal Sovereign" class of the 1913–4 programme (see figs. 4 and 5). These were the first capital ships built by the Admiralty to Sir Eustace d'Eyncourt's designs, he having succeeded Sir P. Watts in Aug. 1912. These vessels were to have the same armament as the "Queen Elizabeth," but as there was some question about the supply of oil fuel when the design was discussed, it was decided to revert to coal, and also to accept the slower speed of 21 knots, which would make them more homogeneous with other "Dreadnoughts." Subsequently, when the vessels were in process of construction and the great advantages of the use of oil fuel with other types of warships became apparent, it was decided to change from coal to oil, so enabling increased power, giving a speed of about 23 knots, to be obtained. When fully laden with about 4,000 tons of oil, the "Revenge" attained 22 knots, which was equal to about 23 knots in the designed load condition. A somewhat different disposition of deck and side armour was also adopted by which the thick protective deck at the

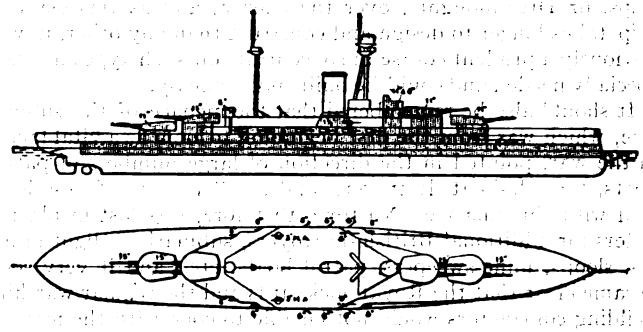

FIG. 4.

centre of the ship was brought up to the level of the main deck; this portion of the protective deck being thus well above the level of the deep load line, and giving more protected freeboard in the damaged condition than on any of our earlier battleships. This was an important feature, as a somewhat reduced metacentric height was decided upon for these ships with a view to making them steadier gun-platforms than some of the ships with more initial stability. The vessels were provided with good under-water protection, which was later reinforced by adding outside bulge protection. This was done to "Ramillies" before her launch and to the other vessels of the class after they had been in commission some time. The addition of "bulges" was suggested first by Sir E. d'Eyncourt originally for the "Edgar" class, for which this form of protection was added in 1914 after experiments had been made. The results proved the efficiency of the bulges.

The three battleships taken over by Great Britain from foreign Governments were of different types. H.M.S. "Agincourt" (see fig. 6) was commenced in Sept. 1911 for the Brazilian Government, from designs got out under Mr. Perrett at Elswick, but modified by Sir E. d'Eyncourt in Rio Janeiro, where he was then representing the Armstrong firm, before his appointment at the Admiralty. The Brazilian authorities, after much discussion, decided upon 14 12-in. guns, twin-mounted in seven turrets. This involved a ship with a length of 632 ft. between perpendiculars and 670 ft. over all. The main armour was somewhat lighter than that of British "Dreadnoughts" and in other respects, such as fuelling facilities, the ship hardly came up to the British standard. However, she was well reported on, and the 14 big guns were liked by the gunnery officers, who preferred a large number of guns for their salvoes. Certain alterations had to be made to fit her for the British service, but in the main she was left as designed.

It should be mentioned that in 1914 the "Agincourt" was transferred by Brazil to Turkey and she was on the point of leaving the Tyne for Constantinople when, on the declaration of war, she was taken over by the British Government.

The design of the "Erin" was settled by three firms, Armstrong's, Vickers and John Brown, in consultation with the Turkish authorities, for whom the vessel was built, being commenced in 1911. In general characteristics she more nearly followed the "King George V." class than any other British ship, except that the secondary armament consisted of 6-in. guns, as in the "Iron Duke" class. This vessel also was taken over by the British Government in Aug. 1914, and certain modifications made to fit her for the British service. In respect of quantity of fuel carried, the "Erin" was below the standard adopted for vessels designed for the British navy.

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The third ship taken over from a foreign Government was ordered and commenced in 1911 at Elswick from designs prepared at Elswick by Mr. Perrett for the Chilean Government. There were two ships of the class, the "Almirante Latorre" (which became H.M.S. "Canada"), and the sister ship the "Almirante Cochrane" (now H.M.S. "Eagle"). The "Canada" had 10 14-in. guns, twin-mounted, in the centre line, and was originally designed to have 22 4·7-in. as the secondary battery, but this was subsequently altered to 16 6-in. guns. The protection again was somewhat lighter than that of the British "Dreadnoughts," but the speed was rather higher, viz. 22¾ knots, and as a matter of fact this speed was considerably exceeded on trial. The ship was taken over by the British Admiralty in Sept. 1914, and completed, after certain necessary modifications, a year later. Her fuel consisted of coal, with the addition of a certain amount of oil, as in most British battleships. In 1920 the "Canada" was returned to the Chilean Government under her original name.

The sister ship, "Almirante Cochrane," remained in an uncompleted condition on the stocks at Elswick till early in 1918, when she was taken over by the British Government and rearranged as an aircraft-carrying ship. She was renamed H.M.S. "Eagle," and as a compliment to the U.S. navy, she was, at the request of the Admiralty, launched by Mrs. Page, the wife of the then American Ambassador to Great Britain.

Battle Cruisers.—As regards the British battle cruisers later than the "Princess Royal," particulars are given in Table IV.

The "Tiger" was included in the 1911–2 programme and followed on the "Queen Mary," the general features of the two ships being much alike, the chief differences being that the secondary armament of "Tiger" is 12 6-in. guns in lieu of 16 4-in. in "Queen Mary," and "Tiger" has two submerged torpedo-rooms, whereas "Queen Mary" had only one.

The "Tiger" was laid down at Clydebank on June 12 1912, and completed in Oct. 1914. In common with so many ships completed during the war, the early commissioning and joining of the fleet was so imperative that no exhaustive trials in deep water were carried out, but the runs made on the Polperro course showed that the designed power of 108,000 S.H.P. could be obtained with little difficulty, corresponding to a speed of 30 knots. In the early stages of the design the oil-fuel capacity was very largely increased from 1,000 tons originally intended to a maximum oil stowage of 3,480 tons, in addition to the 3,320 tons of coal.

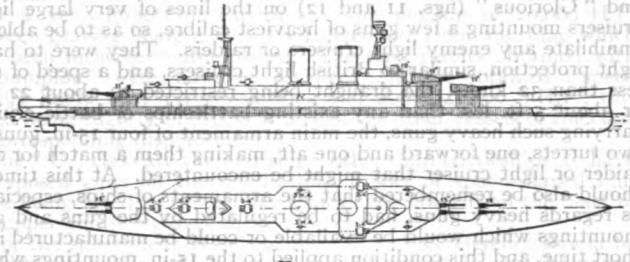

FIG. 7.

At the commencement of the war two additional battleships of slightly modified "Royal Sovereign" type, viz. the "Renown" and "Repulse" (see figs. 7 and 8), had been laid down, but in view of the long time it would take to complete these ships, the construction was not pressed forward. Immediately after the battle of the Falkland Is., in which the British battle cruisers "Invincible" and "Inflexible," in company with other smaller cruisers, annihilated Von Spee's fleet, the value of the battle cruiser type became very apparent, and on the initiative of Lord Fisher, then First Sea Lord, it was decided to stop the construction of "Renown" and "Repulse" as battleships and to alter the design completely into that of very fast battle cruisers.

Instructions to redesign these ships were given about Christmas 1914. The new design had to give a speed of 32 knots, with the largest number of big guns possible for such a vessel, and with protection similar to that of the "Invincible" class. A modified form of bulge was adopted in these ships to give additional under-water protection against torpedo attack. After the war further additions were made to the bulge protection and to the armour.

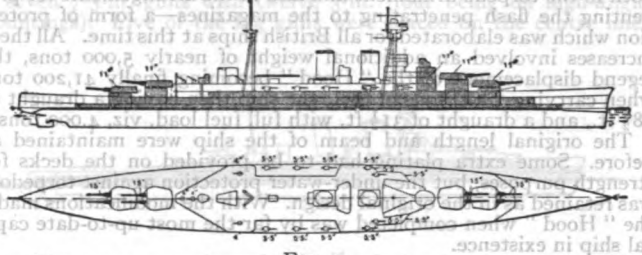

FIG. 9.

The general outline design was completed and approved in ten days, and 6 15-in. guns adopted as the main armament, the secondary armament consisting of 17 4-in. guns, of which 15 were mounted in five specially designed triple-gun mountings. It was necessary that the ships should be completed at the earliest possible date, and the "Tiger's" machinery was repeated with some additional boilers, with oil as the fuel, thus increasing the power to 120,000, which, with the extra length given to the ship, made it possible to obtain the desired speed of 32 knots.

Lord Fisher also insisted that the ships must be completed within 15 months—an abnormally short time for an entirely new design—this period of completion was not realized, although not greatly exceeded. By Jan. 21 1915 the two firms entrusted with the orders, viz. Messrs. John Brown and Fairfield, were supplied with sufficient information to enable them to proceed with the structure, and both keels were laid on Jan. 25, which was Lord Fisher's birthday. All the drawings and specifications were completed by April and the design finally approved in that month.

The arrangement of the whole ship, showing the protection, is given in fig. 7, the plating over the magazines having been considerably increased as a result of the Jutland fight.

"Repulse" was launched in Jan. 1916, less than a year from the laying down, and "Renown" was launched three months later. "Repulse" went through her commissioning trials early in Aug., and "Renown" followed one month later and was completed in September. The speed of "Repulse" on trial was over 31¼ knots in the deep condition, and the "Renown" obtained 32·6 knots mean speed in the normal condition.

The construction of these vessels in a little over one and a half years from the first order to get out the design constitutes a record in design and construction of two such important vessels, and reflected great credit, not only upon the Royal Corps of Naval Constructors, but also upon the contractors and all concerned in the construction and completion of the vessels. In fact, the Admiralty conveyed their appreciation of this to Sir E. d'Eyncourt, the Director of Naval Construction, in a letter dated Sept. 1916.

The battle cruiser H.M.S. "Hood" (see figs. 9 and 10), the latest addition up to 1921 to the capital ships of the British Fleet, was designed early in 1916, and had only just been ordered from Messrs. J. Brown & Co. when the battle of Jutland took place. This great event naturally led to a revision of the design and in view of the damage which was then done to British battle cruisers and also to

TABLE IV.—*Particulars of British Battle Cruisers.*

Vessel	Date of Launch	Length between perpendiculars; (length over all)	Breadth	Mean Draught	Load displacement: Tons	Speed: Knots	Horse Power	Armament	Thickest side Armour
"Lion" . .	1910	660 ft.	88 ft. 6 in.	28 ft.	26,350	28	70,000	8—13·5-in. 16—4-in. 2—21-in. T.T.	9 in.
"Princess Royal" . .	1911	(700 ft.)							
"Queen Mary" . .	1912	600 ft. (703ft.6in.)	89 ft.	28 ft.	27,000	28	75,000	8—13·5-in. 16—4-in. 2—21-in. S.T.	9 in.
"Tiger" . .	1913	660 ft. (704 ft.)	90 ft. 6 in.	28 ft. 6 in.	28,500	30	108,000	8—13·5-in. 12—6-in. 4—21-in. T.T.	9 in.
"Renown" . .	1916	750 ft.	90 ft.	25 ft. 6 in.	26,500	32	120,000	6—15-in. 17—4-in. 2—21-in. T.T.	6 in.
"Repulse" . .	1916	(794 ft.)							
"Hood" . .	1918	810 ft. (860 ft.)	104 ft.	28 ft. 6 in.	41,200	32	144,000	8—15-in. 12—5·5-in. 6—21-in. T.T.	12 in.

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the German ships of similar type, it was deemed advisable to increase the armour protection, if possible. As the result of very extensive investigations, it was found possible, by accepting a deeper draught and a slightly reduced speed, to add very considerably to the protection of the vessel as already designed, without otherwise seriously affecting the design of the ship as a whole. The alterations were of a very radical character, the armour belt being increased from 8 to 12 in. and the barbettes from 9 to 12 in.; and certain increases were also made in the deck protection. At the same time the eight 15-in. gun mountings had their design modified to admit of an elevation of 30 degrees, and certain other modifications were made, both in the torpedo armament and also in the arrangements for preventing the flash penetrating to the magazines—a form of protection which was elaborated for all British ships at this time. All these increases involved an additional weight of nearly 5,000 tons, the legend displacement of the "Hood" becoming finally 41,200 tons when carrying 1,200 tons of fuel; the ship then having a draught of 28½ ft., and a draught of 31½ ft. with full fuel load, viz. 4,000 tons.

The original length and beam of the ship were maintained as before. Some extra plating had to be provided on the decks for strength purposes, but the under-water protection against torpedoes was retained as in the original design. With the modifications made, the "Hood" when completed was by far the most up-to-date capital ship in existence.

The changes in the design and other circumstances militated against the quick construction of the ship, and it was about four years from the approval of the original design in April 1916 to the time of her completion, this being about double the time taken to build recent British capital ships, and nearly three times that taken to build the "Repulse" and "Renown." The modifications were, however, quite justified by the circumstances, and they made the ship a much more powerfully protected one, whilst increasing her displacement, and consequently the weight of material to be worked, to about 50% more than that of "Repulse" and "Renown."

The main machinery of the "Hood," consisting of geared turbines to develop 144,000 H.P., has the largest power which has ever been put through gearing, namely, 36,000 H.P. on each of the four shafts. The machinery is placed in three engine-rooms, of which the forward one contains two independent sets for the outer shafts; the middle and after engine-rooms contain one independent set for each of the inner shafts. This power, which was designed to give 32 knots for the earlier design of 36,300 tons displacement, was expected to give at least 31 knots in deep water with 210 revolutions of the propellers, at a displacement of 41,200 tons for the "Hood" as built. The 24 boilers represented the small-tube type with forced draught, arranged in four boiler-rooms. Such boilers were first adopted for large vessels in the "Courageous" class. Oil is the only fuel used in "Hood." On trials on the measured mile the "Hood" obtained a speed of 32·07 knots with 151,000 S.H.P. at 42,200 tons displacement, and 31·9 knots with 150,000 S.H.P. at 44,600 tons displacement.

It will be seen from the plan (fig. 9) that the main armament of eight 15-in. guns was mounted, as in recent British battleships of the "Queen Elizabeth" and "Royal Sovereign" classes, in four turrets, all on the centre line, with very large arcs of training, the forward ones training to 60° abaft the beam, and the after ones to 60° before the beam. The anti-torpedo-boat destroyer armament consists of twelve 5½-in. guns arranged on the forecastle deck and shelter deck. There are also four 4-in. anti-aircraft guns on the shelter deck aft. There are two 21-in. submerged torpedo tubes, each in a separate compartment forward, and four 21-in. above-water torpedo tubes between the upper and forecastle decks; these above-water tubes being a further addition since the original design was made. The distribution of armour is also shown. The 12-in. belt had a length of 562 ft. and a depth of 9 ft. 6 inches. Above the main belt was a strake of 7-in. armour to the height of the upper deck, and above that again there was 5-in. armour between the upper and forecastle decks. The side armour all sloped outward from below, the shell being thus unable to hit the armour normally, so that the virtual thicknesses were somewhat greater. There was thick plating behind all the armour, varying from 2 in. over the greater portion to 1½ in. and 1 in. elsewhere. The torpedo protection consisted of the bulge arrangement, with an outer compartment of air and an inner one specially strengthened with the necessary separating bulkheads, etc. This protection extended throughout the whole length of the machinery spaces and magazines, and it has been proved that it renders the ship as safe against attack from torpedoes under water as she is against gun attack above water. The oil fuel tanks are arranged along the sides, thus giving additional protection. The "Hood" was successfully launched in Aug. 1918 at Clydebank, the ceremony being performed by Lady Hood, widow of Admi. Hood, who lost his life whilst gallantly leading into action the Third Battle-Cruiser Squadron at Jutland. The launching weight was about 22,000 tons. As the other three ships of the class which were commenced had none of them reached the launching stage at the time of the Armistice, it was subsequently decided not to proceed with them, in view of the international conditions, and the "Howe," "Rodney" and "Anson" were accordingly scrapped.

As regards the general design of the ship, the "Hood" may be cited as an example of what can be achieved by going to a large size. Her design embodies the armament and armour protection of a first-class battleship, including also good under-water protection against torpedoes, and at the same time gives the speed of the fastest battle cruisers. This involved great length and displacement. The under-water bulge protection, which has entirely superseded the provision of torpedo netting, is additional to anything provided in pre-war "Dreadnoughts."

In connexion with the size of the "Hood" and general considerations of design, it is interesting to note the chief characteristics of the "Queen Elizabeth" and "Renown." The "Queen Elizabeth" is a well-armoured ship of about 28,000 tons, with eight 15-in. guns and speed of 25 knots, while "Renown," of slightly less displacement, viz. 27,000 tons, though of greater length, is a vessel with 7 knots more speed than "Queen Elizabeth," but with only six 15-in. guns against eight, and approximately about half the armour protection provided in the "Queen Elizabeth." The "Hood" has the same armament, viz. eight 15-in. guns, as the "Queen Elizabeth," armour protection fully equal to and, in fact, rather heavier in the aggregate than that of the "Queen Elizabeth," 7 knots more speed than the "Queen Elizabeth," which makes the speed about equal to that of "Renown," and in addition complete protection against torpedo attack.

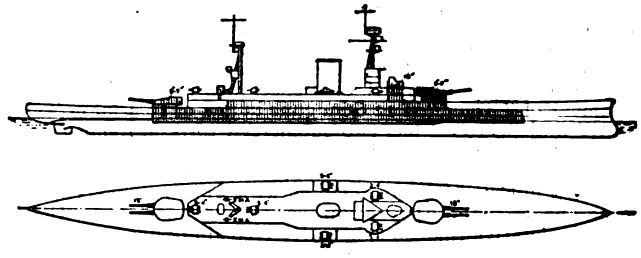

FIG. 11.

Large Light Cruisers.—Early in 1915, as sanction was not given by the British Government for building more capital ships taking two years or longer to complete, while additional light cruisers had been already approved of, it was decided to build "Courageous" and "Glorious" (figs. 11 and 12) on the lines of very large light cruisers mounting a few guns of heaviest calibre, so as to be able to annihilate any enemy light cruisers or raiders. They were to have light protection, similar to British light cruisers, and a speed of not less than 32 knots, the draught being restricted to about 22 ft., or about 5 ft. less than any existing battleships or battle cruiser carrying such heavy guns, the main armament of four 15-in. guns in two turrets, one forward and one aft, making them a match for any raider or light cruiser that might be encountered. At this time it should also be remembered that the armaments of ships, especially as regards heavy guns, had to be regulated by the guns and gun mountings which would be available or could be manufactured in a short time, and this condition applied to the 15-in. mountings which were adopted for these ships. The secondary armament consisted of eighteen 4-in. guns in six triple mountings, similar to the triple mountings of the "Renown" and "Repulse." The side armour consisted of 2-in. protective plating added to the 1-in. shell plating, and a thin protective deck was worked all fore and aft, but this was considerably thickened over the magazines after Jutland. A modified "bulge" was arranged for, as in "Renown" and "Repulse."

The machinery adopted for these ships was of the type fitted in the light cruiser "Champion." It consisted of a 4-shaft arrangement of geared turbines, the power being transmitted to the propeller shafts by double helical gearing. The eighteen boilers of Yarrow small-tube type were also similar to those of the light cruisers, and with all-oil firing a power of 90,000 S.H.P. at about 340 revolutions of propellers was aimed at. Such trials as it was possible to make showed that 32 knots could easily be obtained at the designed displacement, and on service this was actually exceeded.

It was intended that these vessels should be built in a year, or as near that as possible, but this was not realized, and the ships were both commissioned in Oct. 1916.

The "Furious" (see fig. 13), was similar to, but a modification of, the "Courageous" and "Glorious," having about the same length and the same machinery, but the form of midship section was somewhat different, having a more pronounced bulge and a simpler form of main framing and structure of the hull. The armament also was different; each turret, instead of having two 15-in. guns, was arranged to carry one big gun of 18-in. bore.

Early in the spring of 1917 the necessity for having fast aeroplane-carriers became very obvious, and it was approved to fit "Furious" for this purpose. This entailed the removal of the fore turret and making other considerable alterations. A large hangar was built on the forecastle deck, and a flying-off platform 160 ft. long was arranged on the roof of the hangar, which was designed to house about 10 machines. Later it was decided to remove the after-turret as well, and a flying-on deck 300 ft. long, extending from the funnel

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aft, was constructed. The secondary armament, which had consisted originally of 11 5½-in. guns, was retained, with the exception of one gun; the remaining 10 guns being rearranged. Four sets of triple 21-in. torpedo tubes were fitted on the upper deck aft, and one pair each side on the upper deck forward.

After these alterations were completed, the ship was tried and commissioned in July 1917, a speed of 31½ knots being obtained with 94,000 S.H.P. at 330 revolutions. From the speed point of view the great advantage of size and length is clearly shown in these ships compared to T.B.D.s, since with about three times the H.P. of a destroyer it is possible to drive a ship of nearly 20 times the displacement at the same speed. This in smooth water; in anything of a head sea the T.B.D.s are left behind altogether by the great ships (see Table V.).

Light Cruisers.—Following upon the previous light cruisers of the town classes, a very important departure was made in the light cruiser design in the programme 1912–3, when the "Arethusa" class (see fig. 14) was designed by Sir Philip Watts. The importance attached to speed was specially brought out in this design, and it was decided to install very powerful machinery of 40,000 S.H.P. and this could only be achieved by adopting engines and boilers closely approximating to those hitherto used only for destroyers.

In conjunction with high speed a good armament was provided, consisting of two 6-in. and six 4-in. guns, though in the original design the armament consisted entirely of 4-in. guns. The ship's sides up to the level of the upper deck were protected by a high tensile plating varying from 2-in. to 1½-in. and 1-in. in addition to the 1-in. shell plating. This arrangement of plating also greatly added to the strength and stiffness of the ship. Further particulars of the class are given in Table V.

The "Arethusa" and other light cruisers were in the action off Heligoland on Aug. 28 1914.

In the 1913–4 programme the "Calliope" class, slightly larger vessels than the "Arethusas," but with the same power, were decided upon, the designs being made by Sir E. d'Eyncourt. After considerable discussion regarding the merits of mixed or homogeneous armament, it was decided to give these vessels two 6-in. guns, both on the centre line placed aft, and eight 4-in. guns. The protection consisted, as in the previous design, of a belt with a total thickness of approximately 3 inches. Most of this class had practically the same machinery as the "Arethusa," but Parsons geared turbines were installed in two of them, the "Calliope" having four shafts and the "Champion" two shafts. This was at the time a very important experiment, the putting of 20,000 H.P. through gearing being a very bold departure from anything which had been hitherto contemplated. The final results obtained with "Champion" were, however, excellent, and she obtained a speed of 29½ knots with 337 revolutions and about 41,000 S.H.P., this speed being slightly in excess of any of the other vessels of the class at corresponding displacement.

The "C" class are the first ships, other than battleships, to have superposed guns on the middle line, a sort of spoon-shaped bulwark being fitted to protect the crew of the lower from the blast of the upper gun firing over them.

For the subsequent vessels of the "C" class reference should be made to the tables, which show a gradual growth in size and power of armament; "Ceres" class (fig. 14) finally having a length of 425 ft. and a beam of 43 ft. 6 in., and a normal displacement of about 4,200 tons. These vessels carried five 6-in. guns, all on the centre line.

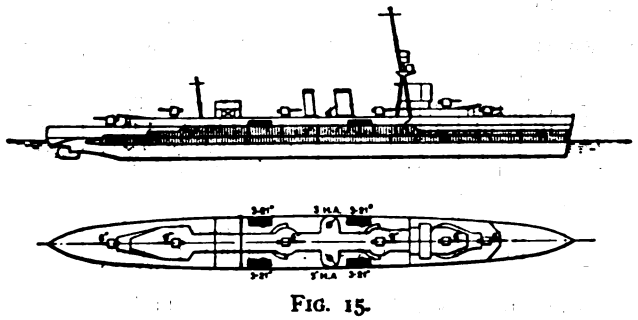

FIG. 15.

The next class were the "D's" (figs. 15 and 16), the general arrangement and protection of which followed that of the "Ceres," except that six 6-in. guns were carried on the centre line instead of five. The power was only slightly increased in these ships over the previous classes, but the revolutions were reduced to 275, all these later classes having the twin-screw geared arrangement, and although the displacement of the "D's" increased to 4,650 tons, the additional length and the reduction of revolutions enabled the speed of close upon 30 knots of the whole class of light cruisers "C's" and "D's" to be maintained.

In addition to these light cruisers, which were all to Admiralty design, two vessels—the "Birkenhead" and "Chester"—built at Messrs. Cammell, Laird's for the Greek Government, were purchased in 1915. These vessels were considerably heavier than the "C" class and more closely resembled the British "Chatham" class. They carried an armament of ten 5½-in. guns. The boilers were modified to burn only oil in the "Chester," instead of coal and oil as in the "Birkenhead," and the resulting increase in power to 31,000 gave the former a speed of 26½ knots.

Designs were prepared in 1915 of the "Raleigh" class (figs. 17 and 18), a considerably heavier type of light cruiser, more especially suited for ocean work in any part of the world. They were to have a speed of 30 knots and a large radius of action. Various armaments were considered, and it was finally decided to adopt an armament of seven 7·5-in. guns with twelve 3-in. (four being on high-angle mountings). Five of the big guns were placed on the centre line,

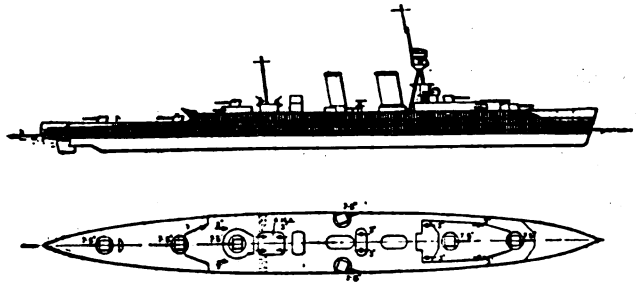

FIG. 17.

and the other two were on the broadsides amidships. The bow and stern guns were superposed, thus giving a fire of four guns, both ahead and astern, and six guns on either broadside. These ships were originally designed to burn oil and coal, but the coal-burning boilers were subsequently altered in three ships of the class to burn a larger amount of oil, the original power of 60,000 S.H.P. on a four-shaft geared turbine arrangement being thus considerably increased up to about 70,000 shaft horse power.

These vessels also differed from the light cruisers referred to above in having modified bulges as protection against under-water attack. The protective plating was similar to that of the other light cruisers. One of these ships, the "Cavendish," was altered into an aircraft-carrier, and renamed "Vindictive."

Monitors (see Table V.).—The first vessels of this type to be added (or reintroduced) to the British navy were the three ex-Brazilian river monitors built by Messrs. Vickers, Ltd., and taken over by the British Government in Aug. 1914, and renamed "Humber," "Mersey" and "Severn." The particulars of these vessels are given in the table, from which it will be seen that the armament consisted of medium-calibre guns, viz. 6-in. and 4·7-inches. These vessels, though designed for river service, did very good work in the war, both on the E.-African and Belgian coasts.

The need for vessels of the monitor type mounting heavy guns soon became apparent, and in Nov. 1914 it was decided to prepare designs of monitors of more substantial structure for sea-going service, but of light draught, with good protection and carrying some heavy guns, the light draught combining the advantages of being able to go close inshore and greatly reducing the risk of being struck by a torpedo.

The earliest design was that of the 14-in. gun monitors, four in number, which was commenced in 1914. Four twin-mounted 14-in. guns and mountings were available, and with the very simple form of structure adopted, these vessels were designed and built in six months. They were quickly followed by the 12-in. monitors, which were of similar design but carried pairs of 12-in. guns, taken from older battleships. These vessels were also built in about six months. They all had a complete bulge of a form which was of simple construction, with an air space outboard and a water space between that and the ship proper.

Following on the 12-in. monitors, early in Jan. 1915 two more vessels were ordered, mounting a pair of 15-in. guns. For these ships, internal-combustion engines, which were well under way, but designed for another purpose, were installed. These vessels were named the "Marshal Ney" and "Marshal Soult."

In Sept. 1915 two improved 15-in. monitors were ordered and named the "Erebus" and "Terror" (figs. 19 and 20). These were of finer form, of more horse power and a speed of 14 knots.

Following the earlier 15-in. monitors, some much smaller vessels, each carrying a 9·2-in. gun, were designed, and others again which carried 6-in. guns. A good many of both large and small monitors went out to the Dardanelles in the early part of the war, and did very good work, and for a long time they seemed to bear a charmed life, as they enjoyed complete immunity from torpedo attack. Later, however, the "Erebus" and "Terror" were both torpedoed; the latter received three torpedoes, two hitting forward of the bulge with severe damage resulting; the third, which hit the bulge itself, did very little damage. The former ship was hit full amidships by a distance-controlled boat carrying a very heavy charge, but the bulge gave her complete protection and both ships were quickly repaired. It is interesting to note in this connexion that some of the old

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TABLE V.—*British Light Cruisers, Destroyers, Submarines, etc.*

LIGHT CRUISERS	Date of Launch	Length between Perps. (Length over all)	Breadth	Draught	Displacement: Tons	Speed: Knots	Horse-Power	Armament	Side Armour
		ft.	ft. in.	ft. in.					
"Courageous" . . .	1916	735 (786)	81 0	21 6	17,400	32	90,000	4—15 in. 18—4 in. 14—21 in. T. T.	3 in.
"Raleigh" . . .	1917–21	565 (605)	65 0	17 3	9,750	30–1	60,000–70,000	7—7·5 in. 12—3 in. 6—21 in. T. T.	3 in.
"Chatham" Class . .	1912–3	430 (457)	49 10	15 10	5,440	25½	25,000	8 or 9—6 in. 2—21 in. T. T.	3 in.
"Arethusa" " . .	1913–4	410 (436)	39 0	13 6	3,500	30	40,000	3—6 in. 4—4 in. 8—21 in. T. T.	3 in.
"Calliope" " . .	1914–5	420 (446)	41 6	13 6	3,750	30	40,000	4—6 in. 4—21 in. T. T.	3 in.
"Caledon" " . .	1916–7	425 (450)	42 9	14 1	4,120	29	40,000	5—6 in. 8—21 in. T. T.	3 in.
"Ceres" " . .	1917	425 (450)	43 6	14 1	4,190	29	40,000	ditto	3 in.
"D" " . .	1918	445 (471)	46 0	14 3	4,650	29	40,000	6—6 in. 12—21 in. T. T.	3 in.
"E" " . .	1919–20	545 (570)	54 6	16 6	7,550	33	80,000	7—6 in. 12—21 in. T. T.	3 in.
MONITORS:									
"Erebus" . . .	1916	405	88 0	11 0	8,000	12	6,000	2—15 in.; 8—4 in.	—
9·2 in. Gun Monitors .	1915	177	31 0	6 0	540	12	600	1—9·2 in.	—
6 in. Gun Monitors . .	1915	177	31 0	4 0	355	10	400	2—6 in.	—
DESTROYERS:									
"M" Class . . .	1914	273	26 8	8 8	1,025	34	25,000	3—4 in. 4—21 in. T. T.	—
"R" & "S" Class .	1916–8	276	26 8	9 0	1,065	36	27,000	3—4 in. 4—21 in. T. T.	—
"V" & "W" " . .	1917–9	312	29 6	9 0	1,300	34	27,000	4—4 in. or 4—7 in. 4 or 6—21 in. T. T.	—
DESTROYER LEADERS:									
"Kempenfelt" Class .	1914	325	31 9	10 0	1,650	34	36,000	4—4 in. 4—21 in. T. T.	—
"Scott" & "Shakespeare" . . .	1917–9	332½	31 9	10 0	1,800	36	42,000	5—4·7 in. 6—21 in. T. T.	—
PATROL BOATS:									
"P" Class . . .	1915	224½	23 9	7 7	573	22	4,000	1—4 in. 2—14 in. T. T.	—
SLOOPS . . .	1915	268	33 6	11 0	1,250	17	2,400	2—4 in. or 4·7 in.	—
MINE-SWEEPERS:									
Paddle . . .	1916	246	29 0	6 9	810	15	1,400	1—3 in.	—
Twin-screw . . .	1916	231	28 9	7 0	750	16	1,800	1—3 in.	—
					Surface / Submerged	Surface / Submerged	Surface / Submerged		
SUBMARINES:									
"E" Class . . .	1912	181	22 6	12 6	660 / 800	15 / 10	1,600 / 840	1—3 in. 5—18 in. T. T.	—
"J" " . . .	1915	275	23 0	14 0	1,210 / 1,820	19½ / 9½	3,600 / 1,350	1—3 in. or 4 in. 6—18 in. T. T.	—
"K" " . . .	1916	338	26 6	16 0	1,880 / 2,560	24 / 9½	10,000 / 1,400	1—4 in. 1—3 in. 8—18 in. T. T.	—
"L" " . . .	1917	231	23 6	13 6	890 / 1,070	17½ / 10½	2,400 / 1,600	1—4 in. 6—18 in. T. T.	—
"M" " . . .	1917	296	24 6	15 9	1,600 / 1,950	16 / 9½	2,400 / 1,600	1—12 in. 1—3 in. 4—18 or 21 in. T. T.	—
"R" " . . .	1918	163	15 6	11 7	420 / 500	9½ / 15	240 / 1,200	6—18 in. T. T.	—
"CHINA GUNBOATS":									
Large . . .	1915	237½	36 0	4 0	645	14	2,000	2—6 in.	—
Small . . .	1915	126	20 0	2 0	98	10	175	1—4 in.; 1—3 in.	—

British cruisers of the "Edgar" class, which had had bulges added to them early in the war, were torpedoed in the Mediterranean, but the bulge gave them complete protection. They were taken to port and repaired. In fact, no bulged ship struck by a torpedo was sunk.

On the heavier monitors it may be remarked that of all ships carrying heavy guns these vessels were probably more often in action off the Belgian coast and elsewhere than any of our heavy-gun ships, and they no doubt gave the enemy in occupation of that coast a very anxious time.

Destroyers and Flotilla Leaders (Table V.).—With regard to the development of British destroyers and flotilla leaders during the war reference may be made to the tables and plans (figs. 21, 22, 23 and 24). These vessels gradually increased in size and power, and war requirements continually added to the weights which they had to carry, including considerably more fuel, heavier armament both of guns and torpedoes, depth charges, larger bridges, and other additions. In fact, some of the ships which before the war were 900-ton vessels, exceeded 1,000 tons towards the end. The introduction, however, of the geared turbine added enormously to the efficiency of the machinery and propellers.

During the war nearly 300 T.B.D.'s and flotilla leaders, which are simply a larger form of T.B.D. with improved accommodation, were added to the British fleet, and the whole class of these vessels was called upon to do continuous work often in heavy weather. They came through the ordeal with very few breakdowns of machinery or other parts of the ship, whilst the duties they were called upon to perform in combating the submarines, convoying, etc. were continuous and varied. Numbers of these vessels were built by firms who had never built a warship before, but the work turned out by them fully met the Admiralty requirements.

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The flotilla leaders, with a deep load displacement of about 2,000 tons and an armament of five 4-in. or 4·7-in. guns, and with their very high speed, might well be described as fast scouts or third-class cruisers.

Patrol Boats (Table V. and fig. 25).—Patrol boats were specially designed to relieve the T.B.D.'s of some of their duties such as patrolling, submarine-hunting and escort work, for which high speed was not a necessity. They had to be as small as possible, consistent with keeping the sea in all weathers, with sufficient speed to run down submarines, besides having shallow draught and all top hamper kept low to prevent their being seen at a distance. Economy of fuel was also an important feature, and it was desirable to have them built of mild steel rather than high-tensile steel, in order to simplify the construction. Some were provided with a special hard steel ram, with which a considerable number of enemy submarines were sunk. The various features were combined in a vessel of something under 600 tons, with geared turbine engines of 3,800 H.P., giving a speed of over 22 knots, with 330 revolutions of the propellers. The boats had large rudder area and were cut up aft, so that they could turn very quickly upon the enemy—a most important feature for ramming purposes. They proved very valuable boats

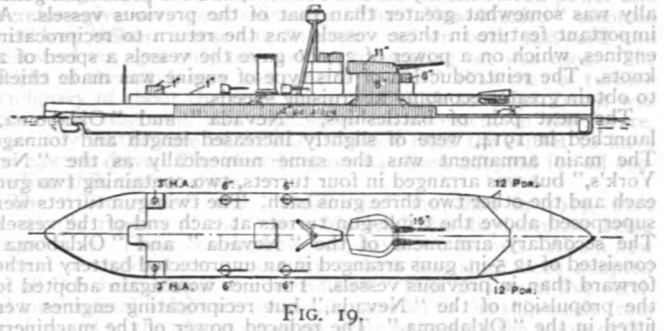

FIG. 19.

on service and did a great deal of work against the submarines in all weathers. They were armed with only one 4-in. gun, mounted in a commanding position on the forward superstructure, one 2-pdr. and two 14-in. torpedo tubes, and later it was arranged to carry depth charges. Their cost was, of course, considerably less than that of a modern destroyer.

Some of these boats were afterwards disguised to look like small mercantile craft—a device which also proved quite successful.

Sloops and Mine-Sweepers.—On the outbreak of war it became clear that there would be a great demand for mine-sweeping vessels. A good many coasting and cross-channel steamers were taken up for this purpose, but more were required, and it was decided in Dec. 1914 to build twelve single screw ships (fig. 26) of simple design to this end. With the view of hastening construction, it was decided to adopt mercantile practice as far as possible in both hull and machinery. The vessels, although of very fine form, were built of simple construction and under Lloyd's survey. The boilers were of ordinary Scotch type, and single screw machinery was provided.

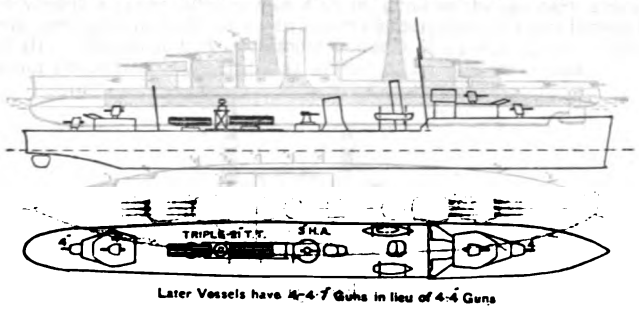

FIG. 21.

In the end nearly 100 of these vessels were built, and the armament, which at first was two 12-pdrs., was subsequently increased to two 4-in. or two 4·7-in. guns. A great many of these vessels were built in about six months from the order, and the first 36 averaged 25 weeks in building. They proved excellent sea boats, and were used not only for mine-sweeping, but also for submarine work and for convoying. At later stages some of these vessels were disguised as ordinary merchant ships. They were economical steamers, and were able to attain a full speed of 17 knots, with a H.P. of about 1,800 to 2,000 in the earlier, which was increased to 2,500 in the later, vessels.

Several of the vessels were mined, but although the damage they sustained was very severe, they kept afloat and were repaired.

The Admiralty was asked to design and provide some vessels of this type for the French Government, and eight of these were designed by Sir E. d'Eyncourt and built for that purpose and armed with somewhat heavier armament than our own ships. The French Government were very satisfied with the vessels.

In addition to this, at a later stage, for sweeping in shallow water, some paddle mine-sweepers were designed at the Admiralty. These were 15-knot boats, with draught just under 6 ft. 9 inches. They did good work, but were of course not such good sea boats as the sloops. As there was some danger of mines getting under the paddles, a further design of twin-screw mine-sweepers was got out. These were vessels of about 800 tons and about 16 knots speed.

Submarines (Table V. and figs. 27, 28 and 29).—During the war the design of submarines was enormously developed. A very large number of these vessels were added to the British Fleet. There were some twelve different types, some embodying very special requirements and all being improvements on their predecessors. The Admiralty produced the fastest internal-combustion engined submarine in "J" class, which attained a speed of over 19 knots. As a still higher speed was wanted for fleet work, the "K" boats were designed with a surface speed of 24 knots. To arrive at this it was necessary to go to steam, and special arrangements had to be made for shutting down watertight the funnels, etc. However, all these difficulties were overcome.

It is an interesting point about these vessels that, besides the steam turbines for full speed on the surface and the electric drive when under water, they were provided with a Diesel engine for use just before diving or immediately after breaking surface, in order to quicken diving or getting away after coming up.

Although the Germans had the advantage of more power per cylinder in their Diesel engines, Great Britain produced submarines, faster and more heavily armed than theirs.

M. 1. submarine was a monitor submarine armed with a 12-in. gun; she was an experimental boat, and proved quite successful.

"China Gunboats."—For use in Mesopotamia or for river work two classes of so-called "China gunboats" were designed by Messrs. Yarrow. The smaller of these vessels, 120 ft. long and of about 100 tons, were constructed in Great Britain in such a way that the parts could be sent out to Abadan, where they were assembled, and the vessels reërected and completed under the supervision of Admiralty officers. Some of the larger boats 230 ft. long and of 645 tons, were completed in England and went out to Mesopotamia, where all of them were of the greatest service in that campaign. Most useful work was also done by motor launches and many other types.

Other Auxiliary Craft and Aircraft Carriers.—The Admiralty was called upon to design many other auxiliary craft—notably some fast Fleet oilers which were able to carry 5,000 tons of oil and had a speed of 15 knots. There were also designed a great number of special smaller craft for all purposes, and a number of merchant ships were taken over and modified to meet diverse requirements.

The most important modifications were those made to vessels taken over and converted into aircraft-carriers, including "Campania," "Ark," "Royal," "Engadine," "Riviera," etc.; the "Furious" was also altered, and the "Cavendish" (now named "Vindictive") was converted into an aircraft-carrier. The "Argus" (fig. 30) was originally built as a passenger mail ship of 20 knots, and was taken over and converted into an aircraft-carrier with complete flush deck, the funnels being carried aft in long horizontal ducts, discharging the smoke astern. The "Eagle" was taken for conversion into a large aircraft-carrier with a somewhat different arrangement, with the funnels and all deck erections included on an "island" on one side of the deck. Aircraft-carrying ships are in fact gradually becoming more important for the Fleet.

Altogether during the four years more than 2,000,000 tons were added to the navy, at a cost between £250,000,000 and £300,000,000 sterling, exclusive of modifications to auxiliaries. Reference to the navy estimates shows that the aggregate sum spent during the four years before the war on new construction amounted to approximately £60,000,000. In fact, during the four years 1915–8, more tonnage was built for the British navy than during the previous 25 years.

II. Navies of Other Countries

During the period 1910–20 foreign naval construction of all types generally followed the line of British designs, with one or two important exceptions which must not be overlooked.

The most important departure from the British practice was in respect of the number of guns mounted in the barbettes. Triple-gun mountings for the main armament have been adopted by several nations, viz. France, Italy, Austria, Russia and the United States, while in 1914 the French began the construction of quadruple-gun turrets, but neither these turrets nor the ships for which they were intended have been completed.

The British example in regard to the adoption of turbine machinery for propulsion of the first "Dreadnought" battleship and battle cruisers was not followed by the other nations at once. In some cases, for example, Japan and the United States, sister vessels were built, one having turbine engines and the other reciprocating engines. Finally, however, turbine engines were almost universally adopted, while the United States made a fur-

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ther advance by the adoption of the electric drive. The first American battleship in which this was installed was the "New Mexico," and it was arranged for all subsequent vessels to be propelled similarly.

In the adoption of oil only as the fuel the British again took the lead, and up to Aug. 1921 this had only been followed by the United States. The German authorities had considered that their sources of supply were not sufficiently reliable to justify their depending on oil alone.

On the whole, therefore, it may be said that the designs, apart from the above features, of foreign warships did not differ essentially from the British types, as can be seen from the notes and tables which follow.

Of the minor navies, many of which depended on British or other foreign builders for the design and construction of their warships, little need be said, as with the war the development of their navies practically ceased, and some of the most important vessels, such as the battleships building for Chile and Turkey, were taken over for the British navy.

At the Armistice both the German and Austrian navies ceased to exist as factors in the general naval situation, all their principal ships being surrendered to the Allies, the great majority of the vessels being finally destroyed, either being broken up or used as targets, with the exception of a few of the less important units, such as light cruisers and destroyers, which were incorporated in the French and Italian navies.

Battleships

(1) *United States.*—The first vessels of the "Dreadnought" type constructed for the U.S. navy were the "Michigan" and "South Carolina," launched in 1908. These vessels, carrying only eight 12-in. guns, were of about 2,000 tons less displacement than the "Dreadnought," and 2 knots slower than this vessel. The main armament of the U.S. vessels was disposed, however, in an original manner, constituting a bold departure in that they were all mounted on the centre line of the vessel in two superposed twin-gun turrets forward, and two aft, with large arcs of training on each beam. This arrangement of turrets gave an ahead and astern fire of four guns and a broadside fire of all the eight guns. The water-line armour belt was 11 in. thick with 8 in. above. Cage masts constructed of a large number of steel tubes were fitted in these vessels and such masts have been fitted in all later U.S. capital ships and also in some of the earlier vessels in substitution of their original masts. The "Michigan" and "South Carolina" were propelled by twin screws driven by reciprocating engines, thus differing from the "Dreadnought."

The next battleships built were the "North Dakota" and "Delaware," launched respectively in 1908 and 1909. These vessels were a considerable advance in size over their predecessors, being more than 60 ft. longer, 4,000 tons heavier, and two knots faster, while they carried two additional 12-in. guns. The 10 guns were mounted all on the centre line, the two turrets forward being superposed as in the previous class, while the three turrets aft were arranged so that one could fire over the other two, which were both on the same deck so that one could only fire on either broadside. The arrangement of guns thus increased the broadside fire but left the ahead and astern fire as before. The armour belt consisted of a tier of 11 in. at the water-line, with a tier of 8 in. above. The advance in speed involved an increase of 50% in the H.P. of the engines, viz. from 16,500 to 25,000. Turbines of the Curtis type were installed in the "North Dakota" for the first time in a U.S. capital ship, but the "Delaware" was fitted with reciprocating engines. An important departure in these vessels was the fitting of 14 5-in. guns as secondary armament in a battery amidships, protected by 5-in. armour.

The next pair of battleships, named the "Utah," launched in 1909 and the "Florida," launched in 1910, were enlarged "North Dakotas," but both had Parsons turbine engines of 28,000 shaft horse-power. The tonnage was increased to 21,800 tons on the same draught, and the speed remained practically the same. The length was increased slightly to 521 ft. and the beam to 88 ft. The main armament was the same in number of guns and arrangement of turrets as in the "North Dakota," but the secondary armament was increased to 16 5-in. guns, protected by 5-in. armour. The armour was practically the same as in the previous vessels.

The succeeding pair of battleships, "Arkansas" and "Wyoming," launched in 1911, were characterized by another large increase in dimensions, the length being increased to 562 ft. and the beam to 93 ft., while on the same draught as previous vessels the displacement was 26,000 tons. The engines were Parsons turbines of about 28,000 S.H.P., the speed being about ½ knot less than the "Utah," of the same power but 4,000 tons less displacement. The greatly increased displacement enabled 12 12-in. guns to be mounted in six twin-gun turrets arranged all on the centre line in three superposed groups, one group forward, another just abaft of amidships and the remaining group aft. The ahead and astern fire thus remained as in previous vessels at four guns, but all 12 guns could be fired on either broadside. The secondary armament was 16 5-in. guns in a 6-in. armoured battery. The protection was generally similar to the previous vessels, the water-line belt and barbette armour being 11 in. thick. The turrets and conning tower were of 12-in. armour.

These vessels were the last U.S. battleships mounting 12-in. guns. The example of the British in fitting 13·5-in. guns in the "Orion" class was followed by the adoption of 14-in. guns in the next vessels laid down by the United States. These were the "Texas" and "New York," launched in 1912, the dimensions of which were slightly greater than those of the "Arkansas" and the displacement 1,000 tons greater. Ten 14-in. guns constituted the main armament and was mounted in five twin turrets, arranged generally in a similar manner to the British "Orion," four guns firing ahead and astern and all 10 on either broadside. The secondary armament remained as before, 16 5-in. guns being mounted in an amidships battery protected by 6-in. armour. The water-line belt was 12 in. thick with a 9-in. belt above it, and the protection generally was somewhat greater than that of the previous vessels. An important feature in these vessels was the return to reciprocating engines, which on a power of 27,000 gave the vessels a speed of 21 knots. The reintroduction of this type of engine was made chiefly to obtain greater economy at cruising speeds.

The next pair of battleships, "Nevada" and "Oklahoma," launched in 1914, were of slightly increased length and tonnage. The main armament was the same numerically as the "New York's," but was arranged in four turrets, two containing two guns each and the other two three guns each. The twin-gun turrets were superposed above the triple-gun turrets at each end of the vessels. The secondary armament of the "Nevada" and "Oklahoma" consisted of 12 5-in. guns arranged in an unprotected battery farther forward than in previous vessels. Turbines were again adopted for the propulsion of the "Nevada," but reciprocating engines were fitted in the "Oklahoma." The reduced power of the machinery, viz. 24,800 H.P. of both vessels, resulted in a reduced speed of 20½ knots.

The British example of adoption of oil only as the fuel for the "Queen Elizabeth" class was followed by the United States in the "Nevada" and "Oklahoma," the total quantity of fuel arranged for, however, being 2,000 tons, compared with 3,400 tons in "Queen Elizabeth."

The saving in weight resulting from the adoption of triple-gun turrets and oil fuel enabled considerable additions to be made to the armour protection of the "Nevada" and "Oklahoma." The belt amidships was 13½ in. thick and extended from 8½ ft. below to 9 ft. above the water-line. The conning tower was protected by 16-in. armour, this being also the thickness of the front plates of the twin-gun turrets, those of the triple-gun turrets being of 18-in. armour. The vessels are further distinguished from their predecessors in that only one funnel, instead of two, is fitted. The uptakes are protected by 13½-in. armour.

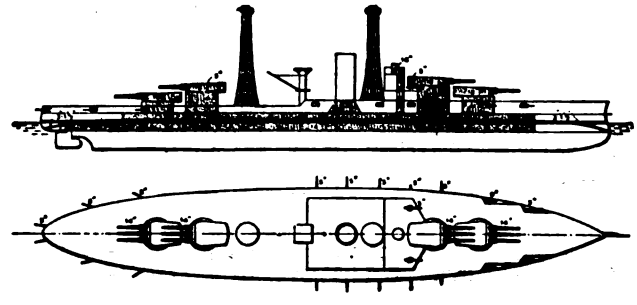

FIG. 31.

The "Nevada" and "Oklahoma" were succeeded by the "Pennsylvania" and "Arizona" (fig. 31), launched in 1915, in which the dimensions were further increased and the displacement became 31,400 tons. The main armament was increased to 12 14-in. guns arranged in four triple turrets in two superposed groups forward and aft. The secondary armament originally consisted of 22 5-in. guns, but has been reduced to fourteen. The protection of the vessels was generally similar to that of the "Nevada" and "Oklahoma," but the side armour was increased to 14 in. maximum. Turbine engines were fitted in both vessels of the class, the "Pennsylvania" having geared cruising turbines in order to secure economy.

The "New Mexico," "Idaho" and "Mississippi," launched in 1917, were similar in general design, protection, and main armament to the "Pennsylvania." The displacement was slightly increased to 32,000 tons. The main armament of 12 14-in. guns was again arranged in four triple turrets, with front plates of 18-in. armour, side plates 9 in. to 10 in. and roof plates 5 inches. The

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secondary battery of 14 5-in. guns was fitted a deck higher than in "Pennsylvania" and was unprotected.

The "New Mexico" was distinguished from her sister vessels by the adoption of electric motors for her propulsion, the other two vessels having turbines arranged as previously; she had two turbo-electric generating sets of 11,400 kw. capacity installed, and this electric power was transmitted electrically to four motors of, nominally, 6,600 H.P., one on each of the four propelling shafts. These motors were reversible, thus avoiding, as in the ordinary turbine method of propulsion, the necessity for astern as well as ahead prime movers. The electric drive appears to have been successful, especially as the "New Mexico" was not originally designed for this method of propulsion; the accommodation for the machinery being obtained by modifications in the arrangement of the spaces provided in the original design for turbines, without affecting the other features of the design. The vessel was put through exhaustive trials with satisfactory results, a maximum speed of just over 21 knots being obtained at 31,200 H.P. on a displacement of 32,800 tons, with economical steam and fuel consumption. An advantage conferred by the electric drive at cruising ship speeds arises from the ability to obtain the necessary power from only one of the electric generating sets, which can thus be worked at nearly full power and therefore give very good efficiency. The "New Mexico" escorted President Wilson across the Atlantic, and on both eastward and westward voyages only one turbine generating set was used. The weight of the machinery was greater per H.P. than that of turbine machinery of about the same power in British warships, but it was considered that this was capable of improvement in the future, especially in the case of vessels intended from the outset to have the electric drive. The electric drive has been adopted for all succeeding U.S. capital ships.

The "Tennessee" and "California," launched in 1919, were practically repeats of the "New Mexico," the displacement being 32,300 tons. These vessels, however, have two funnels. Also a new system of under-water protection (which has since been adopted for all U.S. battleships) was introduced. This consists of five vertical longitudinal bulkheads extending parallel to the ship's side from the forward to the after magazines, thus protecting the whole of the vitals of the ship. The innermost bulkhead is about 17 ft. inboard, the other bulkheads being approximately equidistant from one another; the bulkheads next to the skin bulkhead and innermost bulkhead are all thin plating, the other three being of thicker plating; the middle three of the five spaces formed by this arrangement are utilized as oil-fuel bunkers.

In Aug. 1915 Congress approved the first building programme ever drawn up for the U.S. navy, according to which 10 battleships, 6-battle cruisers, 10 scouts (or light cruisers), 50 destroyers, 9 fleet and 58 coast submarines were to be added in three years to the U.S. navy, in addition to a number of auxiliary vessels.

The first battleships to be built under this programme were the "Colorado" (launched 1921), "Maryland" (launched 1920 and completed 1921), "Washington" and "West Virginia." The dimensions of these vessels are not greatly different from the "Tennessee," except that the displacement is slightly greater, being 32,600 tons, the H.P. of the electric propelling machinery being increased to 28,900 to maintain the speed of 21 knots. The chief departure in the new vessels was the adoption of 8 16-in. guns as the primary armament, arranged in four twin-gun turrets superposed in pairs forward and aft. The secondary armament consists of 14 5-in. guns. The armour protection is generally as in the "New Mexico" class.

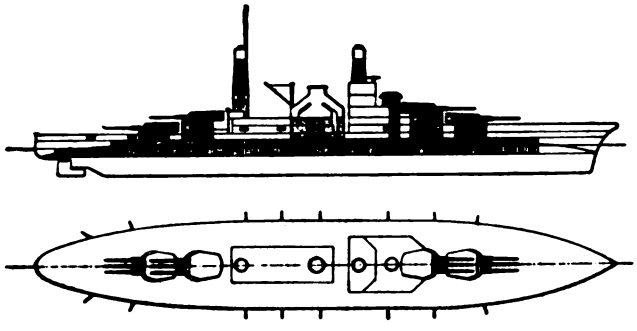

FIG. 32.

The remaining six battleships of the 1916 programme had not yet been launched in 1921. Their names are "South Dakota," "Indiana," "Montana," "North Carolina," "Iowa," and "Massachusetts" (fig. 32). They are a very great advance on their predecessors, being 684 ft. long, 106 ft. wide and displacing 43,200 tons on a draught of 31 feet. An increased speed, 23 knots, is aimed at, the electric drive being of 60,000 horse-power. The main armament is increased by 50%, consisting of 12 16-in. guns mounted in four triple-gun turrets, and the secondary armament comprises 16 6-in. guns. The torpedo armament was two submerged 21-in. torpedo tubes throughout all the battleships described in the foregoing. In 1919 a second three-year programme was considered, to consist of 156 vessels in all, including a further batch of 10 battleships and six battle-cruisers.

(2) *France.*—The French navy did not immediately adopt the single-calibre main armament, their first vessels, designed after the "Dreadnought" era had begun, being the "Danton" class, which resembled the "Lord Nelson" in armament, 12 9·4-in. guns being carried in addition to the usual 4 12-in. guns. They were about 2,000 tons heavier than the "Lord Nelson" and were fitted with turbines of 22,500 H.P., giving a speed of 20 knots.

The first French battleships of the "Dreadnought" type were the "Jean Bart" class, launched in 1911 and 1912. These vessels, "Jean Bart," "Paris," "France" and "Courbet," were a considerable advance on the "Danton" class, being 546 ft. long, as against 481 ft., with increased beam and draught, and displacement of 23,100 tons. Turbine machinery of 28,000 H.P. was fitted, giving a speed of 20 knots. The main armament comprised 12 12-in. guns mounted in six twin-gun turrets arranged in two superposed groups forward and aft, with the remaining two turrets on the broadsides amidships. The ahead and astern fire was thus 6 guns and broadside 10 guns. The secondary armament was very numerous, consisting of 22 5·5-in. guns protected by 7-in. armour. The side armour was 10¾ in. thick, tapering to 7 in. at the bow and stern, the turret armour being also 10¾ in. thick.

The "Jean Bart" successfully withstood torpedo attack by an Austrian submarine in 1915, being struck well forward. Compartments were flooded, but the vessel proceeded under her own power to Malta, where she was repaired in H.M. Dockyard.

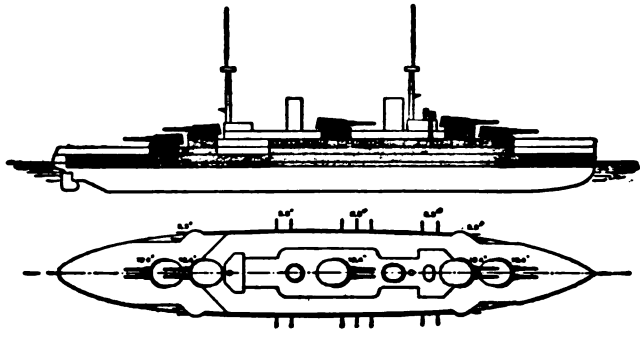

FIG. 33.

The next battleships built by the French were the "Bretagne" (name ship of the class) (fig. 33), "Lorraine" and "Provence," all launched in 1913, practically repeats of the "Jean Barts," except that the main armament consisted of 10 13·4-in. guns mounted in five twin-gun turrets, all on the centre line of the vessels, the usual superposed groups of two turrets forward and aft, the fifth turret being amidships. The secondary armament again consisted of 22 5·5-in. guns, arranged slightly differently from the "Jean Bart," but this number was decreased after the war to 18, during a partial reconstruction when director-firing was installed on a new tripod foremast.

These vessels were the last battleships completed for the French navy, the completion of the five vessels of the "Normandie" class, launched in 1914 and 1915, having been abandoned, with the exception of the "Bearn," which has been converted into an aircraft-carrier. The "Normandie" class were designed to carry 12 13·4-in. in three quadruple-gun turrets, a unique arrangement. The four guns in each turret were arranged on two mountings, so that virtually they comprised two twin guns. The secondary armament was to have consisted of 18 5·5-in. guns. The machinery intended for these vessels was of an interesting type, consisting of a combination of turbine and reciprocating engines, the two inner shafts being driven by turbines and the two outer shafts by reciprocating engines, which alone were powerful enough to have given the vessels a speed of 16 knots, the full power of 35,000 H.P. being designed to give a maximum speed of 21 knots.

It was intended to have laid down in Oct. 1914 four battleships of the "Duquesne" type, but the outbreak of the war caused this intention to be abandoned. The vessels were designed to carry 16 13·4-in. guns in four quadruple-gun turrets, arranged in two superposed groups forward and aft. The displacement was to have been 29,500 tons, and, with combination turbine and reciprocating engine, a speed of 23 knots was anticipated.

It should be noted that during the whole war period the French Government dockyards, and many private yards also, devoted their whole capacity to the production of munitions of all kinds for the army; naval work being almost entirely relegated to the background.

No provision was made in the French naval budget for 1921 for the construction of any capital ships.

(3) *Japan.*—The "Satsuma" and "Aki" were the first battleships built in Japan after the "Dreadnought" era had begun. They were a development of the "Kashima" class, and therefore

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resembled in type the "Lord Nelson." Launched in 1906 and 1907, they mounted 4 12-in. and 12 10-in. guns on a displacement of about 19,500 tons. Turbine machinery of 24,000 H.P. was fitted in the "Aki," giving a speed of 20½ knots. The "Satsuma," with reciprocating engines of 18,500 H.P., was 2 knots slower.

The first Japanese battleships of the "Dreadnought" type were the "Settsu," launched in 1911, and the "Kawachi," launched in 1912. The latter vessel was blown up in 1918 in a Japanese harbour by the explosion of her magazines. These vessels were of 20,800 tons and mounted 12 12-in. guns, arranged in six twin-gun turrets, one forward and aft on the centre line and the other four on the broadsides. The ahead and astern fire was thus 6 guns and broadside fire 8 guns. The secondary armament was 10 6-in. guns, mounted in an amidship battery protected by 6-in. armour. Eight 4·7-in. guns were also mounted. The armour belt was 12 in. thick amidships at the water-line and 9 in. above, with 5-in. armour forward and aft, the 12-in. guns were protected by 11-in. armour, and the conning tower by 12-in. armour. Turbine machinery of 25,000 H.P. was fitted, giving a speed of 20½ knots.

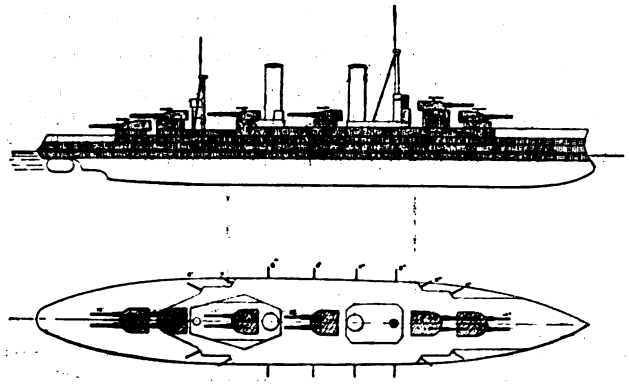

FIG. 34.

Large increases in dimensions and power characterized the next class (fig. 34) of Japanese battleships, 14-in. guns being adopted. These vessels were the "Fuso" and "Yamashiro," of 30,600 tons and 40,000 H.P., launched in 1914 and 1915 respectively, and the "Ise" and "Hyuga," of 31,260 tons and 45,000 H.P., launched in 1916 and 1917. The main armament consisted of 12 14-in. guns mounted in twin-gun turrets all arranged on the centre line of the vessel. Two turrets are superposed forward, with a similar arrangement aft, the remaining two turrets being abaft the forward and after funnels respectively. The first pair of vessels named mount 16 6-in. guns, and the second pair 20 5·5-in. guns, as the secondary armament in an amidships battery protected by 6-in. armour. The belt and turret armour is 12 in. thick. The speed of the vessels is about 22½ knots.

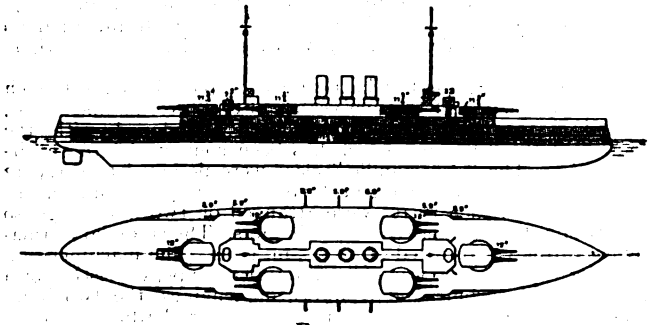

FIG. 35.

The next class of Japanese battleships are characterized by the fitting of 16-in. guns. These vessels were "Nagato" (launched 1919 and completed 1920) and "Mutsu" (launched 1920), of 33,800 tons displacement, and "Tosa" and "Kaga" (building 1921) of 40,600 tons displacement. The former pair of vessels mount 8 16-in. guns in four twin-gun turrets arranged in the now usual manner, with 20 5·5-in. guns as secondary armament. The latter pair of vessels were probably to mount 10 16-in. guns. The torpedo armament, which in previous vessels consisted of five or six submerged tubes, was increased to eight tubes, four of which are mounted above the water-line. The vessels were slightly faster than previous vessels, a speed of 23½ knots being intended, geared turbines providing the requisite power, which was about 46,000 in the "Nagato" and "Mutsu" and 60,000 in the "Tosa" and "Kaga."

Under the 1920–8 Navy Law four battleships were projected.

(4) *Germany.*—The "Dreadnought" type of battleship was adopted at once by Germany, the advance from the "Deutschland" class (of the "Formidable" type) being made without trial as was done in some other navies, of vessels of the "King Edward VII." or "Lord Nelson" types. The first German "Dreadnoughts" were the four vessels of the "Nassau" class, launched in 1908. Shorter but wider and somewhat heavier than the "Dreadnought," the "Nassau," on a displacement of 18,600 tons, carried 12 11-in. guns in six twin-gun turrets, mounted one at each end on the centre line, and two on each broadside, thus giving an ahead and astern fire of six guns and broadside fire of eight. The secondary armament consisted of 12 5·9-in. guns, mounted in a battery protected by 7-in. armour. A large torpedo armament of six 17·7-in. submerged tubes was fitted. The water-line armour belt was 11½ in. thick, with an 8-in. belt above, and tapering to 5 in. forward and 4 in. aft. The speed was 19 knots, the requisite H.P. of 20,000 being developed by reciprocating engines.

The "Nassau" class was followed by the four ships of the "Helgoland" class (fig. 35), launched in 1909 and 1910. These vessels marked a considerable increase in dimensions and displacement. The 12-in. gun was adopted for the first time in these vessels, the Germans claiming that this weapon was the equivalent of the 13·5-in. gun then being adopted by the British in the "Orion" class. The "Helgoland" carried 12 12-in. guns arranged similarly to the 11-in. guns in the "Nassau." The secondary armament was increased to 14 5·9-in. guns and the six submerged tubes were of 19·7-in. diam-

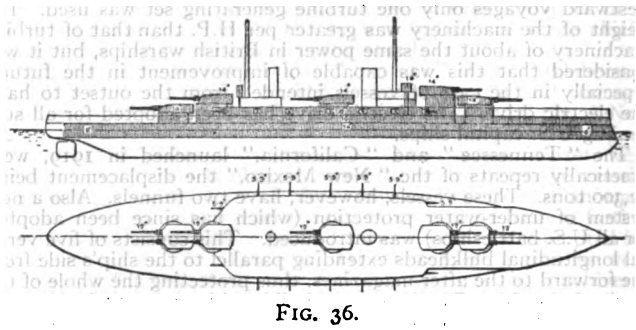

FIG. 36.

eter. The protection was generally the same as that of the "Nassau" class. The speed was increased to 20·5 knots. The various increases involved a displacement of 22,440 tons and engines of 25,000 H.P., but the reciprocating type was still adhered to.

The "Kaiser" class (five vessels), launched in 1911 and 1912, were slightly larger and faster than the "Helgoland" class, being of 24,300 tons and 21 knots, but the main armament was reduced to 10 12-in. guns without loss of broadside fire, as they were arranged similarly to the British "Neptune" (designed two years previously), with one turret forward, two superposed aft and two broadside turrets *en échelon*, all guns thus being able to fire on either broadside. The secondary armament was unaltered and the bow torpedo tube was omitted. The armour protection was considerably increased, the water-line belt being of 13¾ in. maximum thickness

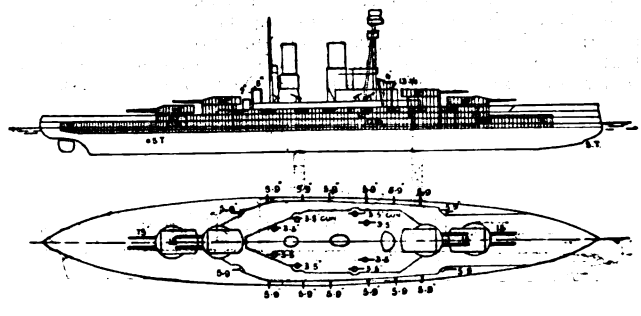

FIG. 37.

tapering to 9 in., with an upper belt of 7¾ in., the secondary battery above and both ends of the ship being protected by a like thickness. Turbine engines were installed for the first time in German battleships, the power being 28,000 for a speed of 21 knots, which was somewhat exceeded on trials.

The four ships of the "König" class (see fig. 36), launched in 1913 and 1914, were, with the exception of slightly greater dimensions and displacement, generally repeats of the "Kaiser" class in respect of number and calibre of guns and torpedo tubes and of protection. The main armament was arranged all on the centre line, as in the British "Orion" class, the amidship turret being, however, between the two funnels. An important advance lay in the increased oil-fuel (700 tons) capacity, previous vessels having only 200 tons.

The last battleships built by the Germans were the "Baden" and "Bayern" (see fig. 37), launched in 1915, two others of the class not being completed at the time of the Armistice. A very complete description of the "Baden" was given in a paper read by Mr. S. V.

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Goodall before the Institution of Naval Architects in March 1921. The "Baden" and "Bayern" were about 3,000 tons heavier than the "König" class, the dimensions being increased proportionately. The chief difference, however, was in the main armament, 8 15-in. guns being mounted in four turrets on the centre line in two superposed groups forward and aft, as in the British "Queen Elizabeth." The secondary armament was increased to 16 5·9-in. guns, and the torpedo armament consisted originally of 5 23·6-in. submerged tubes, one forward in the stem and the other on the broadside forward and aft. The forward torpedo room was damaged by an under-water explosion and when repairs were made the torpedo tubes were not replaced. Turbine machinery of about 50,000 H.P. total was fitted, driving three propellers, and a speed of about 22 knots was obtained on trials. The main armour belt was 13¾ in. thick, tapering to 6¾ in. at the lower edge. Above was a belt of 10-in. armour extending to the upper deck. The secondary battery was protected by 6¾-in. armour. Forward the side armour was 6 in. thick and aft 7 inches. The latter and a deck of 4¾ in. thickness provided protection to the steering gear. The maximum thickness of armour for the barbettes, turrets, and conning tower was 13¾ inches. Protection against under-water attack was provided by a longitudinal bulkhead 2 in. thick, set in about 13 ft. from the side.

(5) *Italy.*—The first Italian "Dreadnought" was the "Dante Alighieri," of 19,200 tons, launched in 1910. This vessel was then remarkable for the high designed speed of 23 knots and the adoption of triple-gun mountings for the main armament of 12-in. guns, of which 12 were carried in turrets all fitted on the centre line of the vessel. The turrets, funnels and masts were so disposed that the vessel could practically be described as "double-ended." The vessel was protected by a water-line belt of 10-in. (maximum) armour amidships and 4-in. at the ends, with an upper belt of 6-in., by which 12 of the secondary battery of 20 4·7-guns were protected. The remaining 8 4·7-in. guns were mounted in four twin-gun turrets on the upper deck. The 12-in.-gun turrets had a maximum thickness of 10-in. armour. Turbine engines of 26,000 H.P. were fitted; these developed 35,000 H.P. on trial, when 24 knots were attained. Three torpedo tubes were fitted.

The "Dante Alighieri" was followed by the "Conte di Cavour," "Leonardo da Vinci" and "Giulio Cesare," launched in 1911. These vessels were 3,000 tons heavier than their predecessor and mounted an extra 12-in. gun, making 13 in all, four of which were in two twin-gun turrets superposed above triple-gun turrets forward and aft, a further triple-gun turret being fitted amidships. This arrangement enabled an increased all-round fire to be obtained over the previous vessel. The secondary armament of 18 4·7-in. guns was carried in an amidships battery protected by 5-in. armour, which was above the upper belt of 9-in. armour, the water-line belt being 10-in. amidships and 4-in. at the ends. Turret armour was 10-in. and conning tower 12-inches. Turbine engines of 24,000 H.P. were fitted to give a speed of 22 knots.

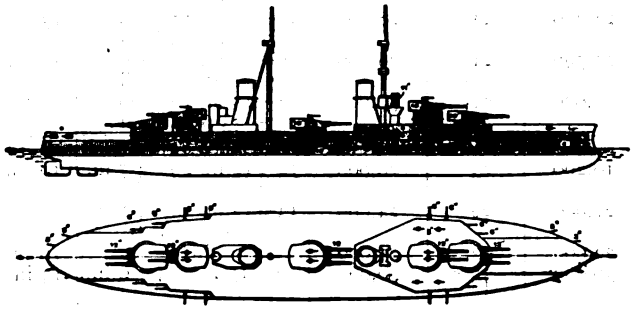

FIG. 38.

The "Andrea Doria" and "Caio Duilio" (see fig. 38), launched in 1913, were slightly longer and heavier than the "Conte di Cavour," but except for an improved secondary armament of 16 6-in. guns fitted abreast the forward and after turrets, the changes were of a minor nature.

The "Leonardo da Vinci," blown up at Taranto in 1916 by the explosion of her magazine, was refloated and dry-docked upside down in 1919. After repairs she was floated out of dock still upside down and then righted. This operation reflects the greatest credit upon the Royal Italian Corps of Naval Constructors, who conducted the operations throughout. The vessel, will, however, not be restored as a warship, but utilized for a subsidiary service.

The last four battleships laid down in 1914 and 1915 for the Italian Navy, the "Caracciolo" class, have not been completed. They were to have been generally similar in size, armament, speed and protection to the "Queen Elizabeth."

(6) *Russia.*—The Russian navy has ceased to exist as an important factor, but technically the various classes of battleships built are of interest.

Following the construction of two vessels of the intermediate "Lord Nelson" type, four battleships of the "Petropavlovsk" class were launched in 1911 and three of the "Imperator Alexander III." class (for the Black Sea Fleet) in 1914. The first four were slightly heavier, longer and faster than the others, but their general characteristics are similar. They all mount 12 12-in. in four triple-gun turrets on the centre line of the vessel, arranged similarly to the Italian "Dante Alighieri," the speed of which, 23 knots, was the same as that of the "Sevastopol," the Black Sea vessels being 2 knots slower, all the vessels having turbine engines.

The "Imperatritza Marie" was blown up by an internal explosion at Sevastopol in 1916, and refloated and docked upside down in 1919, similarly to the "Leonardo da Vinci."

(7) *Austria.*—Three battleships of intermediate ("Lord Nelson") type were completed in 1910 and 1911. Following these vessels four "Dreadnoughts" of the "Viribus Unitis" class were completed in 1912–5. On a displacement of 20,000 tons, 12 12-in. guns in four triple-gun turrets (of 11-in. armour maximum) were carried in two superposed groups forward and aft with 12 5·9-in. guns as secondary armament in an amidships battery protected by 6-in. armour. The water-line belt was 11 in. amidships and 5 in. at the ends. An upper belt of 8 in. was fitted amidships. Turbine engines of 25,000 H.P. gave a speed of about 20 knots.

Two vessels, the "Szant Istvan" of this class and the old battleship "Wien," were sunk during the war as the result of daring attacks by Italian fast motor-boats. The "Viribus Unitis" sank in 1918, due to the explosion of a mine placed in contact with the vessel by two Italian officers in a small torpedo-like motor-boat.

A contemplated programme of four battleships of 25,000 tons, carrying eight 15-in. guns, did not materialize owing to the war.

(8) *Argentina.*—The only "Dreadnought" battleships are the "Moreno" and "Rivadavia," launched in the United States in 1911 and completed in 1914; 12 12-in. guns, in six twin-gun turrets, and 12 6-in. guns are carried on a displacement of 27,600 tons, turbine engines of 39,500 H.P. giving a speed of 22½ knots.

(9) *Brazil.*—The "Rio de Janeiro," laid down at Armstrong's, Newcastle, in 1911, was sold later to Turkey, from whom the vessel was requisitioned by the British on the outbreak of the World War, and renamed "Agincourt." The "Minas Geraes" and "São Paulo" are thus the only two "Dreadnought" battleships possessed by Brazil.

(10) *Chile.*—The "Almirante Latorre" and "Almirante Cochrane" were building at Armstrong's in 1914 for the Chilean navy. The former vessel, after service during the war as H.M.S. "Canada," was sold back to Chile, but the latter vessel remains as H.M.S. "Eagle." Chile thus possesses only one "Dreadnought."

(11) *Greece.*—The "Salamis," of 19,500 tons and 23 knots speed, building in Germany at the outbreak of war in 1914, had not been completed. The four twin-gun turrets constructed in the United States for this vessel were purchased by the British and fitted in the first four large monitors.

(12) *Norway.*—The "Nidaros" and "Bjorgvin" (coast-defence battleships), launched by Armstrong's in 1914, were taken over by the British during the war and completed, with the addition of bulges, as H.M.S. "Glatton" and "Gorgon."

(13) *Spain.*—The smallest "Dreadnought" battleships ever designed have been completed for the Spanish navy. On a displacement of 15,500 tons, the "Alfonso XIII.," "España," and "Jaime I." carry 8 12-in. guns in four turrets (the amidships turrets being *en échelon*) and 20 4-in. guns. Turbine engines of 15,000 H.P. give a speed of 19½ knots. Armour protection consists of a 9-in. water-line belt, with 10-in. armour for the turrets and conning tower. The vessels were built in Spain from designs and under the supervision of British firms.

(14) *Sweden.*—Three small battleships, the "Sverige" (completed in 1917), and the "Drottning-Victoria" and the "Gustav V." (which in 1921 were nearing completion), are of 7,600 tons displacement. They mount four 11-in. and eight 6-in. guns, and with turbine engines of 22,000 H.P. a speed of 22 knots is expected.

(15) *Turkey.*—Two battleships completing in England for the Turkish navy were taken over by the British Government on the outbreak of war and renamed "Agincourt" and "Erin."

Battle Cruisers

Up to 1921 battle cruisers had been built only for Japan, Germany and Russia, besides Great Britain (see Table VII.). The United States had six vessels building.

United States.—The "Lexington" class (fig. 39) were designed in 1916, but no progress was made in their construction during the war. After the Armistice their design was reconsidered. The displacement was increased from 35,300 tons to 43,500 tons, the main armament being changed from 10 14-in. guns to 8 16-in. guns. The S.H.P. was 180,000 total, driving four propellers, and this was estimated to give 35 knots as the original design displacement and 33½ knots for the final design. This enormous H.P. (the maximum so far contemplated for any ship) is developed by the electric drive, on generally similar but improved lines to that of the "New Mexico." Oil fuel only is burnt in the boilers. The changes made included considerably increased protection against gunfire and under-water attack. The result of all the changes made is that the vessels will be powerful battle cruisers, with good offensive and defensive qualities as compared with the initial design. The torpedo

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TABLE VI.—*Non-British Battleships, 1921.*

Country and Class	No. in Class	Date of Launch	Length Ft. In.	Breadth Ft. In.	Draught Ft. In.	Displacement: Tons	Speed: Knots	Horse-Power	Armament	Side Armour
UNITED STATES:										
"South Carolina"	2	1908	453 0	80½	27	16,000	18½	16,500	8—12 in. 12—3 in. 2—21 in. T. T.	11 in.
"Delaware"	2	1908–9	519 0	85¼	29	20,000	21	25,000	10—12 in. 14—5 in. 2—21 in. T. T.	11 in.
"Florida"	2	1909–10	521 6	88¼	29½	21,825	20¾	28,000	10—12 in. 16—5 in. 2—21 in. T. T.	11 in.
"Arkansas"	2	1911	562 0	93¼	29½	26,000	20½	28,000	12—12 in. 16—5 in. 2—21 in. T. T.	11 in.
"New York"	2	1912	573 0	95¼	29½	27,000	21	28,000	10—14 in. 16—5 in. 4—21 in. T. T.	12 in.
"Nevada"	2	1914	583 0	95¼	29½	27,500	20½	24,800	10—14 in. 12—5 in. 2—21 in. T. T.	13½ in.
"Pennsylvania"	2	1915	608 0	97	30	31,400	21	34,000	12—14 in. 14—5 in. 2—21 in. T. T.	14 in.
"New Mexico"	3	1917	624 0	97½	30	32,000	21	27,500 32,000 32,000	12—14 in. 14—5 in. 4—21 in. T. T.	14 in.
"Tennessee"	2	1919	624 0	97½	30	32,300	21	28,500	12—14 in. 14—5 in. 2—21 in. T. T.	14 in.
"Maryland"	4	1920 & bldg.	624 0	97½	30½	32,600	21	28,900	8—16 in. 14—5 in. 2—21 in. T. T.	14 in.
"South Dakota"	6	Bldg.	684 0	106	31	43,200	23	60,000	12—16 in. 16—6 in. 2—21 in. T. T.	14 in.
FRANCE:										
"Jean Bart"	4	1911–2	544 6	88½	29¾	23,100	20	28,000	12—12 in. 22—5·5in. 4—18 in. T. T.	10¾ in.
"Bretagne"	3	1913	544 6	88½	29¾	23,200	20	29,000	12—13·4 in. 22—5·5in. 4—18 in. T. T.	10¾ in.
"Normandie"	5	1914–5 not completed.	574 0	89	29	24,800	21	35,000	12—13·4 in. 24—5·5in. 6—21 in. T. T.	12 in.
JAPAN:										
"Aki"	2	1907	460 0	83½	27½	19,800	20½	24,000	4—12 in. 12—10 in. 5—18 in. T. T.	9 in.
"Settsu"	2	1911	500 0	84	27	20,800	20½	26,500	12—12 in. 10—6 in. 5 T. T.	12 in.
"Fuso"	4	1914–7	640 0	94	28½	31,000	23	45,000	12—14 in. 20—5·5 in. 6 T. T.	12 in.
"Kaga"	4	1919 and bldg.	700 0			40,600	23½		8—16 in. 20—5·5 in.	13 in.
GERMANY:										
"Nassau"	4	1908	478 0	88 4	26 7	18,600	19	20,000	12—11 in. 12—5·9 in. 6—17·7 in. T. T.	11·4 in.
"Ostfriesland"	4	1909–10	546 3	93 6	26 11	22,440	20·5	25,000	12—12 in. 14—5·9 in. 6—19·7 in. T. T.	11·8 in.
"Kaiser"	5	1911–2	564 4	95 2	27 3	24,310	21	28,000	10—12 in. 14—5·9 in. 5—19·7 in. T. T.	13·8 in.
"König"	4	1913–4	573 2	96 9	27 4	25,390	21	28,000	10—12 in. 14—5·9 in. 5—19·7 in. T. T.	13·8 in.
"Baden"	4	1915	588 7	98 5	27 8	28,070	21	50,000	8—15 in. 16—5·9 in. 3—23·6 in. T. T.	13·8 in.
ITALY:										
"Dante Alighieri"	1	1910	549 6	87 6	28 6	19,200	23	26,000	12—12 in. 20—4·7 in. 3—18 in. T. T.	10 in.
"Giulio Cesare"	3	1911	576 0	92 0	29 0	22,000	22	24,000	13—12 in. 18—4·7 in. 3—18 in. T. T.	10 in.
"Caio Duilio"	2	1913	576 0	92 0	29 0	22,600	22	25,000	ditto	10 in.
"Caracciolo"	4	laid down. 1914–5 not completed.	691 0	97 0	29 0	30,900	25	70,000	8—15 in. 16—6 in.	13 in.
RUSSIA:										
"Petropavlosk"	4	1911	590 0	87 0	27 3	23,000	23	42,000	12—12 in. 16—4·7 in. 4—18 in. T. T.	9 in.
"Imperator Alexander III."	3	1913–4	550 0	89 6	29 0	22,600	21	23,000	12—12 in. 20—5·1 in. 4—18 in. T. T.	12 in.
AUSTRIA:										
"Viribus Unitis"	4	1911–4	530 0	89 3	27 0	20,000	20	25,000	12—12 in. 12—5·9 in. 4—21 in. T. T.	11 in.
ARGENTINA:										
"Moreno"	2	1911	585 0	95 0	28 0	27,600	22½	39,500	12—12 in. 12—6 in. 2—21 in. T. T.	12 in.
BRAZIL:										
"Minas Geraes"	2	1908–9	543 0	83 0	25 0	19,200	21	23,500	12—12 in. 22—4·7 in.	9 in.
CHILE:										
"Almirante Latorre"	1	1913	661 0	92 0	28 6	28,000	22¾	37,000	10—14 in. 16—6 in. 4—21 in. T. T.	9 in.
SPAIN:										
"Alfonso XIII."	3	1912–4	459 0	78 9	25 6	15,500	19½	15,000	8—12 in. 20—4 in.	9 in.
SWEDEN:										
"Sverige"	3	1914	397 0	61 0	21 6	7,000	22	22,000	4—11 in. 8—6 in. 2—18 in. T. T.	8 in.

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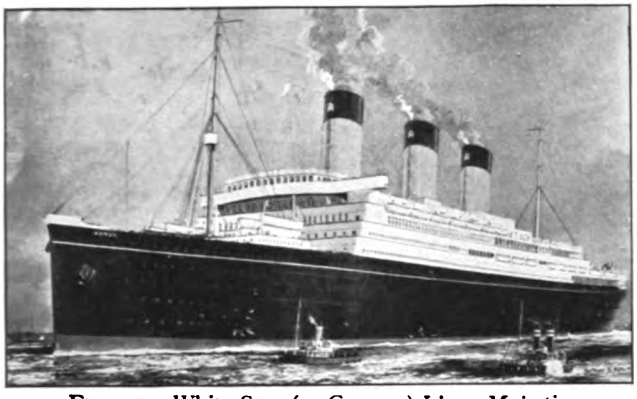

FIG. 45.—White Star (ex-German) Liner *Majestic.*

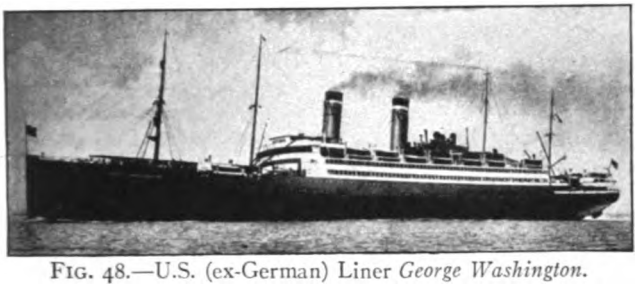

FIG. 48.—U.S. (ex-German) Liner *George Washington.*

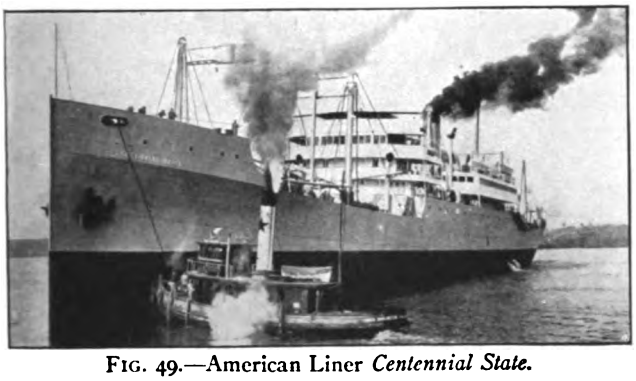

FIG. 49.—American Liner *Centennial State.*

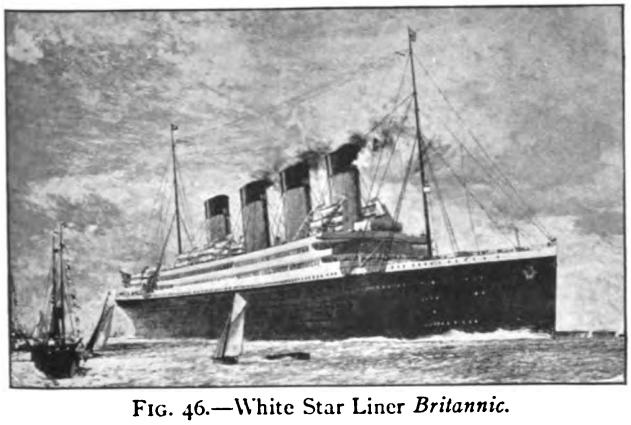

FIG. 46.—White Star Liner *Britannic.*

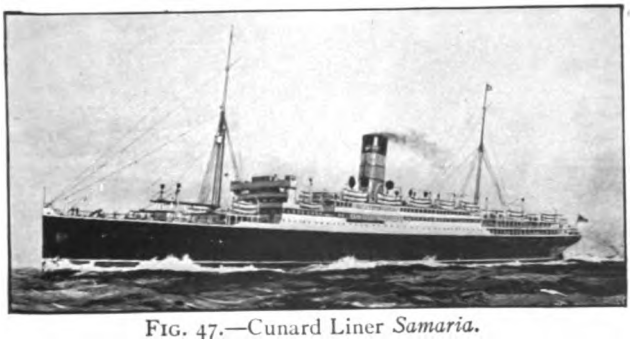

FIG. 47.—Cunard Liner *Samaria.*

FIG. 51.—Richborough Train Ferry (Kent, England).

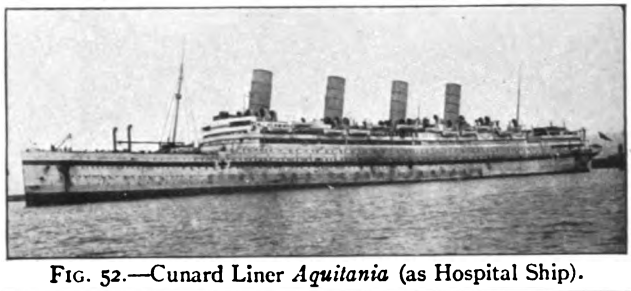

FIG. 52.—Cunard Liner *Aquitania* (as Hospital Ship).

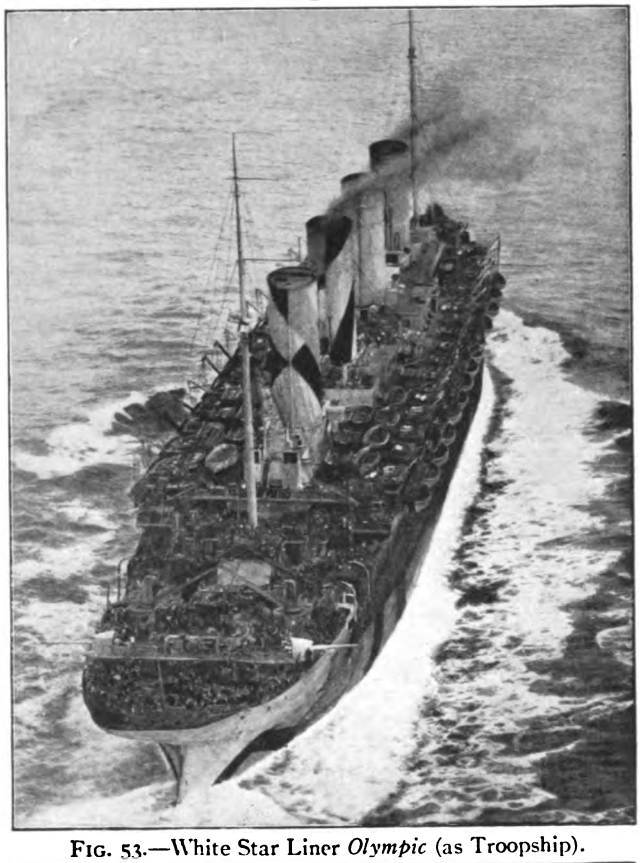

FIG. 53.—White Star Liner *Olympic* (as Troopship).

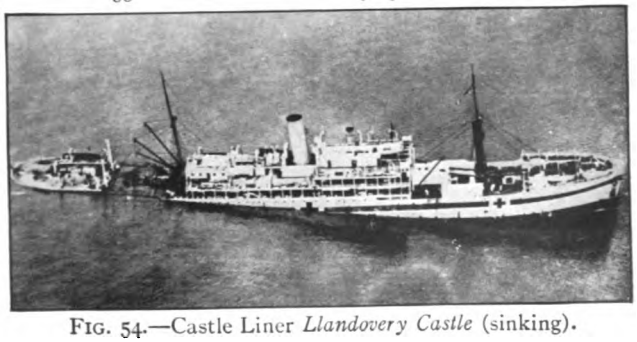

FIG. 54.—Castle Liner *Llandovery Castle* (sinking).

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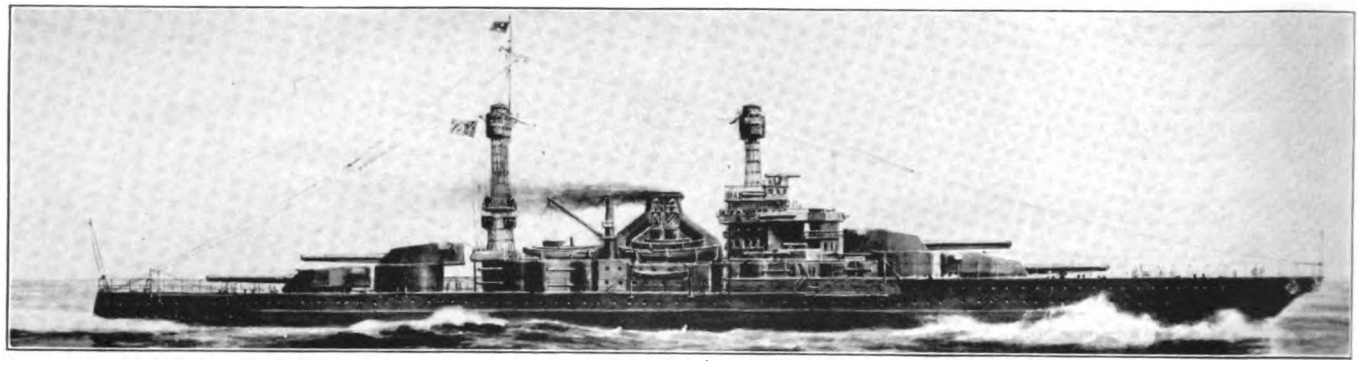

FIG. 32a.—U.S. Battleship *North Carolina* Class.

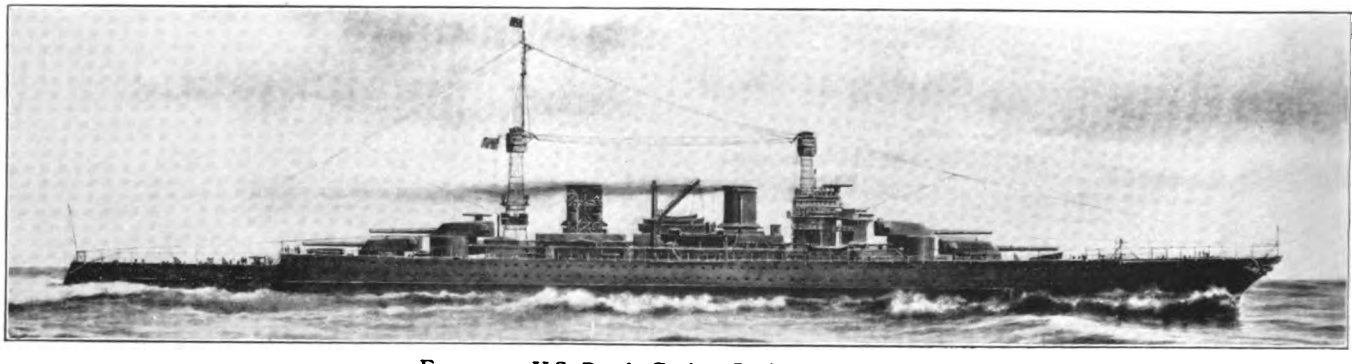

FIG. 39a.—U.S. Battle-Cruiser *Lexington* and Class.

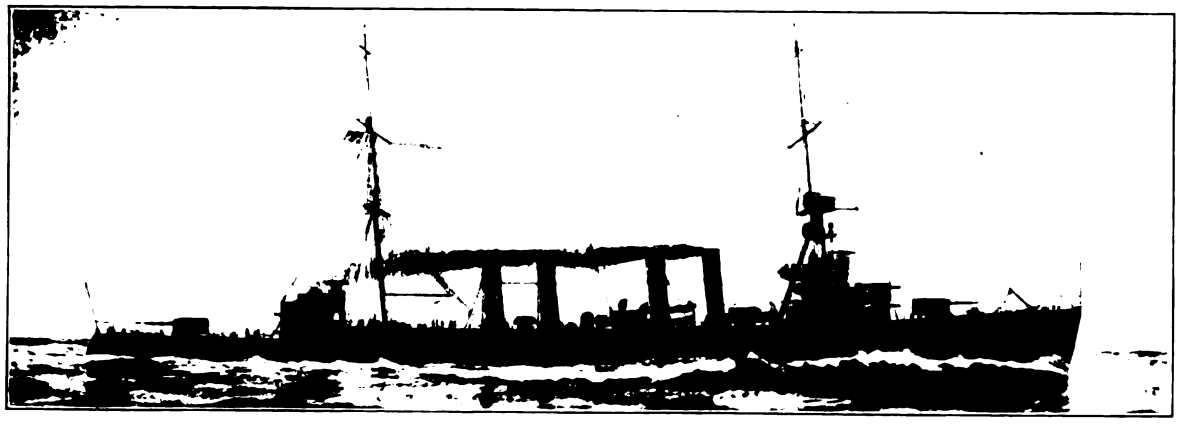

FIG. 42a.—U.S. Scout Cruisers *Nos. 4–13.*

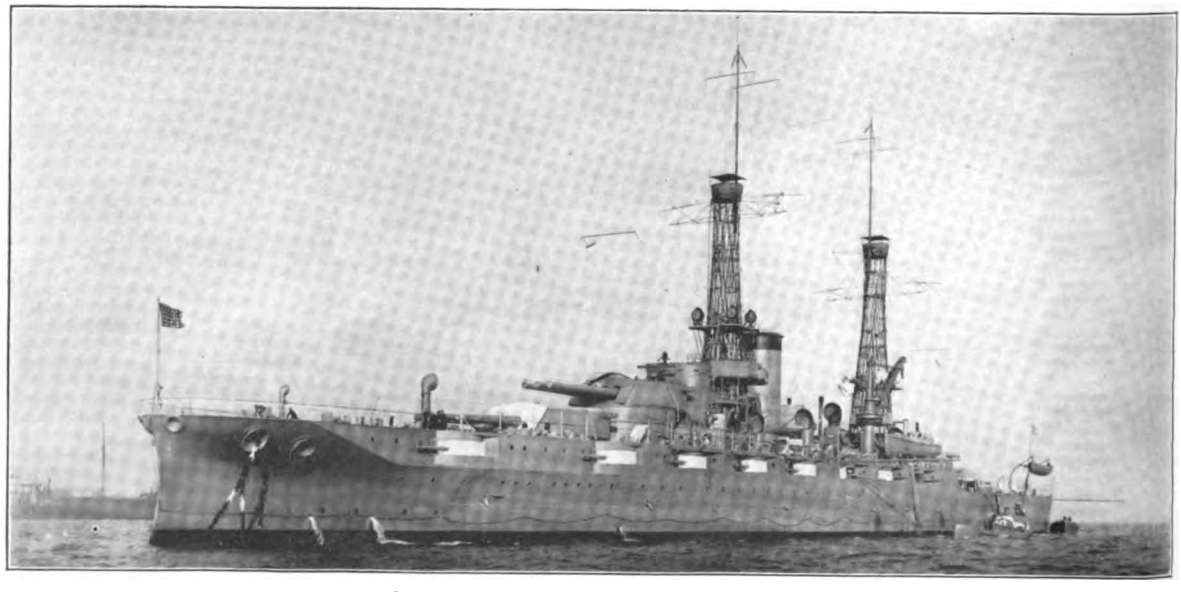

FIG. 31a.—U.S. Battleship *Pennsylvania.*

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armament is very large for a U.S. vessel, consisting as it does of four submerged and four above-water 21-in. torpedo tubes. None of the vessels had yet been launched in 1921.

Russia.—Four battle cruisers were launched in 1915, but they had not been completed up to 1921. On a displacement of 32,200 tons, with a length of 750 ft., 12 14-in. and 24 5-in. guns and 6 torpedo tubes were to have been carried, turbine engines of 66,000 H.P. being estimated to give a speed of 27 knots. The side armour had a maximum thickness of 12 inches.

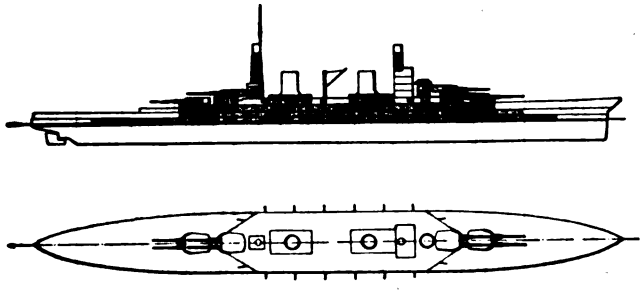

FIG. 39.

Japan.—The "Tsukuba" and "Ikoma" were laid down in 1905 and the "Kurama" and "Ibuki" in 1907. These vessels are classed as battle cruisers, but they lacked the high speed considered an essential feature of the battle-cruiser type. The "Tsukuba" was blown up in a Japanese harbour in 1917. The next battle cruisers built by Japan were the four vessels of the "Kongo" class, launched in 1912–3, the name ship being constructed by Vickers at Barrow, and her sisters in Japan. These vessels resemble the "Lion" class, having an armament of 8 14-in. and 16 6-in. guns on a displacement of 27,500 tons, a speed of 27 knots being obtained with turbines developing 64,000 horse-power. The vessels are well protected by 10-in. (maximum) armour, and they carry a powerful torpedo armament of 8 submerged 21-in. torpedo tubes. Four battle cruisers of the "Amagi" class were in 1921 under construction. They were reported to be vessels of 40,000 tons displacement and 30 knots speed, with a main armament of 8 16-in. guns.

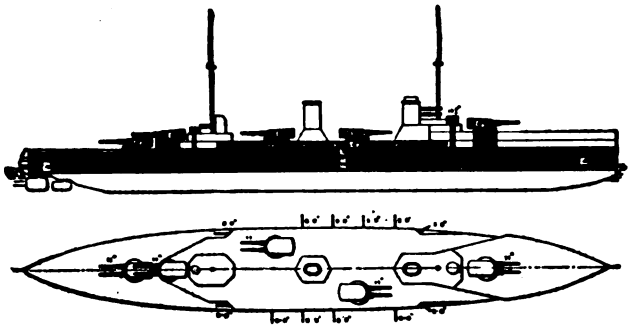

FIG. 40.

Germany.—As with the "Dreadnought" type of battleship, the Germans followed the British in their battle cruisers. The first vessel of the type, "Von der Tann," was launched in 1909. On a displacement of 19,100 tons she carried 8 11-in. and 12 5·9-in. guns. The armour belt was of 10-in. (maximum) thickness and her designed speed was 24 knots, the turbine engines developing about 45,000 horse-power. This speed and H.P. were exceeded on trials. The "Moltke" (1910), "Goeben" (1911), of 22,600 tons and 25 knots, and "Seydlitz" (1912), of 24,600 tons and 26½ knots (fig. 40) were generally improvements on the "Von der Tann." The main armament consisted of 10 11-in. guns arranged as in the British "Neptune" (of two years earlier design), as compared with 8 13·5-in. guns in contemporary British battle cruisers. The "Goeben" was transferred to Turkey early in the war, having been in the Mediterranean when the war broke out. Return to Germany being impossible, she escaped to Constantinople. The "Seydlitz" was badly damaged at the battles of Dogger Bank (1915) and Jutland (1916). Her return to harbour after the latter was only effected with great difficulty, and probably only the close proximity of the German coast enabled her to reach port in time. The "Derfflinger" (1913) and "Lützow" (1913) were the first German battle cruisers to mount 12-in. guns, of which they carried eight on a displacement of 26,200 tons. The speed was 26½ knots and maximum armour 12 in. thick. The "Lützow" was sunk at the battle of Jutland. The "Hindenburg" (fig. 41), launched in 1915 and completed in 1917, and "Mackensen," launched in 1917 but not completed, were virtually repeats of the "Lützow," with the same armament, but improved speed of 28 knots. The "Graf von Spee," also launched in 1917 but not completed, was of 27,000 tons, with six 15-in. guns as the main armament. A sister vessel, "Prinz Eitel Friedrich," had not been launched at the Armistice. The last three vessels were dismantled, as well as other battle cruisers whose construction had not been far advanced.

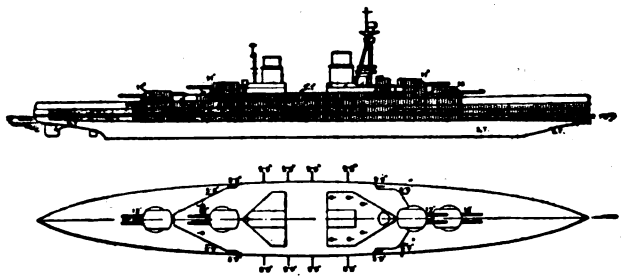

FIG. 41.

Light Cruisers

The light cruiser type of warship has in recent years been constructed by very few nations (see Table VIII.). The *United States*

TABLE VII.—*Battle Cruisers of Non-British Navies.*

Country and Class	No. in Class	Date of Launch	Length	Breadth	Draught	Displacement: Tons	Speed Knots	Horse-Power	Armament	Side Armour
UNITED STATES:			ft. in.	ft. in.	ft. in.					in.
"Lexington" .	6	Bldg.	874 0	105 6	31	43,500	33½	180,000	8—16 in. 16—6 in. 4—21 in. T. T.	8
RUSSIA:										
"Navarin" . .	4	1915 Not completed.	750 0	100 0	30	32,200	27	66,000	12—14 in. 24—5 in. 6—18 in. T. T	12
JAPAN:										
"Kongo" . .	4	1913	653 6	92 0	27½	27,500	27½	64,000	8—14 in. 16—6 in. 8—21 in. T. T.	8
"Amagi" . .	4	Bldg.	850 0	100 0		40,000	30		8—16 in.	
GERMANY:										
"Blücher" . .	1	1908	528 6	80 5	26¼	15,500	24	32,000	12—8·2 in. 8—5·9 in. 4—17·7 in. T. T.	7
"Von der Tann"	1	1909	562 8	87 3	26 7	19,100	24	43,600	8—11 in. 10—5·9 in. 4—17·7 in. T. T.	9·8
"Moltke" . .	2	1910–1	610 3	96 10	26 11	22,640	25	52,000	10—11 in. 12—5·9 in. 4—19·7 in. T. T.	11
"Seydlitz" . .	1	1912	656 2	93 6	27	24,610	26½	63,000	ditto.	11·8
"Derfflinger" .	2	1913	689 0	95 2	27½	26,180	26½	63,000	8—12 in. 12—5·9 in. 4—19·7 in. T. T.	12
"Hindenburg" .	2	1915–7	697 0	96 3	27½	26,640	28	85,000	8—12 in. 12—5·9 in. 6—19·7 in. T. T.	12

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TABLE VIII.—*Light Cruisers of Non-British Navies.*

Country	Date of Launch	Length Ft.	Breadth Ft.	Draught Ft.	Displacement Tons	Speed Knots	Horse-Power	Armament	Side Armour In.
UNITED STATES:									
"Omaha" . . . 10	1920 and bldg.	555½	55	14¼	7,500	33¾	90,000	12—6 in. 4—21 in. T. T.	
JAPAN:									
"Yahagi" . . . 3	1911	475	46½	16½	4,950	26	22,500	8—6 in. 3—18 in. T .T.	3
"Tatsuta" . . . 2	1918	440	41	13	3,500	31	51,000	4—5·5 in. 6—21 in. T. T.	3
"Tama" . . . 20	1919	500	46¾	15¾	5,500	33	90,000	7—5·5 in. 8·21 in. T. T.	3
ITALY:									
"Basilicata" . . . 2	1914	272	42	16½	2,450	16½	5,000	6—6 in. 2— T. T.	
GERMANY:									
"Stralsund"	1912	446	43½	16	4,480	27	24,000	7—5·9 in. 2—17·7 in. T. T.	
"Regensburg" . . . (now French "Strasbourg")	1914	456	45	17	4,850	27½	26,000	7—5·9 in. 2—19·7 in. T. T.	
"Königsberg" . . . (now French "Metz")	1915	450	43½	16	4,200	28½	45,000	7—5·9 in. 4—19·7 in. T. T.	
"Frankfurt"	1915	465	45½	17	5,120	28	45,000	8—5·9 in. 2—19·7 in. T. T.	
"Brummer"	1915	430	41	15½	4,000	30	46,000	4—5·9 in. 300 mines	
"Cöln"	1918	489	47	16½	5,600	27½	29,000	4—19·7 T. T. 8—5·9 in. 4—23·6 in. T. T.	
RUSSIA:									
Admiral class	1915	535	51	18	7,600	30	55,000	15—5 in. 2—18 in. T. T.	

did not construct any after the completion of the "Salem" class in 1908 until after the World War, when the construction of 10 light cruisers of the "Omaha" class (fig. 42) was commenced. These vessels were designed in 1916 and their construction authorized by the Act of Congress of 1917. The chief characteristics of these vessels, which are classed as "Scouts" by the U.S. navy, are an over-all length of 555½ ft., a displacement of 7,100 tons, S.H.P. of turbine engines 90,000, giving an estimated speed of 35 knots. The armament at first consisted of eight 6-in. guns arranged in double-

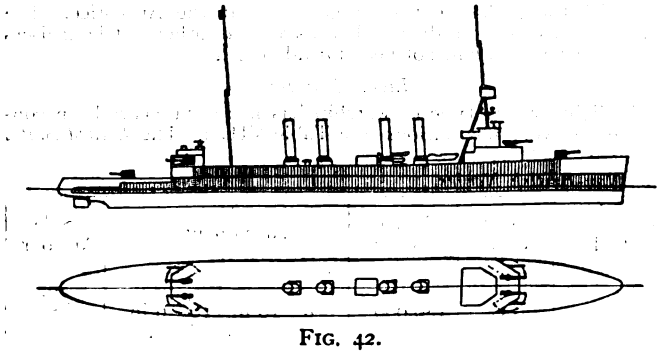

FIG. 42.

storied batteries of four guns each, forward and aft, but recently this armament has been augmented by the addition of a twin 6-in. gun turret on the centre line forward and aft. The torpedo armament is to consist of two 21-in. above-water torpedo tubes. Protection, consisting of 3-in. total, is provided amidships to the machinery compartments. With the exception of some protection to the steering gear, the side protection does not appear to be so extensive as that provided for British light cruisers. Oil fuel only is burnt in the boilers of these vessels, the machinery arrangement of which is of considerable interest. The turbine engines drive four propellers, the engines for the outer shafts being accommodated in an engine-room situated between two groups of boiler-rooms, the engines for the inner shafts being in another engine-room abaft the second group of boilers. The turbines are geared, the reduction gears being of the Westinghouse floating-frame type. Cruising turbines are fitted to obtain economy at cruising speeds.

Japan.—Three light cruisers were completed for Japan in 1912. These vessels, of about 5,000 tons displacement, 26 knots and carrying eight 6-in. guns, are very similar to their British contemporaries of the "Newcastle" class. No other light cruisers were built by Japan until the "Tatsuta" and "Tenryu" were laid down in 1917 and completed in 1919. These vessels are in general characteristics similar to the British "Arethusa" class, with higher speed and reduced armament. On a displacement of 3,500 tons, a speed of 31 knots is obtained with 51,000 H.P. and four 5·5-in. guns are carried. Following these vessels were eight light cruisers of the "Tama" class, some of which have been launched. Twelve additional light cruisers of the 1920 programme will follow. It is understood that these 20 vessels are generally of the same class and are a considerable improvement upon the "Tatsuta." On a displacement of 5,500 tons, seven 5·5-in. guns will be carried and engines of 90,000 H.P. will be fitted to give a designed speed of 36 knots.

Germany.—The German naval programme provided for a small number of light cruisers to be built each year. The four vessels of the "Cöln" class, completed in 1910 and 1911, were of 4,280 tons, 25½ knots and carried 12 4·1-in. guns. They were an advance in size and speed on their predecessors. In 1912 and 1913 six vessels of slightly greater displacement and speed than the "Cöln," but with the same armament, were completed. The next 14 vessels, completed 1914–5, were of 5,000 tons, 27 knots, 30,000 H.P., and had an improved armament of 2 5·9-in. and 10 4·1-in. guns. During the World War a number of light cruisers were built, the chief characteristics of which were their improved armaments, 6, 7, and 8 5·9-in. guns

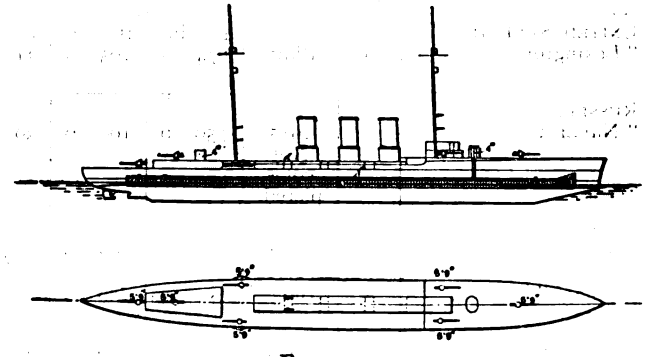

FIG. 43.

being carried. Some of the earlier cruisers were rearmed with 5·9-in. guns in lieu of 4·1-in. guns originally fitted. The "Brummer" and "Bremse," two of the surrendered vessels, were interesting ships. They were mine-laying cruisers of 4,000 tons, and, with turbine engines of 46,000 H.P., were generally credited with a speed of 34 knots, but this was at least 4 knots higher than the actual speed. They were arranged to carry about 300 mines. One of the chief differences between British and German light cruisers lay in the

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protection. British vessels, after the "Weymouth" class, were protected by side plating of 3-in. total thickness, the German vessels having less or no side protection, but with decks of 1-in. or 2-in. thickness. A number of light cruisers were under construction at the Armistice. The "Cöln" is typical of them. On a waterline length of 489 ft. and displacement of 5,600 tons, she was to have carried 8 5·9-in. guns (five of which could be fired on the broadside), 3 3½-in. H.A. guns and 4 revolving 23·6-in. torpedo tubes. Turbine engines of 29,000 S.H.P. were to have been provided for a speed of 27½ knots. The protection consisted of about 2¼-in. side and ¾-in. deck.

Four of the German light cruisers were incorporated, with new names, in the French navy, and three in the Italian navy.

Austria.—In 1910 the light cruiser "Admiral Spaun" was completed and in 1914 three similar but slightly improved vessels. These were of 3,500 tons, 27 knots, and mounted 9 3·9-in. guns. Two of these vessels were taken into the Italian navy, and one into the French navy, all with new names.

Italy.—Six small light cruisers were completed between 1912 and 1916. The most interesting were the "Quarto" class (three vessels), of 3,400 tons and 28 knots, carrying 6 4·7-in. and 6 3-in. guns (see fig. 43).

Russia.—At the outbreak of the World War two small light cruisers, which were taken over by Germany, were under construction in German yards. One is now in the French navy, and the other was lost at Jutland. Eight light cruisers of a larger and more powerful type were under construction in Russia, but were not completed. They were designed to be 520 ft. long, of 7,600 tons displacement, armed with 15 5-in. guns, and, with turbines of 55,000 H.P. a speed of 30 knots was expected.

Holland.—Two light cruisers of 7,000 tons and 30 knots, with 10 5·9-in. guns, were under construction for a long time, but had not yet been completed in 1921.

Spain.—A light cruiser of 5,600 tons, generally similar to the British "Birmingham," was being completed in 1921, and others of this class were projected.

France.—Six light cruisers of 5,000 tons, 30 knots speed and 8 5·5-in. guns, were projected in the 1920 programme.

Torpedo-Boats and Submarines

Specifications of the torpedo-boats and flotilla leaders and submarines of foreign navies are given in Tables IX. and X., and the reader is referred to the *Transactions of the Institute of Naval Architects*, 1920, for further information.

(3) Merchant Ships

The ordinary course of mercantile shipbuilding development, which continued from 1910 until the autumn of 1914, was abruptly checked by the World War. As the result, merchant shipbuilding was practically stopped in France, Germany, Italy and Austria, and it was very much reduced in the United Kingdom owing to men joining the colours. At the same time a great fillip was given to shipbuilding in the United States and neutral countries. In England many of the best ships building were requisitioned and fitted out for war services, or for auxiliary services with the fleet. Large numbers of vessels were also withdrawn from the mercantile fleet for similar purposes, and this, together with the great losses due to submarines, very quickly created great demands for new ships. Shipbuilding resources were developed with great rapidity all over the world, leading up to: (1) a vastly increased output; (2) new types of vessels which could be constructed quickly; (3) development of new methods of construction. At the same time a vast increase took place in the plant of all kinds for the manufacture of armament, etc. The services rendered by the mercantile marine during the war were invaluable (*see* Shipping), while, broadly speaking, the ships themselves stood the brunt of war with very remarkable success. In some cases, however, large passenger ships were quickly sunk because of the existence of passages, or doors in bulkheads, which permitted the sea to find access to compartments other than those directly damaged, thus leading to the foundering of the vessels. This caused renewed attention to be given in all maritime countries to matters of life-saving and subdivision.

Many very notable vessels were lost. Some of the best known are shown in Table XI. Among these losses, the "Britannic" and "Justicia" (formerly "Statendam") were the largest vessels building in the United Kingdom in 1914.

After the war the German ships which had been seized or interned were distributed among the Allies. Germany also had to surrender all ships above 1,600 tons afloat or on the stocks, many smaller ones, floating docks, cranes, and other craft, amounting to about 3,000,000 tons. These were divided chiefly between Britain and the United States, with smaller shares to France and Japan. She also had to undertake to build 1,000,000 tons for the Allies if required, but this was not enforced. Table 12 gives the names of some of the most noteworthy vessels thus distributed.

Table IX.—*Torpedo-Boats and Flotilla Leaders.*

Navy	Date of Launch	Length Ft.	Displacement Tons	Horse-Power	Speed Knots	Armament
Chile	1912	320	1,800	30,000	31	2—4·7 in. 2—4 in. 4—21 in. T. T.
France	1914	269	880	17,000	30	2—3·9 in. 4—18 in. T. T.
	1917	272	675	10,000	29	1—4·7 in. 4—3 in. 4—18 in. T. T.
Italy	1913	238	770	18,000	33	4—4 in. 4—18 in. T. T.
Japan	1916	336	1,300	28,000	34	3—4·7 in. 6—21 in. T. T.
United States	1917	314	1,200	27,000	35	4—4 in. 12 T. T.
Germany	1914	322	1,350	40,000	37	4—4·1 in. 24 mines 6—19·7 in. T. T.
	1917	280	1,000	24,000	33	3—4·1 in. 6—19·7 in. T. T.
	1917	200	350	6,000	26	2—3·4 in. 1—17·7 in. T. T. 4—5·9 in.
	1918	360	2,400	54,000	35	4—23·6 in. T. T.
Russia	1917	315	1,260	30,000	35	4—4 in. 9—18 in. T. T.
Austria	1912	266	787	17,000	33	2—4 in. 4—3 in. 2 T. T.
Italy	1916	310	1,460	40,000	35	5—4·7 4—21 in. T. T.

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Table XII. includes a number of very fine vessels which Germany was building in 1914 to compete with the "Aquitania," "Olympic," and such types of British ships, in order to gain a still larger proportion of the Atlantic trade. Amongst them were the largest vessels afloat in 1921. In certain cases German companies were afterwards enabled to repurchase from the Allies some of the surrendered ships, which then reverted to German ownership. Austria had to surrender all her shipping, about 1½ million tons. This was handed over to Italy, with the exception of about 70,000 tons for France.

Statistics.—The world's output had reached a maximum of 3,330,000 tons in 1913, and was falling again in 1914. The tonnage launched in the United Kingdom reached the record total of approximately 2,000,000 tons in 1913, and in 1914 it had decreased by over 10 per cent. Great efforts had been made in France, Germany, Holland, Japan and Norway, and the totals in these countries showed distinctly upward tendencies. In the United States very great fluctuations occurred: the output on the coast had fallen to 95,000 tons, and on the Great Lakes to 75,000 tons in 1911, while in 1913 228,000 tons were launched on the coast and only 48,000 tons on the Lakes.

Table XIII. shows the tonnage of ships launched in various countries from 1910–20. The diagram Fig. 44 has been prepared on the basis of these figures. The striking results obtained in the British colonies and Japan will be noted, and the overwhelming influence of U.S. shipbuilding. Many of the American yards which were specially constructed for war purposes were in 1921 being closed,

TABLE X.—*Submarines of Non-British Navies.*

Navy	Date of Launch	Length Ft.	Displacement: Tons		Horse-Power		Speed: Knots		Armament
			Surface	Submerged	Surface	Submerged	Surface	Submerged	
BRAZIL	1913	150	250	370	800		14	8½	2—18 in. T. T.
CHILE	1915	150	350	470	480	640	13	11	4—18 in. T. T.
FRANCE	1916	173	410	560	1,300	900	13½	8	1—3 in. 8—18 in. T. T.
	1917	243	850	1,180	2,900	1,650	17	10½	2—3 in. 8—18 in. T. T.
ITALY	1915	207	700	1,000	2,600	1,300	18	10	2—14 V'dr. 6—18 in. T. T.
JAPAN	1917	215	700	1,070	2,600	1,300	18	10	1—3 in. 6—18 in. T. T.
UNITED STATES	1918	186	570	680	880	900	13½	10½	1—3 in. 4—21 in. T. T.
	1918	264	1,100	1,500	4,000	1,500	20	11½	2—3 in. 8—21 in. T. T.
GERMANY Class:—	1914–8								
U86	"	230	800	940	2,400	1,180	16½	8	1—4·1 in. 1—3·5 in. or 2—4·1 in. 4 T. T.
U142	"	320	2,160	2,760	6,000	2,600	18	8	2—5·9 in. 6 T. T.
UB1	"	92	128	143	60	120	6½	5½	1 machine gun. 2 T. T.
UB48	"	181	521	657	1,100	760	13½	7½	1—4·1 in. 5 T. T.
UC1	"	111	170	185	90	138	6½	5	1 machine gun. 12 mines.
UC90	"	184	496	575	650	600	12	6½	1—4·1 in. 14 mines. 3 T. T.
UE71	"	186	762	846	900	800	10½	8	1—3·5 in. 36 mines. 2 T. T.
UE117	"	267	1,170	1,515	2,400	1,150	15	7½	1—5·9 in. or 2—4·1 in. 42 mines. 4 T. T.
Deutschland (U152)	"	214	1,525	1,885	800	800	10	5½	2—5·9 in. 2 T. T.

TABLE XI.—*Merchant-ships lost in the War.*

Name	Tonnage (Gross)	Country	Name	Tonnage (Gross)	Country
"Alcantara"	15,831	U.K.	"Koningen Emma"	9,181	Dutch
"Andania"	13,405	"	"Laconia"	18,099	U.K.
"Arabic"	15,801	"	"La Provence"	13,753	French
"Aurania"	13,936	"	"Laurentic"	14,892	U.K.
"Avenger" (ex. "Aotearoa")	13,441	"	"Llandovery Castle"	11,493	"
"Ballarat"	11,120	"	"Lusitania"	30,096	"
"Britannic"	48,158	"	"Medina"	12,350	"
"Bonheur"	7,132	Norway	"Minnehaha"	13,714	"
"Calgarian"	17,515	U.K.	"O. B. Jennings"	10,290	U.S.A.
"Cameronia"	10,963	"	"Oceanic"	17,274	U.K.
"Campania"	12,884	"	"Otaki"	9,575	"
"Cap Trafalgar"	18,710	German	"President Lincoln"	18,168	U.S.A.
"City of Adelaide"	8,389	U.K.	"Principe Umberto"	7,929	Italian
"City of Paris"	9,239	"	"Rotorua"	11,140	U.K.
"Covington"	16,339	U.S.A.	"Royal Edward"	11,117	"
"Franconia"	18,150	U.K.	"San Hilario"	10,157	"
"Gallia"	14,966	French	"Transylvania"	14,315	"
"Glenart Castle"	6,824	U.K.	"Troilus"	7,562	"
"Hirano Maru"	7,936	Japan	"Tubantia"	13,911	Dutch
"Ivernia"	14,278	U.K.	"Tuscania"	14,348	U.K.
"Justicia"	32,234	"	"Volturno"	11,496	Italian
"Kaiser Wilhelm der Grosse"	13,952	German	"Yasaka Maru"	10,932	Japan

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while others were falling back rapidly to pre-war conditions (*see* SHIPPING: *United States*).

In the United Kingdom, from the middle of 1915, a committee of the Board of Trade, in conjunction with the Transport Department of the Admiralty, assumed control of the British mercantile marine, including shipbuilding. A Merchant Shipbuilding Advisory Committee was formed, with Sir George Carter as chairman. In Dec. 1916 the Ministry of Shipping was set up, under Sir Joseph Maclay. The Shipbuilding Advisory Committee was enlarged, and on its advice steps were taken to standardize the types of merchant ships to be built, and to simplify the details of construction both of hull and machinery to secure the greatest and quickest output possible. Five types of "standard ships" were designed, varying from 3,000 to 8,000 tons deadweight, and between Dec. 1916 and April 1917 considerable numbers of these vessels were ordered. In order to harmonize the work of shipbuilding for the Admiralty and the mercantile marine, the whole was placed under one authority, Sir Eric Geddes, in June 1917, when he assumed office as controller of the Navy. Arrangements were made for setting up new shipyards with a view to producing "fabricated" ships, which could be put together with very much reduced amounts of skilled labour; but the results were disappointing, and at the end of 1918 the output in the United Kingdom was still only at the rate of 1,500,000 tons per annum. In March 1918 Lord Pirrie was appointed controller-general of

TABLE XII.—*Ownership of Some Notable ex-German Ships.*

Old Name	Gross Tons	New Name	New Owners
"Amerika"	22,622	"America"	U.S. Government.
"Barbarossa"	10,984	"Mercury"	U.S. Government.
"Batavia"	11,464	"Batavia"	French Government.
"Berlin"	17,324	"Arabic"	White Star Line.
"Bismarck"	56,000	"Majestic"	White Star Line.
"Blücher"	12,350	"Leopoldina"	Brazilian Government.
"Bremen"	11,540	"Bremen"	Shipping Controller (P. & O. S. Nav. Co.)
"Bulgaria"	11,440	"Philippines"	U.S. Shipping Board.
"Cap Arcona"	9,832	"Cap Arcona"	U.S. Shipping Board.
"Cap Finisterre"	14,503	"Cap Finisterre"	Japanese Government.
"Cap Ortegal"	7,818	"Cap Ortegal"	French Government.
"Cap Polonio"	20,597	"Cap Polonio"	P. & O. Steam Nav. Co.
"Cleveland"	15,746	"King Alexander" (ex "Mobile")	Byron S. S. Co. Ltd.
"Columbus"	35,000	"Homeric"	White Star Line.
"Friedrich der Grosse"	10,688	"Huron"	U.S. Shipping Board.
"Fritz"	3,083	"Assyrian"	Ellerman Line.
"George Washington"	25,570	"George Washington"	U.S. Shipping Board.
"Graf Waldersee"	13,193	"Graf Waldersee"	Shipping Controller (P. & O. S. Nav. Co.)
"Grosser Kurfürst"	12,642	"Aeolus"	U.S. Shipping Board.
"Imperator"	52,022	"Berengaria"	Cunard S. S. Co.
"Johann Heinrich"			
"Burchard"	19,980	"Limburgia"	(Koninklyke Hollandsche Lloyd).
"Kaiserin Auguste"	24,581	"Empress of Scotland"	Canadian Pacific.
"Victoria"			
"Kaiser Wilhelm II."	19,361	"Agamemnon"	U.S. (Navy Dept.).
"Kigoma"	8,156	"Algeria"	Anchor Line.
"Cöln"	7,409	"Amphion"	U.S. Shipping Board.
"König Albert"	10,643	"Ferdinando" "Palasciano"	Italian Government.
"Königin Luise"	11,103	"Omar"	Orient S. N. Co.
"König Wilhelm II."	9,410	"Madawaska"	U.S. Government.
"Kronprinzessin Cecilie"	18,372	"Mount Vernon"	U.S. Shipping Board.
"Kronprinz Wilhelm"	14,901	"Von Steuben"	U.S. Government.
"Main"	10,186	"Main"	French Government.
"Moltke"	12,335	"Pesaro"	Italian Government.
"Neckar"	9,709	"Potomac" (ex "Antigone")	U.S. Shipping Board.
"Patricia"	14,466	"Patricia"	Shipping Controller (Ellerman Line).
"Pennsylvania"	13,333	"Nansemond"	U.S. Shipping Board.
"President Grant"	18,072	"President Grant"	U.S. (War Dept.).
"Pretoria"	13,234	"Pretoria"	Shipping Controller (Ellerman Line).
"Princess Alice"	10,421	"Princess Matoika"	U.S. (War Dept.).
"Prinz Eitel Friedrich"	8,170	"Mount Clay" (ex "De Kalb")	American S. & C. Nav. Corp.
"Prinz Friedrich Wilhelm"	17,099	"Empress of China"	Canadian Pacific Ocean Services, Ltd.
"Prinzess Irene"	10,352	"Pocahontas"	U.S. Shipping Board.
"Rhein"	9,959	"Susquehanna"	U.S. Shipping Board.
"Tirpitz"	19,300	"Empress of India"	C.P.O. Services Ltd.
"Vaterland"	54,282	"Leviathan"	U.S. Government.
"Wm. Oswald"	20,200	"Brabantia"	Kon. Holl. Lloyd.
"Wittekind"	5,640	"Freedom" (ex "Iroquois")	U.S. Shipping Board.
"Ypiranga"	8,103	"Assyria"	Anchor Line.
"Zeppelin"	14,167	"Ormuz"	Orient S. Nav. Co.

TABLE XIII.—*Tonnage Launched in 1910–20* (in thousands of tons).

Year	U.K.	Brit. Dom.	U.S.	Japan	France	Germany	Holland	Other Countries	Total
1910	1,143	26	331	30	81	159	71	116	1,957
1911	1,804	20	172	44	125	256	93	137	2,651
1912	1,737	35	284	58	111	375	99	201	2,900
1913	1,932	48	276	65	176	465	104	266	3,332
1914	1,684	47	201	86	114	387	118	216	*2,853
1915	651	22	177	49	25	(No returns)	113	163	*1,200
1916	608	32	504	146	43	do.	180	175	*1,688
1917	1,163	94	998	350	19	do.	149	165	*2,938
1918	1,348	280	3,033	490	14	do.	74	209	*5,448
1919	1,620	359	4,075	612	33	do.	137	308	*7,144
1920	2,056	204	2,476	457	93	do.	183	393	*5,862

*Returns not complete.

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merchant shipbuilding and given extraordinary powers. The new shipyards were pushed on during 1918, but had scarcely come into active production when the Armistice was signed.

TABLE XIV.—*Gross Tonnage of Shipping owned in 1910–21* (in millions of tons).

Country	1910	1914	1919	1920	1921
United Kingdom and Colonies	19·0	21·0	18·6	20·6	22·1
United States	5·1	5·4	13·1	16·0	17·0
Germany	4·3	5·5	3·5	0·7	0·7
France	1·9	2·3	2·2	3·2	3·7
Japan	1·1	1·7	2·3	3·0	3·4
Norway	2·0	2·5	1·9	2·2	2·6
Denmark	0·7	0·8	0·7	0·8	1·0
Sweden	·9	1·1	1·0	1·1	1·2
Italy	1·3	1·7	1·4	2·2	2·6
Holland	1·0	1·5	1·6	1·8	2·2
All other Countries	4·5	5·6	4·6	5·6	5·5
Total, World's Shipping	41·8	49·1	50·9	57·2	62·0

Largely as a result of the efforts of the United States, by the end of 1918 ships were being built at the rate of 7,000,000 tons per annum, against the pre-war record of 3,330,000 tons per annum. In June 1920 the steam tonnage of the world amounted to about 54,000,000 tons, notwithstanding the losses of the war. The total losses had amounted to about 9,000,000 tons of British ships and 6,000,000 tons others, making a total of 15,000,000 tons. Of the total, 2,000,000 tons were due to ordinary marine risks.

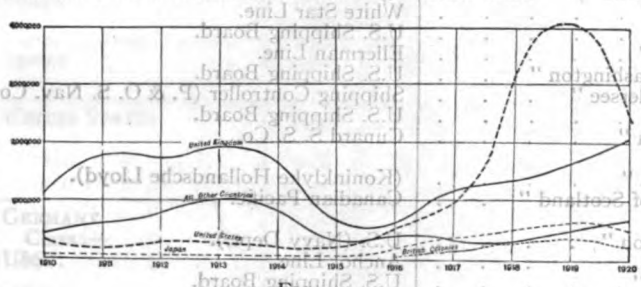

FIG. 44.

Motor-Ships.—The period 1910–21 saw immense changes in the means of propulsion. In 1911 the "Selandia" and "Jutlandia" were launched, and a number of other vessels were being built, in which internal-combustion engines of a more or less experimental character were being fitted. *Lloyd's Register* reports that by 1914 there were 290 motor-ships of 234,000 tons gross, while in 1921 there were no fewer than 1,447 ships of 1,263,000 tons gross, so that in 1921 there were nearly five times as many motor-ships in existence as there were in 1914, and the tonnage of these ships was nearly six times as great. In these seven years motor-vessels increased from ·47 to 2·1 per cent of the world's tonnage.

Dr. Diesel's master patents expired in 1909 and 1910, and since then many successful types of internal-combustion engines have been established in Europe and in America (*see* INTERNAL-COMBUSTION ENGINES), and the proportion of motor to steam vessels building rapidly increased. In June 1921 183 motor-vessels of 502,944 tons were under construction, and out of this number 57 of 241,003 tons were being built in the United Kingdom.

Oil Burners.—Another very great improvement is in the use of oil instead of coal under steam boilers. *Lloyd's Register* reports that in 1914 364 vessels of 1,310,000 tons were fitted to burn oil, but in 1921 these had increased to 2,563 ships of 12,797,000 tons, or from 2·62 to 20·65% of the world's tonnage. In the United States four vessels burn oil to every three vessels burning coal. This use of oil fuel has demanded a large increase in the number of oil-tank steamers. In 1914 there were 385 tankers of 1,479,000 tons, while in 1921 there were 861 tankers of 4,419,000 tons, an increase from 2·94 to 7·16 per cent of the world's tonnage.

Electric Drive.—It has been the almost universal practice for submarines to be propelled by electric motors when submerged. In a few cases of small surface vessels electric drive had also been used prior to 1910. The earliest recorded appears to be Nobel's tank vessel "Sarmat," fitted with the system in 1904. About 1910 a small vessel named the "Electric Arc" was built on the Clyde to test the method of electric transmission devised by Mavor, using Squirrel cage motors. The experiment was not altogether a success, but it gave a good deal of experience. Mavor proceeded to America and discussed his ideas with Emmet, and no doubt assisted Emmet in the great undertaking carried out for the American navy in the collier "Jupiter" (now aircraft-carrier "Langley"). The American navy built three colliers at this time of identical dimensions, about 20,000 tons displacement, 7,500 H.P., 15 knots full speed, and cargo 12,000 tons. The "Cyclops" has two reciprocating engines, the "Neptune" has Parsons turbines and a Westinghouse floating frame mechanical gearing, while the "Jupiter" was fitted with a Curtis turbo-electric generator, running at 2,000 revolutions, giving alternating current at 2,200 volts, and motors driving two propeller shafts at 110 revolutions. The reported engine room weight of the "Jupiter" is 223 tons, compared with 343 tons in "Cyclops" and 189 tons in "Neptune."

Mavor's next step was to fit up an installation of 1,500 S.H.P. in the "Tynemount," built by Messrs. Swan, Hunter & Co. in 1913. This vessel was 250 ft. long, 1,644 tons gross, and of about 8 knots speed. This system, however, did not admit of development on a large scale.

The next important progress was made in Sweden, where two sister vessels were built, 225 ft. x 36 ft. x 15½ ft., 2,250 displacement, 975 tons gross. Each was provided with 900 H.P. for 11½ knots. In the "Mimer" triple expansion reciprocating engines were fitted. In the "Mjolmer" Ljungström turbo-generators running at 800 r.p.m. were fitted, with two motors of 450 H.P. each, and geared to a single propeller shaft running at 85 r.p.m. It was reported that fuel consumption was reduced by over 40%, to ·89 lb. per I.H.P. per hour, and that a saving of 74 tons in weight was effected. A large number of other vessels have since been fitted on the "Ljungström" system. These include the "Turbinia," of 2,259 tons and 1,020 H.P., built in 1916 in Sweden, and the "Wulsty Castle," of 3,566 tons and 1,500 S.H.P., built in 1918 by Blumer of Sunderland. It was reported that in 1921 there were 40 vessels building in different countries on this system with the aggregate of 70,000 horse power.

The success of the "Jupiter" was so great that electric transmission was adopted by the U.S. navy for a great many of their later ships, even of the highest power. The next great experiment in electrical propulsion was put in hand by the U.S. Shipping Board, who decided to remove the mechanical gearing in 12 vessels and fit an electric drive instead. The first vessel taken was named "Eclipse," the next three vessels "Archer," "Independence" and "Victorious." The "Eclipse" is 440 x 56 x 35·2., of 7,589 tons gross and 11,900 dead-weight. The boilers are fitted with Dahl oil burners, steam 215 lb. and 200° super heated. One turbine of the Curtis Impulse type is fitted to run at 2,000 r.p.m. A three-phased generator supplies current at 2,300 volts. An induction motor is fitted directly on the propeller shaft working at 2,300 volts and running at 100 r.p.m. for 3,000 H.P. The speed may range from 20 to 110% of the normal. The result of the trials was very gratifying. The reports as to the first voyage were not quite so good. The other three vessels named had not yet gone on service in 1921.

Another very interesting case is that of the "Cuba," a vessel 310 x 40 x 26·9 of 2,963 tons gross. This vessel has also been fitted with a turbine electric drive by the General Electric Co., Schenectady, but in this case a synchronous motor is fitted. Steam of 190 lb. with 200° super heat is supplied to an 8-stage Curtis turbine, as in "Eclipse." This runs at 3,000 r.p.m. and 1,150 volts. The motor gives 3,000 H.P. at 100 r.p.m. and 1,150 volts, and is fitted directly on the shaft. The trials of this vessel were well reported on. Both vessels are of 11 knots speed.

The question of the efficiency and economy of the electric drive was being very much discussed in 1921. On the one hand it was said that the transmission loss of the electrical system was 8% instead of 3% with the mechanical current, but the other ships with electrical current reported very good economy of fuel.

Wood Vessels.—In 1914 wood vessels amounted to 1% of the total steam tonnage, but owing to the special building during the war it had risen to nearly 4% in 1921. Of this large increase the United States owns one million tons.

The Emergency Fleet programme provided for ordering 1,067 wooden and composite ships, of 3,227,200 tons; but only 607 of 1,948,250 tons, were actually produced. In June 1921 288 cargo carriers remained in the possession of the U.S. Shipping Board, 15 being on active service and 273 tied up. The board also had 14 tugs, of which 9 were on active service. Up to this date 211 had been sold, 12 of which had been built for service as cargo carriers and 61 as tugs. One had been fitted for carrying oil in bulk. Seventy-four were incomplete when sold. In Aug. 1921 the remaining wooden vessels were reported to be sold to the Ship Construction and Trading Company.

Concrete Ships.—Prior to the war a number of small vessels for harbour or river service had been built of ferro-concrete in Italy, Norway and France. During the war a few experimental vessels of small size were built in various places, and the system was adopted to an increasing extent, practically all over the world. As larger vessels were built, the methods received careful consideration, and by proper development vessels up to 7,500 tons dead-weight were successfully produced. The complication of rods and ties in the larger vessels became very great, and sectional or panel systems were introduced, as contrasted with the usual monolith system. The reports as to results varied. The weight of hull was reported to be from 50 to 100% more than for steel, or about equal to wood; while the saving of steel for carrying a given dead-weight amounted to 55 to 66% of the steel ship. This was an enormous advantage during the steel shortage, and a further advantage was the power to build by a new class of labour, giving a greater aggregate of labour for shipbuilding. The most notable vessel was perhaps the S.S. "Faith," built by the San Francisco Shipping Co. in 1918.

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This vessel, 320 ft. long, 3,427 tons gross, and fitted to burn oil fuel, was a great success. On arrival in England with a cargo the holds were found to be absolutely dry. Table XV. gives the total tonnage recorded of vessels of this type.

TABLE XV.—*Ferro-Concrete Vessels Included in "Lloyd's Register," 1921–2.*

Country	Steam and Motor Vessels		Sailing Vessels		Total	
	No.	Tons	No.	Tons	No.	Tons
United Kingdom	13	4,222	46	31,625	59	35,847
Canada (coast)	1	320	..	..	1	320
United States (sea)	15	73,894	..	..	15	73,894
Denmark	3	2,413	..	..	3	2,413
France	3	2,383	1	816	4	3,199
Italy	..	..	3	602	3	602
Norway	14	6,093	..	..	14	6,093
Spain	1	273	..	..	1	273
Total	50	89,598	50	33,043	100	122,641

Large Liners.—Particulars of notable Atlantic liners of recent construction are given in Table XVI. When the "Lusitania" was sunk during the war, the "Mauretania" (30,704 tons) was the only pre-war 25-knot Atlantic liner left. She was followed, however by the "Aquitania" (45,647 tons), of 24 knots, launched by John Brown & Co., for the Cunard Co., in 1914, and the "France," of 23,666 tons gross, launched at St. Nazaire for the Cie. Générale Transatlantique in 1912. The "France" had turbines of 45,000 H.P. on four shafts for her 24 knots, and carried 1,926 passengers besides her crew of six hundred. The "Aquitania" was completed during the war as a hospital ship, but saw very little service as such. After the war she was overhauled and fitted to burn oil fuel, so as to carry 3,250 passengers.

In 1917 another great French liner was launched, the "Paris," of 33,700 tons; it was not completed until June 1921. She could carry 98 passengers in *cabins de luxe*, 468 first-, 464 second-, 1,100 third-class (in cabins), also 1,100 steerage in open berths—the total, including crew, amounting to 3,900 persons. She was fitted with four screws driven by Parsons' turbines, manufactured at Havre. During completion she was modified to burn oil fuel on the Wallsend-Howden system. On her first trip, with 12 boilers out of 15 in service, she averaged 21 knots.

Of the great White Star liners, the "Adriatic," of 24,541 tons gross, capable of carrying a total dead-weight of cargo and fuel of 19,710 tons, at a speed of 18½ knots, may be taken as typical. A later ship, the "Belgic," of 24,547 tons gross, which was put prematurely into service during the war (1917), could carry 22,025 tons at the same speed. The "Adriatic," "Baltic," "Cedric" and "Celtic," averaging 22,600 tons gross, with a total dead-weight capacity of over 55,000 tons, became well known to Atlantic passengers as the "Big Four."

The White Star policy of combining comfort for passengers with a large cargo-carrying capacity found its highest expression, however, in the "Olympic," of 46,359 tons, launched by Harland & Wolff in 1911. She could carry a total of 12,770 tons dead-weight on a draught of 34 ft. 7 in., with a displacement of 52,300 tons, and could take 2,400 passengers, besides her crew of 900, across the Atlantic at 21 knots. Having been altered to burn oil fuel, she could take sufficient at New York (7,500 tons) to provide for the double journey. Her maximum speed is 22½ knots at 55,000 horse power. The "Olympic" was in 1921 the biggest British-built vessel, but her dimensions had been exceeded by the "Britannic," of 48,158 tons, which was launched by Harland & Wolff in 1914, and was sunk in Greek waters while serving as a hospital ship in 1916.

Still larger, however, were the three great liners built in Germany during 1912–4. The largest of these (and in 1921 the largest in the world), the "Majestic," (fig. 45) launched by Blohm & Voss in 1914, and acquired by the White Star for entering service in 1922, is of 56,000 tons gross. Turbines of about 100,000 H.P. on four shafts, the greatest installation yet fitted in any merchant vessel, give her an ocean speed-capacity of 23 knots. She is 956 ft. in length, 100 ft. in width, and 102 ft. in height from keel to boat deck. Parsons' turbines, arranged for triple expansion, are fitted on four shafts, and steam is supplied by Yarrow water-tube boilers at 260-lb. pressure. The machinery weighs 8,500 tons, and 5,700 tons of fuel are consumed on one trip. The funnels come up at the side of the ship, joining together above, and thus leave the central part clear for dining-halls, etc. The ventilation involves 18 m. of piping, while there are 15,000 electric lamps, and 225 electric motors for various purposes, requiring a total of 1,565 horse-power. She can carry 4,000 passengers, while the food for one voyage includes 12 tons of fresh meat, 12 tons of vegetables, 14 tons of milk and about 5 tons of eggs.

Amongst the latest additions to the White Star line up to 1921 was the "Homeric," of 35,000 tons, carrying 2,700 passengers at 21 knots; she was launched at Danzig in 1913 as S.S. "Columbus." The "Homeric" is notable as being the last large ship propelled by reciprocating engines only, of which she has two sets, triple expansion, cyls. 50½ in., 86½ in. (2), 96 in. and 70 in. stroke; but these were exceeded in size by those of "Britannic," (fig. 46) which were 54 in., 84 in. (2), 97 in. and 75 in. stroke, to give 32,000 I.H.P. on two wing shafts, and in addition "Brittannic" had l.p. turbines to give 18,000 S.H.P. on two central shafts. The engines of "Britannic" were probably the most powerful single sets made for an ocean liner, while the "Kronprinzessin Cecilie" (now "Mount Vernon") had the greatest total I.H.P., as she had two sets of 4-cyl. engines on each shaft; they were 37½ in., 49 in., 75 in., and 112 in. (quadruple expn.) and 71 in. stroke. Other new vessels being added by the White Star line are:—"Regina" (16,314 tons), and "Rimouski" (9,281 tons) for Canadian service; "Laurentic" (18,000 tons), "Doric" (16,600 tons) and "Pittsburgh" (16,600) for U.S. services.

The Cunard Co. acquired the "Berengaria" (formerly "Imperator") of 52,022 tons, launched by Vulcan Works, Hamburg, in 1912. This vessel has Parsons' turbines of 60,000 H.P. on four shafts and can attain a speed of over 22 knots with 185 revolutions. She carries 4,000 passengers and a crew of 1,200.

The Cunard Co. decided immediately after the war to build a large number of intermediate vessels somewhat of the "Olympic" type, but smaller and of less speed. The first four were 600 ft. ships of about 21,000 tons gross and 27,000 tons displacement, at 30-ft. draught, and were named "Scythia," "Samaria," "Franconia," "Laconia." The "Samaria," (fig. 47) which may be taken as typical, was built by Cammell Laird & Co. in 1921. Her engines (turbines) are fitted with double helical speed reduction gear, to drive the propellers at an economical speed. The boilers are of the cylindrical type, fitted to burn oil fuel with forced draught on the Wallsend-Howden combined system. They will give steam at 220 lb. with 200° F., superheated by means of Schmidt's smoke-tube type of superheater. Her twin screws are operated by Brown-Curtis turbines, which run at 2,750 revolutions. Triple expansion is arranged for as follows: On each side of the ship a H.P. and I.H.P. turbine are fitted in tandem on the shaft of the first driving pinion, and the l.p. turbine is fitted on the shaft of the second driving pinion of the first reduction gear, both then operate through the second reduction gear and give the propeller shafts a speed of 90 revs. per minute. The total S.H.P. of 13,500 gives a sea speed of 16 knots. The astern turbines are compound, and are incorporated in the exhaust casings of the intermediate and low-pressure ahead turbines, and give a total power equal to about 70% of the ahead power. This may be taken as typical of the best turbine arrangements of 1921. The "Samaria" can carry about 350 first-, 350 second- and 1,600 third-class passengers. Her deck machinery is driven by electric power through hydraulic variable-speed gear at each of the machines. Two large sets of turbo-driven generators are provided for this purpose, and an oil-driven emergency dynamo is also fitted. A gyro-compass installation is fitted, the master compass being on one of the lower decks, with three separate controlled compasses at suitable positions for navigation. Her subdivision is on the most approved principle, with increased numbers of water-tight bulkheads, the water-tight bulkhead doors being operated on the Stone-Lloyd hydraulic system. She is further subdivided by fireproof bulkheads, and the "Grönwald" system of fire extinguishing is installed. Electric passenger hoists are provided.

Among great pre-war German liners which came into the service of U.S. shipping companies were the "America," of 17½ knots and 22,622 tons, launched by Harland & Wolff, Belfast, in 1905, and the "George Washington," (fig. 48) of 18 knots and 25,570 tons, launched by the Vulcan Works, Stettin, in 1908. In addition, the "Leviathan," of 54,282 tons, and 21 knots, launched by Blohm & Voss, Hamburg, in 1914, was still in 1921 awaiting renovation and allocation to service. During the war these great vessels were utilized to transport immense numbers of American troops across the Atlantic. For this service they were specially prepared and ballasted, and, on sailing, the "Leviathan" had what may perhaps be a record draught for a vessel leaving port, viz. 40 ft. 11 in. "Leviathan" carried as many as 11,000 troops on a single trip.

Among American liners the place of the old "St. Paul" has been taken by ships of the "State" class, which were started as 522-ft. troopships (fig. 49). The first on the Atlantic service were the "Panhandle State," and the "Old North State," vessels of 10,500 tons, completed in 1920. There were five other vessels also of the same type, 522 ft. overall, with 502 ft. between perpendiculars. Supplemented by the great ex-German ships named above, they enabled the Shipping Board to send their faster (535 ft.) State type of vessel to the Pacific.

Germany in 1921 retained the old "Deutschland," which had now only machinery for 15½ knots, and was named "Hansa." Just prior to the war Germany was building a series of splendid vessels, most luxuriously fitted out, and supplied with every modern device for the attraction and comfort of passengers in order to capture the S. American trade. They were fitted with a combination of reciprocating engines and turbines. The best-known vessel, "Cap Trafalgar," 18,710 tons, 17½ knots (1913), was, as an armed merchant cruiser, met and sunk after a stiff fight by the Cunarder "Carmania," also fitted out as an armed merchant cruiser. Other vessels of the type were the "Cap Finisterre," 14,503 tons, 17 knots, (1911) (now the "Taiyo Maru"), and the "Cap Polonio," 19,500

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tons, 18 knots (1914). The last had specially luxurious apartments to fit her for the use of the ex-Kaiser, but after the war British owners could not run her at a profit, and she was sold back to Germany, and was, in 1921, far the best and fastest German steamer.

France replied with the "Lutetia," 14,654 tons (1913), and the "Massilia," 15,147 tons (1914), both having a combination of reciprocating engines and turbines for 20 knots.

The "Esperia," of 11,393 tons, the finest passenger vessel built as such in Italy, was launched at Genoa in 1921. She is fitted with Parsons' turbines, of 19,600 H.P., on two shafts, with mechanical reduction gearing, for 21 knots, and carrying 480 passengers in addition to a crew of three hundred. Italy also ordered two fine vessels in Great Britain. One, the "Conte Rosso," built by Beardmore, Dalmuir, was requisitioned by the Admiralty, razeed to give an uninterrupted flat deck, with no funnels, and fitted out as the aircraft-carrier "Argus." She was finished just before the Armistice. To take her place another vessel of the same name was launched in 1921 by Beardmore, 15,500 tons, 18½ knots speed, dimensions 570 ft. x 74·2 ft. x 36·1 feet. The second vessel, "Giulio Cesare," laid down by Swan, Hunter & Co. at Wallsend, stood half plated during the war, and was finally completed in 1920, 21,500 tons, 18½ knots sea speed. In her the fitting-out of the German "Cap" vessels was rivalled by a combination of British and Italian art, and this vessel was in 1921 the largest and finest Italian liner, and the finest vessel trading to S. American ports. She has four sets of turbines of 21,900 H.P. with single reduction gearing driving four propellers, giving a speed of 19½ knots speed on trial, and carries 243 passengers in *de luxe* state-rooms, 306 second-class, 800 steerage and a crew of 520, giving a total of 1,869.

Spain had two fine vessels built just before the war, the "Infanta Isabel de Borbon," of 10,348 tons, 17½ knots, launched by Denny at Dumbarton (1913), and the "Reina Victoria Eugene," 10,137 tons, launched by Swan, Hunter & Co. (1913), 17½ knots, and of about the same general dimensions. Both are fine well-fitted vessels, and both have a combination of reciprocating engines and turbines of 10,000 H.P. for propulsion at 17½ knots speed. Spain also built herself vessels of a steadily improving class. The "Alfonso XIII." (of 10,137 tons gross), built in 1921 at Bilbao, was the finest vessel yet constructed in Spain. Her dimensions are 480 ft. x 61 ft. x 41 feet. She is fitted with two sets of geared steam turbines of 10,300 S.H.P., giving 14 r.p.m. at the propellers, and a speed of about 17½ knots.

Particulars of notable recent Pacific liners are given in Table 17. The wonderful development of what might be spoken of as secondary liners is illustrated by the new vessels built for the Canadian Pacific railway (now Canadian Pacific Ocean services). The "Empress of Canada," of 22,000 tons and 22 knots, built in 1920 by Fairfield will be the finest vessel on the Pacific Ocean.

TABLE XVI.—*Particulars of Notable Atlantic Liners.*

Name	Tons gross	Speed Knots	Owners	Date of build.	Dimensions Builders L B D	Dead-weight Tons	Horse-power	No. of screws	Types of Machinery and Makers	Steam pressure lbs.
"Mauretania"	30,704	26.6	Cunard Co.	1907	762.2 x 88 x 57.1 Swan Hunter, Newcastle.	12,280	70,000	4	Parsons' turbines Wallsend Slipway Co.	195
"Aquitania"	45,647	24	Cunard Co.	1914	868.7 x 97 x 49.7 J. Brown, Clydebank, Glasgow.	12,913	60,000	4	Steam turbines J. Brown, Clydebank.	195
"Berengaria" (ex "Imperator")	52,022	22½	Cunard Co.	1912	882.9 x 98.3 x 57.1 Vulcan Werke, Hamburg.	12,000	60,000	4	Steam turbines Vulcan Werke, Hamburg.	...
"Scythia"	19,503	16	Cunard Co.	1921	600.7 x 73.8 x 40.7 Vickers, Barrow	12,400	....	2	Steam turbines Vickers, Barrow.	....
"Samaria"	20,037	16	Cunard Co.	1921	601.5 x 73.7 x 40.7 Cammell Laird, Birkenhead.	12,400	13,500	2	Brown Curtis turbines with double reduction gear. Cammell Laird.	220
"Britannic" (lost in World War).	48,158	....	White Star Co.	1914	852.5 x 94 x 59.5 Harland & Wolff, Belfast.	....	50,000	3	Reciprocating & l.p. turbine Harland & Wolff.	....
"Olympic"	46,439	22	White Star Co.	1911	852.5 x 92.5 x 59.5 Harland & Wolff, Belfast.	12,770	50,000	3	Reciprocating & l.p. turbine Harland & Wolff.	215
"Majestic" (ex "Bismarck").	56,000	23	White Star Co.	1914	912 x 100 x 57.1 Blohm & Voss, Hamburg.	....	100,000	4	Steam turbines Blohm & Voss, Hamburg.	....
"Belgic"	24,547	18½	....	1917	670.4 x 78.4 x 44.7 Harland & Wolff, Belfast.	22,025	....	3	Reciprocating & l.p. turbine Harland & Wolff.	....
"Homeric" (ex "Columbus").	35,000	19	White Star Co.	1913	750 x 83 x 48.9 F. Schichau, Dantzig.	....	....	2	Reciprocating F. Schichau, Elbing.	....
"America" (ex "Amerika").	22,622	16.7	U.S. Government (War Department)	1905	668.8 x 74.3 x 47.8 Harland & Wolff, Belfast.	20,765	17,500	2	Reciprocating Harland & Wolff.	210
"Leviathan" (ex "Vaterland").	54,282	22½	U.S. Government (Navy Department)	1914	907.6 x 100.3 x 58.2 Blohm & Voss, Hamburg.	15,000	65,000	4	Steam turbines Blohm & Voss.	240
"George Washington")	25,570	17	U.S. Shipping Board	1908	609.1 x 78.2 x 50.1 A. G. Vulcan, Stettin.	13,465	18,000	2	Reciprocating A. G. Vulcan, Stettin.	215
"Agamemnon" (ex "Kaiser Wilhelm II.")	19,361	21½	U.S. Shipping Board	1902	684.3 x 72.3 x 40.2 A. G. Vulcan, Stettin.	8,700	43,000	2	Reciprocating A. G. Vulcan, Stettin.	213
"Panhandle State"	10,533	14	U.S. Shipping Board	1920	502.1 x 62.2 x 28.3 New York S. B. Corp.	13,000	7,000	2	Reciprocating New York S. B. Corp.	220
"France"	23,666	24	Cie. Gen. Transatlantique	1912	689.0 x 75.6 x 53.4 Ch. & Atel. de St. Nazaire, St. Nazaire.	6,384	45,000	4	Steam turbines Ch. & Atel. de St. Nazaire.	....
"Paris"	32,000	22	Cie. Gen. Transatlantique	1917	734.9 x 85.2 x 50.1 Ch. & Atel. de St. Nazaire, St. Nazaire.	....	....	4	Steam turbines Chant. de Penhret. St. N.	....
"Massilia"	15,147	20	Cie. de Nav. Sud-Atlantique.	1916	574.0 x 64.0 x 40.2 Forg. & Ch. de la Médit., La Seyne.	....	....	4	Reciprocating & 2 l.p. turbines Forg. & Ch. de la Médit., M.S.L.	....
"Rotterdam"	24,149	17	Holland-Amerika Line	1908	650.5 x 77.4 x 43.5 Harland & Wolff, Belfast.	....	2,451 N.H.P.	2	Reciprocating Harland & Wolff, Belfast.	215
"Limburgia"	19,980	17	Koninkl.-Hollandoche Lloyd	1914	592.0 x 72.3 x 39.7 J. C. Tecklenborg, A. G., Geestemünde.	....	....	3	Reciprocating & l.p. turbine J. C. Techlenborg, A. G., Geest.	....
"Giulio Cesare"	21,500	18½	Nav. Gen. Italiana	1920	601.4 x 76.0 x 51.0 Swan Hunter, Newcastle.	....	....	4	Steam turbines Wallsend Slipway Co. Ltd., Newcastle.	....
"Conte Rosso"	15,550	....	Lloyd Sabaudo Socy.	1921	570.0 x 74.2 x 36.1 Beardmore, Glasgow.	....	....	2	Steam turbines W. Beardmore, Glasgow.	....
"Esperia"	11,393	20	Soc. Italiana di Servizi Marittimi	1918	492.1 x 61.7 x 34.1 Soc. Esercizio Bacini Riva Trigoso.	....	19,600 H.P.	2	Geared steam turbines N. O. dero fie A Seotui. P.	....
"Infanta Isabel de Borbon"	10,348	....	Cía. Transatlantica	1913	481.0 x 61.3 x 32.7 W. Denny Bros., Dumbarton.	6,229	22,186	3	Reciprocating & 1 l.p. turbine Denny & Co., Dumbarton.	200
"Stavengerfjord"	12,977	15½	Den Norske Amerika Linje	1918	532.5 x 64.2 x 29.3 Cammell Laird & Co., Birkenhead.	7,200	1,567 N.H.P.	2	Reciprocating Cammell Laird & Co.	220
"Bergensfjord"	10,709	....	Den Norske Amerika Linje	1913	512.4 x 61.2 x 29.4 Cammell Laird & Co., Birkenhead.	7,300	1,469 N.H.P.	2	Reciprocating Cammell Laird & Co.	220
"Campania" (lost in World War).	12,884	22	Cunard Co.	1893	601.0 x 65.2 x 37.8 Fairfield Co. Ltd., Glasgow.	....	3,191 N.H.P.	2	Reciprocating Fairfield Co. Ltd., Glasgow.	165
"Great Eastern"	18,915	13	Great Eastern S.S. Co.	1858	680.0 x 82.8 x 48.2 Millwall.	....	11,000 I.H.P	....	S. screw & paddles.	30

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The U.S. Shipping Board has allotted many of its best vessels to various companies for service on the Pacific. The "Wenatchee" and "Creole State" are typical of the 535-ft. vessels so appropriated. These vessels are 535 ft. overall, 516 ft. between perpendiculars, with a beam of 72 ft., and moulded depth 27·8 ft., and to "A" deck 50 ft.; about 14,000 tons gross. When loaded to a draught of 30·6 ft. their total dead-weight is 10,000 tons, and total displacement 21,250 tons. They have accommodation for 257 first-class and 300 second-class passengers, besides 200 of ship's company. They can also carry 6,700 tons of cargo, and can maintain 17½ knots for long distances, having obtained over 19 knots in some cases on trial. They are fitted with water-tube boilers 265 lb., and 75° superheat. Westinghouse double-flow type turbines are fitted, run at 3,650 revolutions, with double reduction gearing, to drive two propellers at 110 revolutions. The smaller vessels of the same type are 522 ft. overall, 502 ft. between perpendiculars; breadth 62 ft. and depth to "A" deck 42 ft. They only carry 78 passengers, but they can take another 1,000 tons of cargo. They are fitted with cylindrical boilers 220 lb., and two sets of four-cylinder triple expansion engines giving 6,000 H.P. for 14 knots at 105 revolutions.

For service between Europe and Australia, via The Cape, the "Ceramic," of 18,481 tons and 17 knots, triple screw, of the White Star line, was the finest and largest vessel running in 1921. She was built by Harland & Wolff in 1913, and can carry 19,590 tons cargo, and bunkers, at a sea speed of 17 knots, with a maximum of 18½ knots. For the India and Australia service of the P. & O., a new series of "N" class of steamers was being built. The first of these "Naldera," 15,825 tons, was built by Caird, and used by the Government during the war. "Narkunda," 16,118 tons, was the first liner to be completed by Harland & Wolff at Belfast after the war. These are vessels of 18½ knots speed. For the India service direct a new series—"M" class—was being built. Typical of these is the "Mongolia," built by Armstrong, 550 ft. x 72 ft. x 42·3 ft. When loaded to a draught of 30 ft. they will have a displacement of 24,500 tons, and 15,550 tons gross, and carry a dead-weight of about 13,000 tons. They can carry over 400 first- and second-class passengers, and of seven cargo-holds two are insulated. Two later vessels—"Maloja" and "Mooltan"—are 20,700 tons gross.

The Cunard Co. has also built a number of vessels of the "Ausonia" type for the Cape and Australia services. These vessels are 519 ft. x 65·3 ft. x 43 ft., and 13,000 tons gross at a draught of 29·6 feet. Their displacement is 20,420 tons with a dead-weight of 10,120. Geared turbines of 8,500 H.P. are fitted for a speed of 15 knots. They can carry over 500 cabin passengers and about 1,200 third-class. The "Ausonia" is remarkable, as making a record of 1,000 ships built by Messrs. Armstrong, of a total of 3,000,000 tons. Of these, 800 were merchant ships and 200 were warships.

The Australian Government was in 1921 providing itself with seven liners of 12,500 tons, 15 knots full speed, built on the Isherwood longitudinal system. The "Largs Bay," built by Messrs. Beardmore, may be taken as typical of all five. She is 530 ft. long, breadth 68·3 ft., depth 39·8 ft., 12,500 tons gross tonnage, and can carry 12,000 tons dead-weight at a draught of 29 ft. 9 in. and displacement 23,120 tons. She can carry 730 third-class and about a dozen first-class passengers. Machinery, of 9,000 S.H.P. on two shafts, is provided for a speed of 15 knots; Parsons' geared turbines are fitted in two complete sets. The h.p. turbines run at 3,200 revolutions, and l.p. turbines at 2,100. They are independently connected to the shafts by double reduction gearing 35·5 to 1, and 23·4 to 1 respectively, giving a speed of propellers of 90 revolutions per minute, and on each ship astern turbines are provided equal to 60 to 65% of the full power ahead.

South Africa.—For the direct service to the Cape the Union Castle line added the "Balmoral Castle," of 13,361 tons, of 18 knots maximum speed, in 1911. Two very fine vessels had in 1921 been recently added: the "Arundel Castle," and "Windsor Castle," 650 ft. x 72 ft., and of 19,000 tons gross. They were the first four-funnelled ships on the Cape line, and were fitted with 15,000 H.P., and single reduction gear, to two shafts, for a sea speed of 17 knots. They could carry 273 first-, 224 second- and 566 third-class passengers, besides the crew of 400, and a large cargo, the total dead-weight being 14,000 tons.

Coast and Channel Steamers, etc.—The finest recent vessels of these types have been built in America. Two remarkable vessels, the "Great Northern" and "Northern Pacific," built by Cramp in 1915 for service between San Francisco and Astoria, are 8,255 tons gross and 24 knots speed. They are 500 ft. x 63 ft. x 50·5 ft., moulded, to promenade deck. When loaded to 21-ft. draught they have dead-weight of 2,185 tons and displacement of 9,700. They carry 550 first-class passengers and 316 second and third-class passengers. They are fitted with 12 water tube boilers of the Mosher type, and Parsons turbines driving three screws, and giving 22,000 S.H.P. These were, perhaps, the finest vessels that had yet been built in the United States, though not the largest.

New Channel steamers have continued to be built in England, France and Belgium. The fastest steamer on the English Channel service in 1921 was the "Versailles," built in France and completed in 1921, 305 ft. long and 36 ft. in breadth; she had obtained 25 knots on speed.

An important type of cross-channel steamer is the train ferry. During the war such vessels were used by England for the first time. These vessels are 363·5 ft. long, 61·5 ft. broad, draught 9 ft. forward and 10 ft. aft. They displace 3,654 tons, and have 12 knots speed. Two were built by Messrs. Armstrong and one by Messrs. Fair-

TABLE XVII.—*Particulars of Pacific, etc., Liners.*

Name	Tons gross	Speed knots	Owners	Date of build	Dimensions Builders L. B. D.	Dead-weight Tons	Horse-power	No. of screws	Type of machinery and makers	Steam pressure, lb.
"Wenatchee"	14,127	15	United States Shipping Board.	1921	516·5 x 72·2 x 27·8 New York S. B. Corp., N. J.	..	..	2	Steam turbines, Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.	..
"Aeolus" (ex "Grosser Kurfürst")	12,642	14½	United States Shipping Board.	1899	560·6 x 62·3 x 35·9 F. Schichau, Danzig.	..	1,016 N.H.P.	2	Reciprocating, F. Schichau, Elbing.	..
"Arundel Castle" . .	19,600	18	Union Castle S.S. Co.	1921	630·0 x 72·5 x 41·5 Harland & Wolff, Belfast.	..	..	2	Steam turbines, Harland & Wolff.	..
"Balmoral Castle" . .	13,361	17½	Union Castle S.S. Co.	1910	570·0 x 64·5 x 38·9 Fairfield, Glasgow.	..	2,234 N.H.P.	2	Reciprocating, Fairfield & Co.	220
"Ceramic" . .	18,481	17	White Star Line (Australian Service).	1913	655·1 x 69·4 x 43·8 Harland & Wolff, Belfast.	19,590	..	3	Reciprocating and 1 L.P. turbine, Harland & Wolff.	..
"Empress of Canada" . .	22,000	22	Canadian Pacific Ocean Services, Ltd.	1920	627·0 x 77·7 x 42·0 Fairfield, Glasgow.	..	..	2	Steam turbines, Fairfield, Glasgow.	..
"Empress of Asia" . .	16,909	21	Canadian Pacific Ocean Services, Ltd.	1913	570·1 x 68·2 x 42·0 Fairfield, Glasgow.	9,135	3,720 N.H.P.	4	Steam turbines, Fairfield, Glasgow.	190
"Niagara" . .	13,415	18	Union S. Shipping Co. of New Zealand, Ltd.	1913	524·7 x 66·3 x 34·5 J. Brown, Clydebank, Glasgow.	..	12,000	3	Reciprocating, J. Brown, Clydebank, Glasgow.	220
"Narkunda" . .	16,118	18½	P. & O. Line.	1920	581·4 x 69·4 x 27·7 Harland & Wolff, Belfast.	..	1,428 N.H.P.	2	Reciprocating, Harland & Wolff.	..
"Ausonia" . .	13,050	15	Cunard S.S. Co.	1921	519·0 x 65·0 x 43·0 Armstrong, Whitworth & Co., Newcastle	10,120	8,500	2	Parsons geared turbines, Armstrong, Whitworth.	220
"Mongolia" . .	15,550	17	P. & O. Line.	1921	550·0 x 71·7 x 42·2 Armstrong, Whitworth & Co., Newcastle	13,000	13,000	2	Steam turbines, Armstrong, Whitworth.	..

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field. On the deck, well protected by deckhouses, are four lines of rails, which will take 54 10-ton wagons. Heavy guns and heavy machinery of all description were transported by these vessels.

Some of the most remarkable vessels in the world are the Sound and Lake steamers of the United States. Recent vessels on the Lakes are the largest paddle steamers ever built, such as the "City of Cleveland III." (1907), 4,568 tons and 19 knots speed; "City of Detroit III." (1912), 6,061 tons and 20 knots speed; and "Seandbee" (1912), 6,381 tons, 19½ knots. This last remarkable vessel is 484·5 ft. x 58·1 ft. x 24·6 ft. To drive her paddle wheels she is fitted with compound, three cylinder engines; cylinders being, one 66 in. in diameter, and two 96 in. in diameter, with a stroke of 9 feet.

Developments in Shipbuilding.—The greatest innovations during 1910–20 were in connexion with rapid shipbuilding during the war. The production of "standard ships" in Great Britain has been already referred to. Six types were "standardized" (*see* Carter I.N.A., 1918, and, for detailed summary with dimensions, *Shipbuilder*, May 1918).

Others were approved at a later date, and permission to build large numbers of such ships was given to various shipbuilders. In these ships special methods were adopted to reduce risk of submarine attack, such as improved sub-division, making both ends alike, with bridge, poop and forecastle ends rounded, funnels and masts symmetrical in profile elevation with regard to a vertical line amidships, but not on the fore and aft centre line so as to increase difficulty of detecting speed and course of vessel. Very greatly improved accommodation for ship's company was also provided.

The best method of expediting the building of merchant ships occupied many minds, and proposals were made by Sir Eustace d'Eyncourt in 1917 to simplify the construction of war-time vessels by making all frame-lines straight, and the plating so far as practicable of developable surfaces. A successful design was proposed on this basis, and adopted by the Controller of Merchant Shipbuilding for use in the fabricated ships about to be built at the National Shipyards on the Severn. The first fabricated "straight line ship," the S.S. "War Climax," was completed at Wallsend by Swan, Hunter & Co., on Sept. 28 1918, 31 weeks from laying keel.

In Great Britain large numbers of vessels of standard designs were built by various shipbuilders according to their usual routine. The "fabricated" ship followed later. In the United States, however, the standard ships were mostly fabricated ships also. The first series were produced by the Submarine Boat Corporation in new premises at Newark Bay. The most wonderful of all the American shipyards was, however, at Hog's I., Philadelphia, which in less than 12 months passed from open 50 ft. ground to the greatest shipyard in the world, with full equipment and deep water jetties. The contract was signed on Sept. 13 1917, and work started Sept. 20. The first keel (S.S. "Quistconck") was laid Feb. 12 1918, launched Aug. 5 1918, and by Jan. 8 1919, 16 vessels had been launched and 7 completed, 50 slips had been built and 7 jetties, 1,000 ft. long and 100 ft. wide for fitting out afloat. By April 17 1920, 102 ships of 800,000 tons d.w. had been launched and 84 of 657,000 tons completed. The fabricated parts were prepared in 90 engineering works from 10 to 1,500 m. away.

Ferro-Concrete Ships.—For many years small vessels had been built of reinforced concrete in localities where steel and the special labour required for steel shipbuilding was not available. Such vessels had been built in Italy, Norway and France. Between 1887 and 1917 some 200 craft had been built, but in the latter year the subject was more seriously considered, and craft of increasing size were built, and greater numbers of them fitted with propelling machinery. In England 1,000 ton barges, tugs of 750 h.p., and cargo steamers of 1,150 tons d.w. were built. The first steamship, "Armistice," was built at Barrow, and was reported to run well and cost very much less than a steel ship for upkeep. In Great Britain most of the concrete vessels were tow barges, but in a number of cases steam or oil engines were fitted. Cargo boats 1,150 tons d.w. 205 ft. x 32 ft. with engines of 350 I.H.P. for 7½ knots, and tugs 125 ft. x 27 ft. 6 in. with engines of 750 I.H.P. were built. In the United States very much larger vessels were built as experience was gained. The S.S. "Faith" was 320 ft. x 44·5 ft. x 30 ft. d.w. 3,950 tons on 22 ft. 6 in. draught, triple expansion engine of 1,600 I.H.P. were fitted giving 10½ knots speed. Others were built of 3,000, 3,500 and 7,500 tons d.w. as well as eight oil tankers of 7,500 d.w. The Emergency Fleet Corporation ordered 56 ships of an aggregate d.w. of 300,000 tons, besides 34 barges and lighters.

Welded Ships.—The Oxy-Acetylene process, for cutting out damaged portions of ships and machinery, and for welding in portions in the course of repair, has been of great service, particularly for the repairs of large forgings, castings and boilers. To a less extent the "Thermit" process has been used for welding purposes, but its application has been of a comparatively limited character. During recent years very considerable progress has been made in developing systems of electric welding, which were used to carry out repair work of considerable magnitude during the war. It has also been proposed that the complete ship should be welded, thus avoiding a great portion of the labour and expense of riveting. Several systems have been developed which can be operated in the ordinary shipyard, and considerable progress has been made in Sweden, England, the United States and France. In 1915 a small vessel was built by Geary at Ashtabula Harbour, Ohio. This vessel was 42 ft. long, 11 ft. beam and 6 ft. 6 in. draught, and the welding was carried out with bare metallic electrodes. Two vessels of 52 to 62 ft. in length have also been built, one in France in 1919 and one in 1920 in Sweden "Esab IV." In each case the welding was carried out by the Kjellberg process, and each of these craft is propelled by semi-Diesel crude oil engines, which can also be used to provide electric power for welding, and compressed air for use in carrying out the repairs of ships by this process as they float in harbour. In this process the arc is also used, but a fireproof sleeve of non-conducting material projects over the arc so as to shield the molten metal from oxidization. A boiler 15 ft. 6 in. in diameter, known as the Hawthorn-Wyber boiler, has been successfully constructed by means of this process. The process of the General Electric Co. is quite different; in this case metallic contact takes place, the welding material is raised to the necessary temperature by resistance to the passage of the current, and it is at the same time pressed into place by hydraulic pressure. A 46-ft. section of a 9,600 ton vessel being built in New Jersey has been used to test the practicability of this, and other methods, and it is reported that these experiments show a saving of 60% on labour and 15% on material, as compared with riveted work.

During the war a steel barge, 120 ft. by 16 ft. and 275 tons displacement, was built at Richborough, Kent, in order to test to what extent labour could be saved. Here the Quasi-Arc process was used and the vessel was satisfactorily completed. On this system the steel electrode has a sheath of blue asbestos, which melts and flows down over the molten metal, thereby extinguishing the arc. This asbestos also forms a floating covering over the molten metal and protects it from oxidization. In order to give further protection, an aluminium wire is carried down by the side of the steel electrode, so that the molten aluminium may take up any oxygen which gets beneath the flux. Messrs. Laird built a small sea-going vessel, the S.S. "Fullagar," in 1920, using the Quasi-Arc process. If welding can be adopted as the general practice, a very large saving should arise in the cost of labour, and an appreciable saving in the case of weight and material.

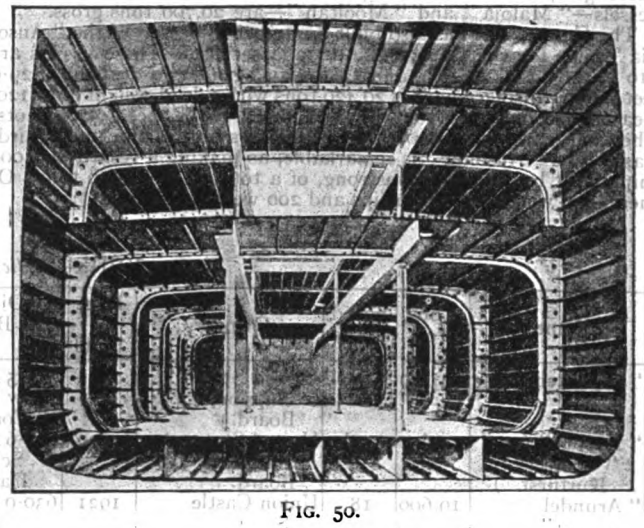

FIG. 50.

Isherwood System.—For many years warships have been built on the longitudinal system of framing, *i.e.* the principal structural members of the framing run fore and aft in continuous girders, the transverse framing being of a secondary character (apart from bulkheads), and fitted between the longitudinal girders as necessary for local support. This system of framing has not found general acceptance for merchant ships, because of the theory long held by shipowners that a merchant ship must have such strong transverse frames that she may ground in an ordinary berth with a cargo on board and without damage. With the improved wharf accommodation now available for important vessels this idea is being gradually relinquished. The most important movement in this connexion was inaugurated by Mr. (later Sir) Joseph Isherwood, who devised a plan for utilizing the whole of the framing of the bottom of the ship and of the decks so that it might be incorporated as part of the structural girder strength of the ship. In 1908, six ships were built of 31,000 tons; for the next six years, 40 or 50 ships were built per annum; but in 1915, under war conditions, the number very greatly increased, and in 1918, 250 ships of nearly 2,500,000 tons dead-weight capacity were built. Clearer holds, greater strength and a saving of about 10% of weight of structure are obtained, as well as decreased cost of building. By June 1921 1,400 ships, aggregating 12,000,000 dead-weight, had been built on this system.

The combination of a longitudinal system in the double bottom, and a transverse system above the bottom, has been adopted by Mr. W. Millar of Greenock, and several vessels have been built on the Millar system. Other systems in which a longitudinal construc-

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tion is adopted are associated with various names—Mr. Foster King, Dr. Montgomery, and Sir Westcott Abell.

The "Unsinkable" Ship.—A so-called "unsinkable" ship has been designed by M. La Parmentier. It consists of two cylinders, 22 ft. in diameter and about 300 ft. in length, each divided into 7 holds, connected so as to form a vessel 320 ft. in length and about 48 ft. extreme breadth, estimated to carry 4,250 tons d.w. on a draught of 16 ft. fitted with twin screws, and engines of 700 H.P. for eight knots. In 1921 several such vessels were being built in the United States.

Cruiser Sterns.—Several of the new liners have a rounded stern, with the profile sloping forward in a curved line as it rises from the water upwards. This is called a "cruiser stern," and is being very generally adopted. It gives somewhat increased capacity, and with the same total length of ship provides a longer water-line, thus facilitating propulsion. In the case of a 550-ft. ship, for 18 knots this meant a decrease of 2,000 H.P., which resulted in a saving of 225 tons of machinery, as well as 220 tons of fuel per trip, giving a saving of over 400 tons available for extra cargo. In 1921 over 160 vessels were built with sterns formed in this way.

On this system the flat plate rudder is replaced by two curved plate rudders ("Kitchen rudders"), forming an almost cylindrical casing round the propeller. By revolving these curved rudders as desired the stream of water is directed as necessary by reaction to steer the ship. For going astern the rudders are brought together abaft the propeller.

Safety at Sea.—During the war many other points were developed for increase of safety in navigation, such as use of range-finders, directional wireless, gyro-compasses, reflex sound apparatus, "clear view" weather screens, submarine sound signalling, and "Leader" cables laid along the bed of the channel.

Following the loss of the "Titanic" on April 16 1912, rigorous enquiries were conducted, in New York under Senator W. A. Smith of Michigan, and in London under Lord Mersey. In both cases recommendations were made that liners should have boats for all, regular boat drill, more efficient W.T. arrangements, and improved sub-division in construction. The British Board of Trade appointed two committees. Sir Archibald Denny presided over the first committee (Bulkheads and Sub-Division) and Sir John Biles over the second committee (Boats and Davits). As a result the Board of Trade laid draft rules before Parliament (Paper Cd. 6402 1912) and took immediate action to improve the supply of boats, while shipowners proceeded to improve the sub-division of their ships. An International Convention was called with a view to similar treatment of these questions by all maritime powers. This Convention was signed on Jan. 20 1914 and rules embodying the agreement as to life-saving appliances were immediately put into force in Great Britain (Parliamentary Paper 219 Merchant Shipping Life-Saving Appliances dated May 8 1914). The whole Convention was discussed in Parliament, and an Act was passed (Aug. 10 1914) authorizing its adoption, but the Board of Trade was left with the power to decide the date on which the Act was to be put into operation. On account of the war, action was postponed, but discussions were proceeding in 1921 between the principal maritime powers with a view to the holding of another Convention.

During the war a great demand arose for improved life-saving appliances. The most successful of all these was the Carley Life Raft, made in the United States. It is made in various sizes. A large copper pipe is bent into the form of an O, brazed up to be airtight, surrounded by cork and canvas, provided with a strong rope netting to form a floor within the O, and fitted with hand ropes, etc. This type was the means of saving very many lives; for instance, a float 9 ft. by 14 ft. will support more than 60 people.

Research and Experiment.—Increasing attention is being given to the study of naval architecture and marine engineering, and of research, in America as well as in Europe. Chiefly owing to the advocacy of Sir W. H. White, and the generosity of Sir A. F. Yarrow, a national experimental tank has, in England, been provided at the National Physical Laboratory at Teddington. The experiment tank is intended for the service of any shipbuilding or shipowning firm. Primarily intended for the experimental investigation of any problems connected with ship resistance and propulsion, it has successfully dealt with such different problems as the manœuvring of ships, torques on rudder heads, skin friction, resistance due to rough seas, rolling and pitching of ships, stability of ships and hydroplanes in motion on the water, and the form of flying-boat hulls for efficient and stable action in getting on and off the water. During the war it dealt with many problems, including the detection of submarines, mine-sweeping, torpedo firing, design of anchored mines, protection against torpedoes, and the design of standard ships.

(E. T. D'E.)

SHIPPING (*see* 24.983).—In the decade following 1910, the influence of the World War had a profound effect on the shipping industry. Nor can it be limited to the period between the beginning of Aug. 1914 and Nov. 1918, when the Armistice was signed. For many months after the cessation of hostilities, a great strain was imposed on the British mercantile marine in the repatriation of millions of men. Goods which could not be transported during the war were waiting in vast accumulations to be carried, and in 1921 the effects on shipping were still being shown. In fact, so far-reaching were the effects that they were certain to be felt for many years.

(1) United Kingdom

The year 1910 was, judged by the ideas then ruling, a comparatively satisfactory one for British shipping, although the industry did not entirely escape the consequences of a strike of coal-miners caused by difficulties traceable to the operation of the Eight Hours Act. In 1911 there were a number of industrial disturbances, notably in the collieries, on the railways, at the docks, among seamen and in the cotton-mills. Yet rates of freight were on a higher basis than for some years previously. The time charter rate, *i.e.* the monthly rate of hire per ton dead-weight for ordinary cargo steamers, may be taken as a good barometer of the condition of freight rates generally. As compared with a rate of about 3s. a ton, or rather more, ruling in 1910, the time charter rate rose to about 5s. in 1911. There was a further upward movement in 1912, which was regarded as a very satisfactory year for the shipping industry. Time charter rates ranged from about 4s. 6d. a ton to 7s. 6d. Employment for shipping was good, although, as some set-off to the increased rates, there was a general rise in working costs. In 1913 rates declined, partly owing to the increase in shipbuilding which had been carried out during the good years. The year 1914, destined to be one of the most important for shipping as for all other industries, opened with freights on a downward grade, and in midsummer the industry was in a very depressed condition. All freight rates for cargo steamers were low, and the liner companies were feeling the severe competition of the German ownerships. The two great German companies in the N. Atlantic trade—the Hamburg-Amerika and the Norddeutscher Lloyd—had been for years claiming a larger share of the passenger traffic. In the summer of 1914 the Deutsche-Australische Gesellschaft announced its intention of inaugurating a direct service from Hamburg to New Zealand. Discussions were in progress with the British shipping managers when war broke out.

Beginning of the World War.—Immediately a number of liners were requisitioned by the British Government for service as merchant cruisers, transports, and hospital ships. Freight markets were almost staggered by the unexpected blow which had fallen, and, at first, chartering of all sorts came to a standstill. Happily, the Government at once put into operation a scheme of war insurance on the lines of the recommendations of a committee which had been previously appointed and was presided over by Mr. Huth Jackson. These recommendations provided for the granting of war insurance on shipping by the Government up to 80% of the values. This insurance was worked through the mutual associations of shipowners which were in existence for the purpose of covering such liabilities as shipowners could not obtain under ordinary marine insurance policies. In the preparation of this scheme Sir Norman Hill, the secretary of the Liverpool Steamship Owners' Assn., had taken an active part. The shipping entered in the Liverpool Steamship Owners' Assn. represented 3,948,623 tons, and that in the Liverpool and London War Risks Assn., which included the great bulk of the liner tonnage of the United Kingdom, 6,371,329 tons.

There were also important associations of the same kind with headquarters in London and on the N.E. coast. The main result of putting this scheme at once into operation was that all ships could proceed on their voyages and others could leave without involving disaster to their owners if the vessels were captured or destroyed by the enemy. Had no such scheme been available, a great many vessels, if not all, must have been detained in port. Commerce would immediately have come to a stop. In those days it was the possibility of capture by the enemy's surface cruisers that was in men's minds: that was considered serious enough. The risk of destruction by the enemy's submarines had hardly been taken into account.

As a complement to this scheme for the insurance of hulls, there was also established a Government office for the insurance

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of cargo. The marine insurance market continued actively in business, but underwriters had themselves realized that bad news or heavy losses could easily have the result of forcing up rates to levels that might be prohibitive for commerce. The Government office was intended to exercise a steadying influence. It was vital that essential goods should continue to be shipped, and, if the risks were greater than insurance companies or private underwriters could bear, it was for the nation to assume them. The first rate quoted by the Government was £5 5s. %. On Aug. 8 the rate was reduced to £4 4s., on Aug. 18 to £3 3s., and on Sept. 2 to £2 2s.

All the time underwriters in the market continued to write war risks. Their rates of premium were frequently below those of the Government, and there were many risks which the Government office would not accept. For instance, the Government office would not accept lines after a ship had left port. Merchants sometimes found that larger quantities of goods had been shipped than they had anticipated, or that the values were greater. Then insurances were effected in the open market. As Germany was no respecter of the rights of neutrals, insurances were also placed in the market on behalf of steamship owners abroad. Some underwriters of insurance companies and at Lloyd's wrote war risks freely from the outset. They took big risks and made large sums of money. The premium incomes of the insurance companies writing war risks were, in some cases, as much as five times the pre-war standard. This was due not only to the demand for insurance against war perils, but also to the great increase in values of commodities which set in as they became scarce.

The Government office was inaugurated under the auspices of the Board of Trade. The services of a number of leading underwriters were enlisted. On Aug. 5 1914, the office was opened at the Cannon Street hotel and the knowledge that there was a market for the risks undoubtedly had a very reassuring effect. While credit was due to several underwriters who gave their services in the working of this scheme, much of the organization fell upon Mr. W. E. Hargreaves, a leading member of Lloyd's, who worked in close coöperation with the Board of Trade.

There were thus in existence from the very beginning of the war facilities for the insurance of ships and cargoes against all the perils that then had to be faced. There was not the same mobilization of the shipping industry.

Immediately after the declaration of war, freights remained listless. A very few shipowners were able to see what was coming, and chartered neutral steamers for "time" at the low rates then ruling, and, in the event, found the transactions very profitable. Most shipowners, however, did not foresee the extremely heavy demands which would be made by the Government upon the industry for ships for direct war purposes. Cargo steamers were requisitioned to act as colliers to the fleet and were needed to carry supplies to the armies abroad. It was not until the end of 1914 that freight rates began to move upwards. Just before the outbreak of war the grain rate from Argentina which may be regarded as a representative rate, was 12s. 6d. per ton. By the end of the year this freight had advanced to 50s. per ton. It rose again sharply in the autumn of 1915, and its movements indicated the influence of the introduction of the Excess Profits duty. On Sept. 20 of that year, when Mr. McKenna, the then Chancellor of the Exchequer, introduced the tax, the Argentine grain freight stood at 57s. 6d. per ton. Within a month it had risen to 70s., by Nov. 20 it had advanced to 85s., and by Dec. 20 to 120s. In 1916 the rate advanced further. By Jan. 20 of that year it stood at 140s. and by Feb. 20 at 157s. 6d. The rate further advanced in 1916 to 183s. 6d. Similar increases took place in other shipping trades. These increases were clearly due, in the first place, to the diminution in the supply of shipping available for commerce, which, in turn, was caused by the ever-increasing requirements of the Government, and by the destruction of shipping by the enemy, and also to the incidence of the Excess Profits duty. This tax provided the argument that the nation got the benefit of the increases. The Treasury did, but not the country which had to pay for them in the increased cost of imported commodities. It represented a form of taxation, at the best, imposed without the authority of Parliament, and the surplus remaining to the owners meant higher profits than, in pre-war years, could ever have been thought possible by them.

For nearly two and a half years the real responsibility for the shipping not requisitioned by the Admiralty rested with the Board of Trade, of which Mr. Walter Runciman was then President. The President of the Board of Trade, with his multitudinous duties of endeavouring to watch over the welfare of all industries, was obviously incapable of giving the close attention to shipping which all the circumstances demanded. The public gradually became keenly interested in the rise that was proceeding in freights and was irritated by it. As its interest developed, it grew into indignation. The matter was raised in Parliament, but the Government of the day showed complacency, regarding the movement apparently as inevitable. It is true that on Christmas Eve, 1915, when freights were still climbing, Mr. Arthur Balfour referred in the House of Commons to the "terrible level" of freights which, he admitted, increased the price, both of the necessities of life to the poor, and of many things which were essential to the Government in the proper conduct of the war. Yet the Government, when it was spurred into action, contented itself with adopting further piecemeal measures.

Government Measures.—One successful measure taken at the outset might have formed a model for a broader policy, and, two and a half years later, did so. This was the requisitioning by the Government of the whole of the refrigerated space in the meat-steamers trading between the United Kingdom and Australasia. This transaction was followed, a few weeks afterwards, by the requisitioning of similar space in the steamers trading with S. America. Arrangements were, at the same time, concluded by the Government with the meat companies for a proportion of their weekly production at fixed prices. Thus, not only were there ample supplies secured for the navy and army at reasonable cost, but supplies were available to maintain the civil population.

In the autumn of 1914 owners were asked to keep the Admiralty informed of the movements of their ships. It was a peculiar fact that very little, if any, information was then in the hands of any Government department of the services of the British shipping companies. Such information had to be sought from the companies themselves.

In the summer of 1916 a scheme was instituted, on behalf of the Indian Government, for buying in India, transporting to the United Kingdom and selling there the exportable surplus of the Indian wheat crop and, through the formation of a committee of brokers, the freight rates were kept on a comparatively moderate basis. In the autumn of that year the Imperial Government was forced into further action. A committee was appointed to consider the desirability of particular voyages and a system of licences was introduced. Another committee was formed for the requisitioning of vessels for the transport of foodstuffs, and a third, known as the Port and Transit Executive Committee, was formed to deal with the congestion at the ports of the United Kingdom, which, by then, had become a very serious matter. As from March 1 1916, licenses were required for all ships of over 500 tons gross trading to and from the United Kingdom.

Licences were granted for whole services or particular voyages. The system also enabled discrimination to be exercised between the different ports of the United Kingdom and so it was important in the relief of congestion.

The committee appointed to deal with the requisitioning of ships for foodstuffs followed the policy of directing owners to load their vessels where the need was most urgent and then to leave the owners to accept the full market rates of freight.

The first chairman of the Port and Transit Executive Committee was Lord Inchcape, and the Committee included representatives of the Admiralty, the War Office, shipping, railways and dock authorities. It was subsequently strengthened by the addition of Labour leaders. It owed responsibility, directly, to the Prime Minister and adopted such measures as would tend to relieve congestion at the ports. Its task was a formidable one and, while the Committee was able to bring about certain reforms, it could not entirely remove the troubles. These actually seemed to be

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at their worst after the Armistice. Immense supplies of commodities which could not be moved during the war were poured into the country, and the facilities for removing these proved quite inadequate, with the result that ships were detained for long periods, owing to inability to discharge their cargoes. Much public attention was focussed on the waste of shipping thereby involved. Strenuous efforts were made by all concerned to improve the situation. As an indication of what was being done, the Port of London Authority issued a weekly bulletin showing the number of vessels detained, and continued to issue this until the situation was completely changed and, early in 1921, the weekly return showed that large numbers of steamers were laid up idle owing to the lack of employment. Lord Inchcape was succeeded as Chairman of the Committee by Sir Norman Hill, who, on a breakdown of health caused by overwork was, in turn, succeeded at the end of 1919 by Sir John Barran. The Committee was formally dissolved by the Prime Minister early in 1921. During the period of its activity it had wide powers, and, at the outset, had, among other measures, effected a change in the Customs Regulations which, as was proved, were then having the effect of accentuating the difficulties.

The chairman of the Ship Licensing Committee was Mr. (afterwards Sir) Maurice Hill, and it included Mr. (afterwards Sir) F. W. Lewis, then deputy chairman of Messrs. Furness, Withy & Co., as vice-chairman, Mr. H. A. Sanderson (president of the International Mercantile Marine Co. and chairman of the Oceanic Steam Navigation Co.), Mr. Scholefield, of Newcastle, Mr. Purdie, of Glasgow, and Mr. Burton Chadwick, of Liverpool.

The Committee for the requisitioning of ships was presided over by Mr. J. H. Whitley, who in April 1921 became Speaker of the House of Commons. It included three shipowners, namely, Mr. (afterwards Sir) T. Royden, deputy chairman of the Cunard Co., Mr. (afterwards Sir) E. W. Glover, of the shipowning firm of Glover Bros., and Mr. R. D. Holt, the chief of the important shipowning firm of Liverpool. All these members had previously been advising the Transport Department of the Admiralty.

In spite of the measures that were being adopted, freights remained on a very high level, and the shipping situation was very unsatisfactory. The need for complete control was urged persistently in *The Times* newspaper, and in Feb. 1916 the Government was again forced to act. In that month an Allocation Committee, or Shipping Control Committee, was formed in order to apportion the tonnage according to the various and urgent demands that were made upon it. Lord Curzon was appointed chairman of this Committee. Other members were Lord Faringdon, then better known as Sir Alexander Henderson, Mr. Thomas Royden, and Mr. F. W. Lewis.

Supply of Tonnage.—It became plainer every day that the ever-reducing supply of tonnage was becoming less adequate to meet all the demands made upon it. Consequently, the Government decided to place restrictions on the importation of various commodities. The first of these to be effected were paper, paper-making materials, tobacco, dried fruits, furniture woods, stones and slates. In March 1916, a prohibition was placed on the importation of many articles under the general heading of "luxuries." Among such articles were motor-cars for private use, musical instruments, cutlery, hardware, cotton and woollen manufactures, chinaware, fancy goods and soap. A restriction was also placed on the importation of certain brewing materials.

The inadequacy of the tonnage to meet the supplies was at that time due more to the requirements of the Government for ships for direct war purposes than to the depredations of the enemy. The highest quarterly loss of British shipping due to the enemy was 356,000 tons in the third quarter of 1915. In 1916 the ratio of loss fell; in the second quarter, the total amounted to 271,000 tons and in the third quarter to 284,000 tons. This drop was, however, only temporary, and in the fourth quarter of 1916 the total sprang up sharply to 617,000 tons and then continued at a high rate until the conclusion of the Armistice.

Throughout 1916 what became known as the "shipping problem" continued to attract great public attention. Articles were published in *The Times* urging the need of centralized control, in order that the utmost use might be made of the continually declining supply of tonnage and so that ships might be employed in the most effective way, irrespective of the individual trades of the ownerships to which they belonged. It was realized that this could only be brought about when all ships were hired to the Government, so that it would become for the owners a matter of more or less inconsequence into which routes the vessels were put. The principle of standardization was also persistently urged in order that large numbers of vessels might be constructed on identical plans and of parts fabricated from the same models. It was not, however, until the formation of Mr. Lloyd George's Government in Dec. 1916 that the shipping situation was completely taken in hand.

Ministry of Shipping.—A feature of the new Government was the creation of a Ministry of Shipping. As Shipping Controller, Sir Joseph Maclay was appointed. Sir Joseph Maclay had been known in shipping circles as a successful manager of cargo steamers and, while he was little known to the general public, the appointment was regarded in the shipping industry as a good one. By his own wish Sir Joseph Maclay was not a member of the House of Commons, but was represented there by Sir Leo Chiozza Money, as parliamentary secretary.

Various measures were soon taken to secure a better grip of the shipping problem. One of the most important of these was a general requisitioning of liners by the Government. These vessels were hired to the Government on the basis of what were known as Blue-book terms—those agreed early in the war with the Admiralty by a committee of owners presided over by Lord Inchcape. The management of such vessels as could be retained in ordinary commerce was left with the owners, who were required to give a financial account of their stewardship to the Government, and to pay over all profits above the Government rates of hire. Under this system it was less important to the individual ownerships into which routes their vessels were put. It was well that control was centralized, for, early in 1917, the enemy submarine war intensified and the losses greatly increased. As compared with a loss of 617,000 tons in the last quarter of 1916, the British tonnage sunk in the first quarter of 1917 amounted to 912,000 tons. The pinnacle was reached in April of that year and for the second quarter of 1917 the losses totalled 1,362,000 tons. Sinkings of foreign vessels were proceeding apace all the time, and in the second quarter of 1917 the total losses for the world amounted to 2,237,000 tons. The losses for each quarter throughout the war period are shown in the following table extracted from a White Paper (C.9221) issued at the end of 1918:—

Period	British	Foreign	Total of World
	Gross tons	Gross tons	Gross tons
1914			
Aug. and Sept.	341,824	85,947	427,771[1]
4th Quarter	154,728	126,688	281,416
1915			
1st Quarter	215,905	104,542	320,447
2nd "	223,676	156,743	380,419
3rd "	356,659	172,822	529,481
4th "	307,139	187,234	494,373
1916			
1st Quarter	325,237	198,958	524,195
2nd "	270,690	251,599	522,289
3rd "	284,358	307,681	592,039
4th "	617,563	541,780	1,159,343
1917			
1st Quarter	911,840	707,533	1,619,373
2nd "	1,361,870	875,064	2,236,934
3rd "	952,938	541,535	1,494,473
4th "	782,889	489,954	1,272,843
1918			
1st Quarter	697,668	445,668	1,143,336
2nd "	630,862	331,145	962,007
3rd "	512,030	403,483	915,513
4th "	83,932	93,582	177,534
Totals	9,031,828	6,021,958	15,053,786

[1] This figure includes 210,653 gross tonnage interned in enemy ports. After Oct. 31 the tonnage lost by enemy action was: British 11,916, Foreign 2,159.

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New Construction.—Attention was at once given by the Shipping Controller to the need of construction, and a programme for standardized ships was laid down. The principle of standardization had already received practical recognition in June 1916, when the Standard Shipbuilding Co., to operate at Chepstow on the river Wye, was formed. This company received very powerful support, the capital being subscribed by, among other companies, the P. & O. and British India, New Zealand Shipping, Orient Steam Navigation, Federal Steam Navigation, Messrs. Furness, Withy & Co., the Shire Line, Messrs. A. Weir & Co., Messrs. Harris & Dixon, Messrs. Trinder, Anderson & Co., Messrs. Bethell, Gwyn & Co., and Messrs Birt, Potter & Hughes. Mr. James Caird, the head of Messrs. Turnbull, Martin & Co., was appointed chairman, and Mr. John Silley, managing director of R. & H. Green and Silley Weir, an old and famous shipbuilding firm, was appointed vice-chairman. In Aug. of that year this company acquired the engineering firm of Edward Finch & Co., Ltd., which had originally been formed to build Brunel's Bridge over the river Wye. In this yard three building slips were prepared, and at the beginning of 1916 two cargo steamers of 3,300 tons were being built there, in addition to a large number of smaller vessels. The first four slips for building steamers of up to 10,000 tons in the Standard Co.'s new yard were also being prepared. Difficulties had to be overcome in the way of securing sufficient labour and part of the scheme provided for the construction of a garden city. Early in 1917 much progress had been made with the provision of housing accommodation under licences from the Ministry of Munitions.

These yards were subsequently taken over by the Government. A great deal of money was spent upon them. Various difficulties arose, and the results of the work there were very disappointing. After the Armistice the great bulk of the property was sold to private interests.

On assuming office, Sir Joseph Maclay at once tackled the problem of shipbuilding, and appointed a committee to advise him on all matters connected with the acceleration of merchant ships under construction and nearing completion, and the general administration of a new merchant shipbuilding programme. This committee included Mr. (afterwards Sir) George J. Carter (of Messrs. Cammell, Laird & Co., Ltd.), president of the Shipbuilding Employers' Federation, as chairman; Mr. (afterwards Sir) W. S. Abell, (chief surveyor to Lloyd's Register of Shipping); Mr. (afterwards Sir) F. N. Henderson (of D. & W. Henderson & Co., Ltd.); Mr. James Marr (of J. L. Thompson & Sons, Ltd.); Mr. Summers Hunter (of the North-Eastern Marine Engineering Co., Ltd.); Mr. (afterwards Sir) C. J. O. Sanders (of the Marine Department, Board of Trade); and Mr. (afterwards Sir) W. Rowan Thomson (of Messrs. D. Rowan & Co., Ltd., president of the North-West (Clyde) Engineering Trades' Employers' Association); Mr. A. R. Duncan, secretary to the Shipbuilding Employers' Federation, who, as Sir Andrew Duncan was later appointed Coal Controller, was secretary to the new committee.

The last word in merchant shipbuilding then rested with the Admiralty, on the ground that it was necessary for the naval authorities to determine what proportion of labour and material should be allotted to naval and merchant construction respectively. These proportions were dependent on the view held as to whether it was better to concentrate on the building of destroyers and other craft for the destruction of enemy submarines and for the protection of merchant vessels, or to build merchant ships. There was a great deal to be said for the theory that it was better to prevent ships being sunk than to build vessels to replace those destroyed. In May 1917 Sir Eric Geddes was appointed to the post of Navy Controller, and shortly afterwards, Maj.-Gen. A. S. Collard, director of inland waterways and docks, in the department of the director-general of movements and railways, was appointed deputy controller for auxiliary shipbuilding. The latter term was used to cover all merchant vessels. In July 1917, Sir Edward Carson was succeeded as First Lord of the Admiralty by Sir Eric Geddes, and Mr. (afterwards Sir) Alan Anderson became Navy Controller. The problem of merchant shipbuilding was at this time acute. The British shipping destroyed by the enemy in 1916 represented 1,498,000 tons, or nearly three times the production in British yards. This had fallen from the very poor total of 650,000 tons in 1915 to 541,000 tons in 1916. The peak in British shipbuilding had been reached in 1913, when 2,280,000 tons gross had been built, consisting of 1,920,000 tons of merchant vessels and 320,000 of warship tonnage calculated on a converted basis. It was to repeat such a production that the authorities at last aimed, the difficulties being enormously increased by the fact that large numbers of skilled men had been withdrawn from the shipbuilding industry for the fighting forces. The military authorities agreed to release such skilled men as could be spared, but as these were scattered over the various theatres of war, their return was very slow.

When responsibility for mercantile shipbuilding was transferred from the Ministry of Shipping to the Admiralty, some little friction arose between the new authorities responsible and the old Advisory Committee to the Shipping Controller, and in the autumn of 1918 a Shipbuilding Council to the Navy Controller was created, consisting of the members of the old Committee and advisers from the Admiralty. The position continued in some respects unsatisfactory, and in the spring of 1918, after an agitation for a more energetic merchant shipbuilding programme, Lord Pirrie was appointed Director-General of Merchant Shipbuilding, the official appointment being announced in the House of Commons on March 20 1918. He was regarded as the outstanding figure in British shipbuilding, and he was able to infuse energy into the shipbuilding programme. One of his first efforts was very greatly to improve the organization for the repair of damaged ships. Many vessels, after being torpedoed, managed to limp into ports, some of which, notably Falmouth, became seriously congested. A system of close and centralized control of the repairing facilities was organized, and much was done to make the damaged ships soon available again for service. The assistance of the United States in merchant construction had been earnestly invited. That country threw itself into the effort with immense fervour, and the height of the shipbuilding campaign was reached there in the summer of 1918. In June 1918, as responsibility for merchant shipbuilding now rested with the Department of the Controller-General, Sir. Alan Anderson resigned from the position of Navy Controller. After the Armistice the responsibility for the completion of the merchant shipbuilding programme was transferred again to Sir Joseph Maclay, the Shipping Controller.

Financial results of the shipbuilding programme were described in the House of Commons on March 12 1921, by Col. Leslie Wilson, parliamentary secretary to the Ministry of Shipping. Colonel Wilson stated that the total cost of 228 ships built in the United Kingdom for the Government was £36,481,000, and that the ships were subsequently sold for £47,591,000, showing a total profit of £11,110,000. An agreement was entered into with the Government by Lord Inchcape, who undertook to distribute the ships to those British owners who desired them, in proportion to their losses. The agreement was made on the basis that no profit should accrue to him through the transaction. Outside the United Kingdom there were built for the British Government 122 ships, the vessels being built at much higher prices than those paid for the vessels constructed in the United Kingdom. The total cost of these vessels was £26,884,000, and the selling price was £18,289,000, showing a loss on the ships built abroad of £8,595,000. The net profit on 378 ships built and sold, excluding any allowance for depreciation, was £2,515,000. Colonel Wilson maintained that the Government would have been fully justified in taking depreciation into account, and, allowing 5% depreciation on 311 ships which were being worked, there would have been a net profit not of £2,515,000, but of £5,122,000. Again, but for the new ships it would have been necessary for the Government to try to charter neutral vessels, for which high rates of freight would have had to be paid. This would, it was estimated, have involved an additional expenditure of £27,000,000. There was no question that the Government acted wisely, at any rate from the financial point of view, in disposing of the ships when it did. They were offered to the ship-

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ping industry at a time when freights were still high, and so substantial prices were bid. A very different situation existed when the ex-German ships allotted to this country were offered to British shipowners, again through the medium of Lord Inchcape. Severe depression had, by then, fallen on the shipping industry, and the absorption of the ships, many of which were not of attractive type to British owners, was a very slow matter.

Replying to a question in the House of Commons on May 24 1921, Sir Robert Horne, the Chancellor of the Exchequer, stated that 202 ex-enemy ships allotted to the British Empire for final ownership had been sold, and that 85 merchant ships and 22 trawlers remained unsold. The gross amount realized was £14,523,074. From this gross total there fell to be deducted expenses of repair, delivery, etc., and a considerable part of the purchase money was payable in instalments over a period of years. The net cash then passing was £6,500,000.

War Services of the Mercantile Marine.—All the classes of British ships which form a great mercantile marine rendered services of immense value to the Allies during the war. Merchant vessels, in comparison with warships, were once described as being mere cockleshells, yet their crews faced the hidden dangers of mine and torpedo without flinching. The persistent reduction of the British mercantile marine which proceeded was a matter of extreme gravity to the Allies. Experience showed that the losses of the large and fast liners were, in every way, more formidable than those of the ordinary cargo vessels. When at last the United Kingdom, enthusiastically supported by the United States, bent energies on the construction of merchant vessels, it was the simple cargo steamers that were built. In both countries the plan of building simple vessels of standard type was adopted. Everything that was complicated was ruled out. Straight lines were substituted for curves, and parts were produced in great numbers, so that identical ships could be built rapidly. In the United States the principle of standard construction was carried further than in England. There, steel works, which had never undertaken shipbuilding work before, produced shapes and angles for ships, and the assembling of the parts was carried out by bridge builders and other steel workers who had had no previous experience of shipbuilding. In England fabrication on somewhat similar lines was planned in connexion with the new shipyards on the river Wye, of which control was assumed by the Government, but these plans did not begin to show their full effect until the conclusion of the war made such methods no longer necessary. While, in a case of emergency, a good case could be established for building cargo vessels in mass production, like Ford motor-cars, there was no similar way of building the large liners. In the height of the crisis and, indeed, throughout the war, the building of such vessels yielded place to the need for carriers of food and munitions. Yet the duties devolving on the liners steadily increased. At first a comparatively small number were requisitioned to serve as merchant cruisers, patrol vessels, hospital ships, and transports. The Dardanelles campaign made heavy demands on this type of vessel, and, later, the Salonika expedition. The climax was reached when, in the spring, summer and autumn of 1918 every possible ship that could be provided was needed to transport American troops. Liners were withdrawn from every British service and vessels never intended for such work were put into the N. Atlantic route. It was indeed fortunate for the nation that a large mercantile marine was in existence at the outbreak of war, and the magnificent services of some of the greatest ships will be always remembered.

Of all the crimes committed by Germany at sea, the destruction of the "Lusitania" on May 7 1915 remains the outstanding example. The liner was torpedoed near the Old Head of Kinsale, when 1,195 persons were drowned, including 291 women and 9 children. Represented in tonnage alone this loss was exceeded by the "Britannic," sunk in the Aegean Sea on Nov. 21 1916, by submarine or mine, while employed as a hospital ship. The "Britannic," uncompleted on the outbreak of war, was of 48,158 tons and was the largest White Star liner. The "Lusitania," built in 1907, was of 31,550 tons.

Splendid service was performed by the sister ship "Mauretania." At first she was employed in the ordinary trans-Atlantic service, where her speed was of great importance in view of possible attacks by German cruisers. In June 1915 she flew the White Ensign, conveying troops to Mudros for the Gallipoli campaign. Four months later she became a hospital ship. In Dec. 1916 she again became a troopship and brought Canadian troops to this country. Early in 1918 she became an armed cruiser, but was soon engaged in bringing American troops to Europe. She also carried many distinguished passengers whose urgent duties made it necessary for them to cross the Atlantic. Fine service was also rendered by the Cunard liner "Aquitania," of 45,600 tons. Only three round voyages between Liverpool and New York had been made by this great ship before the war. At once she was requisitioned by the Admiralty and was commissioned as a merchant cruiser, leaving Liverpool in this capacity four days after the outbreak of war. She became a transport later and carried 30,000 troops to the Dardanelles; then she became a hospital ship and as such carried 25,000 men. Early in 1918 she was refitted as a transport, and in nine voyages carried 60,000 American troops. The liner was extremely useful in repatriating troops after the Armistice, and in the spring of 1921, in the middle of the shipping depression, had the reputation of being the only ship afloat that was earning any money. Besides carrying large numbers of saloon passengers, she was eminently fitted for the transport of emigrants, of whom she carried enormous numbers from the Continent.

The "Carmania," well known as a Cunard liner before the war, distinguished herself by sinking the German merchant cruiser "Cap Trafalgar" in a duel. The "Laconia," another Cunard liner, shared in the operations in the Rufiji river, East Africa, when the German cruiser "Königsberg" was sunk. Besides the "Lusitania," the Cunard Co. lost the following vessels:—the "Caria," "Veria" (1915), "Franconia," "Alaunia" (1916), "Ivernia," "Lycia," "Folia," "Trachia," "Feltria," "Ultonia," "Volodia," "Vinovia" (1917), "Andania," "Valeria," "Aurania," "Ansonia," "Vandalia," "Carpathia," "Flavia" and "Ascania" (1918). These represented extremely serious losses, and after the Armistice the company put in hand an extensive programme of construction. Unfortunately the cost of building was then on a very high level.

Losses of the White Star Line were also serious and included, besides the "Britannic," the "Oceanic," "Arabic," "Laurentic," "Cymric," "Afric," "Georgic," "Cedric" and "Delphic." Shortly after the outbreak of war, the "Oceanic," "Teutonic," "Cedric," "Celtic" and "Laurentic" were commissioned as armed cruisers. The "Laurentic" was sunk by submarine off the coast of Ireland in Jan. 1917, while carrying gold, of which a substantial proportion was recovered in salvage operations after the Armistice. The "Teutonic," built in 1889, and one of the most famous of the White Star liners, was subsequently acquired by the Government and was later publicly offered for sale. Services of immense value were rendered by the "Olympic" of 46,439 tons. She was employed in carrying troops to Gallipoli and in bringing, first, Canadian troops, then Chinese labour battalions, and, finally, American troops to Europe. Her war record included that of transporting more than 200,000 persons during the period, including the wives and families of Canadian soldiers returning to Canada after the war. Among her special services were the rescue of the company of the super-dreadnought battleship "Audacious," sunk by a mine off the N. coast of Ireland, and the ramming of a large German submarine in the English Channel in May 1918.

Several of the ships of the allied company, the Atlantic Transport Co., were employed in the transport of troops. These included the liners "Minneapolis," "Minnesota," "Minnewaska," "Minnetonka," "Marquette," "Manitou," "Menominee," "Missouri" and "Maryland." Besides carrying troops, the vessels of the Atlantic Transport Co. carried large numbers of horses and mules, for which service the vessels were especially suitable. The losses of the line, representing 24,100 tons, or 43% of the fleet, included all the regular passenger liners which were most favourably known in the trade between London and New York.

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Liners of the Canadian Pacific Ocean Services were employed as merchant cruisers and transports. At once the "Alsatian," "Victorian" and "Virginian" were requisitioned and placed in the 10th Cruiser Squadron which was responsible for a share of the blockade of Germany. The "Calgarian" was sunk on March 1 1918 when proceeding in charge of a convoy of 30 ships.

The total number of vessels lost by the P. & O. Co. and its allied lines was 81, representing 491,600 tons, while 14 vessels of 76,600 tons were lost through marine causes. One of the most heroic actions of war at sea was fought between the "Otaki" of the associated New Zealand Shipping Co. (whose commander, Lt. Archibald Bisset Smith, received a posthumous award of the V.C.) and the disguised heavily armed German cruiser "Moewe." After the "Otaki" had suffered several casualties and much damage had been done to the hull which was heavily on fire, Lt. Smith ordered the boats to be launched in order that the crew might be rescued. He remained on the ship and went down with her when the vessel sank with colours flying.

The Orient Co.'s liners "Otranto," "Orama" and "Otway" were early commissioned as armed cruisers and, at the beginning of 1915, the "Orvieto" and "Ophir" were likewise commissioned. Subsequently the "Ophir" was bought by the Government. Other vessels of the line were employed as transports. The "Otranto" was lost by collision on Oct. 6 1918.

Heavy losses were suffered by the various companies controlled by Sir John Ellerman. In all, 103 ocean vessels, with a total cargo capacity of 600,000 to 750,000 tons, were destroyed. These included the liner "City of Athens" mined off Cape Town in Aug. 1917. The "City of Winchester" was the first merchant vessel to be destroyed during the war, being captured by the German cruiser "Königsberg," while homeward bound from India with a very valuable cargo of produce. Another liner belonging to the Ellerman fleets was mined far from Europe. The "City of Exeter," a fine passenger ship, struck a mine in the Indian Ocean, about 400 m. from Bombay. Number 1 hold filled at once, and the master gave orders for the passengers and crew to leave the ship. Then the master and chief engineer returned and, at grave risk, made a thorough examination of the ship. They decided that, with the exercise of the greatest care, the crippled vessel could reach Bombay under her own steam. The passengers reëmbarked and the vessel safely arrived in port. This was only one example of fine seamanship, of which there were many hundreds of magnificent cases during the war. When the enemy's submarine campaign became intensified not a voyage through infested waters could have been completed without the exercise of courage of the highest order, and repeatedly the seamanship and endurance of the officers and crews were put to the severest test. There were lurking dangers for the ancient little collier which had to feel her way up and down the North Sea, her one protection being a little gun—slight armament against a powerfully armed submarine; for the great liners which proceeded without escort and relied on their speed, their own guns, their "dazzle painting," and their zig-zag courses to baffle the efforts of the enemy to sink them with, perhaps, several thousand troops on board; and for the slower cargo vessels which, in convoy formation, when thick weather obscured the other ships, ran the very serious risk of collision.

Vessels of the Royal Mail Steam Packet Co. had the distinction of being the first among British liners to be fitted before the the war for carrying a gun for defensive purposes. This was in accordance with the policy initiated, before the war, by Mr. Winston Churchill when First Lord of the Admiralty. Royal Mail vessels were largely employed as armed cruisers, transports and hospital ships. As armed cruisers there were commissioned the "Andes," "Arlanza," "Almanzora," "Avon," ("Avoca"), "Ebro" and "Alcantara." The last named, only lightly armed, fought the disguised German raider "Greif" for 20 minutes in the North Sea, and sank with colours flying just before her enemy went to the bottom. The "Asturias" was torpedoed while bearing all the marks of a hospital ship. Other ships of the line which bore the Red Cross were the "Araguaya," "Drina," "Essequibo," "Tagus," "Agadir," "Berbice" and "Balantia" (renamed "St. Margaret of Scotland"). Many vessels of the fleets were sunk, including the large liners "Amazon," "Drina," and "Merionethshire."

No fewer than six of the Union-Castle liners were torpedoed or mined while serving as hospital ships, namely, the "Galeka," "Braemar Castle," "Dover Castle," "Glenart Castle" (twice), "Gloucester Castle," and "Llandovery Castle." While based on Southampton the hospital ships of the company carried 331,000 British wounded officers and men to port and also landed 8,200 enemy wounded. The liners "Armadale Castle," "Edinburgh Castle," "Kinfauns Castle," and "Kildonan Castle" were commissioned as armed merchant cruisers. The company's vessels also carried very large numbers of troops. It was not surprising that, after the Armistice, many months elapsed before a sufficient number of vessels could be again placed in the ordinary S. African passenger service to provide weekly sailings.

Recognition of the services of British shipping during the war was made by the King and his ministers in various speeches. Speaking at the Guildhall on July 29 1919, the King declared that the splendid services of the officers and men of the British mercantile marine had been vital to the successful issue of the war. From day to day these men had been facing death no less than the soldiers in the fighting line, and, even when the submarine menace was at its height, no single British crew ever refused to sail. He urged the re-creation of the merchant navy and the development of the ports as essential if the United Kingdom was to regain its old supremacy.

Men of the mercantile marine marched in the procession of the Allied and Associated Forces through the streets of London on July 19, 1919. There was also a special pageant of the Sea Services on Aug. Bank Holiday 1919. This took the form of a procession of lifeboats, bearing the House flags of all the shipping companies, from the Pool of London to Chelsea. The procession was headed by a launch flying the flag of the Port of London Authority, followed by a steam vessel of Trinity House, with the Duke of Connaught, as Master, on board. Then came a picket boat with a naval officer in charge as escort to the Royal barge. In this were the King and Queen, Queen Alexandra, the Prince of Wales, Prince Albert (afterwards Duke of York) and other members of the Royal Family. Following this was a specially prepared barge bearing the Lords of the Admiralty and then the Lord Mayor, as admiral of the Port of London, in the barge of the commander-in-chief at the Nore. These were followed by launches of the Ministry of Shipping, the Customs and Excise, Lloyd's and the Thames Conservancy. A dozen twelve-oared naval cutters, four picket boats and an armed motor-launch of the navy, models of naval guns, motor and steam lifeboats, a motor-launch carrying Trinity House pilots, steam-boats of the Mercantile Marine Association and boats from the training ships, fishermen's motor drifters, and vessels representing the Missions to Seamen. The rear was brought up by 70 lifeboats towed by tugs bearing the flags of the various shipping ownerships. Bands were placed along the line of route and famous old sea songs were sung. Such a commemoration was unprecedented, but then the services of the mercantile marine during the war were likewise unique.

The Commonwealth Government Line.—In the summer of 1916 a development occurred of great importance to shipping. For some time Australia had been seriously disturbed about the difficulties encountered in arranging for her exportable surplus of wheat, a matter of vital importance to the Commonwealth. With the ever-diminishing supply of tonnage, British vessels had naturally been directed more and more into the N. Atlantic, since it was obviously much quicker to bring wheat to the United Kingdom—less than 3,000 m. across the ocean—than more than 12,000 miles. Mr. W. M. Hughes, the Prime Minister of Australia, arrived in the United Kingdom in March 1916, but he got little satisfaction from the Imperial authorities on the shipping question. He sailed for home in June and, when he was on the water, the announcement was made that he had bought, on account of the Commonwealth Government, 15 second-hand

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cargo vessels. The steamers had an average dead-weight carrying capacity of between 7,000 and 8,000 tons, and 10 of them were taken from Messrs. Burrell's Strath line. For the larger vessels the price worked out at about £19 a ton. This was, perhaps, from four to five times greater than the pre-war price, but as events occurred, the purchase proved a profitable one, financially, for Australia. One effect was that the vessels were removed from the United Kingdom Register and were no longer subject to excess profit taxation. This action of Mr. Hughes hardly commended itself to any of the shipping authorities in the United Kingdom, but he had shown unmistakably that full recognition had to be given to the Australian viewpoint. In the autumn of that year the President of the Board of Trade announced that a large purchase had been made of Australian wheat on behalf of the Imperial Government, and that a number of steamers had been requisitioned to proceed to load the wheat in Australia. As the supply of available shipping became steadily less, it proved impracticable to transport all the wheat bought, and immense quantities were stored in Australia until after the conclusion of the war.

The purchase of the 15 cargo vessels represented the foundation of a Commonwealth Government line. Being free from taxation and with freights ruling high, large profits were earned, which made the venture temporarily, at any rate, profitable to the Australian people. A number of German steamers seized in Australia were added to the fleet and, later, ships were built both in Australia and the United Kingdom. In 1919 Mr. W. M. Hughes, on a visit to the United Kingdom, placed contracts for five large steamers with leading builders. These were designed for carrying a large amount of refrigerated cargo, and some hundreds of third-class passengers. Limited accommodation was to be provided for a few passengers in the saloon. The first of these steamers, the "Moreton Bay," of 14,500 tons gross, was launched from Messrs. Vickers's shipyard at Barrow on April 23 1921. It was then asserted that the four other vessels would be in the water during the ensuing few months, and that all the vessels would be in service before the end of 1921. Between the time of the placing of the contracts in 1919 and the time of launching, the cost of ship construction had risen very seriously. All work was done on the "time and lime" principle, by which the owners paid for the cost of materials, the cost of labour, an allowance for overhead charges, and a sum, either as a fixed amount or as a percentage on the outlay, as profit to the builders. The ships were thus understood to have cost considerably more than had been expected, and with freights falling, the problem of making the vessels pay their way was enhanced. A wooden ship programme carried out for Australia in the United States was hardly successful financially. The building of wooden vessels, of which large numbers were constructed for the American mercantile marine, could only be regarded as an emergency measure. The inauguration of the Commonwealth line aroused much criticism from shipping managers, who cordially disliked the idea of a State enterprise. They maintained, and could do so justifiably, that a State enterprise could be carried on without the same consideration for profit and loss as a public company, if, for instance, a Government chose to carry merchandise at below cost price.

The Canadian Merchant Marine.—Canada instituted a line of Government steamers. It found itself after the Armistice with a great fleet of vessels which had been built in the period of emergency. Instead of offering them to the shipping industry, it decided to operate them on account of the nation. A corporation was formed, entitled the Canadian Government Merchant Marine, Ltd., in close conjunction with the Canadian National railways. The policy of the management was to institute new services and to work in coöperation with the existing lines, rather than to compete with them. New services were established to and from the United Kingdom and many parts of the world. In 1920 an agreement was entered into with Messrs. Alfred Holt & Co. for a joint trans-Pacific service to and from Vancouver, and with the British India Co. for a service between Montreal and Indian ports, via the Suez Canal. In the United Kingdom the Cunard Co. acted as managers for the line. The usual practice in making these arrangements with the shipping companies was for the Canadian National railways to represent the steamship companies in Canada, and for the agents of the shipping companies abroad to act similarly for the railways. This policy of working in conjunction with the shipping companies disarmed criticism, which was very strong in the case of the Australian scheme.

Amalgamation and Fusion Schemes.—Numerous amalgamations and fusion schemes took place between 1910 and 1921. Sir Owen Philipps, who at the beginning of 1910 was chairman of the Royal Mail Steam Packet Co., was particularly active in the policy of fusion. In that year the capital was acquired of the Pacific Steam Navigation Co., which was mainly interested in the trade with the E. and W. coasts of S. America. In the same year a fusion agreement was entered into with Elder, Dempster & Co., Ltd., which owed its development largely to the genius of the late Sir Alfred Jones. In 1911, the capital was acquired of Lamport & Holt, Ltd., largely concerned in the trade between the United Kingdom and also the United States and S. America, and in the same year an agreement was entered into with the Glen Line, Ltd., which is concerned in Far Eastern trade. Incidentally, the Glen Line is notable among British ownerships for its policy of building motor-ships, which is known to have been very successful. In 1912 the capital of the Union-Castle Co. was acquired by the Royal Mail Co. and the Elder Dempster Co. This, perhaps, was the most important of the fusion agreements which Sir Owen Philipps effected. The Union-Castle Co., a consolidation of the old Union and Castle companies in the S. African trade, had been feeling the loss of a great chief in the death of Sir Donald Currie, to whose extraordinary powers the line owed very much. In 1913 control was secured of the Nelson Lines, Ltd., which was and is engaged in the carriage of meat to the United Kingdom from Argentina, together with participation in the passenger trade. In 1917 an interest was acquired in MacAndrews & Co., Ltd., concerned in trade with the Peninsula; in the Coast Lines, Ltd., a consolidation of coasting companies trading round the United Kingdom; and in the Moss Line, Ltd. In 1919 an interest was secured in the old-established ownership of David MacIver & Co., Ltd., in Messrs. Bullard, King & Co., Ltd., and in Messrs. J. & P. Hutchinson, Ltd. While Sir Owen Philipps thus had enormous interests in British shipping, Lord Inchcape was also to the forefront in effecting fusion schemes.

At the end of 1914, Sir Thomas Sutherland retired from the positions of chairman and managing director of the P. & O. Company. For 42 years he had occupied the office of managing director and for 34 years that of chairman. The expansion of the P. & O. Co. will always be associated with his name. His last important act was to effect an amalgamation with the British India Co., of which Lord Inchcape was managing director. On the retirement of Sir Thomas Sutherland, Lord Inchcape became chairman and managing director of the P. & O. Company.

In June 1916, the P. & O. Co. acquired an interest in the New Zealand Shipping Co., which, in turn, controlled the Federal Line trading with Australia. Exactly a year later, in June 1917, a representative interest was secured in the Union Steamship Co. of New Zealand, which not only provided various coasting services in New Zealand, but also maintained services with Australia, British Columbia, and India. In the autumn of 1917 shares were secured in the Hain & Mercantile Steamship Co., and also in the Nourse Line, each of which possessed a considerable amount of cargo tonnage. The fleets of these three companies, together, included 107 steamers of 370,000 tons gross.

Other notable fusions of the war period included the acquisition of a controlling interest in the Prince Line, Ltd., which had been associated with the name of its founder Mr. James Knott. This acquisition, which was effected in Aug. 1916, involved the addition of 37 steamers, mainly cargo vessels, to those controlled by Messrs. Furness, Withy.

In Oct. 1916, Sir John Ellerman, chief of the Ellerman Lines, acquired all the shares of Messrs. Thomas Wilson, Sons & Co., Ltd., the Wilson fleet including nearly 80 vessels of about 200,000 tons. Its services were based on Hull. At almost the same time an agreement was concluded between the Anchor Line (Henderson Bros., Ltd.) and the Donaldson Line, Ltd., for a fusion, under the title of the Anchor-Donaldson Line, with Sir Alfred Booth, chairman of the Cunard Co., as chief of the new formation. The agreement meant that the Cunard Co. secured control of the Donaldson Line, for it already had a controlling interest in the Anchor Line.

Shipowners' Associations.—Important work was done by the Liverpool Steamship Owners' Association, especially through the war period. It acted on the principles upon which it was founded in 1848. These were, broadly, that the growth and prosperity of the British mercantile marine is dependent on the enterprise, skill and ability of the individuals directly concerned, and that neither State control nor State aid can prove an effective substitute for these qualities. The Association has not sought to interfere with the individual freedom of its members. It has, however, consistently opposed

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all measures calculated either to transfer the control of the country's shipping to official hands, or to hamper its development by rigid rules and standards. It has recognized that the first duty of the shipowner is to secure the safety of the lives and property entrusted to his care, but it has maintained that the individual shipowner, as long as he is discharging that duty, is entitled to carry on his business in the manner which will attain the best results.

The Association had much to do, particularly through the work of its secretary, Sir Norman Hill, with the establishment of the War Risks Insurance Scheme. Throughout the war period it consistently worked with the object of getting the maximum number of voyages made and the maximum number of cargoes carried. It coöperated with the Government authorities when control of shipping was obviously necessary, and when the great emergency had passed, it pressed for freedom for the shipping industry.

A marked development has taken place in recent years in the organization of London shipowners through an extension of the activities of the Chamber of Shipping of the United Kingdom. Rather curiously, the formation of the Chamber in Feb. 1878, was distinguished by the appointment of a Hull shipowner as president. This member was Mr. Henry John Atkinson. The Chamber was composed of local shipowning associations in various ports and of most of the Protection and Indemnity Clubs, with a central office in London. Its primary objects were to discuss questions affecting shipping; to disseminate information, from time to time, on matters concerning the industry, and to secure the advantages of united action, especially in communications with the Government and various bodies. The Chamber did useful work for many years under its original constitution, but the events of the war showed the need for a more effective organization that would include all classes of shipping. Largely due to the enterprise of Sir Kenneth Anderson, the president of the Chamber in 1915, the reconstruction of the Chamber was carried out. Sir Kenneth Anderson was succeeded as chairman in 1916 by Sir William Raeburn, who held the office for three years assisted by Mr. J. Herbert Scrutton as vice-president. During the years 1916–7 new life was put into the Chamber, and much was done to keep the public informed on matters affecting the shipping industry. Until the reconstruction, the Chamber was fairly representative of the ordinary cargo steamship owners, but the great passenger and cargo steamship companies had not actively been identified with its work. In 1917 a number of highly important steamship companies joined the Chamber, including the Peninsular and Oriental Steam Navigation Co., the Royal Mail Steam Packet Co., and the Union-Castle Mail Steamship Company. The finances were put on a sound basis, enabling the necessary cost of maintaining the work to be secured on the plan of a levy on the tonnage. New offices were taken, and Mr. H. M. Cleminson, a leading shipping lawyer and member of the firm of Messrs. Botterell & Roche, was appointed general manager. Sir William Raeburn, who was elected president in 1916, held office for two years and was succeeded as president by Lord Inchcape in 1918, who also held the position for two years. In 1920 Mr. W. J. Noble was elected president. He was succeeded by Sir Owen Philipps in 1921, with Sir Frederick Lewis as vice-president.

The constituents of the Chamber at the beginning of 1921 consisted of 19 local and special associations, such as those at Belfast, Swansea, on the N.E. coast and Glasgow; 11 Protection and Indemnity Clubs; 7 Freight, Demurrage and Defence Clubs and shipowners entering their tonnage direct, of which early in 1921 there was 5,430,800 tons. The aggregate amount of tonnage entered under the heading of Protection and Indemnity Clubs represented 6,364,300 tons. Membership of these clubs is open to any shipowner possessing a seaworthy vessel who wishes to cover himself against third-party risks. Only British owners are eligible for membership of the Chamber. Until 1919 the Chamber was not incorporated, but in that year it obtained the grant of a Royal Charter. The business of the Chamber is conducted by a council of shipowners who are nominated by the various constituents. Incorporated in the Chamber is the Documentary Committee, which examines and approves forms of charter between shipowners and merchants.

Statistics.—In the 1919–20 edition of Lloyd's Register of Shipping, the figures for the mercantile marines of the principal maritime countries before and after the war were set out. These figures were so important and authoritative that they are given in the table following. Outstanding facts were the decrease of 2,547,000 tons in the shipping owned by the United Kingdom, the gain of 7,746,000 tons to the seagoing merchant marine of the United States, the loss of 1,888,000 tons by Germany, and the gain of 617,000 tons to Japan.

Steam Tonnage of Principal Countries, 1914, 1919.

Country	June 1914 Thousand tons gross	June 1919 Thousand tons gross	Difference Thous'd tons	Difference Per cent.
United Kingdom	18,892	16,345	−2,547	− 13·5
British Dominions	1,632	1,863	+ 231	+ 14·1
America (United States):				
Seagoing	2,027	9,773	+7,746	+382·1
Great Lakes	2,260	2,160	− 100	− 4·4
Austria-Hungary	1,052	713	− 339	− 32·2
Denmark	770	631	− 139	− 18·1
France	1,922	1,962	+ 40	+ 2·1
Germany	5,135	3,247	−1,888	− 36·8
Greece	821	291	− 530	− 64·6
Holland	1,472	1,574	+ 102	+ 6·9
Italy	1,430	1,238	− 192	− 13·4
Japan	1,708	2,325	+ 617	+ 36·1
Norway	1,957	1,597	− 360	− 18·4
Spain	884	709	− 175	− 19·8
Sweden	1,015	917	− 98	− 9·7
Other Countries	2,427	2,552	+ 125	+ 5·2
Grand total	45,404	47,897	+2,493	+ 5·5
Total abroad	26,512	31,552	+5,040	+ 19·0

Within 12 months the position was very much changed. The total tonnage of the world increased from 47,897,000 tons in June 1919 to 53,905,000 tons in June 1920, an increase of 6,008,000 tons. The loss suffered by the United Kingdom as at June 1919 of 2,547,000 tons had been reduced to a decrease of only 781,000 tons. The United States gain of 7,746,000 tons had been increased to one of 10,379,000 tons. Germany's loss had been increased by the surrender of tonnage, from 1,888,000 tons to 4,716,000 tons. Japan further increased her gain of 617,000 tons to 1,288,000 tons. Once more the Register endeavoured to estimate what would have been the position of the world's mercantile marines in 1920 if there had been no war. It found that the loss suffered by the United Kingdom was 2,920,000 tons; that of Germany 6,103,000 tons; and that of other countries a loss of 3,330,000 tons, making a total loss of 12,353,000 tons. As against this loss, the United States gained 8,837,000 tons, thus reducing the world's net loss to 3,516,000 tons. This estimate again did not take into account the question of the comparative efficiencies of the mercantile marines before and after the war. While such calculations are of great interest, the fact remains that, as the result of the great shipbuilding effort during the war, the world's shipping was greater in June 1920 by 9,282,000 tons. This figure was increased further during the year. The president of the Chamber of Shipping of the United Kingdom stated at the annual meeting held on Feb. 25

In this edition the Register went further than setting out the actual figures of gains and losses. It attempted to estimate the position of the world's tonnage as it would have been if there had been no war. There were obvious difficulties in the way of arriving at a definite conclusion in the case of various countries, for many factors had to be taken into account, but a careful estimate was prepared on the following assumptions. These were: (1) it was reasonable to expect that the percentage of addition to the world's tonnage would have continued at the ratio (a decreasing one) recorded during the previous 15 pre-war years, and that the percentage of the United Kingdom tonnage to the world's tonnage would show, approximately, the same ratio of decrease recorded during the most recent of these years; (2) countries in which there had been a large addition of tonnage during the previous quinquennial period might be expected to show a reduction in the ratio of increase, and, as a rule, the larger the previous increase the larger would such reduction be; (3) allowances were made in the special cases of countries where pre-war conditions pointed to the acquisition of tonnage, in the near future, at a higher ratio than that recorded during the previous period.

The net result of the calculations made was to show that the British mercantile marine had suffered a loss of 5,202,000 tons, and foreign mercantile marines, with the exception of the United States of America, a loss of 9,000,000 tons, making a total loss to the world of 14,202,000 tons. As a partial set-off to these losses, the United States gained 6,729,000 tons, so that the net world's loss expressed in gross tonnage, was 7,473,000 tons. Germany's loss was set out as 3,582,000 tons, but it was explained that her losses were actually greater, since vessels which at the date of the Armistice had not been captured or requisitioned by other countries were included in her mercantile marine. Excluding enemy countries, the greatest sufferers after the United Kingdom were Norway, whose losses were estimated at 1,025,000 tons; Italy, which suffered a diminution of 677,000 tons; and France with an estimated loss of 536,000 tons.

In these calculations the question of the comparative efficiencies of the pre-war and post-war merchant fleets was not taken into account. The Register pointed out that, apart from additions to the merchant fleets of the world before the war, replacements of steam tonnage lost, broken up, etc., amounted each year to about 1½ % of the total tonnage owned, while during the war it required new tonnage equivalent to 33 % of the steam tonnage owned in 1914 to replace the losses. There is no doubt that a large amount of the tonnage afloat at the end of the war represented shipping which, in ordinary conditions, would have been broken up and replaced by modern and more economical vessels. How this factor affected the statistical position is indicated by the statement that in the three pre-war years 1911–3, nearly 2,000,000 tons of steamers were sold to foreign owners and replaced by better vessels, while during the three years 1916–8 probably less than 100,000 tons of steamers were sold in this way. Further, a large proportion of the shipping built during the war was, undoubtedly, not the equal in general efficiency of that built in the few years immediately preceding. Taking all these considerations into account, the Register estimated that, through the war, the world had lost 8,500,000 tons gross of shipping, representing a dead-weight carrying capacity of 12,500,000 tons.

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1921, that the world's merchant shipping since 1914 had been actually increased by more than 10,000,000 tons. Unfortunately for the shipping industry, the world's trade had not developed in proportion. Owing to the complete breakdown of credit in some countries trade was practically at a standstill.

An unprecedented step was taken by the Register in April 1921, when issuing its shipbuilding returns for the first quarter of the year. It issued with these returns a statement to the effect that, as the times were not normal, the figures of tonnage reported to be under construction did not provide a true index of the relative position of the shipbuilding industry as compared with, say, 12 months previously.

The total tonnage under construction in the United Kingdom at the end of March 1921 was given as 3,798,500 tons represented by 884 vessels. In ordinary times such an amount of work in hand would have indicated great activity and prosperity in the shipbuilding industry. It compared, for example, with 1,890,800 tons under construction at the end of March 1914, showing an increase of 1,907,700 tons, and with 1,722,100 tons under construction at the end of June 1914, the last quarter completed before the outbreak of the war. But the amount of tonnage stated to be in course of construction at the end of March 1921 included a considerable amount on which work had been suspended, owing to the heavy fall in shipping values consequent on the severe decline in freights and the corresponding decline in the demand for tonnage. The tonnage on which work had been suspended in this way amounted to 497,000 tons. There were also included in the total figures some 350,000 tons, the completion of which had been delayed owing to the cessation of work by ship joiners. To arrive at comparative figures, it was therefore necessary to deduct these two figures, amounting together to 847,000 tons, from the amount of tonnage described as being under construction. The total figures of tonnage on which work was actually proceeding at the end of March 1921 was thereby reduced to 2,951,500 tons, showing an increase of 847,000 tons over March 1914.

There would have been grounds for satisfaction in such an increase if the world's commerce had been active. Unfortunately, enormous numbers of the world's inhabitants were taking no part in international commerce, and, further, there were immense numbers who were not producing goods or working at the same rate as before the war. Consequently the construction of so much tonnage, although the work was proceeding at a slow pace, could not be regarded with unmixed satisfaction. Cancellations of shipbuilding contracts by owners were common, and large sums were paid in order that owners might be relieved of their commitments. The surplus of ordinary cargo steamships was especially large. The losses of mail and passenger liners during the war had not been made good, but the high cost of building tended to prevent replacements.

As compared with the figures for the quarter ended Dec. 1920, there was a reduction in the shipping launched during the first quarter of 1921 of 146,000 tons. The tonnage started during the quarter declined by 113,000 tons, while in the tonnage in preparation, but not actually commenced, there was a fall of 75%, as compared with the figures of the first quarter of 1920. Attention was called by Lloyd's Register both at the end of 1920 and in the beginning of 1921 to the lower rate of construction as compared with pre-war times. In 1913 the average amount of tonnage completed during each quarter was over 23% of the total work in hand at the beginning of the quarter, whereas the figures for 1920 fell below 13%. During the first quarter of 1921 the output fell as low as 8% of that under construction at the beginning of the year.

The total amount of tonnage being built abroad was 3,288,100 tons—not quite so large an amount as the tonnage described as being under construction in the United Kingdom, but actually larger than that on which work was actively proceeding there. The Register pointed out that the returns for foreign countries, unlike those for the United Kingdom, were not subject to any material reduction on account of suspended or delayed work, of which there appeared to be comparatively little in other countries. The shipping being built abroad was less by 183,000 tons than that under construction at the end of 1920. The decline was due to the continued decrease in the United States of America, where the tonnage under construction was less by 27% than that building at the beginning of 1919. Apart from the United States, the countries in which the largest amount of shipbuilding was taking place were France, with 427,100 tons, an increase for the quarter of about 30,000 tons; Holland with 417,600 tons; Italy with 351,600 tons; and Japan with 294,300 tons, an increase of 46,000 tons.

The returns showed that there were then 187 steamers and motorships, each of over 1,000 tons, with a total of 1,320,100 tons, under construction for the carriage of oil in bulk. Of the total number, 84, of 557,000 tons, were under construction in the United Kingdom, and 82, of 632,000 tons, in the United States. In the former the oil-tank tonnage represented 57% of the total amount of construction. The tonnage of vessels under construction to be fitted with internal combustion engines amounted to 503,800 tons.

A highly unsatisfactory feature was the diversion of a large amount of British shipping from British to foreign shipyards for reconditioning. This was due to a refusal on the part of the ship joiners to accept the lower wages proposed by the employers and the consequent cessation of work by the ship joiners in the United Kingdom for many months. Large liners were diverted to Dutch and French ship repairing works. The work of reconditioning was essential, and the stoppage by the ship joiners meant the loss of a large amount of work to the United Kingdom, which, it was to be feared, might have a far-reaching effect on the British industry.

Condition and Prospects.—What might be described as a bird's-eye view of the state of the shipping industry during 1910–21 is afforded by the course of prices of a "new, ready, 7,500-ton cargo steamer" as recorded in the chart published by the weekly shipping journal *Fairplay* and described as "Fairplay's Curve." This type of vessel may be considered representative of ordinary cargo steamers. In 1910 the price of such a vessel was £37,000. Prices then rose sharply and by the end of 1911 a price of £47,000 was reached. A further rise took place in 1912 to £58,000. That year, as has been shown, was a prosperous one for shipping, and from the high point reached, values fell to £48,000 at the end of 1913. A further drop occurred in 1914 to £43,000. The great rise then began. By the end of 1914 the price had advanced to £60,000. In 1915 prices more than doubled and £125,000 was reached. In 1916 there was a further advance to £188,000. The effect of the Excess Profits duty was seen in 1917 and values fell to £165,000. In 1918 there was a recovery to £181,000 and then a fall to £169,000. An extraordinary rise took place in 1919, the high price of £232,000 being reached. Early in 1920 there was a further upward movement. Then a great and steady fall began and by the end of the year the value of £105,000 had been reached. In the first six months of 1920, values again receded. On May 24 two new, ready steamers of 9,250 tons dead-weight built by the Furness Shipbuilding Co. to Lloyd's highest class were sold for £85,000 each, representing rather more than £9 a ton. These ships were of the shelter-deck type, with the tonnage openings closed. Vessels of similar size with tonnage openings would carry only 8,300 tons dead-weight, and on that basis the prices bid for the two ships appear somewhat better. Another ship which was of 5,500 tons dead-weight and was built by Charles Hill & Sons, Ltd., of Bristol, was sold for £40,000, representing only rather more than £7 a ton. This particular ship had not been launched, and was not expected to be ready for sea for at least two months.

The Chamber of Shipping estimated that at the beginning of 1921 there were laid up in the United Kingdom, the United States and Scandinavian ports, 5,000,000 tons dead-weight of shipping, or, approximately 3,000,000 gross. This amount of tonnage was made up of 2,250,000 tons in the United Kingdom, represented by 600 vessels, of 2,000,000 tons in the United States represented by 250 vessels, and of 750,000 tons represented by 428 vessels in Scandinavian ports. In addition, many vessels were laid up in Spain, Italy, Japan and other countries, and in the early months of 1921, the amount of tonnage laid up throughout the world steadily increased.

In 1920 there took place the greatest fall in freights that has ever been recorded. The extent of the drop is shown by the movement of the time charter rate, *i.e.* the monthly rate of hire for ordinary cargo steamers. When vessels are chartered in this way the owners provide and pay the crews and pay for the stores. The charterers pay for the coal, since the amount consumed and the cost depend upon the trade into which the vessel is put. At the beginning of 1920 the usual time charter rate for cargo steamers was 30s. a ton dead-weight. By midsummer the rate had dropped to 20s. a ton or rather less. By the end of the year the rate had fallen to 10s. a ton, and with very little inquiry it fell further. By the end of the first quarter of 1921 steamers were chartered at a rate of 6s. a ton. There were also heavy falls in the voyage rates.

As compared with maximum rates during the war for free British steamers bringing grain from Argentina of about 183s. a ton, the freight early in 1921 had fallen to about 35s. Then, when the coal stoppage occurred at the end of April, rates advanced, owing to the necessity of steamers proceeding from this country in ballast, and to the difficulty of securing bunkers. By the end of May, rates of about 57s. 6d. a ton were being quoted for vessels that were available for immediate loading. It was generally accepted in shipping circles that a freight of about 50s. was necessary to cover the cost of sending a vessel to S. America in ballast and bringing her home with a cargo of grain. The fact that, before the war, cargoes of coal had always been available from the United Kingdom meant competition for the homeward voyage and enabled freights to be restricted. The new conditions were distinctly serious for the shipping industry.

Coal also represented a serious problem for the liner companies. Sir Owen Philipps, chairman of the Royal Mail Steam Packet Co., gave some figures respecting comparative costs at the annual meeting of the company in June 1921. He stated that in 1902 the average cost of all coal consumed by the company's steamers in all ports served, including rail carriage and freight, was exactly 22s. a ton. In 1903, the average price had increased to 22s. 3d., while 10 years later, in 1913, the average cost, including railage and freight, had increased to 22s. 11d., which was then considered a very high average price. In 1920, the average cost per ton of all coal consumed by the company's steamers, including railage and freight, was 120s. 1d. Early in 1921 the price fell very considerably, largely owing to the supply of coal by Germany to France and Belgium, with a consequent falling off in the demand for British coal. Then when the stoppage at the British collieries had been proceeding for some little time, and stocks were being exhausted, British shipping had to look to the Continent for supplies.

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The Cunard and White Star companies were in a favourable position as regards the great trans-Atlantic liners, "Aquitania," of 45,600 tons, and "Olympic," of 46,300 tons, since these vessels had been adapted to the use of oil fuel in 1920. Oil fuel, after the war, increased in popularity, although some owners hesitated to commit themselves too much to it, owing to fears that supplies would not be sufficiently abundant, and planned their vessels with a view to the use of either oil or coal. Scandinavian owners, especially, pinned their faith to motor-engines, and it was notable that while coal-burning steamers were laid up idle, motor vessels belonging to the same ownerships were being profitably employed. There was good reason to believe that an extensive development of the use of motor-engines was to be expected. It was quite certain in 1921 that a strenuous competitive period lay ahead for shipping, and owners had to take into account all possible measures conducive to cheap transport at sea. (C. MA.)

(2) UNITED STATES

From the founding of the Federal Government in 1789 onward the United States has possessed a considerable merchant marine. For a hundred years it was the second power in amount of merchant tonnage in the world, surpassed only by the United Kingdom. From the end of the Civil War in 1865 to the outbreak of the World War in 1914, though the American flag was infrequently seen in foreign waters, a great and valuable merchant shipping was in existence, with well-equipped shipyards and a large force of officers and seamen, chiefly employed in home trade on the Great Lakes or on the Atlantic, Gulf and Pacific seaboards with their insular dependencies. The American people at no time in their history have been out of intimate touch with shipbuilding and navigation.

Unlike other nations the United States has steadily maintained an important and increasing waterborne domestic commerce capable of holding its own with formidable railway competition. This coastwise commerce, including the trade with Alaska, Porto Rico and Hawaii, by an unshaken national policy, has been reserved entirely to American vessels, and has had a significant bearing on the development of the American merchant marine. It is interesting to recall that in 1860, the year before the opening of the Civil War, the commercial fleet of the United States was divided almost equally between 2,379,396 gross tons registered for foreign commerce and 2,644,867 tons enrolled or licensed for coastwise carrying. In 1866, the year after the close of the Civil War, the registered foreign trade fleet, as a result of the war, had fallen off to 1,387,756 gross tons—a decrease of almost a million tons—while the coastwise fleet had increased to 3,381,522 tons. This tendency of the foreign trade shipping to decrease, and of the domestic trade fleet to grow, was even more manifest by the year 1910, when the former had fallen to 782,517 gross tons, or actually less than the 981,019 tons which the United States had possessed a century earlier in 1810, while the coastal fleet had increased to 6,668,966 tons, or more than twice as much as the entire American commercial shipping of 1860.

This sharp contrast between the steady decline of the overseas tonnage and the unbroken advance of the domestic tonnage is attributable to the intensity of foreign competition in the one trade and to the absence of it in the other. Through those years the wages of American crews and their subsistence and general style of living imposed a higher cost upon the operation of American ships, and American-built ships in addition bore a substantially higher cost of construction. Moreover, American laws and regulations governing ships have contributed somewhat to this higher expense by their more exacting character. Against this higher expense the coastwise vessels from 1860 onward were absolutely protected by the exclusion of foreign vessels from domestic trade, while the overseas vessels were protected in no way whatever, except for casual postal subsidies to a few regular lines. In view of the fact that from 1860 high protection has been almost continuous in the United States, this exception of the most intensely competitive of industries, ocean shipping, is difficult to understand. The generally accepted explanation is that it has not been possible at any time to present a definite form of national encouragement to the overseas shipping industry which was acceptable to all of the various sections of the country. Subsidies have almost been voted by Congress several times. Discriminating customs duties and tonnage dues, an expedient first adopted in 1789 and maintained in whole or in part for 60 years thereafter, have had a powerful advocacy but, as a matter of fact, have never been made effective because of general commercial treaties which have forbidden them. "Free ships"—that is, the free admission and registry of foreign-built vessels instead of the general prohibition of American registry for foreign-built vessels obtaining since 1789—were adopted for vessels of less than five years of age in the Panama Canal Act of 1912, but had remained wholly futile up to the war of 1914, which suddenly gave exceptional value to the flag of the greatest neutral.

Pre-war Position.—American overseas shipping as distinguished from coastwise shipping reached almost the lowest ebb in 1910, when only 782,517 gross tons were recorded by the Commissioner of Navigation as registered for foreign commerce and sufficed to convey only 8·7% of the total imports and exports of the United States. Though relatively little effort had been bestowed upon the promotion of foreign commerce in these years of wonderful domestic development, the total foreign trade of the United States had increased markedly from a value of $762,288,550 in 1860 to $2,982,799,622 in 1910. Whatever the cause of the decline of the overseas American merchant marine, it had certainly not been from any lack of cargoes.

No change or event of consequence marked the years from 1910 to 1914 in the annals of American shipbuilding or navigation. Official records show the amount of shipbuilding, the total registered overseas and the total coastwise tonnage, the total merchant marine and the proportion of American overseas commerce conveyed in American ships, for the five fiscal years ending June 30 1914, to have been as follows:—

Year	Ships Built	Registered for Foreign Trade	Enrolled or Licensed for Coastwise Trade	Total Merchant Marine	Proportion of Value of Imports & Exports Carried in American Ships
	Gross tons	Gross tons	Gross tons	Gross tons	Per cent
1910	342,068	782,517	6,668,966	7,508,082	8·7
1911	291,162	863,495	6,720,313	7,638,790	8·7
1912	232,669	923,225	6,737,046	7,714,183	9·4
1913	346,155	1,019,165	6,816,980	7,886,518	8·9
1914	316,250	1,066,288	5,818,363	7,928,688	8·6

These records indicate a condition of virtual stagnation in the American merchant marine during the period immediately before the World War. New construction was only slightly in excess year after year of tonnage lost or worn out and abandoned. It was a time of disheartenment among those who desired to see an adequate ocean service under the American flag, and a valuable naval reserve for an emergency.

In the Panama Canal Act of Aug. 24 1912 Section 5 provided that "No tolls shall be levied upon vessels engaged in the coastwise trade of the United States." It was contended before and after the passage of this Act that it contravened the provision of the Hay-Pauncefote treaty, that "The canal shall be free and open . . . to the vessels of commerce and war of all nations . . . on terms of entire equality, so that there shall be no discrimination against any nation or its citizens or subjects in respect to the conditions or charges of traffic or otherwise." President Wilson, who had originally favoured this exemption of American coastwise ships, and had been elected on a platform approving it, unexpectedly early in 1914 advocated the repeal of the exemption provision on the ground that it was in conflict with the treaty, and also that "repeal be granted by Congress in support of the foreign policy of the Administration." After an animated debate in the course of which the President was opposed by several senators of his own party, and at the same time upheld by some eminent Republicans, including Senator Root of New York, repeal was finally accomplished. No actual advantage had accrued to American coastwise vessels from the toll exemption, for the canal had not then been opened to commerce. It was opened Aug. 15 1914, and was utilized in its first year by 1,317 vessels, including merchant carriers, men-of-war and yachts, of an aggregate net Panama Canal tonnage of 4,596,644. Tolls paid amounted to $5,216,149. In the coast-to-coast fleet of the United States there was soon a notable expansion, and new and important steamers of 10,000 or 12,000 tons dead-weight capacity were plying on the route shortened from 13,000 m. via the Straits of Magellan to 6,000 m. via the Canal. These large coastwise steamers were destined to prove of abundant value to American overseas commerce in the emergency presented by the war.

War Period.—When the World War began in Europe Aug. 1 1914 all but 8·6% of the imports and exports of the United States were being conveyed in foreign vessels, chiefly of British and German nationality. The first result was the voluntary "interning" in American harbours of a considerable fleet of

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German and Austrian steamers, including the "Vaterland," the largest ship afloat, and other passenger craft of the Hamburg-American and North German Lloyd lines. Another and a much more serious effect upon the carrying of American passengers, mails and cargoes was produced when the British Government, under the increasing stress of the conflict, withdrew month after month from overseas service to and from American ports its own passenger ships and freighters, for the transport service of the gathering British armies and for the auxiliary service of the war fleets. Then the lack of an adequate merchant shipping of its own began to be severely felt throughout the United States.

In the autumn and winter of 1914 agriculture, both North and South, was gravely depressed by the inability to export grain, provisions and cotton, because of the scarcity of ocean ships. Freight rates soon became exorbitant. In Dec. 1914 the freight on cotton from New Orleans to Rotterdam had risen to three or four times its pre-war figure, or to $2 per hundredweight. Grain in July 1914 had been carried from New York to England for four or five cents a bushel. In Dec. 1914 the cost was 16 to 17 cents, and it still went on advancing. The Democratic party, in power at that time, had as a whole opposed shipping subsidies, but in this crisis the Wilson administration early in 1915 brought forward in Congress a proposal to create a great merchant marine under government ownership and operation. This proposition for what was stigmatized as a dangerous adventure into state socialism was sharply opposed in Congress by conservative Democrats and the great body of Republicans. Meanwhile, the crisis continuing, Great Britain, France and Norway in their acute need of ships to make up for losses by German submarines, began to place contracts for new tonnage in the established and not over-busy shipyards of the Atlantic and Pacific coasts of the United States. In the report for the fiscal year ending June 30 1916 the Commissioner of Navigation noted that of ships building or ordered at that date in American yards "fully 125,000 tons were for foreign shipowners," and that "since July 1 1916 the tonnage ordered in American yards for foreign shipowners exceeded that ordered for American owners." Many of these vessels, it transpired, were being built by funds furnished or guaranteed by the British Government.

So much antagonism had been created by the proposal for a government-owned and operated merchant marine that it was not until Sept. 7 1916 that the Shipping Act desired by President Wilson was passed, and then in a much-amended form with government ownership and operation reduced to a temporary character. Section 3 of this important law provided:—

"That a Board is hereby created, to be known as the United States Shipping Board, and hereinafter referred to as the Board. The Board shall be composed of five Commissioners, to be appointed by the President, by and with the advice and consent of the Senate; said Board shall annually elect one of its members as chairman and one as vice-chairman.

"The first Commissioners appointed shall continue in office for terms of two, three, four, five and six years respectively from the date of their appointment, the term of each to be designated by the President, but their successors shall be appointed for terms of six years, except that any person chosen to fill a vacancy shall be appointed only for the unexpired term of the Commissioner whom he succeeds."

Under the authority of this act the President appointed on Dec. 22 1916 the first Federal Shipping Board, headed by Mr. William Denman, an admiralty lawyer of San Francisco. Not one of the members of the Board had ever operated American-flag ships in ocean commerce. Under the Act the Board was authorized to form a shipping corporation with a capital stock not exceeding $50,000,000, of which a majority was to be held by the United States for the purchase, construction, equipment, lease, charter and operation of merchant vessels in the commerce of the United States. This became known as the Emergency Fleet Corporation. Its power to operate vessels would cease, under the original Act, five years after the close of the war.

Less than four months after the appointment of the first Shipping Board the United States itself entered the World War, and the powers and resources of the Board were immensely increased by war legislation. Vast sums of money were placed at the disposal of the Board for the rapid construction of merchant ships on a scale before undreamed-of. Chairman Denman resigned on July 24 1917, and the President nominated in his place Edward N. Hurley, who had been the President of the Illinois Manufacturers' Association, an organization long committed to the development of the merchant marine. A subsequent change made Charles M. Schwab, the steel manufacturer and head of the Bethlehem Shipbuilding Corp., the Director of the Emergency Fleet Corporation. Under the stimulus of Messrs. Hurley and Schwab, the war programme of merchant shipbuilding, which had at first lagged badly, began to take on a new life and vigour. These men had not only directed their vast organization, but aroused the country to respond with all its wealth and power to Mr. Lloyd George's appeal for "Ships, and more ships and yet more ships," to compensate for the havoc wrought by the German submarines. When the United States entered the war in the spring of 1917 there were in the country 37 steel shipyards with 162 ways, and 24 wooden shipyards with 72 ways, capable of launching vessels of 3,500 dead-weight tons. At the signing of the Armistice there were in all 223 shipyards, steel and wood, with a total of 1,099 ways.

There is no parallel in history for this swiftness with which additional shipyards were created. In April 1917, when the United States declared war, every one of the 234 shipways in this country was occupied by a vessel under construction—in part for American owners, in part for foreign owners, the remainder for the navy or other branches of the Government. It was absolutely necessary to create at once the additional facilities required for the building of the 3,115 vessels of a total of 17,276,318 dead-weight tons provided for in the maximum building programme of the Shipping Board. Scores of new shipyards, for steel and wood vessels alike, had to be built. Proper sites were rapidly selected on the Atlantic, the Gulf and the Pacific seaboard, the yards hurriedly laid out, and the requisite tools and machinery installed. This work was pushed with the utmost vigour. Long before the new yards were ready a nation-wide movement had started to recruit an army of shipyard volunteers. It was represented to the workers that they were as truly serving the Allied cause as if they had enlisted in the navy or army. This new crusade was advanced by the State Councils of Defense and by the Department of Labor. Within the first two weeks no fewer than 280,000 workers were enrolled. At the signing of the Armistice 381,000 men were employed in the old and new American shipyards, as against 44,000 when the war began.

American shipyards before 1917 were adequate only for the fairly steady demand of the coast and lake trades and for the requirements of the navy, which, however, were partly filled from Government yards. Only now and then was an overseas steamer constructed. But the coast and lake trades of the United States employ many relatively large and heavy vessels of from 6,000 to 10,000 tons, fit for the 2,000-m. voyages from Portland, Boston, New York and Philadelphia to the Gulf of Mexico, or the 6,000-m. voyages through the Panama Canal between the Atlantic and Pacific seaports. Six or seven yards on the Atlantic and two on the Pacific before the war were capable of building the most powerful dreadnoughts and armoured cruisers. Ocean shipyards, large and small, possessed well-trained and experienced managers and workmen, and there were also many excellent shipyards on the Great Lakes. These efficient staffs were drawn on for the more responsible positions in the new war-born shipyards. The great body of 381,000 workers enlisted were, of course, unfamiliar with ship construction. Most of them had never laboured in a shipyard of any kind. There were thousands from the general building, electrical and other engineering trades, and other thousands from inland farms. It was a composite array, and there was undoubtedly at first much inefficiency and shirking. But the men already trained were set to show the others. Proficiency was rewarded by high wages. The incompetent were gradually weeded out. Appeals to patriotism were effective. Riveting and other work was "speeded up" by offers of prizes, and more and more all hands were made to realize that they were taking an essential part in the winning of the war.

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As a result, unheard-of achievements in the way of production speed were soon recorded. The "Tuckahoe," a 5,500 dead-weight ton collier, was completed by the N.Y. Shipbuilding Co. at Camden, N. J., in 37 calendar days; the "Crawl Keys," a 3,500-ton freighter, at the Great Lakes Engineering Works, Ecorse, Mich., in 34 days. Heavy 8,800-ton freighters were built in Pacific shipyards in from 78 to 88 days, where before the war from six to ten months would have been required. The Bethlehem Shipbuilding Corp. yard at Alameda, Cal., launched the 12,000-ton cargo liner "Invincible" 31 days after the laying of her keel. It was thoroughly realized that such haste would often mar the quality of the work—that ships built in such brief time might well prove less efficient and enduring. But the Government and the builders realized also that it was a race with the German submarines, and that enough ships must be provided by whatever methods at whatever cost to feed and supply the Allies, and to carry and sustain the troops that would soon be crowding over.

One expedient which greatly helped toward quick production was the fabricated ship. One factor in the choice of this plan of construction, never adopted on a large scale before, was the success of the Submarine Boat Corp. in building in 1916 a fleet of 550 submarine-chasers for the British Government. These little vessels were of wood. It was obvious that steel would lend itself more readily to fabrication, and Mr. Henry R. Sutphen, Vice-President of the Submarine Boat Corp., submitted to the Emergency Fleet Corp. a proposal for manufacturing standard steel ships from the same kind of commercial structural steel that is employed for buildings and bridges. This plan was successfully carried out. Structural plates, shapes and other material were prepared at plants all over the country where they could be produced to the best advantage, and shipped to the assembling yards for final riveting together, a certain number of rivets indeed having already been driven before the material arrived. One hundred and fifty fabricated steamers of about 5,000 tons dead-weight were contracted for with the Submarine Boat Corp.'s. yard on Newark Bay, N.J. One hundred and eighty fabricated ships of about 7,500 tons were ordered from the great Hog I. Shipyard near Philadelphia. This shipyard, the largest in the world, with 50 ways, was created in less than six months under the direction of the engineers of the American International Corp., out of what had been a waste marsh on the shores of the Delaware River. With its ways, storehouses and workshops it covered 900 acres. Its cost was $66,000,000. On the completion of its building programme, and when its ships were no longer needed, it afforded an admirable site for a great rail and ship terminal.

Several hundred wooden steamers of a dead-weight capacity of from 3,500 to 5,000 tons were ordered by the Emergency Fleet Corp. in the war emergency. There was much criticism of this project, for the building of wooden steamers for overseas service had long been abandoned in America. Among practical men there never was any delusion that wooden steamers would be of lasting value in peace time service. As Chairman Hurley of the Shipping Board stated: "It was not contended by any responsible authority that wood ships would prove commercially advantageous, that they would be formidable competitors with the ships of the maritime powers in time of peace; but they were regarded, at least as far as the subsequent development of the wood ship programme was concerned, as mere war emergency ships." It should be borne in mind also that when these wooden steamers were contracted for a war lasting for years was contemplated as possible, and elaborate general preparations were being made to that end. As a matter of fact few wooden steamers were completed in time to carry supplies before the signing of the Armistice, and most of the wooden craft that did get to sea were laid up as soon as possible. Many of them seemed structurally fit, but their cargo capacity was too small to permit of profitable employment. The Emergency Fleet Corp. built more of the relatively small steel ships than could be absorbed by the requirements of normal commerce. Justification for this is to be found in the inexorable needs of war. These small steel steamers of from 3,500 to 5,000 dead-weight tons are of a type very useful in limited numbers in a near-by trade, like that with the West Indies, for example. Some of them, particularly the oil-burners, are capable of engaging advantageously in trans-oceanic trades. Moreover, no steamers more than 260 feet in length and of about 4,000 tons dead-weight capacity could be brought out into the St. Lawrence River and the Atlantic through the Canadian canals, and it was important in the war months that the Great Lakes shipyards should be utilized.

American commerce, coastwise and overseas, is relatively a trade of rather large cargoes. It is the larger ship, with the lowest crew wage cost per ton, which American shipowners can operate to the best advantage. Nevertheless, these prudential considerations were frankly cast aside by the American Government in the crisis of the war. The authorities deliberately planned and built the kind of a merchant fleet that could be most quickly constructed in the greatest numbers and employed to the best advantage of their Allies.

After the War.—On the signing of the Armistice immediate steps were taken by the Shipping Board to reduce its programme of construction. In most cases where a contract could be cancelled at a cost to the Government less than the difference between the cost to complete and the probable market value of the ship at time of completion, cancellation was ordered. By June 30 1920 the building programme of the Shipping Board, which in Oct. 1918 had totalled 3,115 vessels of 17,276,318 dead-weight tons, was reduced to 2,315 vessels of 13,675,711 tons, of which 1,696 vessels of 11,656,961 tons were of steel construction. An important element of the new fleet not cancelled consisted of 23 passenger and cargo steamers of about 13,000 tons each, which were designed as army transports but have been adapted to commercial use. This class of ships, of which the American merchant marine still had too few, is adapted to service across the Atlantic and Pacific and to South America.

Appropriations for the Emergency Fleet Corp. up to the end of the fiscal year 1920 amounted to the immense sum of $3,255,413,024, of which nearly all was expended for shipbuilding in the war emergency and afterward. Government-built steamers cost on the average $200 to $225 per dead-weight ton. Ships of the same type were built in the United States before the war for from $60 to $70 per ton, as compared with $40 to $60 in the United Kingdom. The record of America's war effort is clearly written in the returns of the Commissioner of Navigation of the total gross tonnage of shipbuilding in the United States in the fiscal years from 1915 to 1920 inclusive:—

Year	Gross Tonnage Built
1915	225,122
1916	325,413
1917	664,479
1918	1,300,868
1919	3,326,621
1920	3,880,639

In 1920 a marked decline in shipbuilding set in as the Government war programme approached completion. On March 1 1921 only 330 steel vessels of a total gross tonnage of 1,434,000 tons were on the ways. More than one-half of this tonnage was of tank oil carriers. Fifty-four of the 330 vessels, representing 435,000 tons, were building on Government account, and 276, of 999,000 tons, for private ownership. This sharp decrease in shipbuilding was then manifest all over the world, and was intensified by the shrinkage of trade and the unprecedented fall of ocean freight rates, which characterized the winter of 1920–1.

Manning and Operation.—Far less formidable than the task of creating new shipyards and building 13,000,000 dead-weight tons of ships for the war emergency was the work of officering, manning and operating these vessels. In the existing merchant marine of the United States, in Aug. 1914, there was a trained personnel of about 86,000, only a small part of whom could be spared for the new overseas services which the war demanded. Moreover, many of the trained American officers were required at once in the navy and the naval reserve. Two steps were promptly taken to meet the crisis; the President, by executive order July 3 1917, suspended the provision that watch-officers of vessels of the United States registered for the foreign trade must be American citizens, and the Shipping Board established an extensive sea recruiting and training bureau for the instruc-

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tion of both officers and men. Many who had followed the sea in their youth and had left it now returned, and new recruits appeared in great numbers. From June 30 1917 to June 30 1920 this service produced 9,642 licensed officers and 32,335 men, all American citizens. Many others who did not pass through the training service also joined the new ships, and wherever there was need officers and men were ordered from the navy personnel, which had reached a total strength of 500,000. Few ships were anywhere seriously delayed for lack of crews.

For the control of the new Shipping Board tonnage a division of operation was developed. Relatively few of the new vessels were directly operated by the Board itself. Most of them were placed in the hands of the established private companies or new concerns which the war had brought into existence. The vessels were placed on routes indicated by the Shipping Board. Their freight rates were controlled by the Board during and for some months after the war. Division of expenses and profits was difficult to arrange, and was long the cause of much friction between private operators and the Government. Not until 1920 was a fairly satisfactory plan finally devised by which the Shipping Board assumed the risk of the voyage, and a fixed percentage of the gross receipts was allowed to the manager for his services. Government ownership and operation of shipping, especially in the stress of war, proved a difficult undertaking in the United States, as elsewhere. Particularly important was the work of the Ship Control Committee, which directed the movements of shipping to the best advantage. This committee was composed of President P. A. S. Franklin of the International Mercantile Marine Co., President H. H. Raymond of the American Steamship Owners' Association, and Sir Connop Guthrie, representing the British Government.

At the signing of the Armistice, Nov. 11 1918, the Shipping Board controlled a total fleet of 1,196 vessels of 6,540,205 deadweight tons, composed of American, requisitioned, chartered, neutral and seized German tonnage. On Aug. 3 1917 the President, under authority bestowed by an Act of June 15, requisitioned for the national service all steel hulls and materials in American shipyards of vessels of over 2,500 deadweight tons, building either for American or foreign owners, a total of 431 vessels, of 3,056,000 deadweight tons. On Oct. 12 1917, as a further step in Federal control of the shipping situation, another executive order requisitioned all American steel-built power-driven cargo vessels of 2,500 deadweight tons and over, and all American passenger vessels of 2,500 gross tons and over fit for overseas service. This established control over an American fleet of 444 vessels of 2,938,758 deadweight tons. Many of these ships were transferred to their owners for operation. Others were chartered to the war and navy departments. About 600,000 tons of German vessels, seized in American ports when the United States entered the war, were divided among the Shipping Board and the army and navy. In addition the Shipping Board secured the use of a considerable fleet of enemy vessels seized in waters of other countries. To obtain an adequate amount of tonnage the Board also chartered many Allied and neutral ships, a resource which on Sept. 1 1918 amounted to 331 ships of a deadweight tonnage of 1,084,986. By order of March 20 1918, an act which though necessary was deeply regretted at the time, the President caused the navy to seize for the use of the United States 87 Dutch vessels of 533,746 deadweight tons, at that time in or bound to American waters.

A little more than one-half of the two and one-quarter million American soldiers sent to Europe were conveyed in the passenger steamers of Great Britain, France and Italy, chiefly in large vessels of the British lines. Most of the soldiers sent over under the American flag were borne in the former German liners that had had their damaged machinery repaired. After the Armistice, however, most of the American troops were repatriated under the colours of their own country.

The La Follette Law.—In the years from 1915 to 1920 inclusive there were several important Federal enactments relative to the merchant marine. One of these was the La Follette Seamen's Law, approved March 4 1915, after a long and bitter controversy in the House and Senate. This law to a large extent governs working conditions on American ships at sea and in harbour. It requires a certain fixed proportion of able seamen and certificated lifeboatmen, a complement of boats and rafts sufficient for all passengers and crew, and improved living spaces and sanitary conditions. Most of the Act in fact deals with life-saving methods and appliances, in accordance with the recommendations of the London Conference on safety of life at sea, following the "Titanic" disaster. Several sections require a more humane discipline than had been frequent in the old days. One section, which has been the cause of much displeasure among the foreign shipping companies, brought about the amendment of treaties requiring the U.S. Government to seize and return to their ships seamen deserting from foreign vessels in American waters. This, and a complementary section permitting seamen of American or foreign vessels to demand at every port the payment of one-half of the wages due to them, once every five days, is charged with promoting the desertion of foreign crews in American waters and of burdening foreign companies with the cost of hiring substitutes at the American wage rate and with the expense of returning these substitutes to their country. It is insisted by the seamen's unions, however, that these provisions of the law tend to bring foreign ship wages up to American standards.

Other Legislation.—By Act of Congress of Aug. 18 1914 the free ship clause of the Panama Canal Act of Aug. 24 1912, which had proved wholly ineffective, was amended by admitting ships more than five years old, and exempting all foreign-built vessels admitted to American registry from compliance with American survey, inspection and measurement laws and regulations. Under this amended law 140 foreign-built vessels of 583,000 gross tons, owned by American citizens or corporations, were admitted to American registry for foreign trade in the fiscal year 1915, when the security afforded by the American flag was valuable. The number of vessels thus admitted fell off, however, to only 26, of 69,697 tons, in the fiscal year 1916, as the higher wages and operating costs of the American flag came to be realized by the owners of foreign-built tonnage. Many of these owners, indeed, sought to change their naturalized ships back to foreign registry, and 160 American vessels, of 102,479 tons, were transferred to foreign flags in 1916. On Feb. 5 1917 the President by executive order forbade the sale, lease or charter of American vessels to foreign flags without the approval of the Shipping Board.

In the spring of 1920 a most important measure known as the Merchant Marine Act of 1920, or the Jones law (from Senator Wesley L. Jones, Chairman of the Committee on Commerce), was finally passed by large majorities in Congress and signed June 5 by President Wilson. This Act solemnly declared it to be the purpose of the American people to possess a merchant marine capable of carrying "the greater portion" of their commerce and to serve as a naval or military auxiliary in time of war, this merchant marine "ultimately to be owned and operated privately by citizens of the United States." A new Shipping Board of seven members, fairly representative of political parties and of all sections of the country, was authorized in the Act and given large authority over the merchant marine. This Board was directed to sell the Government-owned tonnage to private owners "as soon as practicable." Postal subsidies and encouragement to new and necessary shipping routes were provided for. Deferred rebates and discrimination against shippers were forbidden. The coastwise law barring foreign ships was extended after Feb. 1 1922 to the trade between the Philippines and the United States. Benefit of preferentially low railway rates on imports and exports was reserved to American vessels wherever their capacity is sufficient. Encouragement was given to American marine insurance, and to the American Bureau of Shipping, the "American Lloyd's." A new and favourable system of ship mortgages was provided. American vessels in foreign trade were exempted from excess profits taxes on condition that the amount of the exemption and twice as much more of the capital of the owners were applied to the building of other ships in the United States. The President was directed to secure the amendment of provisions in commercial treaties that prevented the United States from imposing discriminating customs taxes and tonnage dues on goods imported in ships of foreign registry. President Wilson refused to carry out this last-named requirement on the ground that the action indicated would provoke the resentment of foreign ship-owners and their Governments. The Treasury Department failed to prepare regulations for the application of the clause exempting American foreign-trade ships from excess profits taxes. Preferential treatment for American ships in the dispatch of imports and exports hauled at low rates on American railways was not made effective by the Shipping Board and the Interstate Commerce Commission, whose cooperation was necessary for the actual enforcement of the law.

Statistics.—The amount of shipbuilding, the total registered overseas and boastwise tonnage, the total merchant marine, and the proportion of American imports and exports conveyed in American ships for the six fiscal years ending June 30 1920 are as follows:—

Year	Ship-building	Registered for Foreign Trade	Enrolled or Licensed for Coastwise Trade	Total Merchant Marine	Proportion of Value of Imports and Exports Carried in American Ships
	Gross tons	Gross tons	Gross tons	Gross tons	Per cent
1915	225,122	1,862,714	6,486,384	8,389,429	14·3
1916	325,413	2,185,008	6,244,550	8,469,649	16·3
1917	664,479	2,440,776	6,392,583	8,871,037	18·6
1918	1,300,868	3,599,213	6,282,474	9,924,518	21·9
1919	3,326,621	6,665,376	6,201,426	12,907,390	27·8
1920	3,880,639	9,924,694	6,357,706	16,324,024	42·7

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A new Shipping Board, appointed in June 1921, by President Harding, headed by Albert D. Lasker of Chicago and including Admiral William S. Benson in its membership, quickly effected an important reorganization of the executives of the Board, installing a group of practical shipping men as officials of the Emergency Fleet Corporation, and committing to these men the active management of the government-owned merchant fleet. Following this reorganization, the new Shipping Board addressed itself to the working out of a comprehensive subsidy system for postal liners and cargo ships, intended to facilitate the sale of the government-owned fleet to private owners, as directed by the Merchant Marine Act of 1920.

(W. L. M.)

SHOCK, in surgery (*see* 24.991*).—Experience during the World War has thrown new light on the nature of "shock" in pathology. The first effect of an injury is usually to produce a state resembling that of fainting. This is clearly produced through the nervous system and is recovered from more or less rapidly, supposing that the injury is not in itself sufficiently severe to be fatal. This "primary shock," as it may be called, does not show itself to any important degree in the case of operations done under an anaesthetic. But it has long been familiar to surgeons that another kind of shock may appear during or after an operation. This "secondary shock" was of frequent occurrence during the war of 1914–8 and the cause of many deaths. To define it, Cowell suggested the name "wound-shock." The symptoms are very difficult to distinguish from those of mere loss of blood, but it became obvious that it might be present although actual haemorrhage had been very slight. This fact is of significance in the interpretation of the actual pathology of the condition, as will be seen later. As indicated above, it does not show itself at once; it may, however, develop in less than an hour if the injury has been great, and primary shock may sometimes pass into it gradually without a period of recovery. It shows itself by a state of general collapse, with pallor, coldness, thirst, low blood pressure and the various consequences of this, such as vomiting, sweating and sometimes rapid shallow breathing. No evidence of heart failure or of paralysis of vasomotor centres has been obtained. The higher nerve-centres do not suffer until the late stages. Pain is not a prominent factor. If the state has not been of long duration nor of severe intensity, it may pass off on warming and rest, but if left alone death nearly always ensues.

Observations made by Sir Cuthbert Wallace in operations before the war suggested to him that the actual injury to the tissues, and especially to muscle, played an important part. This surgeon noticed that operations involving much section or removal of tissues were more liable to produce shock. The fact might, of course, be also interpreted as the result of the irritation of nerves, acting subconsciously on the centres; but Quénu, a French surgeon, at an early date in the war, propounded the view that the serious effects of wounds are due to an absorption into the blood of toxic products arising in the injured cells. This view was confirmed by the recognition of the importance of early removal of the injured parts; operative procedure was pushed nearer and nearer to the fighting line as the war progressed. It was also noticed that, even after shock had developed, a marked improvement was frequently brought about by excision of the damaged structures. Experimental work by Bayliss and Cannon showed that it was possible to produce in anaesthetized cats a condition similar to that of wound-shock. This could be done by extensive injury to the muscles and skin of the legs. It was found that the results were identical whether the nerve channels from the injured tissues were severed or not, but that they were absent if the blood returning from the tissue was prevented from passing into the general circulation. Thus the name "traumatic toxaemia," proposed by Quénu, is an appropriate descriptive title for the state under consideration.

But what is the nature of the poison and how does it act? These are important questions in dealing with appropriate methods of treatment. The possibility of bacterial toxins has been definitely excluded, and although it cannot be stated that we have yet found the actual substance produced in wounded tissues, the work of Dale and his colleagues on the properties of a base called "histamine," which is formed by removal of carbon dioxide from one of the component amino-acids found in the proteins of tissues, namely histidine, shows that we have to deal either with this compound or with a very closely related one.

Dale and Laidlaw found, in fact, that a small amount of histamine injected into the veins of cats or dogs produced a large fall of blood pressure, accompanied by the other signs of shock, which increased progressively until death. The heart was unaffected and continued to beat powerfully, although nearly empty of blood. Now, until the work of Dale and Richards, it was believed that to produce a fall of blood pressure without removal of blood or depressing the heart it was necessary that the muscular coat of the arterioles should be relaxed and thereby the peripheral resistance decreased. But the previous work had shown that histamine has the effect of causing *contraction* of all smooth muscle, including that of the arterioles. The fall of pressure produced by a very small dose of histamine remained a paradox until the work mentioned, which was published in 1918. In this research it was shown that the effect was due to a wide-spread dilatation of the capillary blood vessels. In order to appreciate the significance of this discovery, a few words are necessary on the reactions of the capillaries and on the importance of the volume of blood in circulation. Although various observations had been made indicating that the capillaries are not merely inert channels, but that their walls are capable of contraction and dilatation in response to chemical stimulation or nervous influence, there seemed to be difficulty in realizing how protoplasmic cells such as those of the capillary wall succeed in doing this. The changes of shape in amoeba and in pigment cells, nevertheless, show the possibility. Dale and Richards, by an ingenious series of experiments, demonstrated that histamine does actually cause a marked widening and opening-up of the capillaries of the body generally. It may also be pointed out that Krogh has recently shown the existence of a nervous regulation of these vessels, which appears to be of an antidromic nature, like that of the dorsal roots described by Bayliss. Now, when we observe how enormous a share of the total vascular system the capillaries make up, we realize what a large volume of the total circulating blood may be penned up or pooled in these vessels when they are dilated, leaving very little to be sent round by the heart to supply the organs with oxygen obtained by its flow through the lungs. The whole of the body is therefore suffering from want of fresh blood containing the oxygen necessary for its existence.

These facts have caused renewed attention to be paid to the question of the volume of blood in circulation. By the injection into a vein of an innocuous dye, which does not quickly diffuse out of the blood vessels, such as "vital-red" or better "congo-red" (Harris), the degree of dilution of the amount injected indicates the volume of the fluid part of the blood. When observations of this kind were made by N. M. Keith on men suffering from shock, it was found that, even when they had lost little or no blood, the volume actually in circulation was greatly reduced. Hence we are justified in postulating the presence of a toxic action dilating capillaries, an action similar to that of histamine.

It was early recognized that shock might be greatly exaggerated or even brought on by various conditions incidental to the state of the wounded man, or to the treatment necessary afterwards. Some of these throw additional light on the subject.

Anaesthetics.—Dale observed that a dose of histamine highly toxic to a cat under ether was innocuous to a normal animal. Thus there are processes in the healthy organism which either destroy the poison rapidly but are inactive under ether, or the anaesthetic itself makes the capillaries more sensitive. In any case, it was often noticed in the war that a state of shock came on during an operation under ether and that there was less risk with nitrous-oxide and oxygen.

Haemorrhage.—Since the serious nature of shock is due to the deficiency of circulating blood, it is obvious that when blood has actually been lost a lesser degree of capillary stasis will suffice to induce shock. This was also found to be the case, experimentally, by Dale and by Bayliss and Cannon. A practical conclusion as regards operations seems to be that loss of blood should be avoided as far as possible and that means for replacing it by intravenous injection should be at hand in case shock makes its appearance.

Thirst.—There was always a notable demand for water by the wounded soldier. If he was already suffering from thirst when

* *These figures indicate the volume and page number of the previous article.*

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wounded, his blood volume was diminished. Water is a valuable remedy and, as absorbed from the alimentary canal, it is very effective in restoring the blood volume. As we shall see, it is the actual volume of the blood, rather than its dilution, that is of consequence. Unfortunately, the vomiting frequently present in shock prevents this treatment in many cases. Water or saline solution may, however, be given by the rectum.

Cold.—Exposure to cold has a very potent exaggerating effect in shock. It may happen that spontaneous recovery takes place in the comparative comfort of the casualty clearing station, but, for the reason to be given below, it is not well to wait long if no sign of improvement is seen in a short time. It is difficult to give precise reasons why cold is so markedly deleterious. It may be the result of the generally depressing effect on all bodily functions, which would naturally be greater in states of inadequate circulation of blood.

Anxiety and Fear are recognized also as predisposing factors of shock. Perhaps the depressing effect is the cause, as with cold.

Treatment.—Since the cause of the trouble is the deficiency of blood in circulation, it is obvious that the chief remedy is to increase this. Much attention was given during the war to improving the methods of transfusing blood and there seems no doubt that many lives were saved by this means. But donors are not always available and it is clearly a matter of importance to possess, if possible, an artificial solution which can be used in unlimited amount. Simple saline or glucose solutions were soon found to be useless. They disappear from the blood in less than an hour. To prevent this disappearance, it is necessary to add to the solution some colloid which has an osmotic pressure equal to that of the colloids in normal blood. This is done in the "gum-saline" introduced by Bayliss. The solution contains 6% or 7% of pure gum arabic in addition to 0·9% sodium chloride. The reason for the addition of the colloid may be stated thus; the blood-vessels are impermeable to colloids, hence the osmotic pressure of these substances can manifest its effects. The important point is that it causes an attraction of water and thus prevents any rapid filtration by the blood pressure on the arterial side and brings about a reabsorption in the capillary and venous regions, where the blood pressure is lower than the osmotic pressure of the colloid. Thus a solution containing a sufficient amount of gum arabic is not lost from the circulation.

Of course, the blood actually in circulation is diluted by such injections, but the work of Gesell shows that the greater flow more than compensates for the lesser oxygen-carrying capacity per unit volume. Moreover, as the circulation improves, the capillaries begin to give up their stationary corpuscles to the general mass of blood.

When the state of shock is complicated by haemorrhage it might seem that the addition of blood itself is imperative. It is remarkable, however, that in actual experience the benefit of gum-saline was more obvious after haemorrhage than in severe cases of wound-shock without haemorrhage. It seems probable that these latter cases were such as to have arrived at that stage in which a second action of histamine shows itself. To this we may now turn. After large doses or prolonged action of smaller ones, the capillary blood-vessels become permeable to the colloids of blood as well as to the salts. The addition of solutions of colloids or even blood itself is useless in this stage. They are quickly lost. It was found by observations on wounded men that the plasma of the blood transfused was lost rapidly. Whether the effect on the capillaries is a direct one or whether it is due to the asphyxial state brought about by the low blood pressure is not clear at present. Krogh brings evidence that, when the capillaries are rapidly and widely dilated, there may be formed minute pores between the cells of their walls, which allow colloids to pass through. The fact warns us, in any case, not to allow the state of low blood pressure to last for any length of time.

Cases of shock in this stage were generally regarded as hopeless. It was not found possible to restore them either by blood or by gum-saline. Some experiments made later by Bayliss suggest, however, the possibility that further repeated injections might in some cases have been effective. Although the greater part of the fluid of the first injection was lost, it seemed that some improvement in the state of the capillaries resulted, since a second injection produced a slight permanent rise in the blood pressure and a third injection recovery.

Owing to the fact that gum-saline is quite innocuous and can now be obtained in sterilized form from the dealers, it should always be at hand in operations for use if shock threatens, as also for accidents or serious haemorrhage from any cause.

See *Special Reports, Nos. 25, 26, 27, Medical Research Council* (London H.M. Stationery Office, 1919); E. Quénu, *La Toxémie traumatique* (Paris, Alcan, 1919); Bayliss, *Intravenous Injections in Wound-Shock* (London, 1918). (W. M. B.)

SHORT, SIR FRANCIS JOB (1857–), English engraver (*see* 24.1007), was elected R.A. in 1911, and in the same year was knighted. In 1910 he became president of the Royal Society of Painters, Etchers and Engravers. His later work exemplifies every type of his activity. Among etchings, "On the Banks of the Bure" and "The White Mill, Canterbury" show his adherence to the use of line in that medium, and a version of Turner's "Ehrenbreitstein to Coblentz" continues his series of translations of paintings. He also added "Moonlight on the Medway at Chatham" and "Dumbarton Rock" to the plates in etching and mezzotint completing Turner's "Liber Studiorum." Two aquatints, "The New Moon" (1918) and "'Twixt Dawn and Day," show broad handling and remarkably rich quality in the darks; and two mezzotints, "Orion over the Thames" (1913–4) and "The Night Picket Boat at Hammersmith" (1914–5), are among his finest plates in a medium peculiarly his own.

SHORTER, DORA (Sigerson) (1866–1918), Irish poet, was born in Dublin, Aug. 16 1866. She was the daughter of Dr. George Sigerson, the Celtic scholar, and married in 1896 Clement K. Shorter (b. 1857), editor of the *Sphere* and other London illustrated papers (*see* 19.563). Her first volume of verse appeared in 1894, and she established a considerable reputation as a writer of lyrics and ballads; the subjects often religious, or drawn from the treasures of Irish legend, or in praise of the Irish country. Her *Collected Poems* were published in 1909, and she wrote one novel, *Through Wintry Terrors* (1907). She died in London, Jan. 6 1918. Two posthumous volumes of poems appeared in 1918 and 1919, as well as *A Dull Day in London and other sketches*, with a preface by Thomas Hardy, in 1920.

SHORTT, EDWARD (1862–), British lawyer and politician, was born at St. Anthony's Hall, Newcastle-on-Tyne, March 10 1862. He was educated at Durham school and University, and in 1890 was called to the bar. In 1907 he became recorder of Sunderland and in 1910 a K.C. In 1910 he entered the House of Commons as Liberal member for Newcastle. In May 1918 he became Chief Secretary for Ireland, but in 1919 resigned and was appointed Home Secretary.

SIAM (*see* 25.2).—For the purposes of administration the kingdom of Siam is divided into 17 provinces (Monthons), the area of which is given officially at 484,128 sq. kilometres. The revised census figures for 1910–1 gave a pop. of 8,149,847, and the official estimate of the pop. for the year 1920 was 9,022,000.

On the death in 1910 of King Chulalongkorn he was succeeded by his son, the Crown Prince Maha Vajiravudh, who in 1917 assumed the title of King Rama VI. Under this monarch the work of consolidation and development progressed steadily. To foster the idea of the duty of national service among the elder generation the "Wild Tiger" Corps was established. The Siamese boy scout organization, of which the King became president, educates the younger generation on the same lines. The number of boy scouts was in 1920 over 15,000.

Among various changes may be noted the royal decree that all privy purse property should be subjected to ordinary taxation, the abolition of lottery farms and public gambling-houses, the strict regulation of the opium traffic, and the great development of football and other athletic sports. Under the patronage of the King, a Navy League was established, and the Red Cross Society was reorganized. The Red Cross Society has under its direction the Chulalongkorn hospital, the Pasteur institute and laboratories for the preparation of vaccines and serums.

The calendar has been revised. The Siamese year formerly dated from the foundation of Bangkok. It now corresponds with the Buddhist era. The new year begins on April 1 and terminates on March 31. Hence April 1921 to March 1922 is, in the Siamese calendar, B.E. 2464. The day is divided into two periods of 12 hours each as in Europe, except in the railways and the post and telegraph department, where the 24-hour day is used.

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On July 22 1917 Siam declared war on Germany and Austria-Hungary. Enemy aliens were interned, and later sent to internment camps in India. A military mission was sent to Europe early in 1918, and a Siamese military contingent landed at Marseilles in Aug. of the same year. This contingent comprised motor ambulance transport, which rendered efficient service on the western front, and an aviation corps. The aviators were trained by French officers, and although many had gained pilot's certificates, hostilities ceased before the corps was prepared to commence operations. The contingent returned to Siam in 1919. Siam was represented at the Versailles Peace Conference by three delegates, who signed the general Peace Treaty on behalf of their country.

The main clauses affecting Siam are Articles 135, 136 and 137. In *Article 135* Germany recognizes that all treaties, conventions and agreements between her and Siam, and all rights, titles and privileges derived therefrom, including all rights of extra-territorial jurisdiction, terminated as from July 22 1917. In *Article 136* all goods and property in Siam belonging to the German Empire or to any German State, with the exception of premises used as diplomatic or consular residences or offices, pass *ipso facto* and without compensation to the Siamese Government, while the goods, property and private rights of German nationals in Siam shall be dealt with in accordance with the provisions of Part X (Economic Clauses) of the Treaty. By *Article 137* Germany waives all claims against the Siamese Government on behalf of herself or her nationals arising out of the seizure or condemnation of German ships, the liquidation of German property, or the internment of German nationals in Siam, this provision not to affect the rights of the parties interested in the proceeds of any such liquidation, as governed by the provisions of Part X (Economic Clauses) of the Treaty. Under the Treaty Siam became a member of the League of Nations, and took part in the first Assembly of the League at Geneva in 1920.

Agriculture.—Owing to deficient rainfall in 1919, rice, the main agricultural crop of Siam, was barely sufficient to supply the needs of the population, and the price rose to five times pre-war rates. To meet the deficiency the export was prohibited, but was resumed in 1921. The question of extensive irrigation works, which had been considered in the previous reign, was again investigated in 1915, and important works were started. The difficulty of obtaining steel work from abroad during the war delayed their progress but work on the Prasak scheme, estimated to cost some 13,000,000 ticals, was afterwards vigorously pushed forward, and was expected to be completed in 1922.

Army and Navy.—The law of 1903 making military service compulsory was revised in 1917. Every able-bodied man of 21 to 22 years of age is liable to be called to military service for a period of two years with the colours, passing afterwards into the reserve, of which there are three classes according to age. There are various military schools for the training of officers, non-commissioned officers, aviators, military engineers, etc., as well as a General Staff school. The arms and equipment are modern, and in 1914 a national cartridge factory was established. The navy is recruited from the maritime population under the military service law. There are some 5,000 men available for service afloat, with a reserve of 20,000. In 1920 a 35-knot destroyer was purchased from the British Admiralty and rechristened the "Phra Ruang."

Communications.—On the declaration of war the northern and southern State railways were amalgamated under a Commissioner-General, H.R.H. Prince Purachatra of Kambaeng Bejra. The personnel, which had included German engineers, became chiefly Siamese, with a few engineers of Allied nationality. A standard metre gauge was adopted for all lines. The southern line through the Malay Peninsula was originally constructed of metre gauge to permit of through connexion with the Federated Malay States railways. The work of converting the northern line, first built to the normal gauge of 4 ft. 8½ in., was begun. A through service of trains from Penang to Bangkok was opened on the southern line in 1918, and in March 1920 railhead reached the Siam-Kelantan boundary. The northern line reached Chiengmai in 1920, and the Bandara-Swankalok branch was then under construction. The length of State lines in 1920 was: opened 2,215 km., under construction 211 km., and under survey 460 km. The average capital cost per km. of open line was tcs. 54,584.

Education.—There were in 1920 over 380,000 pupils receiving primary education, of whom 250,000 were being educated by priests in the Buddhist monasteries, 100,000 in local and private schools, and 30,000 in schools directly under the Ministry of Education. Secondary education, reaching a standard approximating to that of the London University Matriculation, is provided for by the Ministry of Education, with 120 schools attended by 8,500 pupils, by the two Royal Pages' schools and King's College, under the direct patronage of the King, and by certain missionary schools. In 1917 the Chulalongkorn University was opened at Bangkok with four Faculties: Medicine, Arts and Science, Engineering and Political Science. It includes hostels for 100 resident undergraduates.

Finance.—Annual revenue rose from tcs. 17,334,469 in B.E. 2437 (1894–5) to tcs. 86,494,066 in B.E. 2460 (1917–8). During this period the expenditure increased from tcs. 12,847,165 to tcs. 74,149,289. The national debt consisted in 1921 of two sterling loans both of 4½%, one for £1,000,000 floated in 1905, and one for £3,000,000 floated in 1907, both free of taxes present or future, levied by the Siamese Government and repayable by yearly drawings. The 1905 loan will be entirely paid off in 1945, and the 1907 loan in 1947. In 1909 a loan of £4,000,000, increased in 1913 to £4,750,000, was negotiated with the Federated Malay States Government. This loan is exclusively for constructing railways in the Malay Peninsula, the amount advanced is limited to £750,000 in any one year, and interest is at the rate of 4% on the money actually received. The amount actually advanced on this account to March 31 1921 was £3,880,000, when the total debt of the kingdom stood at £7,312,560.

The mint was closed to the free coinage of silver in 1902, and, supported by the Treasury, exchange had steadied to around tcs. 13 to the pound sterling by 1909. In 1917 and 1918 the rate was maintained at tcs. 13·02 to the pound sterling, but by 1918 the Treasury had sold to the banks tcs. 77,000,000, representing nearly £6,000,000 sterling. As a result of these sales a large proportion of Treasury funds was transmitted abroad. The rise in the price of silver nearly denuded the country of silver coinage, and in 1920 the exchange rose to tcs. 10 to the pound sterling and over. The gold standard reserve fund, established for the maintenance of the gold value of the tical, remained untouched on March 31 1918 at £1,222,146.

Trade.—For 1917–8 the value of imports exceeded tcs. 97 million, including tcs. 3½ million of gold leaf and treasure. This shows an increase of some 10 millions over the previous year and 22 millions over 1915–6. The exports amounted to tcs. 123½ million, showing an increase over the previous year of tcs. 2 million and over 1915–6 of nearly tcs. 18 million. The value of rice exported was over tcs. 97½ million and of teak tcs. 5½ million.

Justice.—The Penal Code became law in 1908, and the preparation of other codes continues. All courts are under the Ministry of Justice. The judiciary is composed of native or European-trained Siamese judges, assisted in cases where foreigners are concerned by European legal advisers. In commercial cases where there is no Siamese statute or precedent customary law is administered. Where precedents are wanting the Siamese courts are guided generally by English statutes and cases as circumstances admit. On the outbreak of war with Germany and Austria a prize court was established to deal with enemy ships seized "*jure belli*." Twenty-five enemy vessels were taken, and condemned as lawful prize by this court.

Public Health.—Modern sanitation began in Siam in 1897 with the creation of a Public Health Department under a director-general, assisted by a medical officer of health and a city engineer. The principal developments have been the inspection of cattle and meat and the regulation of the public abattoirs under veterinary inspection, the establishment of infectious diseases hospitals, medical treatment of the insane, quarantine, registration of births and deaths, compulsory notification of plague and cerebro-spinal diseases, and compulsory vaccination and revaccination against smallpox. An efficient public-health laboratory has been organized under the department. Bangkok is now efficiently drained and lighted. Pure filtered water is supplied from the Government water works. New roads have been cut through congested districts, and numerous bridges have been built over the canals which intersect the city. On the outskirts new residential quarters have been laid out, with broad roads lined with trees. (A. C. CA.)

SIBELIUS, JEAN JULIUS CHRISTIAN (1865–), Finnish musical composer, was born at Tavastehus, Finland, Dec. 1865. He was educated at Helsingfors, and later studied music at Berlin and Vienna. In 1916 he became a professor of literature at Helsingfors. His orchestral works include "Romance in C" (1890); *Karelia* (1893); *Frühlingslied* (1893); *Finlandia* (1905) and five symphonies (1897, 1901, 1905, 1910, 1915). He also composed many songs and pianoforte pieces. His music to the tragedy *Kaolema* (1904) contains the "Valse triste," which has gained wide popularity. In 1921 he visited England and produced his 5th symphony.

SIBERIA (*see* 25.10).—The name Siberia now generally excludes the Steppe provinces but includes Kamchatka and Russian Sakhalin.

Little progress has been made in the mapping of the wide tracts between the great rivers or the mountainous regions in the south. Even in the existing maps of southern Siberia little reliance can be placed on the detail except near the railway. There are no large scale maps of northern Siberia. The whole course of the Yenisei river has been mapped on a large scale, the shores of Lake Baikal have been surveyed and geological exploration in the Amur basin and some parts of the upper Lena basin has resulted in accurate maps.

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Kamchatka contains a notable range of volcanoes which forms part of the Pacific ring. Forty have been located of which 14 are active. The loftiest active volcano, the loftiest mountain in Siberia, is Klyuchevskaya, 16,130 feet. Koryatskaya is 11,522 feet.

Investigations in Lake Baikal have shown that there are three basins of unequal extent and depth. The southerly basin has an extreme depth of 791 fathoms, and is separated by a shoal ridge of less than 300 fathoms from the middle and most extensive basin which reaches 832 fathoms in depth. The northern basin does not exceed 540 fathoms. On the W. of the lake the deep water goes inshore but on the E. the coastal waters are shoal. The area of the lake is 13,200 sq. m.; its surface is 1,561 ft. above sea level.

New surveys of the Arctic coast by Tolmachev, Vilkitski and others have resulted in considerable modifications in the chart. Shitkov explored the Yamal peninsula and cleared up some doubtful points in its hydrography. The small islands between the Gulf of Yenisei and Taimir peninsula have proved to be more numerous than was supposed and Taimir Gulf has been found to be relatively narrow. Cape Chelyuskin lies in lat. 77° 42′ N. Nikolas Land and other islands have been discovered to the N.W. of this cape, and new discoveries have been made in the New Siberia and Wrangel Is. (*see* ARCTIC REGIONS). There is still some doubt about the configuration of the coast-line between Cape Chelyuskin and the Lena delta. Hydrographical surveys have resulted in the discovery of some harbours on the Arctic coast including several in Taimir Land; Tiski Bay, E. of the Lena delta; and Chaun Bay in long. 170° E. Surveys in the Sea of Okhotsk have shown that the best harbours are Yamskaya Bay; Ola Bay, off Taui Bay; and Port Ayan. Okhotsk is falling into decay owing to its poor site. In Kamchatka Baron Korfa Gulf has been found to contain several good harbours. In the Maritime province the best harbours, in addition to Peter the Great Bay, are de Castries Bay, Imperial Bay and Olga Bay. De Castries Bay, a little S. of the Amur mouth, affords a far better and more accessible harbour than the Amur estuary. The Tartar harbours are closed by ice from Nov. to April or May and the Okhotsk harbours for a month or two longer.

Population.—There has been no census since 1897 but in 1915 the pop. was estimated at 10,377,900 on the basis of the last census and the yearly rate of increase. It was distributed as follows:—

Governments and Provinces[1]	*Area in sq. m.*	*Population*[2]	*Density per sq. m.*
Tobolsk (Govt.)	535,739	2,085,700	3·9
Tomsk (Govt.)	327,173	4,053,700	12·0
Irkutsk (Govt.)	280,429	821,800	2·5
Yeniseisk (Govt.)	981,607	1,143,900	1·1
Yakutsk (prov.)	1,530,253	332,600	0·2
Transbaikalia (prov.)	238,308	971,700	4·0
Amur (prov.)	154,795	261,500	1·6
Maritime or Primorsk (prov.)	266,486	631,600	3·0
Kamchatka (prov.)	502,424	41,600	0·1
Sakhalin (prov.)	14,668	34,000	0·5
Total	4,831,882	10,378,100	2·0

[1] These indicate the administrative divisions in force under the empire. The present (1921) divisions are uncertain and unstable.
[2] The pop. estimates are probably somewhat too high.

The two Steppe provinces, Akmolinsk and Semipalatinsk, which are geographically part of Siberia, though they were administratively distinct under the late imperial regime, have a combined area of 403,394 sq. m. and an estimated pop. (1915) of 2,421,400. The figures given above include native tribes (see below).

Colonization.—The Russians number over 85% of the total pop. of Siberia as a whole and about 93% of the total pop. of western Siberia (Tobolsk and Tomsk). The number of settlers entering Asiatic Russia (including the Steppe provinces) from Russia in Europe rose from 141,000 in 1906 to 619,000 in 1909. For some years after there was a decline, due, it is said, to a succession of good harvests in southern Russia: in 1912 and 1913 the annual immigration was little over 200,000. In 1914 it was 242,000. From 1906 to 1914 nearly 3,000,000 Russians entered Asiatic Russia, about 2,000,000 of whom went to Siberia. The Siberian railway zone continued to attract most settlers in western and central Siberia but many went to the Baraba steppe, the Altai region and the district round Minusinsk and the upper Yenisei. The Uryankhai region around the head streams of the Yenisei in the Sayansk mountains, which is nominally part of outer Mongolia under the suzerainty of China, contains many Russian settlers and for some years has been more or less under Russian control. In Transbaikalia much land is occupied by Cossacks and their descendants, and natives (largely Buryats), but in the upper Amur and the Ussuri valleys there are considerable areas of Russian settlement. The efforts, however, that were made by the State before 1917 to attract colonists to the Amur and Maritime provinces met with somewhat meagre response. Attempts to colonize Kamchatka have been practically abandoned and for many years Russian Sakhalin has failed to attract settlers. North of lat. 58° N. in western Siberia, and lat. 54° N. in eastern Siberia, there are very few Russians permanently settled. Total exemption from military service and other privileges which the State offered colonists in the lower valleys of the Yenisei and Lena did not succeed in attracting many settlers. The migration of Chinese and Koreans to the Amur and Ussuri valleys and the Transbaikal region was marked for many years. The Chinese came as temporary labourers but the Koreans were more inclined to become permanent settlers. Japanese artizans are found throughout eastern Siberia. In 1914 the Russian Government was making attempts to exclude Asiatics at the same time that it offered inducement to Russians to settle in the Far East.

Native Races.—While no strictly ethnological classification of Siberian natives is yet possible, it is recognized that the tribes of the extreme N. and E., even if they differ from one another, have certain characteristics in common which distinguish them from later arrivals in Siberia. For these earlier tribes, who may possibly have migrated to Siberia from America at a very early period, the name Palaeoasts is used by Schrenk and Palaeo-Siberian by Czaplicka. For later tribes the term Neo-Siberian has supplanted Ural-Altaians to which there are linguistic and ethnological objections. Czaplicka classifies the native tribes of Siberia as follows, taking numerical statistics from Patkanov, who based his estimates on the census of 1897 which gives the latest trustworthy data: I. Palaeo-Siberians. i. Chukchee; in north-eastern Siberia, 11,771. ii. Koryak; S. of the Chukchee, 7,335. iii. Kamchadal; southern part of Kamchatka, 2,805. iv. Ainu; in southern Sakhalin and Yezo, 1,457. v. Gilyak; near Amur mouth and in northern Sakhalin, 4,649. vi. Eskimo; shores of Bering Strait, 1,307 (in Asia). vii. Aleut; in Aleutian Is., 574. viii. Yukaghir; between the lower Yana and lower Kolima, 754. ix. Chuvantzy; S. of Chaun Bay, 453. x. Ostyak of Yenisei; on the lower Yenisei, 988. II. Neo-Siberians. i. Finnic tribes (*a*) Ugrian Ostyak; lower and middle Ob, 17,221. (*b*) Vogul or Maniza; middle Ob, 7,476. ii. Samoyedic tribes; in far N. from Europe to Khatanga mouth, 12,502. iii. Turkic tribes (mainly outside Siberia) (*a*) Yakut; from the Lena to the Amur and Sakhalin, 226,739. (*b*) Turco-Tartars of Tobolsk and Tomsk, 176,124. iv. Mongolic tribes (*a*) Kalmuk or Eleut; practically all outside Siberia (*b*) Mongols proper or Kalkha, 402. (*c*) Buryat; around Lake Baikal, 288,599. v. Tunguskic tribes (*a*) Tungus; far eastern Siberia, 62,068. (*b*) other Tunguskic tribes, totalling 14,439, viz. Chapogir: on the lower Tunguska; Goldi: on the lower Amur; Lamut: on the shores of Sea of Okhotsk; Monagir: on the middle Amur; Oroche: E. of the lower Amur; Orochon: on the Olekma; Oroke: in Sakhalin; and Solon: S. of the middle Amur. Tribes who live in the more fertile parts seem to be increasing in numbers but those who occupy the more barren regions of the N. are dwindling. The natives probably do not exceed one million.

There is much disease, particularly among the native tribes, although the climate itself is not unhealthy. In addition to goitre, leprosy occurs in the Lena and Amur valleys and elsewhere. Smallpox is endemic in many parts and tuberculosis is prevalent. Cholera is never absent in the Far East and occasionally assumes the proportions of an epidemic. Plague sometimes enters from Manchuria. Venereal diseases are rampant throughout Siberia. A curious nervous affection known as Arctic hysteria is common among the natives of the far north. It is not infrequently associated with melancholia and suicide. The hysterical manifestation of Shamanism may not impossibly be associated with this nervous affliction.

Education.—The last statistics date from 1912 when there were 6,245 schools in Siberia with a total of 341,271 pupils. The number of pupils per 1,000 of the pop. was thirty-six. Out of every 100 persons under nine years of age only 16 could read and write.

Towns.—Towns situated on or near the railway have grown rapidly but others have made little or no progress. In 1914 towns with a pop. of 10,000 or over numbered at least 21 compared with 17 in 1900; but estimates of the pop. of Siberian towns vary considerably and must be accepted with reserve. The largest towns are Tomsk (112,000) and Irkutsk (113,000), the capitals of western and eastern Siberia respectively. Omsk (128,000) is really a Siberian town but actually within the Steppes. Other large towns in western Siberia are: Novo-Nikolaevsk (63,000), a centre of rapid growth situated where the Siberian railway crosses the Ob; Barnaul (52,000) and Biisk (28,000), both centres in the rich Altai region. Kurgan (35,000) on the Tobol, a great agricultural market; Tyumen (30,000) now on the railway and a focus for trade between Russia and Siberia; Tobolsk (21,000), a declining fur and fish market on the Irtish; Kolivan (13,000) on the Ob, with agricultural interests; Mariinsk (13,000), a mining centre on the railway and Achinsk (10,000) a little farther east. In eastern Siberia other important towns are: the great port of Vladivostok (95,000); the two Amur ports and agricultural centres, Blagovyeshchensk (76,000) and Khabarovsk (53,500); Chita (73,000) with growing agricultural and commercial interests; Krasnoyavsk (73,000), the chief river and railway port of the Yenisei; Nikolsk-Ussuriski (34,700), a rising industrial and railway centre 70 m. from Vladivostok; Nikolaevsk (12,500), the port at the Amur mouth; the two mining centres on the Yenisei, Minusinsk (14,000) with agricultural interests, and Yeniseisk (10,000); Kansk (10,000) on the upper Yenisei and Siberian railway; Stryetensk (10,000), at the head of the Amur-Shilka navi-

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gation; and Verkhne-Udinsk (9,500), a railway and industrial centre in Transbaikalia. The towns of the far N. are small and primitive. Yakutsk, a fur-trading centre on the Lena, has a pop. of 8,200 and Verkhoyansk, on the Yana, only 450. The pop. of Sredne-Kolimsk, on the Kolima, which is the largest centre in the N.E. of Siberia, is 650. Petropavlovsk, the capital of Kamchatka, has fallen to some 500; Alexandrovsk, the capital of Russian Sakhalin, about 6,000, a figure, however, which includes more natives than Russians; and Okhotsk to less than three hundred.

Agriculture.—In western Siberia about 17,000 sq. m. are under crops (1913) but there are still great areas of natural grassland waiting for cultivation. In eastern Siberia agriculture has not made great progress except in the southern Ussuri plain: natural grasslands are scarce but there are many forest areas on the Amur which, if cleared, would afford good agricultural land. The area under crops in eastern Siberia is 2,800 sq. m. (1913). Agricultural methods in the W. have undergone some improvement, through the use of fertilizers and the importation of American agricultural machinery. Many flour-mills have been erected. Western Siberia sends its surplus wheat to Russia and eastern Siberia. The latter region also imports corn from Manchuria. In 1913 the total cereal production of Siberia was 68,200 cwt. and the average annual production (1908–13) was 50,200 cwt.

Land Tenure.—After the revolution of 1917 the State became the owner of all land in Siberia except some 5,000,000 ac. granted to Cossacks or other private persons. All other holders of land are tenants of the State, enjoying in some cases hereditary leases. The State ownership would seem to apply also to minerals, timber, fisheries and water power but some concessions have been recognized in favour of foreigners.

Live Stock.—The rearing of live stock has made more progress than agriculture. In 1913 the Steppe towns of Petropavlovsk and Omsk had become great centres for the export of meat to European Russia, drawing a large part of their supply from the Tomsk province. In the Transbaikal, Amur, and Maritime provinces cattle-breeding promises to attain greater importance than agriculture, but the meat supply of eastern Siberia is partly dependent on imports from Manchuria. The successful acclimatization of the merino sheep in central Siberia holds promise of much wool production in the Yeniseisk and Irkutsk provinces. Pig-breeding is a growing industry in western and central Siberia and by 1914 bacon exports had become important. Reindeer-breeding is the chief occupation of most of the far northern tribes. Maral deer and other species of wapiti are bred in the Altai, the Maritime province and elsewhere for their horns, which to the Chinese have a reputed medicinal value. The official figures (in round numbers) for the number of live stock in Siberia in 1911 and 1914 are as follows:—

	Horses	*Horned cattle*	*Sheep and goats*	*Pigs*
1911	4,598,000	5,719,000	5,250,000	1,126,000
1914	4,840,000	6,541,000	5,745,000	1,428,000

The dairy industry has developed quickly, fostered by State encouragement and the export facilities afforded by the railway. In 1912 there were 1,060 coöperative dairies in the Tobolsk province, and 2,042 in the Tomsk province. The export of butter from western Siberia reached 35,000 tons in 1903 and 76,000 tons in 1913: in the latter year the home consumption accounted for an additional 75,000 tons. The industry is of less importance in eastern Siberia.

Hunting.—The fur industry retains great importance and was much stimulated during the early years of the World War by the high price of skins. But decrease of game is causing hunting in many parts of the N. to take a secondary place to fishing and reindeer-breeding. The sable became so scarce that from 1913 to 1916 its slaughter was forbidden. The white fox is becoming rare. The principal fur fairs are at Irbit (Feb.) and Yakutsk (July), but Ishim, Blagovyeshchensk, Nikolaevsk and Anyui are also frequented by traders in search of furs. Yakutsk has also a trade in fossil ivory from the New Siberia Is.: in 1913 nearly 20 tons were sold. In order to prevent their extermination the few seals of the Commander Is. were protected for five years from 1912.

Fishing.—In western Siberia the most important fisheries are on the Ob. Tobolsk is the headquarters of the industry: Obdorsk, Beresov, Surgut and Narim are also important centres. At least 10,000 men take part in the fishery and the annual catch is about 15,000 tons. On the upper Irtish Pavlodar and Lake Zaisan are centres of fishing. The fisheries of the lower Yenisei send S. about 3,000 tons every year. In Lake Baikal there are valuable fisheries both in summer and, through the ice, in winter. In the Lena and Kolima regions the natives live chiefly on fish but lack of transport facilities prevents export. Fisheries in the Amur, Okhotsk and Kamchatka regions steadily increase in importance. The fish are mainly species of salmon but not the same as those in western Siberia. The fisheries are largely in Japanese hands but legislation in 1899 restricted to Russians all fisheries in the Amur and its estuary. In 1913 the mouths of certain rivers on the Okhotsk and Kamchatka coasts were closed to all fishing in order to conserve the fisheries. In 1913 the Okhotsk and Kamchatka fisheries resulted in a total catch of 46,000,000 salmon, most of which went to Japan. Salmon caviar to the extent of 2,477 tons was exported from the same districts. Salmon-canning is a new industry: in 1913 the output from Kamchatka was over 500,000 tins, and from the lower Amur 100,000 tins. Attempts to send frozen fish from the Amur to Europe met with some success when begun in 1913. The fisheries of Russian Sakhalin are losing their importance. In the Sea of Japan the herring-fishing from Imperial and Peter the Great bays is growing in value.

Timber.—Siberian forests of commercial timber are estimated to cover about 470,000 sq. m. or about one-tenth of the total area of the country, but owing to absence of transport facilities only 150,000 sq. m. are considered to be exploitable. In western Siberia there is little trade in timber and the demands for home use and the havoc of forest fires are decreasing the available supply. The principal saw-mills are at Tobolsk, Tyumen, Omsk, Novo-Nikolaevsk and Tomsk. In eastern Siberia the timber industry is confined to the Amur and Maritime provinces except in respect of the demand for fuel for railway, industrial and domestic purposes. The principal saw-mills are at Irkutsk, Blagovyeshchensk, Nikolaevsk, Imperial Bay, Vladivostok and Alexandrovsk (Sakhalin). Export is from Vladivostok, Imperial, Olgi and Posiet bays to Australia, the British Isles and Japan. Before the war great efforts were being made to encourage this trade.

Minerals.—Gold is the most important mineral in Siberia. The Lena drainage area, especially the valleys of the Olekma and Vitim, is considered to be the richest gold-producing area in the world. All the gold worked is alluvial and the annual yield (1916) was some 400,000 oz. Bodaibo, connected by rail to the Vitim, is the centre of the industry. The gold-fields of the Amur valley when fully explored will probably prove to be even greater in extent. The new town of Zeya Pristan on the Zeya is the principal mining centre on the middle Amur. The Bureya valley is also rich in gold. On the lower Amur there are rich gold-fields near Lake Chyla. The Amur gold is alluvial and most of it is very fine. British interests control the principal gold-fields of both the Lena and Amur basins. Gold is reported from several places on the Sea of Okhotsk, in the Chukchee peninsula and in the Anadir region. The output in Transbaikalia is falling off. In the Yeniseisk region there are valuable deposits in the Abakan valley. In western Siberia the gold output is declining but, as placer mining gives way to quartz crushing, shows prospect of reviving. Quartz veins are rich in the neighbourhood of Ust-Kamenogorsk and Lake Zaisan. The gold-bearing rocks in Siberia as a whole, including the Urals, are estimated to cover over 800,000 sq. miles. The total output of gold in 1913 was estimated at 1,500,000 oz., of which over 90% was from eastern Siberia; but there is reason to doubt the accuracy of official figures. In the same year the number of men employed in the gold industry in Siberia was 56,400. Climate, labour and transport, apart from political difficulties, afford obstacles in the development of the industry. The output of silver has shown a decline for many years, but numerous rich deposits are known to exist in the Altai region and around Nerchinsk. The production of zinc has increased, largely due to the rich Tyutikha mines in the Priamur. Lead is obtained from these mines and also from the Altai mountains and Ust Orlinskaya on the Lena. Zinc and lead mines at Riderski in the Altai are linked to the Irtish by a 70-m. narrow-gauge railway. Tin occurs in the Onon valley in Transbaikalia, but it is little worked. New deposits of graphite have been reported from Cape Dezhneva on Bering Strait. Copper occurs mainly in the Urals and in the Karkaralinsk district of the Kirghiz steppes, both of which regions are outside Siberia proper. There has been little if any progress in the production of iron except in the Urals, but valuable deposits of iron ore are reported in the Amgun valley near the Amur mouth, in the vicinity of Vladimir and Olgi Bays in the Priamur, in many parts of the Altai and near Karkaralinsk in the Steppes. Considerable coal deposits of varying quality have been located, but comparatively few are mined. Want of markets and transport facilities are drawbacks even where the coal is of good quality. The most promising deposits are the Kuznetsk beds in the Altai region which contain coking coal; beds around Cheremkhovskoe, 70 m. W. of Irkutsk, where some 5,000,000 tons of lignitic coal are mined annually, principally for use on the railway; the Suchan mines, 60 m. from America Bay, on the Sea of Japan, and the Mongugai beds near Amur Bay on the Tartary coast. The Mongugai beds and those at Due in Sakhalin both consist of good anthracitic coal but neither is seriously worked. Coal in the Amur and Lena valleys and Transbaikalia is chiefly lignitic. There are large deposits of lignite at Baron Korfa Gulf in Kamchatka. In the Kirghiz steppe coking coal is worked at Ekibas-tuse. The mines, which are controlled by a British company, are connected with the Irtish at Yermak by a railway 70 m. in length. Petroleum-bearing strata exist on the eastern shores of Lake Baikal and near Nabilski Bay in Sakhalin, but the oil is not exploited.

Manufactures.—Manufactures on a large scale have made little progress except in engineering works and repair shops for the railways. The competition of the Ural iron foundries, which have better transport facilities, has adversely affected the Siberian foundries, but a few persist, notably at Petrovsk in Transbaikalia, Blagovyeshchensk and Tyumen. At Ekibas-tuse in the Steppes the zinc and lead ores from the Riderski mine are smelted. Some river ports, as Khabarovsk, Blagovyeshchensk, build and repair vessels.

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Tanneries, tallow factories, brickworks and breweries are widely scattered. Only 7·6% of the pop. is estimated to be engaged in manufacturing industry (1914).

Communications.—Efforts to open up communication with Siberia by its northward flowing rivers and the Arctic Ocean have met with some success, but access by this route is possible only in the height of summer. Experience has shown that during Aug. and Sept. ice seldom presents any real difficulty in the Kara Sea and a steamer can rely on making the estuary of the Ob or Yenisei. One or two vessels take this route annually. Along the eastern part of the Arctic coast the only regular navigation is by occasional vessels between the mouth of the Kolima and Vladivostok.

The Ob affords 17,000 m. of navigable waterways, but the delta impedes communication with the Arctic Ocean. Seagoing vessels can reach Obdorsk, but large vessels have to lie at Nakhodka Bay in the Gulf of Ob. River steamers ascend the Ob to Biisk, 2,059 m. from the sea, and the Irtish to Lake Zaisan, 3,100 m. from the sea. The Ob-Yenisei canal between the Ket and the Kas is accessible only to small barges. In 1915 there were 350 steamers and several hundred barges on the Ob and its tributaries. The Yenisei is navigated to Minusinsk, 2,045 m. from the mouth. Small seagoing vessels can reach Yeniseisk, but larger vessels discharge and load at Golchikha (Ghilghila) in the delta. The Yenisei is the only Siberian river for which sailing directions and large-scale charts are published. Beacons and buoys assist navigation. In 1915 there were 60 steamers on the Yenisei. The tributaries are of little value for navigation. The Lena has a navigable length of 2,760 m. to Kachugskoe, 230 m. from Irkutsk, the nearest point on the railway. In 1914 there were some 30 steamers on the river, mainly between Yakutsk and Vitimsk. The Vilyui, Aldan and Vitim are tributaries on which a few steamers ply. The Amur with the Shilka is navigable for 2,000 m. to Stryetensk on the Siberian railway. There are many sandbanks, but vessels drawing 3 ft. can make the whole journey. The river is buoyed and marked and supplied with a few dredgers. Seagoing vessels stop at Nikolaevsk in the delta, but if the stream was dredged in a few places they could reach Khabarovsk. In 1916 there were about 400 steamers and several thousand barges on the Amur and its navigable tributaries. Practically all the vessels were Russian, although Chinese vessels have equal rights down to Khabarovsk. On the Sungari, the Manchurian tributary of the Amur, there is Chinese and Japanese shipping. The Ussuri is navigable throughout its length. Steamers ascend the Ussuri and Sungacha to Kamen-Ribolov, on Lake Khanka, 500 m. from Khabarovsk. Navigation on Lake Baikal has become less important since the construction of the railway round the southern end. In addition to two powerful ice-breakers there are about 12 steamers on the lake, some of which ascend the Selenga. The shores of Lake Baikal are well provided with lighthouses. The best harbors are Baranchuk on the west and Misovski on the east. Both are provided with breakwaters and wharves and are on the Siberian railway.

In 1916 the railway mileage in Siberia was approximately 6,800 m., not counting the Chinese Eastern (trans-Manchurian) railway. The Amur railway was built between 1908 and 1916. It marks a reversion to the course originally projected for a railway to the Pacific and provides a through route independent of Chinese territory. The Amur railway is a single track linking Kuenga via the Amur valley with Khabarovsk, 1,295 m.; the embankments and bridge piers are built for a double track. There are branches to the Shilka river at Chasovaya, and to the Amur at Reinova, Chernyaeva, Blagovyeshchensk, Innokentievskaya, and Pashkova. The bridge across the Amur at Khabarovsk is 7,038 ft. in length and has 22 spans. In western Siberia the line from Petrograd to Tyumen has been extended via Ishim to Omsk on the original Siberian line. A line from Ekaterinberg destined to reach Tobolsk goes via Irbit and ends at Saitkovo on the Tavda river. The Altai railway from Novo-Nikolaevsk to Barnaul (with a branch to Biisk) and Semipalatinsk, 408 m., was opened in 1915. It serves mining and agricultural interests in one of the most promising parts of western Siberia. The new line from Achinsk to Minusinsk, 300 m., opens a rich agricultural district in the valley of the upper Yenisei and tributaries. From Tatarskaya, 105 m. E. of Omsk, a line goes S. to Slavgorod, 196 m., in a region which in 1913 was attracting settlers. From Yurga, 385 m. W. of Krasnoyarsk, a line to Kolchugino, 200 m., taps rich coal-fields. These two lines were built by private enterprise. The Siberian railway is now double-tracked from Omsk to Karimskaya where the Stryetensk and Amur line begins. Some of the bridges still require to be widened. There is a double track from Nikolsk-Ussuriski, the junction of the Ussuri and Chinese Eastern railways, to Vladivostok. A line 93 m. long connects the Suchan coal-mines with Vladivostok. During the years 1915–6 the Siberian rolling-stock was much increased from the United States, and new railway shops were erected at Pervaya Ryeka near Vladivostok.

The telegraph system has been extended into Arctic Siberia: lines follow the Ob to Beresov, the Yenisei to Turukhansk and the Lena to Yakutsk and Vilyuisk. There are lines from Yakutsk to Okhotsk and from Khabarovsk to Nikolaevsk with connexion to Sakhalin. The Siberian telegraph system is linked via Semipalatinsk with that of Turkestan, and via Chuguchak with that of Mongolia. A second line to Mongolia between Kosh Agach, on the frontier, and Kobdo was incomplete in 1921. The Siberian and Chinese systems join at Kyakhta. Wireless telegraph stations exist in many places in the far N., and in 1916 were working at Cape Mare Sale in the Yamal peninsula; Dickson I. at the Yenisei mouth; Novo-Mariinsk and Markovo on the Anadir; Gizhiga Bay; Okhotsk; Khabarovsk; Nikolaevsk; Petropavlovsk in Kamchatka; Imam on the Ussuri and Vladivostok.

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SICKERT, WALTER RICHARD (1860–), British painter, was born at Munich, May 31 1860, the son of the painter, Oswald Adalbert Sickert, a well-known contributor to *Fliegende Blätter*, and grandson of Johannes Sickert of Altona, painter and lithographer. Walter Sickert studied painting and etching under Whistler in Tite Street, Chelsea, but in 1885, following the advice of Degas, began to paint from drawings instead of from nature. His first work on these lines, "Mammoth Comique," was published in the *Yellow Book*. The dramatic quality of his work owes much to his study of the technique of wood engraving and to his interest in the work of John Leech and Charles Keene, while he was also much influenced by Wilhelm Busch (*see* 4.869) and Adolf Oberländer (*see* 19.946). His subject pictures include "Mamma mia po' areta" (1903), "Noctes Ambrosianae" (1906), "The Camden Town Murder" (1906), "Army and Navy" (1913), "Ennui" (1914), "Sinn Fein" (1915), "Pierrots on Brighton Beach at Night" (1915), "Baccarat at Dieppe" (1920) and "Supper at the Casino" (1920). He also produced some architectural paintings, including "Hotel Royal, Dieppe" (1900), "Miracoli" (1903), "Lansdowne Crescent" (1917) and "Pulteney Bridge" (1918), while his best known landscapes are "The Happy Valley" (1919) and "The Priory of Auberville" (1919). Examples of his work are in the British Museum, Tate Gallery, Bibliothèque Nationale, the Luxemburg and the art galleries of Manchester and Johannesburg. He became a member of the Société du Salon d'Automne, the Society of Twelve and the International Society, and was a fellow of the Royal Society of Painters, Etchers and Engravers. As a teacher he exercised a strong influence over the younger school of British painters.

SICKLES, DANIEL EDGAR (1825–1914), American soldier and diplomatist (*see* 25.36), died in New York City, May 3 1914. In 1912 after having served for more than a quarter of a century as chairman of the New York Monuments Commission he was removed following the discovery of a shortage of $27,000. His last years were disturbed by financial difficulties.

SIDGWICK, ARTHUR (1840–1920), English scholar (*see* 25.39), was in his later years an ardent advocate of the abolition of compulsory Greek at Oxford, both in the interest of the classics and with the view of extending the field whence the university should draw its students. He was also a warm supporter of the admission of women to the university degrees, as he

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had previously been both of woman suffrage and indeed of all aspects of the higher education of women. He died at Oxford, Sept. 25 1920.

His elder brother, WILLIAM CARR SIDGWICK (1834–1919), also a classical scholar and fellow of Merton College, Oxford, died at Rugby, Oct. 18 1919.

SIDGWICK, ELEANOR MILDRED (1845–), British educationalist, was born in Scotland, March 11 1845, the daughter of James Balfour of Whittingehame and his wife Lady Blanche Cecil. She was thus the sister of Mr. Arthur James Balfour. She was educated at home, and in 1876 married the philosopher Henry Sidgwick (*see* 25.39). Mr. and Mrs. Sidgwick were both much interested in the advancement of the higher education of women, and were actively concerned in the founding (1880) of Newnham College, Cambridge, of which Miss Clough was the first principal. On the death of Miss Clough in 1892, Mrs. Sidgwick succeeded her as principal, and retained the position until 1910. In that year she retired, and until 1919 was bursar of the college. Mrs. Sidgwick shared her husband's interest in psychical phenomena, and in 1910 became secretary of the Society for Psychical Research.

SIEGECRAFT AND SIEGE WARFARE.—The earlier article on FORTIFICATION (10.679) reviews the prevailing ideas of defence against siege-warfare just before the World War. Opinion was then still unsettled on fundamental points, as well as on those differences in arrangement of the available elements of defence which have always divided the military engineering world into two or more schools. In the earlier days, Vauban and his competitors might disagree as to design, but they were in agreement as to purpose; and even at a later date, when the "bastion" school carried on its controversies with the "polygonal" or *caponnière* school, there was complete unity as to the necessity of permanent fortifications and substantial unity as to their functions. But the economic history of the 19th century, and the military history of its latter half, had brought the principles as well as the practice of fortification into the melting-pot.

Amongst many reasons for this, the following were the more important:—

(*a*) The increased size of armies, made possible by the credit system of finance, the universal service system of recruiting, the industrial system which could arm them, and the road and rail system which enabled them to disperse without risk in order to feed on the countryside, or to remain massed without starving through a breakdown of convoys, or both.

This increased size soon reached a point at which the old-fashioned fortress ceased to be an adequate base for the army's depots, or an adequate shelter in which to refit after defeat. There were signs of this even in 1870, although by that date the fortress had expanded into an entrenched camp of large perimeter, and between 1870 and 1914 the scale of field artillery, field transport and field ammunition for a given force, was practically doubled.

(*b*) The character of war, as between "armed nations," in which, in principle, a speedy decision by battle was sought at all costs, whereas warfare between the old professional armies had been prolonged from campaign to campaign. The objects sought by each side were now rather spiritual than material, or at any rate more general than local; and the fortress, which used to be judged according to the degree of protection it gave to the material objects of enemy desire—a city, a province, a port—came to be judged according to the degree in which it aided or impeded the manœuvres of a field army seeking to win the war in battle. The task of fortification thus became much less positive and definite, and a programme of works took on a somewhat speculative character.

(*c*) Development of communications, which, besides the effects referred to under (*a*), had that of making civilized countries everywhere or nearly everywhere penetrable. The fortress as conceived of in the 18th and early 19th century, therefore, no longer exercised any power of control beyond the range of its guns or the striking radius of its semi-mobile garrison. And it could easily be "turned," and then either enveloped or—by means of a masking force—eliminated as a factor in the campaign. Cases indeed remained, and still remain, of "obligatory points of passage," where local control of the route by means of fortification implies strategic control of the adjacent regions which are limited for their intercommunication to that route. Especially is this true still of rail communication. But in the main, armies and their transport can, in present-day west and central Europe, move where they will, except through areas directly under the tactical control of fortifications.

Further, the rapidity of communication as well as the wealth of routes enables a modern state to concentrate its defensive forces in the threatened region far more rapidly than of old, and the necessity for fixed defences, to gain time for the assembly of mobile forces, steadily declined.

(*d*) The development of the technique and manufacture of weapons of war, from about 1860, became so rapid that permanent fortifications of any given design were liable, like modern warships, to fall into obsolescence after a brief life of usefulness which contrasted sadly with the long career of a place like the old citadel of Antwerp, built in 1567 and besieged with all the forms and means of siegecraft in 1832.

Three out of four of these operating causes, it will be noted, are extrinsic, and one only intrinsic. In the case of the latter, operating alone, it is easy to conceive of a sort of duel between the gun constructor and the military engineer, analogous to the continued contest of gun *versus* armour plate. Few fortresses have ever had the good fortune to be fully up to date in design and equipment at the moment of siege. The reply of the French engineer who was asked what he would do if the Germans made the length of their scaling ladders greater than the depth of his ditches, expresses an inevitable condition of permanent fortification design. "It will always be easier," he said, "for the Germans to make scaling ladders than for me to dig ditches." Similarly, it will always be easier to make a new gun that will cut through a given thickness of concrete or armour than to increase the latter. For—questions of expense apart—the fort is a permanent sentry guarding against surprise, and the reconstruction of its works is a heavy piece of engineering which not only takes time but frequently renders them useless for the period of the repairs. Thus, in 1914, war surprised the fortress of Belfort when four of its principal works were under reconstruction. And if, as is generally the case, the programme of reconstruction is so drawn up as to minimize these risks, some part of the fortification system is sure to be obsolescent at any given moment. At any such moment, then, the question is not whether the means of attack have the upper hand—practically this is almost always the case—but whether the superiority is of such an order that the fortress or fort is useless. The new long-ranging powers of siege artillery in 1870, subjecting the area *intra muras* to concentric bombardment by an indefinitely numerous attacking artillery, and the demolishing powers of the superheavy siege howitzers evolved in Germany and Austria between 1900 and 1914—at least as against average concrete—were superiorities of that order.[1] But such cases are not frequent in military history, and it is more usual—in modern times, especially—to find a sort of thrust and parry, in which the artillery of the attack maintains a lead, but not a decisive lead.

The extrinsic causes in operation, meantime, were tending to bring about radical changes in the very meaning of fortification.

Outwardly, the controversies of the period 1885–1914 turned on technical questions, and chiefly on whether improvised fortifications could be shown to possess a resisting value practically equivalent to that of permanent fortifications. But in reality it was the feeling that the purposes and principles of fortification,

[1] Even in this instance, it must be admitted, the event was due in part to faulty designs which were not up to date even when laid down. Thus the new Antwerp forts (*see* ANTWERP) were only built to resist the 21-cm. mortar, although the Japanese had already, under very unfavourable conditions as to communications, managed to employ 28-cm. pieces at Port Arthur. On the other hand Fort Douaumont at Verdun, where the concrete was excellent (1892) and of adequate thickness, resisted a far heavier bombardment even by 42-cm. howitzers.

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as they had been understood in the past, no longer responded to the needs of warfare, that produced the multiplicity of designs and proposals for artillery works and infantry works, armoured and unarmoured works, self-contained and mutually interdependent works, and so on, characteristic of the period of unsettlement. If most of this ingenuity remained, as it did, unconvincing, this was due to the fact that there were great general causes at work, of which, in default of war experience, only the existence and not the effects could be seen.

The size of armies steadily increased, all the European continental Powers being drawn into a competition based on the numbers of citizen soldiers who could be conscripted and financially maintained. The power of armament increased also, and with it the possibility of holding a wider front per unit of armed force. The special results of this, from the point of view of fortification and siegecraft, were the extension of perimeters and the thinness with which a circle or arc of investment could now be maintained. But the more general results were the more important. An army developed along a front of some hundreds of miles could no longer be worked by radial lines of communication centring upon one or two ring fortresses. In Napoleonic practice, a stronghold of some sort was always the centre of operations on which the army's movements pivoted; and only that portion of the theoretical base-line, which was in relation with the stronghold in use at the moment, formed what has been called the "effective" base. With the modern extended fronts, on the contrary, the effective base has widened more and more, until it practically coincides with the theoretical base. In other words, each part of a great army has its own lines of communication and its own sources, the connexion between the army line and the base line, or front edge of the home supply area, being a sheaf of more or less parallel routes. Whatever local variations may appear when portions of the system are isolated and examined by themselves, in the *ensemble* the strategic structure of warfare in civilized countries had become linear.

But the more the front extended, the more difficult it became to collect any considerable force at one part of it for offensive effort. The "parallel battle in all its horror"—unit facing unit all along the line—was admitted to be the negation of generalship. But whether the dispositions were made *a priori* or by manœuvre within the battle, whether envelopment or break-through were the method chosen, the parallel battle could only be avoided by reducing the living forces on certain passive or semi-passive parts of the line to a minimum. The small economies that could be effected on these parts by judicious tactical arrangements in the open—though certainly not to be despised—would no longer suffice to give the really considerable superiority of force necessary for decisive victory on the active front. The expedient of economizing force by sacrificing territory had become, under modern conditions of social and economic life, more dangerous than it had ever been before. Recourse was had, therefore, to fortification. It became one of the rôles, if not indeed the principal rôle, of permanent fortification to economize active living forces on the passive fronts—a principle already applied to field fortification within the tactical sphere. As soon as the competition in numbers had set in all over military Europe, we find permanent fortification developing a new tendency to be *linear* instead of *circular* in type. The ring fortress becomes a sort of end-redoubt to a long line of forts, usually drawn along some natural barrier. This tendency is shown in the creation of the Meuse line (Verdun–Toul), and the Moselle line (Épinal–Belfort) in France, the line Namur–Huy–Liége in Belgium, the Sereth line in Rumania, the Bobr–Narew–Bug line in northern Poland, and lastly the Diedenhofen–Metz and Molsheim–Strassburg–Istein lines in Germany. In the same way, most of the new ring fortresses that were not so connected by permanent works were so placed as to be keystones of a linear battle-system; conspicuous instances are the systems Lille–La Fère–Laon–Reims–Verdun and Dijon–Langres–Epinal. Of the rest—setting aside the fortresses of eastern Europe where poverty of communications enabled permanent works, as of old, to dominate great areas by dominating a few nerve-centres—we find Antwerp, Copenhagen, Bucharest, Paris, designed as self-sufficing ring-fortresses, but not so much for playing a part in a battle-system as for serving as refuge for an army and a government that for the time being could not maintain its line of battle in the open field. Three of these four were called upon in the World War to play the assigned rôle and it is significant that not one of them did so successfully. Bucharest was evacuated as the result of an unsuccessful linear battle in the foreground; Antwerp was given up by the Belgian field army and Government as soon as the choice had to be made between standing a siege and continuing the war in the open; while in the crisis before the Marne the evacuation even of Paris was seriously considered.[1] Two ring-fortresses, Maubeuge and Besançon, were constructed in France in advance of the battle-system, in order apparently to draw upon themselves a part of the invader's effort condensed on the wings, and to control certain nuclei of communications which might otherwise be useful to him as he pressed forward. But the latter task is really that of a barrier-fort, and indeed Maubeuge was in process of being converted into a pure barrier position when war broke out, the old intention of an isolated defence *à outrance* having been abandoned. The linear systems with end-redoubts, on the other hand, performed in the war all the services for which they had been designed, with the exception of Liége–Namur; and even in this case failure—so far as there was failure—was due not to any vice of principle but to other factors.

The tendency to force a speedy decision in battle at all costs, specially characteristic of citizen armies, could not but reinforce the effects that the size of armies in itself produced upon fortification. With such a tendency on both sides, the initial deployment on each side would inevitably be carried out, wholly or largely, in accordance with an *a priori* plan of battle. Strategic considerations for the side which had chosen the pure offensive and moral and political considerations for the side which had chosen the defensive-offensive, imposed concentration close up to the frontier, in the first case so as to seize the initiative, and in the second so as to surrender as little of the national territory and resources as possible. Frontier fortification therefore had as its first duty protection of a line or zone of railheads close behind it; and since railway communication is in principle highly sensitive, a system of ring-fortresses at intervals could not give the same protection against sudden raids as linear defences of equal trench-length. But there was a further consideration. An *a priori* scheme of battle, with frontage and not depth as its main characteristic, is liable to require considerable modification when contact has been made and the first serious combats have produced their varied results, and thus a regrouping process begins in the course of the operation itself. In this regrouping, fortification is called on not only to protect the lateral shifting of masses by rail (as for instance the moves of the French IX. and XVIII. Corps from eastern Lorraine to the Ardennes in the middle of Aug. 1914), but also to send away its own local reserves to the area of decision (as in the case of the three French divisions transferred from the Meuse-line front to the Somme at the end of Aug. 1914).

The more penetrable the country, the more pronounced the linear character of the fortifications that must cover it. Not knowing the direction of attack, the defender must either prepare for it at all points of his allotted frontage of influence, or else resign himself to giving up country that *ex hypothesi* is economically valuable, and manœuvre in retreat to gain time. The old policy of devastating a deep zone to cover manœuvre, occasionally practicable when the organization of the state was simple and predominantly agricultural, is almost or wholly inapplicable in an industrial country. In Oct.–Nov. 1914 Hindenburg devastated part of W. Poland as cover for a lateral regrouping. But when it came to including Upper Silesia in the devastation programme, industrial influences promptly intervened to mitigate it. The

[1] In the event Paris played the part, originally assigned to Laon-La Fère, of end-redoubt in the battle-system. Antwerp, after capture, was organized by the Germans for the same purpose, viz. to serve as end-redoubt to the Antwerp–Meuse line.

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expedient of making even a narrow zone truly impenetrable by means of radical destructions, adopted by the Germans in France in the spring of 1917, requires both time and an elaborate labour programme, neither of which is available in a battle crisis. In some cases, inundations serve the purpose, but even inundations take time to spread. On the Yser front in Oct. 1914, five days elapsed between the order to open the sluices and the creation of an effective barrier thereby. Moreover, in a generally penetrable country the area of decision might turn out to lie in an unexpected direction, and, if so, a system of fortifications designed to protect regrouping by likely lateral routes might prove to be useless for covering those which actually were required to be used. Thus, a speculative element began to come into schemes of fortification. It was no longer possible to justify heavy capital expenditure on works by reference to plain and definite needs. Already it was admitted that if the unexpected happened, it would be necessary to make shift with improvised works; already a considerable body of opinion held that permanent works, if admitted at all, should be similar in general design to field works; and the tendency in these circumstances was inevitably to trust to the latter, which were cheaper, could be built just where they were wanted, and according to many experts were just as good in principle as permanent works, and indeed better than most of the expensive fortifications already in existence.

This underground growth of the linear principle was fostered by another cause. The time-honoured relation of the town and its defences was altered. Under the influence of tradition theory continued to conceive of the fortress as a circular defence round a town. But the town had ceased to interest the military engineer, who now called it the "nucleus." He disposed his ring of defences at such a distance as to protect the nucleus from bombardment, a convention which was imposing a larger and larger perimeter with every improvement in the range of guns, but his works were now meant primarily to take a share in the operations in the field. That being so, except in such cases as that of Port Arthur, where the nucleus contained establishments regarded as essential to the conduct of the war, it was almost a matter of indifference whether a particular town should be protected or not. The old relation of the town and its walls had been based on the fact that the walls preserved the town from pillage and murder. In the course of time this had changed to a great extent, and in the era of "cabinet wars" it had almost vanished. But the old mediaeval spirit of the towns came to life again in such instances as Zaragoza, Colberg, Venice, and even if the towns-people were indifferent or sullen, the governor could usually resist pressure from them, because he was strong in the conception of his plain duty as a soldier to defend the post entrusted to him. But when the defence perimeter had advanced out of sight of the town, and the *enceinte* had either been turned into a public garden or retained, demilitarized, as a historical monument only; when, further, in peace-time no military barrier whatever differentiated the defended area from the open country; when, lastly, two generations of railway traffic had destroyed the self-centred economic life of the town and blurred its particularism—then from the point of view of the town it was in much the same position as any undefended town or village in the theatre of war. It might come within the ambit of military operations or it might not; if it did, it might either resist the invader heroically in the manner of Belfort in 1870–1, or agitate for demilitarization as Lille did in 1914, but the fact that a ring of forts lay out in the country around it had very little influence either way on its conduct as a town. Open towns in modern times have behaved like fortresses of old, and fortresses like open towns of old.

Correspondingly, the position and outlook of the governor has changed. Formerly the town was his charge, and almost his viceroyalty. His troops were his own; organized for sedentary warfare and not for campaigning, they were not at the disposal of a field army which happened to be operating in the neighbourhood, and the town was in practice defended—sometimes with spirit, sometimes feebly—whatever course operations took outside. Up to the very eve of the World War a French fortress governor was responsible to the Government only, and took no orders from the commander-in-chief of the field armies. The era of "cabinet wars" made little difference to this state of things; the population might be indifferent to the war in the towns as in the country, but to the governor and his troops the fortress was still a charge to be defended. Moreover, it was a real base for the armies in the field, in that the stores and supplies for those armies were accumulated in the fortress, and a real strategic aid in that it commanded routes that were obligatory for both sides. But when, in our own times, the governor had become simply the commander of a certain group of forces destined like other forces to take their part in a general scheme of battle; when the area within his defences had to a great extent ceased to be the source of stores and supplies for the field army, and when railways, needing protection at all points and not merely at a focus, became the principal lines of communication, the choice between evacuation and defence came to be governed by larger considerations of strategy. The governor's decisions therefore were assimilated in principle to those of any tactical executant of the strategist's instructions. He might defend or evacuate as a field commander might hold his ground or retire. But the peculiar character of his responsibility was gone. Even in France, the country which has been most tenacious of the fortress tradition, the old regulation, already quoted, was modified in the 1913 "Regulations for the conduct of Higher Formations," which empowered the commander-in-chief to assume control of any fortress and its forces if he thought fit.[1]

On the German side, units made up from fortress garrisons formed quite one-third of the Eastern armies during the first campaigns of 1914 operating sometimes a hundred miles away from their fortress of origin and in the sequel, never returning to it.

In sum, therefore, causes of a general character operating before 1914 produced these tendencies: (*a*) to divorce fortifications from their nucleus or central town, (*b*) to make them rather linear than circular in trace, (*c*) to bring them into conformity with the battle-scheme of the field armies (with *déclassement* as the alternative), and (*d*) to construct them as far as possible according to the principles of field fortification.

The theory of fortification, on the other hand, was still bound by the notion of a nucleus, and unable, therefore, for the moment to employ its stock of ideas and methods to the best advantage. The practical technique of fortification and siegecraft was, meantime, progressing in details; reinforced concrete had come into normal use, armour was improving in quality, the defence had it in its power no less than the attack to profit by developments in the design of quick-firing guns and howitzers of medium calibres. Observation balloons and kites were available, superior to the old spherical types; wireless telegraphy removed some of the dangers of investment and made it possible to coordinate the activity of a besieged garrison with that of a relieving army. The technique of bored mines developed, and trench-mortars and grenades reappeared. The lessons of Port Arthur in matters of detail-tactics and design were assimilated in the various armies. The enormous defensive power of the machine-gun was realized and to some extent exploited. It remained to synthesize the application of these elements, old and new, in an art of fortification that responded to the new demands and conditions of warfare.

This art began to take shape with the introduction of the "group" principle. Advocated by several theoretical writers in the period of controversy, it was applied practically, and on a large scale, by the Germans in the celebrated *Feste* constructed on the Moselle and the Rhine in the last ten years before the

[1] It was in virtue of this new regulation that Galliéni's Paris forces were brought under Joffre's command in the battle of the Marne; and in accordance with the spirit of it that Sarrail acted in the same crisis, when, although only an army commander, he sent imperative orders to the governor of Verdun to despatch his mobile reserves to the battle-field of Revigny. The fact that the governor, General Coutanceau, though himself under attack, complied with this requisition instead of standing on his undoubted legal rights, is itself evidence of the changed outlook of the fortress governor in modern warfare. In a somewhat different way, the confused story of the *déclassement* of Lille in Aug. 1914 points the same moral.

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World War. They may be considered from two points of view: locally, as examples of a type of fortification, and collectively as a defensive *ensemble*.

The *Feste*, as its name indicates, is rather a self-contained fortress on a smaller scale than a fort in the old sense. Although it forms with other such works, and with forts or batteries, part of a defensive system which as a whole may be either linear or circular, it contains within its own wire entanglements each of the elements of defence—artillery for counter-battery, artillery for flanking the intervals, and infantry works for the protection of this artillery against a close attack. But it combines them in a way which differentiates it in principle from the types of fortification characteristic of the 1873–1903 epoch.

In that period there were, broadly, two opposed schools of thought, and a school of compromise. One school, fairly perhaps designated as the French, favoured an arrangement in which the "forts" form the close-defence element and intermediate battery-positions the distant-defence element. The opposite, or Brialmont school, exemplified in the Liége and Namur works (*see* 10.698–9 for plans), relied on a simple ring of powerful self-contained forts, each including both these elements. Variations within the respective schools turned chiefly on the use or non-use of armour, some relying upon it for the protection of all defensive weapons, others confining it to the close-defence weapons and yet others excluding it altogether. The compromise school, favoured by Austrian opinion, sought to modify the characters of each type so as to combine them. In all cases, it should be added, the intervals were intended to be garnished in war with an improvised trench system, with its wire, its dugouts, and its machine-gun emplacements.

The *Feste*, on the contrary, attempts to combine the two elements of defence without modifying either. Full security for the long-range elements is given in principle by dispersing them, equally full security for the close-defence armament by concentration within an obstacle. To add positive or negative protection, armour is introduced wherever necessary, and loose and "provisional" as the forms may seem to the student of earlier fortification, it must not be forgotten that, structurally, every detail of the *Feste* is a piece of permanent work.

This very warning, however, suggests that it is necessary—more necessary than ever—for the student of fortification, whether practical or theoretical, to find a satisfactory answer to the question: What is it exactly that we require of "permanent" fortification in the tactical sphere?

The rôle of permanent fortification, it is suggested, is to give to the garrison or defence force a greater degree of security, and to its armament better conditions of employment, than "provisional," *i.e.* heavy field, fortification can give.

To prevent the enemy's guns from obliterating the defences of the front attacked, and thus enabling his infantry to make its way into the defended area, these guns must be counter-battered and (if possible) destroyed, but in any case neutralized as far as practicable. This implies a counter-battery armament on the side of the defence. According as the guns of this armament are exposed to enemy observation or not, they require, or they can dispense with, fighting protection. But in both cases, and especially in the second, they require to be screened against hostile raids or brusque infantry assaults that may develop during this counter-battery phase, emerging perhaps from dead ground close in front.

This protection can be given in the form of an obstacle to the enemy's passage, so serious that a great and organized effort is necessary to reduce it. Such an obstacle may be a deep ditch, or a system of wire entanglements or grilles, or both. Normally, the former is the better obstacle, but except in country already intersected with canals, wet ditches, river-channels, the use of a ditch requires that the armament to be protected shall be grouped very closely. Unless, therefore, the engineer and his Government are prepared to face the expense and provide cover of the solidest kind[1] the ditch as obstacle is usually excluded, so far as concerns the protection of what may be called the main armament. The wire or grille, as compared with the ditch, is greatly inferior as an obstacle, but much more readily created, more easily destroyed, but more easily repaired also. Obstacles can be traversed, either after being broken down by bombardment in advance of the assault or by means of scaling ladders and bridges accompanying it. As against destruction by bombardment in advance, the only remedy of the defence is the counter-battery which entirely or partially stops the bombarding guns. But even without such destruction, the obstacle may be overcome by ladders and bridges, wire cutters, petards and other appropriate means, in the course of the assault itself, unless the work of placing these devices is made impossible by the defenders' fire. Hence the obstacle, whether it be ditch or wire, must be protected by a close-defence armament, and nowadays it is generally admitted that this armament must be a specialized organ. But how is this in its turn to be protected against destruction or neutralization at the critical moment? Practically by its own defensive arrangements alone. And thus, in the element designed to guard the obstacle, we reach the alternate unit of fortification upon which the whole system depends, that which in the last analysis ensures for the main armament the power of undisturbed counter-battery (in the case of a *fort d'arrêt* of keeping the forbidden area under steady fire).

The close-defence organ, then, has two functions—to protect other elements and to protect itself. The former presents no particular difficulty, and is merely a question of providing the necessary fire-power. But the latter is the critical problem of modern fortification.

If the counter-battery guns are concentrated, as in a fort, and the obstacle is a ditch, then—quite apart from the material cover required for these guns to enable them to fight—material cover is also needed for the close-defence organ, since its position is practically obligatory. But the cover is obtained relatively easily since the weapons covered are sunk to the level of the ditch-floor, and any necessary thickness of protection can be provided over it both on first construction and later.

But such a concentration of counter-battery methods creates large intervals between work and work, and access to the defended area (which with a dispersed main armament is automatically barred by the obstacles defending this and the fire of the organ which protects them) must be prevented by organs in the works so placed as to control the open zone. In some systems reliance has been placed on the counter-battery guns themselves to do this, but modern engineer opinion generally may be said to be opposed to this, since guns which have been engaged in the artillery duel may have been put out of action by the time that they are wanted for close-defence, and even if intact should be wholly absorbed in their proper task. The organ providing ditch defence, by reason of its situation is not as a rule able to undertake control of the open intervals; and in short the only alternatives are small cupolas or *traditore* batteries. The former are open to many objections. If built into the same work as the main armament they are almost as much exposed to premature destruction as the latter is[2] and must be provided with fighting protection on the same scale. If mobile, they are exceedingly costly in proportion to the fire-power they develop. For these reasons modern practice generally favours the *traditore* battery, which is a casemated emplacement (sometimes a cupola) at or near ground level, giving fire only to the flanks and rear of the work, situated in the rear portion of it and protected against bombardment to a great extent by the mass of the work itself.

But, from the nature of its duty, the site of the *traditore* battery is frequently obligatory, and when it is combined inside the same obstacle with a concentrated counter-battery armament, the needs of the latter as to site may conflict with those of the *traditore*. In the avoidance of this, perhaps more than in any other

[1] As Col. J. C. Matheson has pointed out, the closer the grouping the denser the material required to protect it.

[2] The cupolas of this class in the Antwerp forts suffered nearly as severely as those of the main armament, although they were hardly called upon to exercise their special functions, since the infantry attack of the Germans was not pressed into the intervals before the fire of the forts had been beaten down.

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single factor, lies the central idea of group-fortification of the *Feste* type. Two dissimilar elements have to be both protected by the same obstacle and yet spaced some distance apart. But the obstacle (in such conditions mainly wire or grille) itself requires local close-defence. This "ultimate unit" has thus not yet been arrived at. Nevertheless, this ultimate unit, in group-fortification, has only to give short-range protection to the obstacle, and in practice it is an infantry-manned stronghold, designed to give fighting protection to its garrison,[1] sometimes provided for, its own local safety with a deep ditch and sunken flanking defences, sometimes organized with a fighting parapet frontally commanding an artificial foreground which is wired, but always having as its real function the protection of an obstacle external to itself.

In the case of concentrated main armament, therefore, it would seem that fighting protection for the counter-battery guns, for the *traditore* batteries, and for sunk ditch defences is required to be designed on such a scale as will enable these elements to defy, actively or passively, the attack guns of the day and the morrow. The same applies to the shelters in which—in the case of group fortification—the garrison of the infantry work is placed in readiness to man the parapets, but not necessarily to these parapets themselves. Further, in proportion as wire replaces the deep ditch, as an obstacle, heavy and expensive work in peace-time is dispensed with.

In the system of deployed main armament, on the other hand, the proportion of permanent work, it would seem, can safely be much less. With modern artillery means, the sites for counter-battery armament are rarely obligatory; observation must be provided for; but the actual position of the guns, and therefore the line of liaison between observation post and guns, are—to a great extent at least—free from limitations of ground. This being so, the close-defence element of the fortifications may be disposed to the best advantage for carrying out its task—that of protecting a system of obstacles suitably placed between the battery zone and the enemy.

In point of permanent work, then, although parts of the battery positions themselves may occasionally require concrete or even armour, concealment of virgin earth, and alternative positions in the great majority of cases afford all necessary protection. For the close-defence guns, on the other hand—the element which must be able to endure at all costs—the chosen positions are often (if not in most cases) obligatory, and full-scale fighting protection must be given. Even so, there being by hypothesis no necessity to develop frontal fire, and the volume of the required lateral protective fire being relatively little, a permanent work which is essentially a *traditore* battery and nothing else can be both small and well-covered against frontal fire at an expense much less than that of a great self-contained fort. Its own local protection may be either a ditch with sunk defences or an infantry system surrounded by wire, but these auxiliaries, too, would be withdrawn from the crest facing the enemy to positions on the reverse slope. The only case in which it would be necessary for any part of the system to go forward to the crest and front slope would be that in which the artillery observation and command post is combined with the *traditore* in one work or one enclosed group. In such a case the post in question would undoubtedly require special treatment as regards its own close-defence. But all that in principle is necessary is that the post and its liaisons should be immune.

On the other hand, the security of the main armament against a rush of hostile infantry was far greater when an obstacle defended by fire completely surrounded it, and military engineers were very loth to impair this security. No doubt, when the obstacle covering the front of the batteries in the deployed order was fully organised, the latter might be considered safe enough for practical purposes so long as the interval-defence remained effectively in action to protect it. But a danger period was foreseen in which the obstacle was not yet fit to perform its function with certainty. The "brusque" or (more accurately) the "abbreviated attack," proposed by the Bavarian General von Sauer, had many supporters; and as the tendency already mentioned, of modern warfare between "armed nations" is to push the line of resistance as nearly up to the frontier as possible, the fortifications of that line were in fact exposed to instant attack.[2] Those of Verdun and Toul were little more than 20 m., the easternmost fort of Liége only 13 m., from the German frontier, while the western Metz forts could be bombarded from French soil. In former days, this would have mattered less, but the growing mobility of heavy artillery—from about 1890—for the first time made it possible to employ true siege artillery within a few hours of the opening of hostilities. The attacker, on the other hand, naturally had to forego some of the power of his attacking means in attempting a *coup*. His truly mobile siege artillery was limited, or supposed to be limited, to the calibre of 21 cm. Heavier pieces though they no longer took weeks or months to arrive in their emplacements, at any rate took days to do so, and by a sort of general agreement (to which however there were exceptions) the situation was met by placing a part of the main armament of the defence—called the safety armament—inside a closed obstacle. Usually it was an existing fort that was adapted to house the safety armament, but sometimes it was included in the design of a new work. The fort thus in practice reverted partially to its old duty of serving as a battery position, while in theory its function had become entirely that of locally protecting a *traditore* or other interval defence. The distinction between property and accident was no doubt clear to specialists, but the result was that the generality of armies and peoples continued to look upon a fort as their fathers had looked upon it, till the astonishing events of Aug., Sept. and Oct. 1914 so thoroughly undeceived them—too thoroughly, indeed, for in the revulsion, not merely safety-armament guns but even interval-flanking guns were removed from closed works.

In the system of group-fortification, it was naturally much easier to house a safety armament. No element within the ring of wire need cramp any other, or be drawn into the fighting activity of another, or suffer from the shells intended for another.[3] Full fighting protection will be necessary, as is always the case with safety armaments, but, as has been noted above, with more room the same safety can be given with less expense.

In sum, therefore, the necessity of compromise on this question of safety armament has caused the dispersed-elements and the concentrated-elements schools to agree upon: (*a*) the group or *Feste* principle for interval-flanking elements, obstacles and defence of the same, and safety portion of main armament; (*b*) the order principle of deployed artillery, with an obstacle covered by flanking fire, for the remainder of the main armament. This, it will be noted, leaves a real liberty for the treatment of particular cases. The proportion of total armament installed as "safety" is whatever the designer chooses to make it in each instance, the *Feste* being adaptable to any proportioning within reasonable limits fixed by the contour of the ground. A practical check on enclosing an unnecessarily high proportion will always be the expense of giving full fighting protection.

Examples of Group-Fortification.—Types of forts, both main armament forts and others, being described and illustrated in 10.696,

[1] The term "storm-proof," frequently applied to such infantry works, hardly seems to connote their real function.

[2] To wire a perimeter or frontage of 30 km. to a depth of eight yd. only requires three eight-hour shifts of (in round numbers) 6,000 workers each, as well as mechanical, animal or human transport for about 4,000,000 yd. of barbed wire, weighing 300 tons or so, and 100,000–130,000 stout posts. Other work to be done includes the clearance of the field of fire, the digging of trenches, the construction of shelters (if not in existence already), opening of communications and liaisons, etc. Land which is occupied by a fortress garrison in war rarely belongs to the Government in peace.

[3] This can be demonstrated by the "theory of probabilities." Assume a main-armament cupola 16 ft. in diameter, under accurate attack by a gun having a probable error of 60 ft. in range and 3 ft. in line. Calculation shows that this will probably be hit by 7% of the shots fired. Now assume a *traditore* element having a vulnerable surface on top of 20 ft. from front to rear and 25 ft. laterally. Placed with its front edge 120 ft. behind the centre of the cupola, this will receive 3·62% of the shots aimed at the latter. Placed with the front edge 240 ft. behind, it will be hit by 0·2% of the shots. In other words, at twice the distance it is eighteen times as safe.

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it is only necessary here to consider examples of the newer group-fortification. Three forms may be taken, one of which, the Metz form, has been applied on a large scale, while the others, though academic examples, are fully representative of principle.

Common to all, it will be seen, are: (*a*) a wire obstacle round the whole group, and behind it an infantry trench-position; (*b*) very large area, equalling that of town and fortifications together in some of the old Vauban fortresses, and six to eight times that of the typical 1873–1903 fort; (*c*) batteries, closed and under armour, for the guns of the main armament (or safety armament) irregularly disposed within the wired area.

So far, all are in agreement. But beyond, there are some important differences. Thus, the Metz group, and those proposed by de Mondesir, both possess powerful infantry works with ditches, whereas the Austrian type lacks this element. Again, de Mondesir and the Austrian text-books agree in attaching the greatest importance to the *traditore* element, remarkably neglected in the Metz works—at least as originally built. Lastly, the Austrian and German engineers tend to place the centre of gravity of the artillery, and even that of the infantry, defence well forward, while the French author puts them as far back as possible, with only observatories and frontal trenches in the forepart of the area.

The Austrian design (fig. 1) as the simplest, is taken first. On the height 130 is an armoured battery P B, containing four 6-in. howitzers in cupolas, with an observation post in a small cupola in the centre.[1] Between the cupolas are magazines for the storage of 800 rounds per gun. A passage runs along the backs of the cupolas and ammunition rooms, and two barrack rooms are provided at the ends, with other small rooms as offices, etc., in the centre. In the actual design the thickness of the concrete is, in places, less than 2 metres, which is considerably below present-day standards.

On the forward slopes at S, S, S, are small works, combining in each 2 cupolas for quick-firing guns (intended for frontal close-defence, not main-armament work), with an armoured observation post between them and a shelter for infantry and machine-guns in waiting, to man the trench-line against assault. These are built with a roof of about the same thickness as that of the main-armament battery. On the rear slopes are two powerful *traditore* batter-

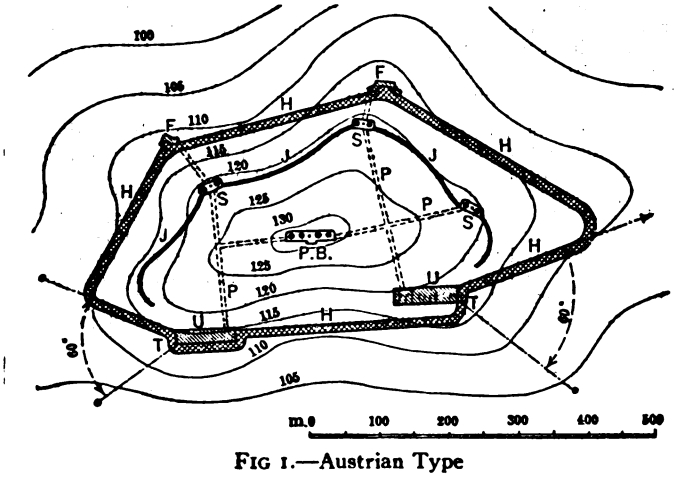

FIG 1.—Austrian Type

ies, T T with quick-firing guns (4 to 6 in each, in order to have sufficient for a distributed fire over the interval, in case fog or darkness makes accurate aim impossible). The inner parts of the concrete masses are organized as barracks (U) and magazines. The *traditore* is in two tiers, the upper commanding the country outside and the lower sweeping the (wired) bottom of the ditch. Armour is used for the faces of the gun casemates and nearly 3 metres of concrete form the roof. Those parts of the wired ditch not swept by the *traditores* are flanked by counterscarp casemates (F F) containing machine-guns or pompoms and protected by 2·8 metres of concrete. Tunnels connect the various elements of the group. In this design, which is simple and, owing to the absence of refinements that would not stand bombardment, strong, there are nevertheless some points of weakness, which may be discussed here, not by way of criticism but because they afford convenient illustrations of certain practical points which the engineer cannot ignore.

The whole of the front wire depends for its intimate flanking upon the counterscarp casemates, F F. In such cases it is necessary to protect the backs of the casemates and their communicating galleries from mine attack, by providing the roots of a counter-mine system at the outset. This was a form of attack which played a considerable rôle at Port Arthur. It is perhaps the only way of dealing with counterscarp casemates, but it is an effective one. At Fort Vaux (Verdun) the Germans made their way through a counterscarp casemate into the tunnel system of the fort, and the terrible gallery fighting of Port Arthur repeated itself. But, unlike the Japanese, the Germans had no difficulty in gaining access to the galleries in the first instance, as the French had themselves blown away the backs of the casemates in order to get convenient access to some external trenches. It is noteworthy that in the final stages of refortifying Metz on the group principle, the Germans were careful to provide the foundations of counter-mine systems. In the Austrian design here considered, nothing prevents the development of mine attack on these casemates except the fire of the central battery P B and the batteries, S, S, S, all of which are exposed and liable to neutralization or destruction by counter-battery. The depth of the ditch containing the main wire varies, and no walls exist to make it an important obstacle in itself. The integrity of the obstacle therefore depends purely on the fire of the counterscarp casemates, and—quite apart from the question of mining attack on these—later war experience has shown that there is great risk of the flanking fire being impeded or intercepted by the débris produced by intensive bombardment. This weakness is common to all ditches, and the problem of keeping the field of fire open had not yet been solved in 1921. But it is evident that the longer the ditch, the more chance there is of a heap of débris collecting at some point in it. In any case, it would seem that to attempt ditch protection for the whole perimeter of a group work involves the expenditure of money that might more profitably be devoted to other elements of defence. Another defect seems to be the small number of the infantry shelters, having regard to the time required for the defending infantry to come out and man the parapet. This is the more important, as this design altogether lacks the strong self-contained infantry work which is the kernel of those now to be described. The evolution of Metz as a ring-fortress is dealt with at 16·696. Allusion is there made to new works in progress outside the existing perimeter. These were the famous *Feste*. They were built in succession from 1899 to the outbreak of the World War, and were continued and practically completed in 1915. Their characteristics were only approximately known at that time, but when Metz was retroceded to France by the Treaty of Versailles, not only their present condition, but their history and cost accounts became available. (See the French official *Revue du Génie* of Jan.–Feb. 1921.)

The *Feste* in fig. 2 (from the *Revue du Génie*) shows an actual example. It should be understood that the Germans designed the earlier works of this class with a minimum of defensive precautions, notably in respect of external interval flanking, but that, in the later works constructed in the two or three years prior to the World War, there was a marked tendency to develop the hitherto inadequate external flanking, even at the expense of the main armament, which on this line of evolution would, in due course, have become a "safety" armament only. The group-work illustrated is rather of the earlier than of the later kind, as it is lacking in the *traditore* element. But it is one of the greatest advantages of the group-work over the cramped fort that additions and alterations can be made as required, and in fact many such works at Metz were provided later with 57-mm. and 77-mm. *traditore* batteries.

The *Feste* forms an irregular quadrilateral, measuring, from outer edge to outer edge of wire, 1,200 yd. from front to rear and the same from flank to flank, with an area within the outermost wire of about 120 acres. At the front and rear angles there are strong and minutely organized infantry works, which form the basic units of the system: their rôle is to flank the wired perimeter and to look after their own close-defence as well. At the right and left angles, the perimeter trench takes the form of redoubts, which contain, in their forward sides, infantry observation posts, and, in their rear sides, both observation posts and organs for flanking the rearward wire. In the interior of the *Feste*, four armoured batteries for main armament are disposed irregularly and each has a war barracks attached, communicating with it by underground passages. The perimeter trench is provided at intervals with armoured sentry posts. The artillery observatories are aligned on the front slope, and have tunnel connexions with their batteries. The fifth battery is a dummy—a device freely used in these Metz works, in which there is plenty of room. The perimeter wire is sunk to a depth of 2 metres, and the ground in which it is bedded is sloped up to the infantry line, which has the lowest command compatible with its functions. This perimeter wire is carried round the main works (01, 02) also (though partly unflanked), but the strength of these lies in their inner system. Behind the perimeter wire and the advanced parapet or covered way lies a deep ditch (20 ft.), wired at the bottom and provided with a concrete counterscarp. The floor of this ditch is flanked (in the case of the forward work 01) by a double counterscarp casemate at the apex and a small *caponnière* in the gorge.

About the same time as these Metz works were being evolved in Germany, Lt.-Col. (afterwards General) Piarron de Mondesir, in France, advocated another type of group-fortification, which, though generally of the same class as the *Feste*, shows some characteristic differences.

De Mondesir's group is in general outline oval, or rather lens-shaped, with the curved front towards the enemy and the flattened front towards the defended region. Like the *Feste* it bestrides the

[1] This is a miniature of the gun cupola, with a telescope placed in the port. The development of the periscope now makes the provision of protected command ports much easier than it was at the time of this design.

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natural crest. Immediately beside the main wire is a continuous infantry parapet, which has at frequent intervals concrete shelters for machine-guns as well as infantry. On the natural crest, a central structure of concrete and armour contains the commanding officer's observation post and two machine-guns in cupolas for the direct

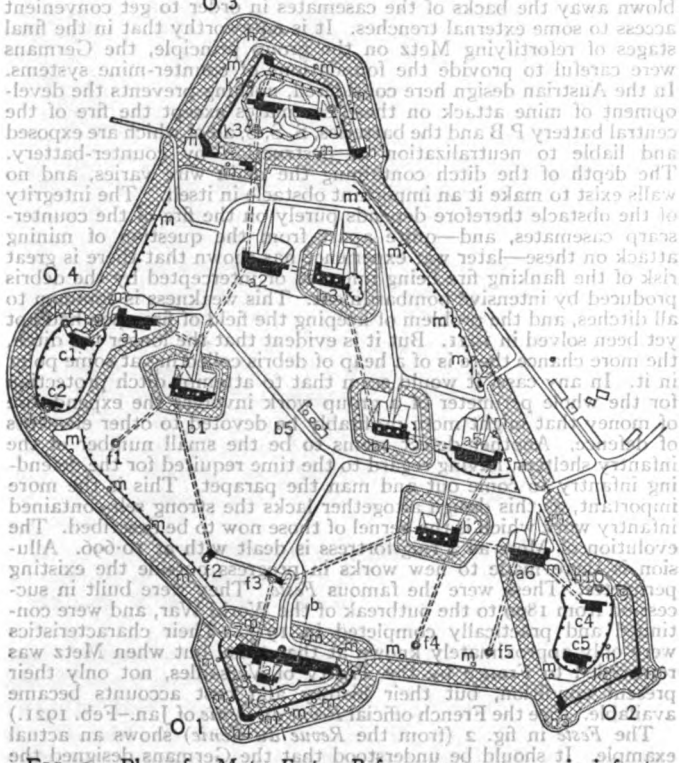

FIG. 2.—Plan of a Metz *Feste*. *References*. 01, 02, main infantry works; 03, 04, flank portions of infantry positions organized as "redoubts"; b1, b2, etc., armoured batteries (b5, dummy); a1, a2, etc. war barracks, f1, f2 etc. artillery observatories; h1, h2 etc. counterscarp casemates, *caponnières* and the like for flanking perimeter wire or ditch wire; k1, k2, etc., infantry observatories (armoured); m, m, parapet sentry posts; cf, c2 etc. concrete shelters for infantry on duty; i, entrance blockhouse.

sweeping of the foreground, and towards the flanks two somewhat similar structures house each a 75-mm. Q.F. gun, its observation post, and the observation post of one of the main armament batteries mentioned below. Just behind the crest are two large battle-batteries," was destined to survive and multiply in the World War. The rear defence of the inner system is provided by the rear portion of the perimeter trench, with its concrete machine-gun shelters and its wire.

The most marked characteristic of this design is the fact that the interior space of the "group" is organized principally for step-by-step close-defence, whereas it is utilized in a *Feste* for battery sites. The middle foreground is under the fire of two quick-firing guns in cupolas, but the author of the system evidently does not trust to these organs overmuch, for he arranges that they shall be fired into and destroyed by the main-armament guns if captured. The essential element of the first stage of close-defence is the machine-gun detachments in the front trench, which are housed under concrete till the moment of action. The second stage, which begins when the assault has broken into the front trench, is a combination of counter-attack from the great shelters behind the crest with machine-gun fire from the central crest cupolas; to facilitate this counter-attack, the back of the front trench is smoothed to glacis-form. When all this is lost, the inner system with its "infantry batteries" sited well down the reverse slope, has still to be carried before the main-armament or *traditore* batteries can be reached, and the machine-gun cupolas of the keep not only coöperate in this third stage, but (with the blockhouses attended to earlier) make it difficult for the enemy to make a lodgment even in the fourth and last stage. In all stages after the first, the curved fire of the trench-mortar battery plays a part. In this respect, and in the free use of machine-guns and local counter-attack, de Mondesir's fortification anticipated by ten years or more the trench-warfare methods that developed in the World War.

The above outline account of applications, practical and theoretical, of the new "group" principle requires the addition of a few details as to the principal constituent elements of such works,—the counterscarp casemate or *caponnière* for low-flanking of a ditch, the main-armament or safety-armament battery made up of cupolas (as distinct from the cupolas themselves), and the *traditore* battery.

The Austrian counterscarp casemate, illustrated in fig. 4, is constructionally a simple example. Under the counterscarp wall, on the further side of the ditch, facing the salient angle of the work, a chamber is formed with embrasures for rifle, machine-gun or light-artillery fire along the two adjacent ditch lengths. In this case armour is used for the embrasures, each gun-room (K K) having two very light guns or pompoms. B is a living room for the squads assigned to the defence, A a latrine, St a stairway leading to P, a concrete tunnel under the ditch which communicates with the body of the work.

Fig. 5 shows a counterscarp casemate of more advanced type. It is amongst the most modern examples of such structures, forming part of a 1914 work at Metz. It fires in one direction only. The inner portion of its mass is in ordinary, the outer in reinforced concrete, and the total thickness is 3 metres. Fire is arranged in two tiers, for rifles, and for machine-guns, and one embrasure (the safest) is allotted to a searchlight. The details are worthy of close attention. The top of the wall is formed as an overhang, under which the fronts of the fighting chambers are recessed. This gives enhanced protection from fire, and also from the risk of grenades

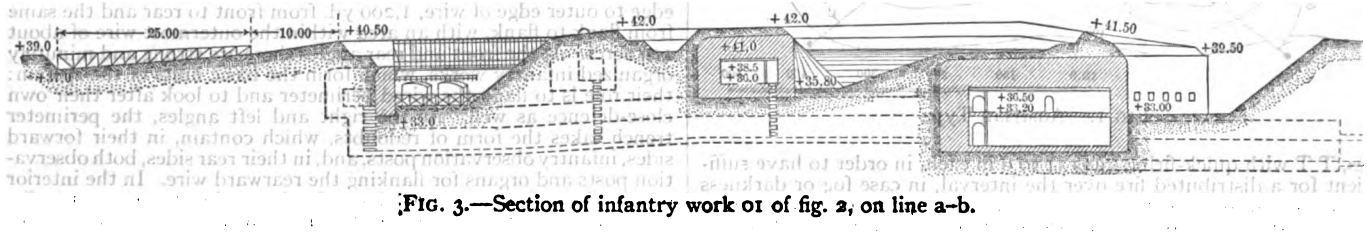

FIG. 3.—Section of infantry work 01 of fig. 2, on line a–b.

shelters in concrete for counter-attack infantry. Then, well back, comes an inner system forming a still flatter "lens." This contains the main armament batteries, the *traditore* element, and the infantry keep. Its front wire traverses the whole interior of the group, leaving the crest elements and counter-attack shelters outside it, and resting its flanks on the infantry parapet, the junction being sealed by blockhouses. Within this wire, which is protected frontally by several "infantry batteries," *i.e.* loopholed steel screens or penthouses for riflemen, lie, towards the flanks, two batteries of main armament artillery in cupolas and one or two "Bourges casemates"—genuine *traditore* batteries which can only fire to the flank and rear and are heavily protected and masked towards the front. Centrally placed between the artillery positions is the infantry keep, in this case as in the German the basis unit. It is four-sided and has a deep wired ditch which is flanked not by counterscarp casemates, but by two low *caponnières* springing from the base of the escarp at the diagonal angles. In the concrete of this keep are the war barracks of the whole garrison, observation cupolas, and at least two machine-gun cupolas which are in fact the essential defence of the keep. Embryonic counter-mine systems are provided at the salients of the keep. Behind the keep is a battery for small short-range mortars—a novelty which, unlike the present writer's "infantry being thrown in by an assailant overhead. At the foot of the wall is a pit which lowers the floor of the ditch so far that the assailant in the ditch cannot reach the embrasure. This pit also serves to take debris that might otherwise mask the fire of the lower tier. A gallery formed in the mass of the counterscarp connects the casemates of the different angles.

An example of the modern counterscarp is shown in fig. 6 from another Metz work. Here it will be noticed that, for defence and also for ventilation, the gallery possesses a loophole. Over this is a grille to prevent the placing of scaling-ladders and the upper part of the counterscarp wall is formed to a peculiar section which gives a minimum foothold to an assailant scrambling down, and presents an unfavourable striking angle to all projectiles.

The Mass—for it is a mass rather than a wall—is 7 metres thick for 7 metres of height. The communication tunnel between such a gallery and the body of the work (fig. 7) gives 2 metres of (ordinary and reinforced) concrete protection besides that afforded by the earth of the ditch floor.

Some designers, owing to the risk of the backs of counterscarp chambers and galleries being breached by mining, or the communicating tunnel destroyed from above or below, prefer to keep the ditch between the enemy and the flanking organ. In this case a

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low *caponnière* is built out into the ditch from the escarp or from the mass of the work; in the work of fig. 2 the ends of the two-story concrete barrack are arranged to act as *caponnières*.

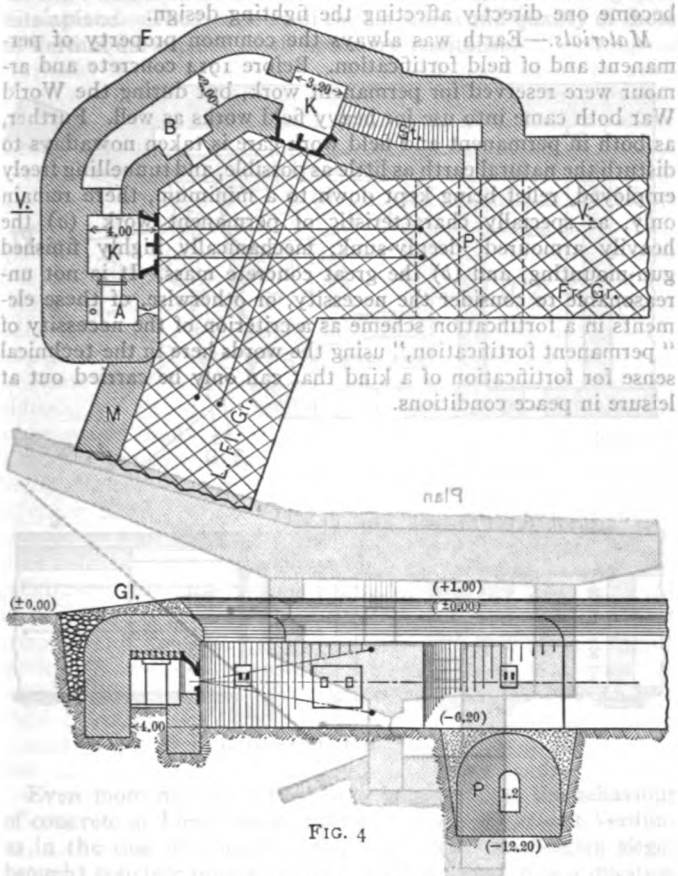

FIG. 4

An unusual flanking organ designed for Metz is shown in fig. 8. Here the difficulty of giving sufficiently thick protection for an organ flanking wire at or near ground level (*e.g.* the outer wire of a *Feste*) is met by providing a sort of detached *caponnière* in the form of a low, fixed, armour-structure bedded in concrete, the guard-room, etc., being formed in the mass of the latter. It is intended for rifle and pistol fire through loopholes, and like all modern German flanking organs it has a small searchlight.

A battery for main armament is substantially an assemblage of two to four individual gun or howitzer cupolas in line within one mass of concrete, with the space available between and behind cupolas formed into expense-magazines, shell-rooms, duty men's rooms, offices, etc. Being as a rule dispersed over the open ground comprised in the "group" they require subterranean communications with each other and with their observation posts. The latter are sometimes included in the same concrete mass with the gun cupolas, but it is more usual to withdraw the battery mass behind the crest and to push the observatory forward. Batteries are often wired in, and sometimes given means of local protection against surprise attack. They contain not only a large stock of ammunition, but also, nowadays, laboratories and workshops.

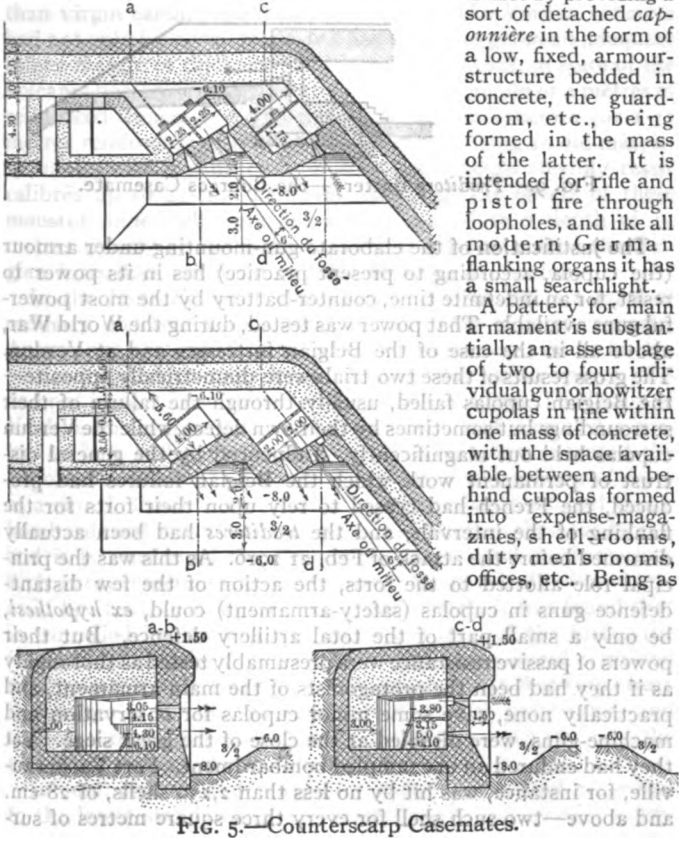

FIG. 5.—Counterscarp Casemates.

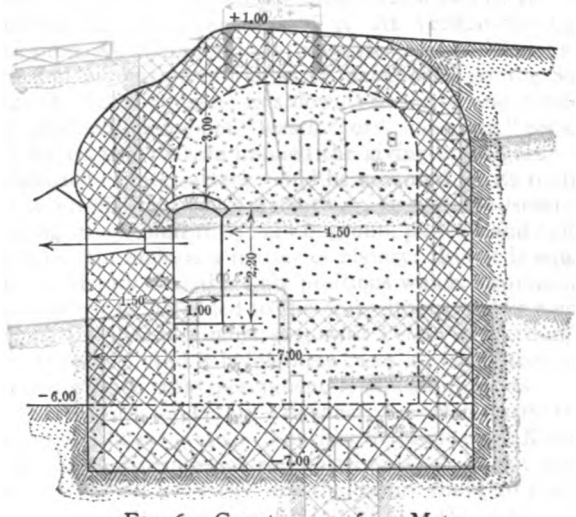

FIG. 6.—Counterscarp from Metz.

Traditore batteries, by hypothesis, fire only to the flank and rear. They are thus always placed, so to say, behind a corner; that is, protection is accumulated in front of the gun casemates, and this protection is continued laterally for such a distance that a projectile from any likely direction will either meet the covering mass or pass clear of the gun muzzles. The original form is that designed in France and known as the "Bourges casemate" (fig. 9) from de Mondesir's *Fortification Cuirassée*.

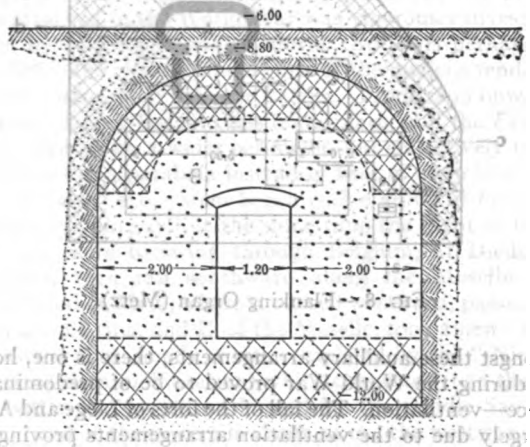

FIG. 7.—Communication Tunnel to Counterscarp.

A larger *traditore* of Austrian design is shown in fig. 10. This is formed in the end of a concrete mass of which the remainder contains the war barracks, storehouses, etc. The lower embrasures flank the floor of the fort ditch, the upper—the real *traditore* battery—sweep the flanks and rear of the external intervals. (T T are the gun casemates; B St is the post of the officer controlling the fire; M M the ammunition room; G S a small flanking element to control the ditch just under the *traditore*.) Armour is used to reduce the thickness of concrete, both vertically and horizontally.

The gun usually employed in *traditore* batteries is a field gun of about 75-mm., or a gun of the small naval or tank class, 57-mm., being the commonest calibre. Pompoms (1-pdr. Maxims) and even machine-guns are also found, but as a rule it is the field artillery type of effect that is required and provided for. Cupolas are sometimes, but rarely, employed, as their characteristic virtue of all-round fire is not wanted.

Administrative Arrangements.—Any work that has to act in isolation, or semi-isolation, is provided with all the necessary "services." Store-rooms, hospitals, barrack-rooms, etc., with all

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furniture and equipment, must be formed in the interior of the available concrete masses; water must be laid on, lighting and heating provided for. Though hitherto it has not been thought desirable to provide power for working cupolas, etc., it has already become necessary to include a power-room (dynamos and Diesel engines) in the equipment of the *Feste*.

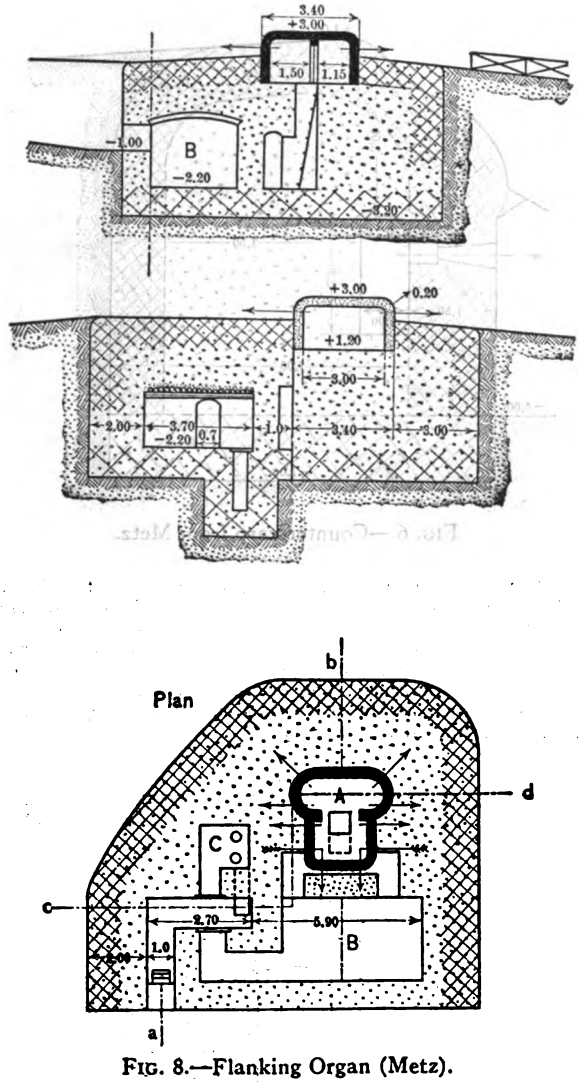

FIG. 8.—Flanking Organ (Metz).

Amongst these auxiliary arrangements, there is one, however, which during the World War proved to be of predominant importance—ventilation. The fall of the forts of Liége and Antwerp was largely due to the ventilation arrangements proving inadequate. Poisonous fumes from the burst shell penetrated the concrete fissured by its explosion, and filled the underground galleries of the fort, asphyxiating or disabling a large proportion of the already overstrained garrison. In the latter part of the war, the development of gas warfare added a further complication, as it became unsafe to draw in air from outside. The solution adopted by the French for the Verdun forts (which, it should be noted, no longer contained either main-armament or *traditore* artillery, but had become pure close-defence infantry works) was to deliver filtered air from a considerable distance, under slight pressure, to certain rooms in the fort, which were sealed against local air by air-tight doors or otherwise. All men working elsewhere than in these rooms wore gas-masks. Although the group principle of fortification, by dispersing the elements of defence, *ipso facto* dispenses with the subterranean labyrinths of the Belgian forts, and so reduces the effects of explosion fumes, the fact remains that the men in the armoured batteries and the *traditore* and flanking organs, must be protected from gas entering either by embrasures, cupolas, seatings or fissures, while pure air must be supplied and foul air evacuated somehow. It may be, indeed, that the question of aëration, hitherto subsidiary, will become one directly affecting the fighting design.

Materials.—Earth was always the common property of permanent and of field fortification. Before 1914 concrete and armour were reserved for permanent work, but during the World War both came into use for heavy field works as well. Further, as both in permanent and field work care is taken nowadays to disturb the natural earth as little as possible, and tunnelling freely employed, relief being kept down to a minimum, there remain only, as specially characteristic of permanent work, (*a*) the heavily armoured, deeply-sunk, mechanically highly finished gun-mounting, and (*b*) the great concrete mass. It is not unreasonable to consider the necessity, or otherwise, of these elements in a fortification scheme as a criterion of the necessity of "permanent fortification," using the words here in the technical sense for fortification of a kind that can only be carried out at leisure in peace conditions.

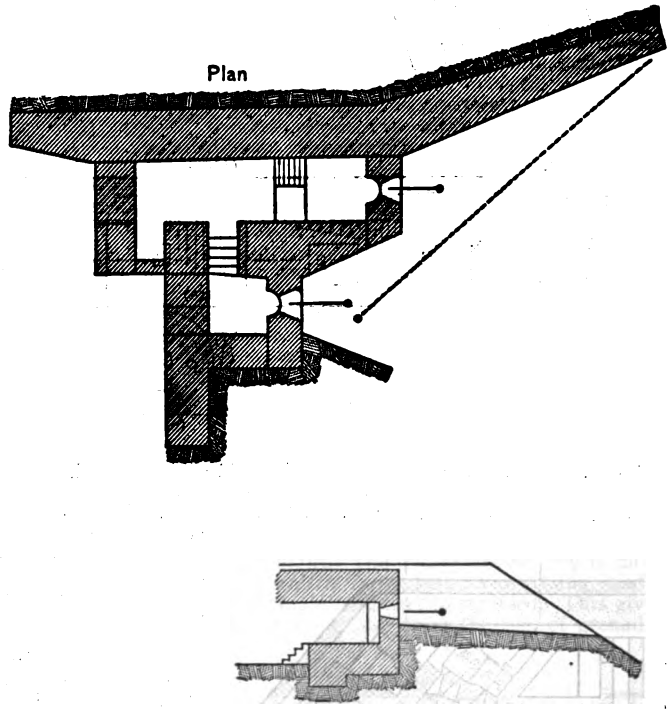

FIG. 9.—*Traditore* Battery—the Bourges Casemate.

The justification of the elaborate gun-mounting under armour (the cupola, according to present practice) lies in its power to resist, for an indefinite time, counter-battery by the most powerful guns available. That power was tested, during the World War, above all in the case of the Belgian fortresses and at Verdun. The gross results of these two trials were diametrically opposite—the Belgian cupolas failed, usually through the failure of their surroundings but sometimes by their own defect, while the Verdun cupolas held out magnificently. Influenced by the general distrust of permanent work which the Belgian failures had produced, the French had ceased to rely upon their forts for the flanking of the intervals, and the *traditores* had been actually disarmed before the attack of Feb. 21 1916. As this was the principal rôle allotted to the forts, the action of the few distant-defence guns in cupolas (safety-armament) could, *ex hypothesi*, be only a small part of the total artillery defence. But their powers of passive resistance were presumably tested as thoroughly as if they had been the protagonists of the main-armament, and practically none, save some minor cupolas for observation and machine-guns, were disabled at the close of the great siege. Yet they had endured an unexampled bombardment. Fort Vacherauville, for instance, was hit by no less than 2,250 shells, of 28-cm. and above—two such shell for every three square metres of sur-

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face. Monlamville received 330 hits by 42-cm. shell. The more exposed forts, such as Douaumont and Souville, deluged with medium and field as well as heavy shell, received over 30,000 hits apiece. Thus, cupolas of the thickness and quality of those of Verdun are capable of all necessary resistance.

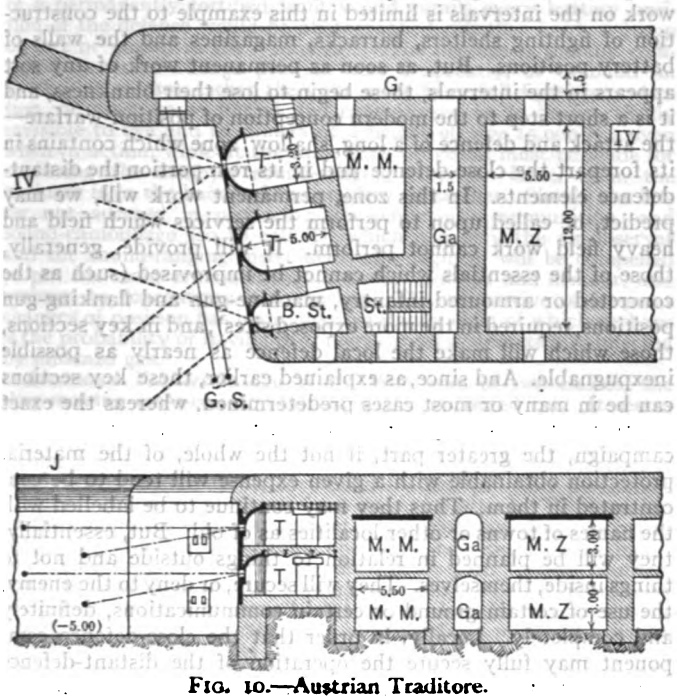

FIG. 10.—Austrian Traditore.

Even more marked is the discrepancy between the behaviour of concrete at Liége and Antwerp and its behaviour at Verdun; as in the case of armoured gun mountings, the Belgian sieges brought concrete into discredit. Here, however, it is a question of quality of material and of conscientious painstaking work. The best concrete has a resistance such that a test bar will break across the stones rather than the cement; the worst is feebler than virgin earth, especially rooty earth. The Verdun concrete had not only been well made, but had also been given an adequate safety margin of thickness; and it was found that, in spite of the volcanic bombardment, 3 metres of special concrete or 2 metres of reinforced concrete, or 2½ metres of special concrete (or 1·75 metres reinforced) disposed as an apron overlying an old masonry vault, with a sand cushion interposed, would steadily resist calibres up to 42-cm. inclusive. Although the effects of these monster mine-shell were felt in the ground to a depth of 14 metres (nearly 47 feet), the fissuring which had ruined the Belgian forts does not seem to have occurred at Verdun.

In the Metz *Feste* the characteristic disposition is a mass of ordinary concrete with a thick outer casing of ferro-concrete. An arrangement which is favoured by some engineers is to dispose reinforced concrete in layers separated by air-spaces; this had not in 1921 been subjected to the test of siege. The lesson of Verdun, however, is held to be not so much that it proved 3 metres to be a sufficient thickness, but that it demonstrated the importance of *mass* as a material element of resistance and *depth* as a *moral* element. The smaller concrete masses suffered under bombardment much more severely in proportion than the larger, and it is considered therefore that organs small in themselves such as *caponnières* should form part of a larger body of concrete, as in fig. 2, 01, or in fig. 10. As regards depth, it was found that in tunnelled habitations well below the level of the forts—the foundations of which at Verdun are in rock—*moral* remained unimpaired by the heaviest bombardment. At Antwerp, from the nature of its site, no such burrowing was practicable, and the *moral* of the defenders was subjected to a fresh strain at the explosion of every monster shell.

In sum, armour and concrete in masses calculated according to the lower standards of a previous epoch, but given a safety margin in application, proved capable of meeting the heaviest strain of bombardment which history records. The problem of the engineer to-day is to determine what safety margin is required for new work or reconstruction calculated according to the standards of Verdun.

A fixed resistance, *in situ*, of several months, then, is practicable with the materials and means of permanent fortification. That it is not so with those of field fortification is shown by the various trench-warfare offensives of 1916–7. At Verdun the German attack progressed rapidly till it confronted a close-defence system which had permanent works as its backbone. At the Somme, though the Allies' progress was slow, it was sure, and the defense finally evolved a system of "elastic" or "coilspring" resistance; which by its very nature implied the giving-up of ground until an organized counter-attack could be mounted for its recapture. The success of this type of defence, so long as the *moral* of the defending troops, and their skill in group, platoon and company tactics, remain high, is a matter of history. But it is equally a matter of history that there are positions which, strategically or morally, must be defended to the end without yielding ground, on which the defender must say, with Pétain at Verdun, "*On ne passera pas.*" And it is for these cases, so far as they can be foreseen in peace, that permanent fortification exists.

The very words of Pétain's defiance, however, carry the implication of a linear system. Fournier at Maubeuge, Kusmanek of Przemysl—governors of ring-fortresses—could not say that the enemy "shall not pass," for the enemy could go round. It was not Verdun the ring-fortress, but Verdun the end-redoubt of the fortified line Verdun–Toul, that compelled the Germans to traverse Belgium in August 1914. In 1916 Falkenhayn hesitated between Belfort and Verdun as the objectives for his attack. Both had been ring-fortresses, but both were now key-points in a long line of battle, and derived their whole strategic importance from that fact. At Liége, we find the ring-fortress splitting itself into two halves which acted to the best of their ability as successive barrier positions. At Antwerp the attacks on the defence were purely frontal; and indeed, save Przemysl, not one ring-fortress attacked in the World War was vigorously invested and attacked by convergent radial efforts. But it is perhaps Metz which affords the clearest illustration of the modern tendency to convert the stronghold into the barrier. From 1899 onward the old ring becomes of less and less importance, and the *Feste* were not only disposed on a wider perimeter, but collectively took the form of a sort of a parabola instead of that of a circle or ellipse. Facing westward, the system began with a group of *Feste*, forming an end-redoubt; and at the same time the pivot of the field armies that were to swing through Belgium, at Diedenhofen (Thionville), then ran southward along the Moselle to the neighbourhood of Metz, where it curved westward, passed round the S. of the old ring, and E. of the Moselle, took a new direction north-eastward, till finally it was completed by the "Nied position" (created on mobilization) which connected it to the stable line of battle that would be formed by the middle Saar. The southern bend of the system is about 14 m., the westward-facing limb 36 m. and the south-eastward-facing limb about 38 m. in frontage, the whole differing in scale rather than in principle from the familiar "Western Front" of the trench-warfare years which constituted between the Oise and the Moselle a great salient with the apex at Verdun. Outside this blunted redan, Diedenhofen–Metz–Rehlingen, the Germans were prepared to yield ground, but on it the defence was meant to be absolutely stable. The growth of the linear tendency is discernible even in the creation of the successive parts of the system. Beginning with the endeavours to increase the perimeter of Metz itself, the Germans presently bore away at a tangent on each side of the southern sector. The individual *Feste* became longer in proportion to depth, and finally, in the case of the Amanvillers-Horimont works, of 1912, attained a frontage of nearly 2 m. and consisted substantially of a great ditch with its flanking-organs.

Correspondingly, a change follows in ideas as to interval organization. It is evident that, in a ring-fortress of the 1873–1903 type, the individual "forts" occupy only a small proportion

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of the perimeter as compared with group-works. The latter, therefore, allow of an extended perimeter for the same admissible intervals. Presently, as we have seen in the case of Metz, the perimeter attains an enormous length, and the ring opens out on the home side, becoming a gigantic redan or salient which comprises a whole region. The standard interval between work and work continues to be honoured at and near the exposed apex, but the gap increases towards the rear till near the root of the salient permanent work may give place to field work and simple utilization of natural obstacles, as in the "Nied position."

In the early 19th century, the ring-fortress was practically an enlarged enceinte-fortress with the curtains omitted. Later, though perimeters increased (in order to prevent bombardment of the "nucleus"), the forts still contain the whole of the main armament and retain responsibility for the defence of the interval against methodical attack. The interval is organized according to the needs of minor tactics, so as to prevent the enemy penetrating to the nucleus by any method but regular, large-scale attack. At the next stage (which is the most important in the evolution of ideas) the main artillery (except the safety-armament) is taken out of the forts and deployed in the intervals, the forts becoming "strong points" on a line of battle which has to protect this artillery. It is this stage which is represented in fig. 11, taken indirectly from a semi-official Russian work of 1913, by Colonels Golyenkin and Yakovliev (which, incidentally, marks the acceptance in Russia, after long opposition, of the principle of armour protection).

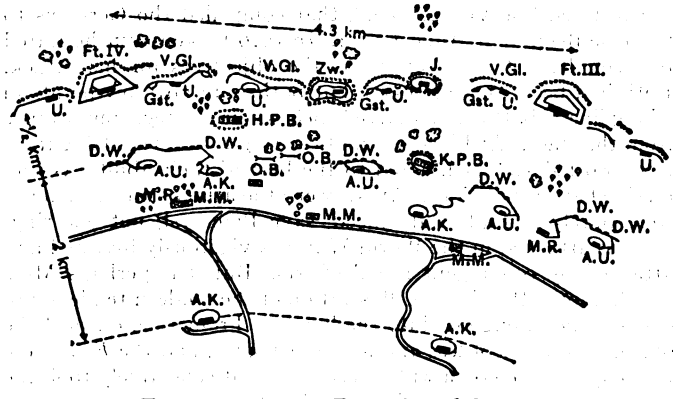

FIG. 11.—Russian Fort, close-defence.

The "fort" is a large and elaborate close-defence work designed specially for the sweeping of the intervals by *traditore* batteries, immunity of these being secured by a full equipment of flanked ditches, quick-firing guns under armour and fighting shelters. The arc of fire of the *traditores* is sometimes carried unusually far forward, as it is laid down in principle that special flanking guns, in or out of the fort, must cover the ground from 1,200 yards in front to 700 yards behind the next fort. No part of the main-armament is included in the fort.

From fort to fort, the interval, it is laid down, should not exceed about 4,500 yards. Otherwise, the responsibility placed on the *traditores* is too heavy (the average interval of Verdun, it may be remarked, is only about half this), and closed infantry work (Zw. in the plan) may sometimes be required to command some part of the interval that is not well covered by the forts. Frontally, the interval is held by a number of separate trench-positions formed with glacis foregrounds (V. Gl.) and provided with concrete fighting shelters (U.) and sometimes barracks (J.). Some of these positions have their own light quick-firing guns (Gst.) for flank protection. Four to five hundred yards in rear of this guarded obstacle are armoured batteries (H.P.B., K.P.B.), wired in, which contain the "safety" part of the main-armament with its ammunition. For the rest of the main-armament, battery positions (D.W.) with (M.R.) shelters for detachments on duty (A.U.) and protected barracks for those in waiting (A.K.) are prepared 600–800 yd. behind the front line and connected up as required by trenches. For other batteries, told off as a mobile reserve, positions are marked out (O.B.). The main magazines of the sector are shown at M.M. and barracks for the third relief of artillery at A.K. in rear.

Apart from the batteries of the safety-armament and occasional foreground-flanking guns not comprised in the forts, peace-time work on the intervals is limited in this example to the construction of fighting shelters, barracks, magazines and the walls of battery positions. But, as soon as permanent work of any sort appears in the intervals, these begin to lose their blankness, and it is a short step to the modern conception of position-warfare—the attack and defence of a long, shallow zone which contains in its forepart the close-defence and in its rear portion the distant-defence elements. In this zone, permanent work will, we may predict, be called upon to perform the services which field and heavy field work cannot perform. It will provide, generally, those of the essentials which cannot be improvised (such as the concreted or armoured infantry, machine-gun and flanking-gun positions, required in the more exposed sites), and in key sections, those which will make the local defence as nearly as possible inexpugnable. And since, as explained earlier, these key sections can be in many or most cases predetermined, whereas the exact position of the rest may vary according to the opponent's plan of campaign, the greater part, if not the whole, of the material protection obtainable with a given expense will tend to be concentrated in them. Thus they may continue to be labelled with the names of towns or other localities as of old. But, essentially, they will be planned in relation to things outside and not to things inside, themselves. They will secure, or deny to the enemy, the use of certain ground or certain communications, definitely and completely. Locally, in order that the close-defence component may fully secure the operation of the distant-defence component, the permanently fortified key section may form a ring, or possess turned-back flanks of considerable length. But in the *ensemble*, and in many cases even locally, the tendency will be to reduce the depth and increase the frontage of permanent fortifications, so that the works of standard strength which can be built with the available funds may offer the widest direct and positive barrier to an enemy.

New Weapons in Siegecraft.—The evolution, during the World War, of weapons essentially unlike those for which the permanent fortification above-outlined was designed to use and to meet, raises the question—what modifications, if any, do these new weapons impose?

If the conclusion reached above be correct—that permanent fortification has now become, from general causes, the backbone of position-warfare, instead of being a thing apart—it follows that the new weapons will affect it in any case through their influence on position-warfare generally. Were it the case, for instance, that aerial warfare totally superseded land warfare, the ring-fortress might return in a new form as the means of protection of flying bases. But such speculations would serve no useful purpose here, and it is preferable to confine ourselves to the modifications of detail to be expected in permanent fortification as such.

Chemical Warfare is a term covering several very different weapons. Smoke which "blankets" the defence organization, gas which disables the defenders, vapour-producers which infect areas, are all tactically dissimilar. The strength of chemical warfare as against fixed defences lies in their fixity, its weakness in the fact that anti-gas protection is not limited, as it is in field warfare, to apparatus and devices that can stand rough usage and be carried without inconvenience by the already burdened soldier. One form of anti-gas defence has been mentioned above—the supply of pure air under slight pressure to rooms sealed from contact with local air. Improvements on this line of progress would include more and more of the interior chambers of a work in the protected space, while other devices made the gun embrasures as gas-tight as possible. The most important defence against gas is the impermeability of the structure of the work itself, which practically means its solidity under bombardment. The direct influence of aircraft on permanent fortification is not easy to estimate. There is no limit to the power and flexibility of anti-aircraft guns sited in fixed defences. All fighting elements in the works are fully protected against the attack of super-heavy artillery, and *a fortiori* against that of air-bombs. The attack of *traditore* or *caponnière* embrasures by machine-gun fire from low-flying planes, if practicable, could be

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easily countered. Direct attack from the air, therefore, is not likely to affect design seriously. But observation from the air is another matter. Local superiority in the air may pass, in the course of the operations, back and forth several times, and design has to provide against the unfavourable case. It may be assumed with certainty that, in prolonged operations (such as by hypothesis the reduction of a permanently fortified front would entail) every battery position of the defence would be photographed, whether inside a group or fort or placed in the "interval." The defence is thereby compelled either to change position very frequently, or to build in. In the latter case, either the guns must have full fighting protection, or must be so buried and camouflaged as to be practically invisible to eye and to camera at a height of, say 15,000 ft., even when in action, while at the same time provision must be made for confusing the enemy's sound-ranging records. Here, then, the engineer is in the hands of the artillery researcher. Should the latter not succeed in producing gun-mountings, ammunition, and sound-camouflage (so to call it), which can defy the air-observer and the sound-ranging instrument, the engineer will be compelled to put his main armament again under concrete and armour, and perhaps to concentrate it somewhat. The alternative of frequent changes of position has many disadvantages, chief of which perhaps is the probability of having to traverse areas systematically infected by mustard gas.

Armoured Vehicles in the World War were of two classes, the slow-moving cross-country tank and the armoured car. It seems probable that these will fuse into one class, the fast tank. The tank was originally designed for traversing and crushing wire entanglements, and it is in this capacity that permanent fortification is chiefly concerned with it, for the defenders of solid permanent works are practically immune from its actual attack. The question for the engineer is—will the present types of obstacle-flanking organ succeed in dealing with the tank, and if not, how must they be modified? One type of obstacle, the deep ditch with vertical counterscarp, is impossible for the unprepared tank, but such ditches are liable to be bridged at ground level by suitable girders carried by a "bridging" tank; and the best safeguard of permanent works against invasion by tanks is the fact that the latter must traverse a belt of ground which is swept at close range by an organ specialised for that duty alone, and invulnerable to the tank's guns. Although the dimensions of tanks will doubtless be taken into account in planning ditches, the first care of the designer will be to provide flanking pieces sufficiently powerful to destroy the tank as it crosses the line of fire, and to provide flanking fire in such a form that a disabled tank will not mask it. More generally, permanent works which form a section of a long battle zone will be organized to participate in the anti-tank defence of the system, and for this duty the *traditore* batteries are naturally the most appropriate organ.

The armoured car, or fast light tank, owing to its ability to make an inroad from a great distance at the shortest notice, may prove very dangerous to a fortified area which is in the crisis of mobilization and war armament. Special measures to deal with this risk could never be omitted; so far as fortification is concerned it would seem necessary to maintain at all times a clear field of fire for, and a state of readiness in, the *traditore* batteries, as well as in such gun positions of the safety armament as command obligatory or probable points of passage in the foreground.

Field and Heavy Field Fortification.—The methods of field fortification in vogue at the outbreak of the World War (*see* 10.719) were concerned essentially with light fortification, that is, incidental fortification on the battlefield. Starting from the conception of an advance brought to a standstill or a retreating army turning to fight, the engineer gave the infantry man types of works which were defensible after an hour's labour and which could be improved gradually during a more prolonged stay in the position. Lateral and overhead cover were provided, but only against rifle, machine-gun and the lightest artillery fire. Great stress was laid upon concealment, obtained by moulding the work as closely as possible to the ground, turfing exposed soil, keeping relief as low as conditions of effect allowed, and also upon communications; a system of short trench lengths was preferred to long continuous lines, which entailed unnecessary labour and assisted the enemy to locate the defences. A good field of fire up to 400 yd. from the rifles was considered essential. Pivotal positions, whether localities, woods or hills, were organized for all-round defence. These principles, so long as the general course of the operations retained the foreseen open-warfare character, substantially justified themselves; perhaps, indeed, they justified themselves only too well, since it was the great strength of even lightly fortified fronts which compelled each side, in France, to extend ever further and further to a flank in the hope of turning the opponent's frontal defence, and so in the end produced a trench-line that was continuous from the Swiss frontier to the English Channel. The deadlock which ensued marked the beginning of a position-warfare which was locally indistinguishable from siege warfare as that term was understood in 1914. Nor was it only from the point of view of local, minor tactics that the analogy of siege operations held good. The succeeding campaigns were indeed a siege of the east front of Germany, whose western offensives of 1916–8 have sometimes been described by the Germans themselves as sorties from the *Festung Frankreich*. For the Allies, as against these offensives, the nature of the defence, especially after the middle of 1916, resembled that of an investing cordon attacked by a desperate sortie, and fighting to gain time for the arrival of forces from other parts to drive in the prisoners and bolt the door again,—though it is true that the siege was mutual and the "sortie" was at the same time a penetrating assault.

Regarded from this point of view, the principal factors which, directly or indirectly, governed revolution were: (*a*) a theatre of war richly provided with communications; (*b*) highly developed industrial resources at the back of both sides; (*c*) enormous numbers of men and therefore labour power; (*d*) an initial situation of tactical deadlock in positions not deliberately selected but representing only the line on which offensive effort in open warfare had expired; (*e*) the haunting idea of a break-through, followed by exploitation in open-warfare in the old style.

Taking the technical effects of (*d*) and (*e*) together, it was inevitable that positions naturally unsound should be maintained by an equilibrium of forces acting in opposite directions. The attacker of the moment was necessarily attracted by these weak sectors, while the side which intended to attack in the future had a strong motive for holding as forward a position as possible. Fortification was called upon to make these intrinsically unsound positions safe, and all its resources in design and labour were taxed to the utmost to meet the call.

Taking (*a*), (*b*) and (*c*) together, we find these factors enabling each side to produce, to bring up and to apply *in situ*, technical stores on a scale hitherto undreamed of in siege warfare.

Taking the factors singly (*a*), by enabling artillery to be collected in enormous strength for an attack, compelled field fortification to develop unimagined powers of passive resistance, and by facilitating the concentration of great attack masses, induced commanders to strip non-offensive sectors of every human defender who could be spared, thereby forcing fortification to adopt forms which required a minimum garrison. By (*b*) there were brought into current field use not only materials hitherto reserved for permanent work, *e.g.* concrete, but also novel scientific devices and weapons of war, such as the air camera, gas, tanks, and, above all, improved methods of production, which increased the quantities of guns, ammunition and machine-guns available per unit of living force. By (*c*) trenches and obstacle-lines were multiplied to such an extent that there were eventually 20 to 25 miles of trench-work for every linear mile of frontage. Through (*d*), in the first year of trench-warfare, numerous bitter fights were engaged in on all parts of the battle-front for minor rectifications of position; in these fights there were developed new forms of detail tactics, with corresponding demands upon rear resources for a varied armament for the front-line combatant, whose equipment finally comprised, besides rifle and bayonet, grenades (hand and rifle), the light and medium trench mortars, flame throwers, periscopic sniper-rifles, knives, clubs, helmets and body-armour, not to mention gas masks. It led, further, to the retention of waterlogged trenches, and so to the introduction of pumping apparatus, trench-flooring, and other bulky non-combatant stores, into the front line. Through (*c*) it was demanded of fortification that it should protect both the masses of men assembled for attack and exposed to enemy "counter-preparation," and also the minimized garrisons of other parts of the front. These factors, operating, singly or together, with different relative intensity at different times, caused position-warfare to evolve, between 1914 and 1918, through three distinct phases, which may be distinguished by the titles field-fortification, position-fortification, and zone-fortification. The first of these characterized the western front from the end of the battle of the Marne to about the end of 1915, and the eastern front from the beginning of stabilization (which occurred at different periods on different parts of the front) to July 1915, and then again from Oct. 15 1915 to the end of the war on that front. On the eastern, Salonika, and extra-European fronts, evolution did not pass beyond this stage, because in these theatres the more important of the factors above enumerated were more or less inoperative. The second stage, position-fortification, is that of the Battles of Verdun, the Somme and the Aisne and the Artois battles of 1917; also of Asiago and the last six of the Isonzo battles on the Italian front. The third stage, zone-fortification, is characteristic of the Flanders battles of the latter half of 1917 and of all the 1918 battles. These indications of date do not of course imply that the changes specified came into force, formally and simultaneously, at any specific time. They are landmarks in the evolutionary process, which in this, as in other things, does not tolerate leaps.

In the first period fortification devotes itself, substantially, to the improvement and multiplication of the trenches bequeathed by the expiring offensives of 1914. The trenches are deepened, kept narrow, provided with more numerous traverses and shelters, though the protection afforded by the last-named only with difficulty manages to keep up with the increasing volume of fire from the enemy's medium howitzers. The close ranges at which the 1914 offensives died out have left the opposed front lines separated by a very narrow "no man's land," which is heavily wired by both parties. Concealment, as understood before the war, has thus lost its significance, more especially as all trench systems are regularly photographed from the air. Detail fighting produces the need of circulation and supervision trenches and other parallels behind

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"the trenchy," and calls for more numerous communication-trenches, to which there is no further objection on the score either of concealment or economy of labour. In plan, the general result is an irregular skein of trenches, from 50 to 150 yards across, following the contour of the front line, which itself undulates considerably and at certain points forms sharp cusps or salients of local importance. The closing-in of key positions for all-round defence, which figures in pre-war fortification, has become more thorough, and internal subdivision has converted these wired-in areas into the "Labyrinth" of Neuville-St. Vaast, the "Hohenzollern Redoubt" of Hulluch and the "*Trapèze*" of the Champagne battlefield. At the same time the interpretation of what constitutes a "key" position is different; it is chosen in relation to the trench system rather than in relation to the ground. Mining plays no small part in the fight for the possession of particular hillocks, or trench lengths, with a view to improved observation or better defence. But from the standpoint of evolution, the most important difference between 1915 and 1914 work is the deliberate withdrawal of the infantry firing-line behind the military crest of the position. This was far from being universal in practice, but it had become the recognized ideal. As in permanent fortification, so also in field, the preservation of the close-defence element from bombardment was the motive of abandoning the command of the foreground. Stress begins to be laid, especially, on the local flanking of wire by machine-guns in covered emplacements. But—again as in permanent fortification—the needs of the artillery observer frequently conflict with those of the close-defence; and each local problem, solved according to the value attached to these conflicting requirements at one time, has to be re-solved by fighting when the conditions change.

In this phase there are no marked innovations in the materials employed. The works are cut deeply in the earth and revetted by the conventional sandbags, hurdling, etc. of the text-books; details typical of trench-warfare fighting, such as trench blocks, sap-heads, island traverses, have been added. The "shelter" has become the "dugout," roofed in by layers of logs, house material, or in exceptional cases railway iron, and as a rule, though not always, withdrawn from the front line into one of the parallels behind. Guns are casemated, and dugouts provided for their ammunition and personnel as well as for a variety of command posts, aid posts, signal offices and the like.

In the second phase, which grew by degrees out of the first, the technique of fortification is modified owing to new conceptions of general tactics and to the bringing in of different materials. This is the phase that will remain forever typical of the western front campaigns. Its chief tactical characteristic is intense preparation and concentration of means of all sorts on the attack front, with a corresponding absence of the surprise element. The first consequences for fortification were: (*a*) the deepening of forward dugouts, and their construction by mining methods which leave the natural earth undisturbed; (*b*) the quasi-certainty of losing the first trench system, at least temporarily, with the certainty of its being reduced to a tormented ruin in any case; (*c*) reliance for close-defence upon the concealed machine-gun almost to the exclusion of other weapons; (*d*) multiplication of systems instead of multiplication of trenches in a system; (*e*) more elaborate provision for the maintenance of supply for forward troops, represented in practice by the accumulation of stores in forward dumps of all sorts. It was in positions organized on these lines that the Germans fought out the battle of the Somme. But their Higher Command did not at first accept the implications of (*b*), and paid a heavy penalty for attempting the impossible task of holding the devastated front line in strength. Especially heavy was their loss in prisoners, due to the "deep" dugout, which was so deep that the men could not get out of it in time to man the trenches. Yet without adequate protection it was impossible to hold the front line, or any other line, under bombardment, even after converting it into a line of machine-gun posts; and the first modification due to the Somme experience was the introduction of the only alternative to the deep dugout, viz. concrete. This was a step of great importance, both tactically and technically. Concrete had already been used, here and there, to reinforce parts of an earth-system, and was constantly employed in various back-area installations. But it was not till the latter part of 1916 that it became the principal material of "field" fortification. Instructions for mixing quick-setting concrete, and even for making ferro-concrete, on the spot begin to figure in training manuals, and in the chief belligerent countries a new industry springs up for the manufacture of standard concrete elements, which are transported to the scene of operations and built up as required. The timber, mine-gallery framing hitherto used in dugouts gives place largely to standard semi-cylinders of corrugated iron, also made at home and transported to the front in great numbers. Thus the ideal dugout for troops becomes a concrete structure lined with corrugated iron, proof against all field and medium calibres without being buried to any great depth; and the machine-gun emplacement and its dugout are fused in one concrete or ferro-concrete structure of the casemate type, famous in 1917 under the name of "pillbox" or "Mebu" (in full *Maschinengewehr-Eisenbeton Unterstand*). With this, the trench itself becomes of secondary importance. Though tradition and its undoubted usefulness in all circumstances except those of great-battle days made the command in all countries exceedingly unwilling to give up the trench altogether, it is the chain of dugouts and machine-gun casemates, which, with the wire, defines the "position" of position-warfare at its highest development in the spring of 1917.

In the broadest sense, a "position" consists of several distinct, and more or less parallel, systems, each of which is at such a distance from the one in front that the enemy's artillery must change position—with all the attendant difficulties and delays of repairing communications through the battle-devastated area—and mount a new attack. At intervals, a switch-line, designed on the same general principles as the parallel lines, is drawn so as to bolt off the area which may be lost in one battle phase. Between the first and second systems lies a zone in which a very active infantry resistance is carried on by means of "strong points," which are no longer labyrinths of the 1915 type but well protected and wired-in machine-gun strongholds, resembling in principle the *traditore* batteries of permanent fortification. With these as a basis, light trench-work will be run out in the directions required by the battle-situation from time to time, *e.g.* so as to fence off a lost sector; and for this purpose conveniently situated shell-holes are made defensible so as to constitute the framework of such lines. Tunnelling is largely used for short communications, especially where forward slopes have to be held so as to include artillery observation positions. The trench system bequeathed by the older methods is now broad (12 ft.) as well as deep, and is utilized as a covered-way, defensible in emergencies, rather than as a battle element. From 3-ft. to 5-ft. thickness of concrete (or ferro-concrete) over corrugated iron covers the casemated guns and machine-guns. With dugouts of similar design (the old deep dugouts are now sealed up or filled up by order of the command) these constitute the new defence system, whether disposed in lines or belts along the frontal systems or switch-lines, or scattered in the intermediate areas. Wire is now disposed in very wide belts, and does not conform to the direction of the trenches but lies in irregular salients and reëntrants, each part under the eye of some machine-gun or trench-gun casemate. In short, the site of the "position" is governed by the needs of artillery *observation*, and by those of *supply*, while the organization of the site is based on the time, labour and material available for the construction of *casemates and dugouts of concrete*.

But "trench" warfare has thereby divorced itself from the element which has been its characteristic for ages, the trench, and from June 1917 to the close of the World War is the period of zone-fortification. The elements of defence are now dispersed in innumerable "nests," containing machine-guns, anti-tank guns, or counter-attack groups. The "position" attains hitherto unheard-of depth, and its forepart is held only by outposts, whose function is to police the ground in quiet times and give warning of assault in battle. Behind the "outpost zone" lies the "battle zone," in which machine-gun and anti-tank-gun defence break up the attack, which a counter-stroke then sweeps back to its starting points. As a precaution, a "rear zone" is organized behind the battle-zone. But field-fortification has at this stage been completely merged in field tactics, which it assists, no longer by ingenious tracing of lines of defence, clearances of foreground, economical disposition of working parties and materials, but simply by placing, at points indicated by the tactician, standard casemates and personal shelters, borrowed from the practice and made with the materials of permanent fortification.

Thus, while permanent fortification is concentrating its stock of ideas and devices upon the task of holding a long front of diminished depth, without any yielding of ground whatever, against the heaviest bombardments, field tactics have become fluid and mobile, ground being lost and won almost as readily as in the days of "manœuvre" warfare, though by different methods. It is at the points of junction between permanent fronts and field fronts, where particular features of ground are neither quite indispensable nor yet of negligible importance, that a field-fortification of the future will presumably find its proper scope. Like the zone-fortification of 1917–8, but to a further extent, it will have at its disposal many of the forms and methods of permanent fortification. (The illustrations to this article are reproduced by permission of MM. The Librairie Berger-Levrault, of Paris, from *La Revue du Génie Militaire*.) (C. F. A.)

SIENKIEWICZ, HENRYK (1846–1916), Polish novelist (*see* 25.54), died at Vevey, Switzerland, Nov. 14 1916.

SIERRA LEONE (*see* 25.54).—There was a modification of the S.E. frontier in 1911, when Sierre Leone acquired the Kanre-Lahun district from Liberia in exchange for a district on the Morro river. The new boundary was delimited in 1913–4, Col. Cowie being the chief British commissioner. The total area of the colony and protectorate is estimated at 31,000 sq. miles. The census of 1911, partly based on estimates, gave a population of 1,402,878, Freetown, capital and chief port, having 34,090 inhabitants. The European population numbered about 1,000, that of the colony (as distinct from the protectorate) being 702, including 62 women; the Sierra Leonians some 70,000. There were also some hundred Syrians, almost all traders.

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The commerce of Sierra Leone is bound up with the products of the oil palm, which constitute some 75% of the exports. Next in importance is the kola nut, in universal demand among the natives of West Africa; scarcely any of the nuts reach Europe. Minor exports are ginger, piassava fibre, gum copal, rice and hides. Rubber and ivory have virtually ceased to be exported; cotton-growing experiments were abandoned. Native cocoa plantations have been made since 1910 in the Northern Shebro district, but up to 1920 cocoa did not figure in the exports. From 1909 to 1913 (inclusive) there was a steady expansion of trade, the total value rising from £1,960,000 to £3,481,000, imports and exports being almost equally balanced. Revenue showed a corresponding expansion, from £361,000 in 1909 to £618,000 in 1913. Expenditure in the years named was £336,000 and £622,010 respectively. During this period, in 1912, an extension of the railway going north from Boia junction on the Freetown-Liberian border was begun. In 1916 this northern line reached Kamabai, 118 m. from Boia and 182 from Freetown. A loan of £1,000,000 raised in 1913–4 was expended as to £308,000 on railway extension and as to £110,000 on improvements to Freetown harbour. As to shipping, British tonnage in 1913 was 2,050,000 out of a total of 2,931,000 tons, and during and after the World War the proportion of British tonnage increased.

At the beginning of 1914 a fall in the prices paid in Europe for palm kernels, rubber and other products of the country led to a decline of trade, and the outbreak of war in August aggravated conditions, as the German market was closed. Some 87% of the palm kernels had been exported to Hamburg, and the British kernel-crushing machines could not cope with the great quantity of kernels diverted to the Liverpool market. The erection of new oil mills in England—the oil enters largely into the composition of margarine—met this difficulty, but in 1915 a decrease in the market value of the kernels led to a smaller return from a larger output than in 1914. By 1917 however the quantity of kernels shipped exceeded that ever previously exported and also realized a higher price. Of 58,000 tons exported France took 1,380; the rest went to the United Kingdom. Thus the readjustment of trade was safely accomplished. As to palm oil, next to kernels the most important export, the greater part was always taken by Britain. (Of 828,750 gal. exported in 1919—the largest quantity exported for 10 years—Great Britain took 819,375 gallons.)

By 1918 the total value of trade was £3,197,000, the United Kingdom taking over 50% of the exports and furnishing over 80% of the imports, the United States providing the bulk of the other imports. Trade in 1918 surpassed in value that of any year since 1913, and there was a further marked rise in 1919, when exports were valued at £2,101,000 and imports at £2,034,000. Excluding Government imports, exports showed an excess over imports of £12,000, as compared with an excess of imports in 1918 to the value of £163,000. The high figures both for 1918 and 1919 were, however, due largely to inflated prices, though there was also an increase in the quantity of exports. Revenue in 1919 was the highest recorded—£748,000, expenditure being £740,000. The estimate for 1921 put both revenue and expenditure at over £1,000,000.

The colony and protectorate made progress in spite of the World War. There was an increased demand for education among the natives, chiefly met by the missionary societies, but the Government maintained schools for Moslems, and an agricultural training college for vernacular teachers was established at Njala, in the protectorate. In 1919 there were 163 elementary and intermediate schools in the colony and protectorate, with an average attendance of 6,285. Including secondary and technical schools there were in all 192 centres of education with over 12,000 pupils on the rolls. Sir L. Probyn, appointed Governor in 1910, was succeeded (1914) by Sir E. M. Merewether, and (1916) by Mr. R. J. Wilkinson. The natives showed much loyalty to Great Britain during the World War, and the Sierra Leone forces played a prominent part in the Cameroon campaign.

Notwithstanding the increase in trade, 1919 witnessed much distress in the colony and protectorate. Owing to adverse weather conditions in 1918 and an epidemic of influenza at harvest time, there was a great shortage of rice and other food crops, and famine resulted. This led in July 1919 to serious rioting, the Syrian traders, who were accused of hoarding food-stuffs, being attacked and driven from their houses and stores. As the bulk of the kola nut trade was in the hands of the Syrians that industry suffered severely. The high price of imported goods also caused much distress. The year was further notable for the prohibition of the import of "trade spirits," but it was not until 1920 that total prohibition was enforced.

See H. O. Newland, *Sierra Leone* (1916); N. W. Thomas, *Anthropological Report on Sierra Leone* (1916); H. Michell, *An Introduction to the Geography of Sierra Leone* (1919), and the annual reports issued by the Colonial Office, London. (F. R. C.)

SIFTON, SIR CLIFFORD (1861–), Canadian politician, of Irish descent, was born in Middlesex, Ont., May 10 1861. His father, John W. Sifton, was Speaker of the Manitoba Assembly, and the son, after graduating at Victoria University, Cobourg, was called to the Manitoba bar in 1882, and six years later entered the Manitoba Legislature as member for North Brandon. He was Attorney-General and Minister of Education in 1891, became K.C. in 1905, and joined Sir Wilfrid Laurier's Dominion Cabinet in 1896 as Minister of the Interior. He represented Canada at the International Conference on Conservation of Resources at Washington (1909) and was chairman of the Commission for Conserving the National Resources of Canada (1909–18). From 1910–7 he was Premier of Alberta and president of its Executive Council. In 1917 he became Minister of Customs and Inland Revenue in the Dominion Cabinet, exchanging that portfolio for the Ministry of Public Works in 1919 and becoming Secretary of State for Canada. In that capacity he represented Canada at the Peace Conference in Paris and signed the Treaty of Versailles. He was created K.C.M.G. in 1914 and was sworn of the Privy Council.

SIGHTS (*see* 25.60).—Although in the years before and during the World War, the instruments employed in artillery work were considerably improved and developed, research was in the main directed rather to auxiliary instruments such as range-finders than to gun and rifle and machine-gun sights as such. It may be said, therefore, that the modern artillery sight, as designed before 1914, stood the test of war; and the task of the present article is only to review developments. In one respect, however, those developments were wholly new. The anti-aircraft sight which was virtually non-existent in 1910, has already become an elaborate instrument and its evolution is still in progress. Considerable importance—practical rather than technical—attaches also to the new machine-gun panorama sight and to the application of aperture sights to the military rifle and light machine-gun.

Gun Sights.—The purpose of a sight is to ensure the accurate laying of the gun both in direction and elevation. The sight must provide for movement in a vertical plane to register the "angle of sight," the "tangent angle," and hence the "quadrant angle," and thus the range for which the gun is laid; also for movement in a horizontal plane, to allow the direction of the gun to be corrected for deviation due to "drift," wind, want of level and any movement of the target. In order that the operation of laying shall be unaffected by firing, the sights are in modern equipments fixed to a non-recoiling part of the carriage; this may be the cradle, the trunnions, or the intermediate carriage, and, in the last-named case, it must be so connected to the trunnion that the same angular movement is given to it as is given to the gun.

Laying for elevation may be accomplished in the following ways:—(*a*) By setting the required tangent angle in the sight and directing the sight-line upon the target. (*b*) With fixed mountings on level platforms, the quadrant angle may be registered on an elevation or range indicator incorporated in the elevating system; or, with both field carriage and fixed mountings, the gun may be laid at the required quadrant angle by means of a clinometer. (*c*) With fixed mountings at a definite height above sea-level, by connecting the sight through a cam with the intermediate carriage in such a manner that for a given quadrant angle the sight is automatically depressed to the correct angle of sight.

Laying for direction may be either direct or indirect; direct when the sight-line is aligned on the target, indirect when a convenient object or auxiliary aiming-mark is used. It may be accomplished as follows:—(*a*) By aligning the sight-line upon the target, the inevitable deviation of the shell from the vertical plane containing the gun being allowed for automatically, or set on the sight as deflection. (*b*) By using a panoramic sight and any convenient aiming-point; the horizontal angle between aiming-point and target is determined and set on the sight and the latter aligned on the aiming-point. (*c*) With fixed mountings, by obtaining the direction from an independent source and setting it on the oriented training-arc on the pedestal.

For laying both in elevation and direction it is essential that the sight should be truly vertical. This is attainable easily with a fixed mounting; but with field carriages the wheels or the platform may be out of level; in such a case, the elevation registered on the sight will not be correct, and the gun will shoot towards the lower side. If, however, the verticality of the pivot be maintained, it is immaterial whether the carriage basic structure be level or not. Adjustment for verticality is permitted by the reciprocating principle, in which the sight can always be made to move in a vertical plane parallel to that containing the axis of the gun. Thus the sight-line

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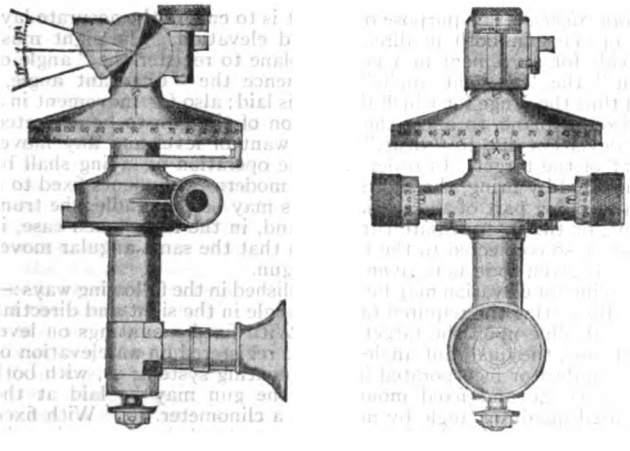
and gun, when laid, lie in parallel vertical planes, so that neglecting drift, etc., correct direction is obtained.

Means to compensate automatically for drift of the projectile by giving appropriate deflection to the gun are usually introduced into the sight. As drift increases with the range, so also does the necessary deflection; but in some instances, a fixed deflection (representing an average correction) is put on to the sight system. The correction is effected by arranging the sight, when setting for elevation, to move in a plane inclined slightly to the vertical and intersecting the vertical plane in a line parallel to the axis of the gun; thus the greater the elevation on the sight, the greater the automatic deflection imparted. This method of compensation allows of a convenient combination with the reciprocating sight, by mounting a transverse bubble in such a manner as to ensure that, when central, the body of the sight is tilted to the left at the required angle; but the open, telescopic or panoramic sights are mounted on the rocking portion so as to have true verticality when the bubble is cross-levelled. Thus the cross-levelling gear neutralizes any want of level, and permits drift to be corrected for by movement of the sight in a tilted plane when setting for elevation; but the range-scale must be graduated to register elevation in a vertical plane.

In the system of independent line of sight in use with certain light field carriages the two parts of which the quadrant angle is composed—the angle of sight and the tangent angle—are applied to the gun independently and by different men. This system necessitates an intermediate component carrying the sight, and two elevating systems, the lower of which elevates the intermediate component, sight, cradle and gun for angle of sight, and the upper elevates the cradle and gun for tangent angle. Thus, conjointly, the two elevating gears give the quadrant angle. A sight clinometer is fitted to the sight to register the angle of sight for indirect laying, whilst a range-indicator, operated by the upper elevating gear, registers the tangent angle. Once the sight has been aligned on the target, the tangent angle may be altered to correct the range without disturbing the layer for direction. Such a system is useful when firing at moving targets, the direction and elevation having to be altered simultaneously, but it has a disadvantage in that it is difficult to apply the reciprocating principle when the gun has to be moved independently of the sight. Drift is usually corrected for by inclining the trunnion axis. The latest method of securing this principle, though not truly "independent," combines the reciprocating sight with an automatic drift correction.



The rocking-bar sight is mounted on a pivot which is always parallel to the gun axis, and thus can be rocked laterally under the control of cross-levelling gear to maintain verticality, which is indicated by a transverse bubble. An acorn-pillar, or front sight, and notched leaf, or rear sight, are fixed at the extremities of a sight-bar which is mounted on a vertical pivot on top of a rocking-bar; the rocking-bar is pivoted transversely at the front of a sight-carrier attached to a support on the cradle. The sight is set for elevation by means of a worm and arc-pinion drive in mesh with an arc on the rocking-bar, the range or tangent-angle being registered on a drum fixed to the pinion-spindle. The pivot of the rocking-bar is inclined so as to give an approximate drift correction at all ranges. To give deflection, the rear of the sight-bar is fixed to a nut mounted on an endless screw carried at the extremity of the rocking-bar; the nut traverses across a degree scale fixed to the rocking-bar. Bearings for a telescope are fixed to the sight-bar.

A sight clinometer is usually fitted to the rocking-bar so that, if necessary, the sight can be set first for angle of sight and subsequently for tangent angle. In effect, the clinometer is an adjustable spirit-level. A bubble is mounted in a sliding segment having worm-teeth cut on a curved base; the segment is moved relatively to a carrier by a screw mounted in the latter and in mesh with the teeth. Degrees of elevation or depression are registered on the face, while the screw is fitted with micrometer head to read minutes.

The employment of muzzle-velocity correctors for use in conjunction with the range drum is becoming general. The corrector (not to be confused with the "corrector" employed for varying the height of burst of time fuzes) also provides means for determining the muzzle velocity from firing at a known range, allowances being made for standard conditions; sights so fitted are known as calibrating sights. The corrector, which may be attached to the oscillating bracket or to some part of the range-gear in independent-line sights, fits over the face of the range-drum and is graduated in ranging muzzle velocities; a knife-edge reader, hinged at one end, has the other end attached to a nut mounted on a screw in the corrector and engraved with an arrow for reading the muzzle-velocity scale. The knife-edge reads the yard-scale graduations while fine adjustment along the muzzle-velocity scale is ensured by the nut-and-screw arrangement. The yard-scale is engraved upon a spiral designed in conjunction with the muzzle-velocity scale to give the correct tangent angle for the muzzle velocity used.

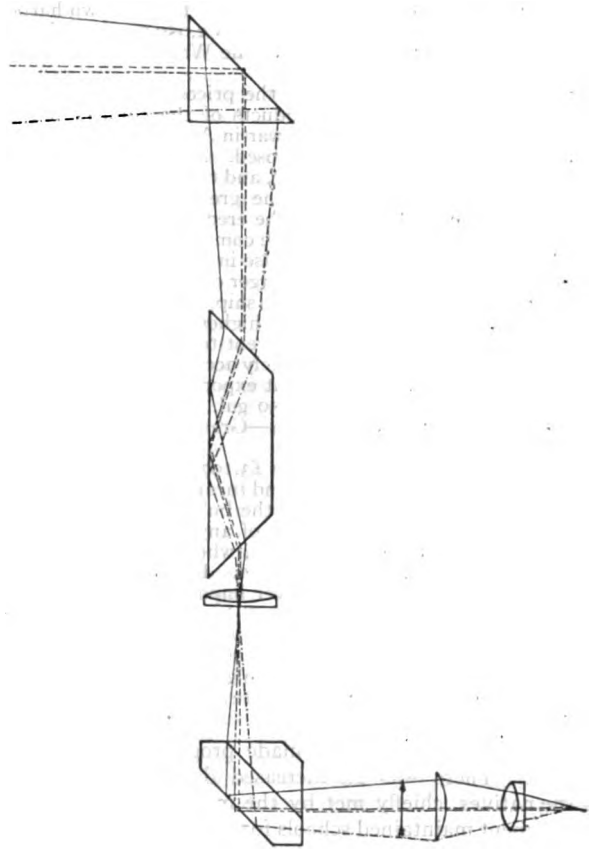


FIG. 2

With certain carriages it is inconvenient to mount the sight on either the trunnion or the cradle. In such cases the sight is mounted upon a pivot on the intermediate carriage, the sight-carrier being constrained, by means of parallel link-motion gear, to make the same angular movement as the gun. For the sight to be effective, the parallelogram must be correct, and adjustments may be required for the lengths of the link and the arm. In certain designs the independent line of sight is obtained without the use of an intermediate component, and combined independent-line and reciprocating sights are also in use.

The automatic sight is discussed and an example illustrated at 25.64; here, therefore, it is sufficient to recall its basic principle, which is, that for a gun mounted on a level platform at a fixed height above mean sea-level, there is only one angle of depression of sight and one quadrant angle for any given range. Thus, if the sight be pivoted transversely to the cradle and made with an arm projecting downwards from its front end, there is, for a given quadrant angle, one position only for the lower extremity of this arm; if the arm be caused to engage with a suitably cut cam fixed to the intermediate carriage, any quadrant angle on the gun will impart the correct sight-depression to the sight.

A distinctive feature in connexion with all anti-aircraft sights is the necessity for an automatic reduction in the tangent angle for a given range as the angle of sight and quadrant angle increase. Consequent on the varying range, height and speed of aerial targets, large corrections have to be applied to compensate for the vertical and lateral angular movements of the target; these corrections inter-

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act to complicate further the design of an efficient sighting system. No description of such a sight, therefore, is possible within the limits of this article. For reasonable accuracy of fire, the mounting must be level. Anti-aircraft mountings are generally fitted with training arcs; in some cases a second set of indicators is fitted to enable horizontal ranges and quadrant angles to be used. A sighting system which also embodies the principle of the independent line of sight has been tried in the British service.

The panoramic sight is used with field ordnance for indirect laying for direction, from a position out of view of the target. The layer is enabled to take advantage of any auxiliary aiming-mark and to lay without exposing himself. The sight may be used also for direct laying.

A typical panoramic sight is shown in fig. 1. It is a prismatic telescope mounted in a vertical tube having a rotating hood at the upper, and a horizontal tube at the lower end; the hood is mounted on a horizontal graduated dial-plate with which it may be revolved through a complete circle, by worm-gearing; the worm-spindle is mounted in an eccentric to enable the worm to be thrown out of gear for quick setting; on the periphery of the dial-plate are graduations read by a pointer fixed to the vertical tube; while the ends of the worm-spindle are fitted with micrometer-heads to read smaller divisions. A prism mounted within the hood can be rotated about a horizontal axis by means of a worm-spindle in mesh with a toothed arc on the prism holder; this permits of a wide selection of aiming-points in the vertical plane. The optical arrangements are shown in fig. 2. They consist in a reflecting prism mounted within a holder in the hood; in the vertical tube, an erecting prism controlled by differential gear to move at half the rate of the dial-plate and hood; a fixed object-glass below the erecting prism; and a reflecting prism below the object-glass to reflect light along the horizontal tube; in the horizontal tube, a glass diaphragm engraved with horizontal and vertical lines, and in rear of this, eye-lenses to give a magnified image. The rays of light from the object enter through a plain glass window and are reflected downwards by the prism in the hood; they pass through the erecting prism, the purpose of which is to give an erect image, whatever the rotation of the hood, and are focused by the object-glass; they then pass to the lower prism and are reflected along the horizontal tube; the eye-piece magnifies the image which is seen on the cross-lines of the diaphragm, the latter being illuminated by a plain window let into the horizontal tube.

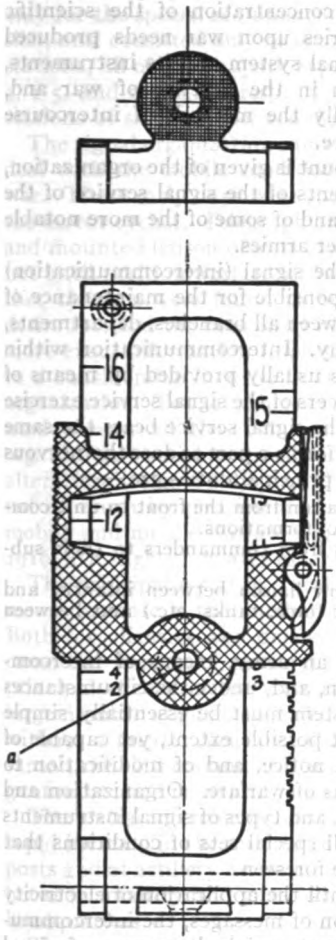

FIG. 3

Other forms of dial sight are, the simple graduated and flexible dial fitted with an open sighting-bar; and the *collimator*, which exists in several forms. In principle an eye-lens and ground-glass window are mounted at the ends of a tube, an arrow or cross on the window being at the principal focus of the lens. With one eye applied near the lens, the cross will be seen, but there is no vision beyond the cross due to the ground-glass; the other eye sees the aiming-point. The gun is traversed until the cross appears superimposed on the aiming-point. Both eyes are used, and are viewing approximately parallel rays. Unlike ordinary open sights, there are not three points at varying distances to be brought simultaneously into alignment, but the eyes view two points under practically the same conditions.

Sights for Rifles and Machine-Guns.—The improved ballistics of rifles generally, on the one hand, and the shortening of the sight radius due to shortening of the barrel, on the other, have made the question of better sights a very urgent one. Attempts to retain the old sight radius by bringing the rear sight closer to the eye resulted in the discovery that it was impossible effectively to use an open sight nearer than twelve to fourteen inches from the eye (owing to the inability to focus on rear sight, front sight, and target at the same time) and led to the reintroduction of the aperture or peep sight, in itself an old invention. In this the rear sight is placed close to the eye, and no attempt is made to focus on the aperture. The eye looks through the aperture and instinctively centres the front sight. Any blur around the aperture will not impair the accuracy as it is equal on all sides of the opening. If the eye is now focused on the target, the front sight is at sufficient distance to afford very good definition. Another advantage is that the accuracy of the sight is not affected by slight changes of light.

Aperture sights are of two general types: the disc aperture consisting of a large disc, which shuts off all view of the target except that seen through a peep hole of from ·03 to ·06 in. in diameter; and the Lyman type which has a thin rim with peep hole about ·010 in. in diameter. Disc sights, which are used principally for target shooting, are unsuitable on account of their limited field for moving-targets, or where quick aiming is required.

In the Lyman type the entire target and its surroundings may be seen while aiming; it may be used in poor lights where open sights cannot be used, and moving objects may be quickly aimed at. The sights on the British 1914 rifle (U.S. Rifle Model of 1917), and the Browning automatic rifle are of this type (fig. 3). The aperture (*a*) is 0·1 in. in diameter, and is made through a disc of about twice the diameter of the aperture. The battle-sight[1] is vertical and in use when the leaf sight is flat and vice versa; the sizes of aperture and ring are the same in both. This sight was found very satisfactory during the World War. It has no lateral adjustment, service experience having shown that the sights were satisfactory without this refinement. An aperture 0·1 in. in diameter is thought by many to be too large, ·070 in. to ·080 in. being the size most favoured. The U.S. 1903 Rifle (Springfield), and the now abandoned Ross rifle are the only other military rifles with an aperture sight. In the case of the Springfield, which has also sight notches of the usual type on the slide, it is found that, although the aperture is very small (0·05 in.), and too far from the eye, it is always preferred to the V. for fine shooting. The superiority of the aperture sight over the open sight is in fact now generally admitted. It is almost universally used by rifle experts, and the delay in its general adoption for military use is due to the impracticability of effectively and cheaply applying it to rifles now in existence.

Optical rifle fore sights designed for use with aperture rear sights have recently been placed on the market. These sights consist of a dioptric convex lens of magnification of about 2½ diameters, with a spot or ring in the centre for use as a bead. The lens when viewed 3 or 4 ft. from the eye gives an upright magnified image of distant objects. An aperture rear sight, preferably of the disc type, with an aperture of 0·03 to 0·04 in. diameter, or a lens rear sight should be used. Better definition as well as magnifying power is claimed for these sights.

Luminous sights for night use have been experimented with and used to a limited extent on machine-guns and rifles for military purposes. These sights, as a rule, consist simply of metal sheaths which slip over the front sight and rear sight and have suitable containers for the luminous material used. For periscope sights see RIFLES AND LIGHT MACHINE-GUNS.

Telescope sights are often applied to sporting rifles and military rifles used for special purposes. These sights consist of a telescope with a reticule for aiming which takes the place of a front sight. The magnification is usually from 2·5 to 6 diameters; those from 2·5 to 3 power are considered the best for general purposes as they give a larger field and can be used in poor light. Adjustments for range are made either by moving the crosshairs only, as in most German rifle telescopes, or by means of holding brackets with adjusting screws which give both vertical and lateral adjustment; the latter type being more accurate. The advantages claimed for telescopic rifle sights are that they permit more accurate aim by magnifying the errors of holding the rifle, also that they allow objects to be seen more distinctly, particularly in a poor light. The latter is probably their greatest advantage; their superiority to a good aperture sight not being as great as is popularly supposed.

The Vickers and Browning machine-gun sight embodies the principal small-arms-sight developments of recent years. The slide, which is made to travel obliquely in the leaf to compensate for drift, has a revolving disc with apertures of various sizes which may be used for different ranges and light conditions. A fine adjustment for elevation and a windage adjustment are provided, also an open battle-sight. The fore sight is a blade, open or hooded.

The Lewis gun has a simple tangent aperture sight without drift or windage adjustments, but with a vertical adjusting screw for fine adjustments in elevation. The sights used for direct fire on Continental European machine-guns are all of the open type and are usually without correction for either drift or windage.

Tubular sights, which consist simply of a straight piece of tubing, are used to some extent on tank machine-guns, as these sights only require a very small opening in the armour plates for their effective use. The latest tendency, however, is to provide tank machine-guns with a telescopic sight of special construction.

Anti-aircraft machine-gun sights, which compensate for the drift and trajectory of the bullet and offset the speed and direction in

[1] A battle-sight is one which requires no adjustment for distance, or rather is permanently set to a certain range, inside which the bullet in its flight never rises more than a man's height above the line of sight.

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which an aeroplane is travelling, were brought into use during the World War. One of these is illustrated in fig. 4, showing a design used by the British and U.S. armies. This consists of a slide having an aperture 0·25 to 0·5 in. in diameter and fitting on the regular back sight leaf. The aperture (*b*) is set at a given height for a standard range. The front sight has two concentric elliptical ovals which are mounted as a leaf sight to the barrel or casing of the gun. The shapes of the ellipses are proportional to the actual horizontal sections of a cone of fire from the gun at a given height and elevation. The design of the outer oval (*a*) is based on an assumed angle of gun elevation of 50°, height of target about 1,000 ft., and a speed of plane of 100 m. per hour; that of the inner oval, on an assumed angle of gun elevation of 15°, a height of 250 ft., and a speed of 120 m. per hour. The middle figure shows the correct firing position with the hostile plane central as viewed through the rear and front sights; that on the right shows a plane at close range flying at an angle with the gun position and perpendicular to the axis of the bore; and that on the left shows the target at a greater range and at an angle with the gun. (H. O.'L.)

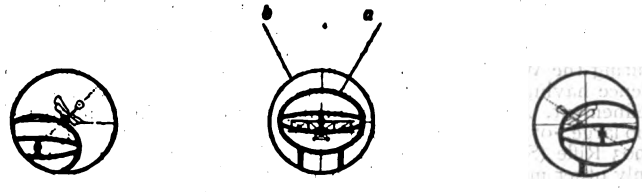

FIG 4

The Panoramic Machine-Gun Sight.—The use of machine-guns for indirect fire during the World War was followed by the demand for instruments for obtaining data and laying the guns. This demand led to the production of many devices, some of which were well fitted for their purpose, and some of which were make-shifts. But, as the war progressed, it became apparent that indirect fire was becoming increasingly important, and an attempt was made to produce one high-grade device that would replace as many instruments as possible. This effort, in the case of the United States, resulted in the production by the Ordnance Department of the panoramic machine-gun sight, described below. At the same time, all Browning machine-guns were fitted with a bracket on the left side which was designed to carry the panoramic sight and also to furnish on its upper surface a flat space for applying the clinometer.

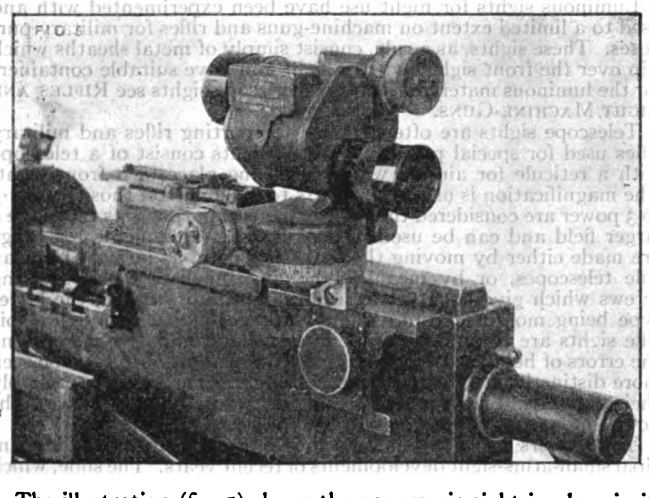

FIG. 5

The illustration (fig. 5) shows the panoramic sight in place in its bracket on the Browning machine-gun. The sight consists of a X6 prism telescope capable of movement in elevation and azimuth (360°). The movements of the sight are controlled by means of graduated knobs. The lower knob is for movement in azimuth (deflection), and a quick release is furnished to enable large changes to be made quickly. The upper knob controls the vertical movement of the sight. This knob has two sets of graduations. One of these is for ranges, and the second, which is on a ring-sliding friction tight on the knob, is for vertical angles, above or below the horizontal (angle of site). The telescope is provided with a spirit-level which is parallel with the axis of collimation. This instrument is used on the same principles as the panoramic sight of artillery, to measure angle of site and to lay the gun on a visible or invisible target. The telescope has, besides the usual cross-lines, graduations showing both vertical and horizontal angles, and also a vertical scale resembling an inverted sight leaf, which is employed for the correction of fire when the strike of the shots can be observed. The sight can also be used separately from the gun (in combination with a compass and a tripod of non-magnetic metal) for the same operations as those performed by our artillery director. (J. S. Ha.)

SIGNAL SERVICE, ARMY (*see* 25.71).—In the ten years that elapsed between the Russo-Japanese War of 1904–5 and the outbreak of the World War in 1914, evolution in military signalling was rapid, both as regards organization and as regards instruments employed. The old principle of deliberate crudity of means, based on the idea that no refined instruments could be relied upon to survive the rough conditions of war employment, was giving way to a sense of the great possibilities opened up by modern science as applied to army signalling, while, in tactics, the ever-increasing tendency towards articulation of forces and distribution in depth was forcing the problems of liaison more and more into the foreground. But such evolution as there was in the period 1904–14 was naturally slight indeed compared with that which took place during the World War, in which stabilized conditions of warfare and the concentration of the scientific talents of all belligerent countries upon war needs produced results, both upon the army signal system and its instruments, that amounted to a revolution in the practice of war and, moreover, must affect profoundly the methods of intercourse between civilized nations in peace.

In the following article an account is given of the organization, working principles, and instruments of the signal service of the British army in the World War, and of some of the more notable features of signal practice in other armies.

(1) *Definition and Duties.*—The signal (intercommunication) service of a modern army is responsible for the maintenance of efficient intercommunication between all branches, departments, formations, and units of the army. Intercommunication within units, other than signal units, is usually provided by means of regimental signallers, but the officers of the signal service exercise supervisory control here also. The signal service bears the same relation to the army of which it forms a part as does the nervous system to the human body. Its principal duties are:—

(*a*) The transmission of information from the front to unit commanders and to the headquarters of formations.

(*b*) The transmission of orders from commanders to their subordinates.

(*c*) The maintenance of efficient liaison between infantry and other arms (such as artillery, air force, tanks, etc.) and between neighbouring formations.

For the efficient working of an army, means of intercommunication must be swift, certain, and, under the circumstances of modern war, varied. The system must be essentially simple and standardized to the greatest possible extent, yet capable of considerable expansion at short notice, and of modification to meet the most diverse conditions of warfare. Organization and working schemes must be elastic, and types of signal instruments must be devised to cope with all special sets of conditions that have been experienced or can be foreseen.

(2) *British Army System.*—Until the application of electricity to the long-distance transmission of messages, the intercommunication of armies was carried out mainly by means of visual appliances or by the use of message carriers. Liaison officers and orderlies have been used from the very earliest times; the arrow was frequently employed in mediaeval times for the transmission of information into and out of besieged towns; the pigeon was used with success, notably in the wars of the Netherlands against Spain; permanent lines of semaphore communication (masts with movable arms) were employed both by the French and the British during the Napoleonic Wars. Later, the invention of the Morse code and the adaptation of the semaphore principle to field signals led to the general employment of flags, lamps and, later, of the heliograph. The field telegraph made its appearance in the middle of the 19th century, and in the last years of the century the field telephone came into use. Lastly, in the Russo-Japanese War of 1904–5 wireless telegraphy came on the scene.

In 1911 the British "Signal Service" was constituted as a distinct branch of the Royal Engineers. At about the same time, the adoption of the buzzer telephone as a standard army instrument and the employment of the motor cyclist as a message carrier placed two new methods of intercommunication at the disposal of the signal officer. The outbreak of the World War in

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Aug. 1914 found the Expeditionary Force equipped with a signal service controlled by a director of signals on the general staff at G.H.Q. This service included a signal unit at G.H.Q., a lines-of-communication signal company, and a signal company with each corps and each division. Artillery intercommunication was, however, entirely a separate matter for which that arm itself was solely responsible. So also, was intercommunication inside the infantry unit; and the absence of a chain of command within the signal service itself (each unit commander being responsible only to his own general staff) caused a looseness of organization which soon showed itself to be a grave defect. The means of intercommunication employed were those already mentioned, viz., telegraph, telephone, flag, lamp and heliograph, with the addition of wireless telegraphy, which was, however, at this time adopted only for the special requirements of the far-ranging cavalry division, and consisted only of one lorry and a few wagon and pack stations, all of rotary spark type. (The power of the stations was 3, 1·5, and 0·5 K.W. respectively; the range, when working to stations of similar type, 100, 80 and 30 miles.)

The signal organization summarized above proved adequate to deal with the mobile conditions of the first few months of the war. These early days were specially notable for the triumph of the motor cyclist. Telegraph and telephone, visual and orderlies, and mounted liaison officers also played useful parts, and it was not until position warfare set in in the winter of 1914–5 that further changes were found to be required. Then, however, the desire for, and the possibility of collecting, a greater quantity of more exact information (especially for artillery observation) led to a considerable increase in the complexity of the army signal organization. To the exigencies of position warfare may be attributed almost all the evolution in signal implements and signal organization which marked the course of the war. The chief alteration in signal policy, on the other hand, was brought about not so much by position warfare as by the resumption of semi-mobile and mobile warfare which took place to a slight degree in 1916, to a slightly greater extent in 1917, and completely in 1918.

The principal result of "stabilization" was naturally an immense increase in the number and weight of the guns employed. Both for offensive and defensive purposes massed artillery became the weapon of paramount importance, and this had two principal effects on the forward signal service. The fire of the large number of guns employed could not be effectively directed without a greater measure of intercommunication; while at the same time, intercommunication in the region subject to heavy gunfire became more and more precarious.

The extra intercommunication required was supplied by a rapid increase in the number of telephones in use at observation posts and at artillery headquarters. The need for intimate liaison between infantry and guns led to a similar increase at infantry headquarters.

The magneto telephone came into use for the first time forward of corps headquarters, and, once the superior convenience and efficiency of the instrument were recognized, the demands for its installation increased so rapidly as to tax the signal service to its uttermost capacity. A new danger at once arose and threatened to wreck the whole intercommunication service. The tendency was to concentrate all available energies on the installation of telephones and the laying and maintenance of telephone lines. All other means of signalling lost their proper proportion, and an inefficient telephone service was soon in a fair way to become the only means of intercommunication throughout the whole army. Such an undesirable result was only prevented by the incidental troubles arising from the indiscriminate laying of lines. In effect, it was the "overhearing" menace, which will be referred to later, that, together with the prevalence of induction trouble and the difficulty of making "safe" the forward lines, proved to the signal service and to the commanders it served that it was unwise to stake everything upon one method of intercommunication.

The difficulty of maintenance of forward intercommunication was overcome partly by the adoption first of shallow and subsequently of deep buried cable; partly by the evolution of various new alternative methods of signalling; partly by the perfection and adaptation of methods which had temporarily fallen into disrepute under the new conditions.

In 1915, cables were buried 2 or 3 ft. deep and by this means temporary immunity from shellfire was gained; in 1916, the general adoption of the 6-ft. bury (while it saddled the signal service with endless labour problems) successfully solved the difficulty of the maintenance of an efficient forward telephone and telegraph system. One inevitable consequence of the adoption of the "bury" was the concentration of the forward lines into a few main routes, thus paving the way for the great reform in policy which was later brought about under the pressure of rather different circumstances.

The induction which resulted from the collection of 20 to 100 circuits in these main corps and divisional routes was reduced to a slight extent by the general substitution of the sounder for the vibrator in forward units[1] and by the elimination of the buzzer as a general means of intercommunication. It was later almost entirely overcome by the adoption of metallic circuits of twisted cable[2] for all forward lines.

Mention should be made of the alternative methods of signalling which underwent their first main period of evolution in 1915. In 1914, the weight and accuracy of modern artillery fire had caused visual signalling to fall into disrepute as being too dangerous. It was soon found, however, that the lines which were at that time the only general alternative to forward visual signalling, were also untrustworthy, and that salvation lay in employing as many alternative means as possible and therefore in improving all available methods as well as evolving new ones. Visual was rehabilitated by the invention of the inconspicuous signalling disc and shutter, by the general adoption of "D.D. D.D." working (signalling from front to rear without reply) and by the adoption of the efficient electric signalling lamp in place of the more conspicuous and noisy Begbie oil lamp which was the standard equipment at the outbreak of war. At the same time the use of pigeons as message-carrying agencies was revived, and wireless telegraphy began to be adapted to forward work. The former were first used by the Intelligence Corps towards the end of 1914, when the British were operating in a district noted for its pigeon fanciers. From this small beginning grew a service which at the Armistice numbered over 20,000 pigeons, while no less than 90,000 men of all arms had been trained to handle the birds. Lofts were kept usually on a line passing about through divisional headquarters and pigeons were forwarded by motor cyclist and taken into the trenches by selected pigeoneers. Here they remained until required for use or until 48 hours had elapsed, when they were released with or without messages.

Wireless telegraphy for the forward area was first attempted in the summer of 1915, when experiments were carried out which resulted in the standardization of two types of set, the 120-watt (Wilson) and the 50-watt (British field) set. The former was intended for work at divisional and corps headquarters and consisted of separate transmitting and receiving apparatus. The spark transmitter received its energy from a 26-volt accumulator through a small motor-driven interrupter fitted in the set itself; its original complement was a crystal receiver specially designed for the short waves (350, 450, and 550 metres) on which the forward sets were obliged to work. The 50-watt set, on the other hand, was a combined transmitter and receiver, the transmitting

[1] The two telegraph instruments, the sounder and the vibrator, are worked on entirely different principles. In the former case the currents used rise to their full value very rapidly and then remain steady a comparatively long time. On the vibrator system, on the other hand, the currents used are constantly altering in value and even changing in direction, the vibrations being at an audible rate of frequency (several hundred per second). It is these latter rapidly alternating currents which set up rapidly alternating EMF in the earth surrounding the conductor and provide the ideal conditions for overhearing at a considerable distance. A buzzer is a particular type of instrument using "vibrating" or "alternating" current.

[2] In a telegraph circuit consisting of two wires laid side by side, the electromotive force set up around one conductor will be neutralized by that set up around the other in which the current is travelling in the opposite direction. The most efficient disposition of such neutralizing cables is naturally that where the two halves are most intimately interturned, as in twisted cable.

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portion of which was energized by the current from a 10-volt accumulator. It was intended for work in posts close to the front line and at brigade and battalion headquarters and the complete station with its two 15-foot masts could be carried by a party of three men. Both types of set fulfilled their original purpose admirably. They remained the standard wireless sets for forward infantry command intercommunication purposes throughout the war, and have only gradually been superseded by the continuous-wave wireless sets which are now the standard sets for practically all purposes.

Other wireless sets which were evolved during the war, which owed their invention to the same necessity for indestructible and invisible alternative means of forward intercommunication, were the loop wireless sets. These were sets of short fixed wave-length (66 and 80 metres respectively) which were arranged in two complementary installations—a "forward" and a "rear" station to each set. The forward station was distinguished by the possession of a rectangular aerial of folding tubing which could be erected wholly below the surface of the ground in a deep trench or in a dugout, thus rendering the station invisible and often invulnerable. The rear station had a short wire aerial, much of the type used with the standard "British field" (50-watt) set. It was intended, as its name suggests, for work at places not in the direct observation of the enemy. These sets with slight modifications, remain in use at the present day for intercommunication within the infantry battalion.

At least as important as this evolution of alternative methods was the consolidation and reorganization of the signal service which took place during the years of position warfare.

For the understanding of the present organization of an army signal service some account of the effect of the interaction between the requirements of the general staff and the unfamiliar war conditions experienced in the years 1914–7 is essential. Whereas in the pre-war organization of the signal service the ruling consideration was mobility, a military situation arose within six months of the declaration of war, and continued for three years, in which extended movement was the exception and not the rule. The effect on the signal service was a multiplication of the calls for intercommunication made upon it and at the same time an increase in the unreliability of all means of forward signalling. Work in the danger zone had usually to be done not once but many times; duplication of routes forward, first of brigade, and then of divisional headquarters, became essential. At the same time, the demands of the staffs, of the unit commanders, and especially of the artillery, increased manifold.

An establishment adequate to the demands of mobile warfare could not possibly cope with those of position warfare. The small degree of supervision and absence of coördination, due to the practical autonomy of the signal service within each formation, which had been recognized as drawbacks in the manœuvre warfare of 1914, became impossible obstacles to efficiency in 1915.

The first reforms which enabled order to be wrought out of the chaos into which forward signals were in danger of falling were—(1) the vesting of the control of all forward signals in the hands of the divisional signal company commander and (2) the assumption by the signal service of responsibility for, and a measure of control over, artillery signals. By this means it proved possible towards the end of 1915 to eliminate unnecessary lines and to insist on the reeling-up of derelict cables. At the same time steps were taken to supplement the obviously inadequate personnel.

The original signal service units of the British Expeditionary Force of 1914 had consisted essentially of (*a*) the personnel to man one or at most two headquarters offices; (*b*) sufficient cable or airline detachments to lay one main route to all subordinate formations or units then considered to be entitled to telephone or telegraph; and (*c*) a few despatch riders, orderlies, and visual signallers. This establishment only just sufficed for the skeleton intercommunication system required in a mobile army, and neither office staff, line-building detachments, nor orderlies, were sufficient to man the greatly swollen system of position warfare. Reinforcements were essential, and not only reinforcements but radical reorganization as well. Much of the personnel required was for the maintenance of heavily shelled, long divisional and corps lines through the danger area. If these routes were to be efficiently maintained and circuits allotted with due regard to the relative urgency of individual requirements, the men manning them must remain at their posts irrespective of divisional moves. This meant the formation of pools of area-maintenance personnel and units at corps or army headquarters and the creation of these pools was one of the main features of signal reorganization during the position-warfare period. Individual increases to the mobile portions of units also took place, corresponding to changes in signal methods (all in the direction of increased complexity) or alterations in procedure (*e.g.* the assumption of responsibility for artillery and machine-gun signals) which applied equally in position and in mobile warfare.

The increases in the strength of signal units during the war are indicated by the figures in the annexed table, which gives the strength of the signal personnel in an army of two corps, each of three divisions, in 1914 (when the only equivalent of an army signal company was the G.H.Q. signal company) and in 1918, respectively.

Strength, 1914, at Mobilization.

Unit	Each		Total	
	Off	Other Ranks	Off	Other Ranks
G.H.Q. signal company	5	75	5	75
Two army corps H.Q. companies	4	63	8	126
5 airline sections	1	57	5	285
8 cable sections	1	35	8	280
6 divisional signal companies	5	157	30	942
Total personnel			56	1708

Strength at Armistice, 1918.

Unit	Each		Total	
	Off	Other Ranks	Off	Other Ranks
One army signal company	15	340	15	340
2 cable sections	1	34	2	68
3 airline sections	1	43	3	129
8 area signal detachments	1	13	8	104
One signal construction company	3	113	3	113
One light railway signal company	1	61	1	61
9 army, field artillery brigade sig. sub-sections	1	19	9	171
17 heavy artillery group sig. sub-sections	1	28	17	476
Two corps signal companies	6	105	12	210
4 airline sections	1	43	4	172
4 cable sections	1	34	4	136
Six divisional signal companies	15	400	90	2400
Total personnel			168	4380

While the above description applies principally to the evolution of organization in the general signal service, some special mention of the alterations which took place in wireless units is necessary, particularly since wireless telegraphy will in all probability play a more dominant part in the intercommunication service of the army of the future. The few wireless sets which were in use in the British Expeditionary Force at the outbreak of war were manned by personnel who were all incorporated in a single "wireless section" which shortly became a "wireless company." The first great increase in the value of army wireless came with its application to intelligence purposes, originally for the simple interception of enemy wireless messages, and then also for the location of enemy wireless sets whether in the field, at sea, or in the air. For this latter use of wireless alone,—"position finding"—many special sets were devised and a numerous personnel collected in special intelligence wireless units.

Next, the invention and perfection of the portable "trench" wireless sets in 1915 and 1916 created a further demand for wireless personnel and increased the already swollen establishment of the central "wireless company." The result was a measure of devolution and the formation of an army wireless company in each army. The commanding officer of this unit acted as staff officer for wireless to the chief signal officer of the army, and was

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responsible for the organization and practice of wireless within the limits of the army.

Yet another direction in which wireless personnel found employment was in the detection and prevention of the indiscretions which, in 1916 particularly, enabled the enemy to glean important information by listening to the traffic over the British telephone system. It was in 1915 that this menace first became important and in the following year "overhearing" became so serious that the forward telephone service was stultified. Many important results followed, directly, or incidentally. Of these may be mentioned:—

(1) The general adoption of closed metallic circuits everywhere within 3,000 yd. of the front line.
(2) Alterations in the system of identification calls.
(3) The replacement of the buzzer telephone by the fullerphone in the forward area.
(4) The invention of the screening buzzer, a powerful vibrator used for drowning all sounds carried forward by induction from the front line.
(5) The invention and perfection of the 3-valve listening sets and the formation of detachments of the army wireless companies to work them.[1]
(6) The growth of an organization for the interception of speech on enemy lines and the policing of our own telephone system.
(7) The application of earth induction telegraphy to signalling which resulted in the invention and evolution of the power buzzer.
(8) The increased employment of alternative methods of signalling (visual, wireless, etc.) so obviously liable to overhearing or overseeing that they were used with caution.

It is difficult to decide which of the many results was the most important, but perhaps the most interesting from the present point of view was the evolution of the power buzzer. This was a powerful vibrator worked by the current from a 10-volt accumulator, and connected to inconspicuous earths of insulated wire which could, if necessary, be buried 6 ft. deep with little labour. It occupied a place in position-warfare signals for which no other instrument, except perhaps the loop sets which lately more or less superseded it, was suitable. Detachments of troops isolated by the enemy could send out code signals which could be picked up by listening sets, themselves inconspicuous, at ranges up to

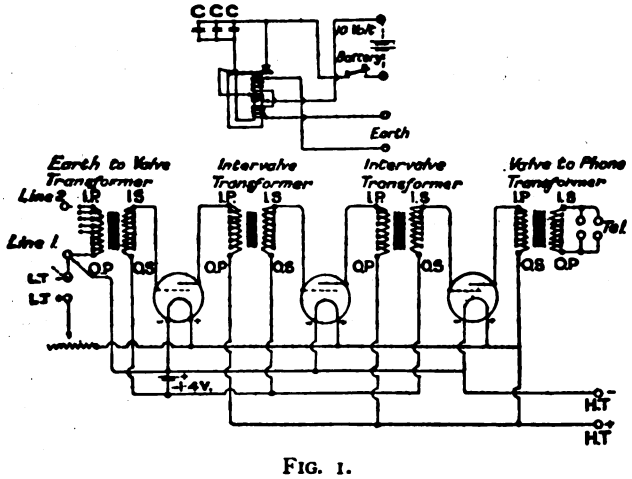

FIG. 1.

3,000 yd. On several occasions of importance these sets remained the only means of communication with and from units that had advanced rapidly in attack, or become isolated in defence.

The diagrams in fig. 1 show the principles of the power buzzer amplifier system. The transmitter (*a*) is a powerful buzzer taking its current from a 10-volt accumulator. When the Morse key is pressed, a current from the 10-volt battery flows through the key to the upper contact, across to the lower contact, along the armature, thence along the primary coil, and back to the battery. The current magnetizes the coil which attracts the armature, thus breaking the contact, and allowing the armature to fly back and remake contact, etc. Each time the primary current is thus completed and broken, currents in the opposite direction are induced in the secondary coil and are passed to earth through shut lengths of cable and earthpins. Condensers, as shown, are connected across the break to reduce the sparking to a minimum.

To obtain the best results in two-way working a three-valve amplifier (*b*) is employed. The currents, received on similar earths, pass through the primary circuit, are induced into the secondary of the earth-to-valve transformer which is connected to the grid and, through a single dry cell, to the filament of the first valve. The amplified signal from the first valve passes through the second and third valves and, finally, the three-amplified signal passes through a valve to telephone transformer with ordinary wireless receivers in series with the primary winding.

With all these developments, and especially with the rapid increase in the number of listening sets, the wireless service, as a separate entity, was becoming unwieldy, and its absorption into the general signal service organization was essential to its most efficient administration. In 1917 and 1918, therefore, the army wireless companies were broken up, the section which had composed them being allotted to the divisional, corps, and army signal companies, according as they were equipped with portable trench sets, Wilson and listening sets, or the larger and more powerful Crossley motor sets used for supervisory and tactical work at army headquarters. In this form wireless organization survived the war.

The only change of moment in army wireless after this time was the application of the continuous wave system to army use. The early experimental sets made their appearance in 1917, but for some months they proved to be too delicate and untrustworthy for the work under the hard conditions of active service. Gradually, however, technical difficulties were overcome and more robust types of instrument devised. Before the end of position warfare, portable 30-watt continuous wave sets of about the size and portability of the 50-watt spark sets, but with forward aerials only 4 ft. high and a normal range of 12 m. were doing good work with heavy artillery observation stations. The Armistice in Nov. 1918 found continuous wave wireless still chiefly confined to the artillery, but new and more powerful sets had already been devised and tested. Since that date, spark wireless has been entirely ousted from its former position except for the short-range loop sets—the successors of the power buzzer—which are retained for work within the battalion and similar small units working in the immediate vicinity of the front line. There seems little doubt that in the future development of army signalling, continuous wave wireless is likely to play an all-important part.

While the chief characteristic of the earlier position-warfare period was the evolution of signal implements and the adaptation of signal organization to stationary tactics, it was in the great battles of 1916 and 1917 that signal policy began to crystallize in very definite shape. The first result of the stabilization of the situation was the running forward of lines in all directions to serve the multifarious units which now for the first time made good their claims to telephone communication. Magneto and buzzer telephones and magneto, buzzer, and combined exchanges made their appearance in all formations from brigade rearwards, and buzzer telephones and exchanges were issued to battalions and batteries. The lines to serve these telephones and exchanges had in many cases to be duplicated and even triplicated, and a festoon of lines, converging from front to rear, or stretched transversely and at all angles across the front, hampered movement and defied the utmost efforts of the signal personnel whose business it was to maintain them. The necessity for economizing signal personnel and for the protection of lines alike tended to bring about two reforms. On the one hand, control was vested in the signal officers of superior formations; on the other hand, by their orders, all circuits were concentrated into a certain limited number of well-defined main routes.

The first of these reforms in point both of importance and of time was the rearward movement of the centre of gravity of the

[1] The early overhearing experiments were made with ordinary telephone receivers and results, while they pointed out the danger, were not very satisfactory. In the German, French and British armies, it was the discovery of the possibility of using the new 3-electrode valves for magnifying extremely small changes in electric potential which at the same time raised the "overhearing" menace to its greatest pitch and caused the development of large branches of "Intelligence" and Signals to deal with this new branch of scientific warfare. The valves were used in receiving circuits both as detectors and amplifiers and revolutionized both telephony and wireless telegraphy.

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command of forward signals from the uncontrolled battalion, through brigade, division, and corps, to army. Concurrently with this, the commanders of signal units became staff officers—*i.e.*, representatives of the command itself—instead of simple executants.[1]

In the meantime, the idea of the central signal route in each formation having been launched, it was natural that other means of signalling should at once tend to concentrate along these routes, with their protected test-points and signal offices. Economy and greater trustworthiness at once followed, and in the battle of the Somme, 1916, when the British army first carried out a great offensive from prepared positions, the central signal route, running from front to rear of each divisional sector and reinforced with all possible means of intercommunication, was attempted as a definite policy. The line system was carried forward in 6-ft. buries to a cablehead in, or even in advance of, the front line. Cable detachments were organized and held in readiness to extend the lines. Runners and despatch riders were organized in relay posts along the cable route. Wireless and power buzzer sets were also erected in convenient dugouts close to cablehead and the forward communication centres. By this concentration of means along one line, and by an all-round training which made the personnel to some extent interchangeable, economy of personnel, elasticity of procedure, and a minimum of casualties were ensured.

In the more extended offensives of 1917, this principle was carried still further and reinforced by instructions issued by G.H.Q., which required the headquarters of formations to give the signal officers concerned early and detailed information as to projected operations, forbade movements of headquarters without good cause, and laid down other important points of principle.

The culmination of position warfare thus arrived in the spring of 1918 to find the signal service quite equal to the calls made upon it. At G.H.Q. and on the lines of communication were adequate office staffs and a sufficient number of permanent line and airline construction companies and sections. The bases, camps, depots, and stores concerned with the administration and supply of a great army were served by army telegraph and telephone routes. Maintenance parties at all offices dealt with ordinary day-to-day repairs; breakdown gangs at central positions were in readiness to cope with the catastrophic breaks due to bombing and long range shelling. At G.H.Q. itself powerful wireless stations formed the initial link of a chain line which reached right forward to the front line; other stations were engaged in intercepting the German wireless; and a headquarters wireless staff coördinated the activities of the Intelligence stations scattered throughout the rear army zone. Here, also, was the nerve centre of the whole signal service in France—the directorate of signals—the staff which formulated the policy of the service, supervised its organization and working, and allocated the incoming reinforcements of men and material.

The basis of the signal system of the army was again a telegraph and telephone network which was built up on a "chessboard" or "grid" system, that is with front-to-rear routes and routes transverse to the front, spaced at regular intervals and with the main signal offices and test-points at the junction of the two. Until late in 1917 the approved theory was to make the line system approximate as nearly as possible to the perfect "grid" with as few and as heavy routes as possible. With the increase in the amount of long-range shelling and bombing which was a marked feature of early 1918, this principle required considerable modification. Two or three parallel routes usually took the place of the single heavy route of each corps or army area, and all routes were diverted to a much greater extent in order to avoid centres likely to be bombed or shelled.

The constitution and working of the army signal company perhaps more nearly reflected the conditions of position warfare than did that of any other. A telegraph construction company, a light railway signal company, and airline sections were the chief elements of the construction personnel, though there were also cable sections for connecting up isolated units at any time, and dealing with emergency connexions in battle. Here, also, were wireless light motor sections, mainly employed on supervisory duties, but like the G.H.Q. wireless, available to take their place in the chain of intercommunication in the event of the failure of the lines. Most of the traffic was dealt with by wheatstone, duplex, and simplex telegraphy, and the magneto telephone, wireless telegraphy being chiefly utilized to assist and police the more forward stations. The chief signal officer of the army had also to coördinate the signal schemes of the formations in his army, and under his command were the area detachments whose permanent duty was the maintenance of the buried cable in the army area.

In the area of a corps—the forward position of which was liable to frequent shelling—the main routes were still permanent line and airline and the construction personnel consisted in the main of airline detachments. In addition, corps cable sections were available for emergency cable-laying, for loan to overworked divisions (a frequent case), for artillery signal work, or for running spurs to isolated offices off the main airline routes. The personnel of the corps cable sections was also often employed to supervise labour parties in the construction of the buried cable system, though, as above mentioned, maintenance personnel was provided through the army area detachments. The corps wireless section, while principally concerned with store distribution and supervisory and police duties, was more intimately connected with the tactical employment of wireless than was that of the army. Particularly in battle periods, the corps-directing station was frequently obliged to step in and assist its less powerful subordinates to attract the attention of other stations or to rebuke stations using undue power or contravening priority regulations, besides policing procedure and listening for occasional windfalls from forward German stations.

Lastly, the chief signal officer of the corps had to supervise and control the signal communications of the heavy artillery. For this purpose a special section had been added to his company, but this was altogether inadequate and in practice the whole energy of one corps cable section was usually devoted to the construction and maintenance of artillery lines. These corps units were differentiated in principle from the area detachments by the fact that they possessed sufficient transport to enable them to move forward while continuing their work. In all adaptations of the signal units of formations below army the essential characteristic of mobility was respected. Those elements of the service which required to be specialized to areas were embodied almost entirely in the army company, others being organized so as to be able to move as integers.

This principle of mobility naturally applied with still more force to divisional signal companies. Even when position warfare seemed to be most definitely established the retention of its horse transport by the divisional company was insisted upon, in spite of the extra work entailed by the care of horses upon a personnel fully occupied with its technical work. This insistence had its reward in the long run, for mobility regained all its old importance on March 21 1918 and retained it to the end of the war.

The original divisional signal company in 1914 consisted of the following elements—three "brigade sections" (in principle serving the infantry brigades), each of a telephone detachment and a squad of signallers, a "headquarters section" consisting of a small office staff and a few signallers and despatch riders, and a "No. 1 section" of three cable detachments, each of which was capable of laying 10 m. of cable and carrying three offices. By the spring of 1918 the "headquarters section" had been enlarged in every branch, and "No. 1 section" had been increased to four detachments to cater for the field artillery headquarters; but the "brigade sections," though much overworked, had remained practically unchanged. To these three original elements, however, others had been added. A small section, similar to a "brigade section," was serving with every field artillery brigade in the division. The reorganization of the machine-gun service in Feb. 1918 added another small section to serve the divisional machine-gun unit. The extension of wireless telegraphy to the division had involved the addition of sufficient personnel to man a "Wilson" and three "50-watt" sets and a charging set for accumulators. In addition, men were attached from brigades to man six power buzzers and their corresponding receivers, and to eke out the still undermanned visual detachments.

Forward of battalion headquarters, the direct responsibility of the divisional personnel ceased and, in battalions and batteries, signal communications were built and maintained by regimental signallers. Occasions occurred when the requirements of these units could be accommodated on the central system, but these were exceptional. Usually their signallers were fully occupied with the lines and with visual communication between the front line and their headquarters. The means at their disposal were light cable lines and enamelled wire with D3 buzzer telephones; heliograph, lamp, flag,[2] disc, or shutter; pigeon, messenger dog, message-carrying rocket and runner. In the case of power buzzer, pigeon, and messenger dog, communication was usually roundabout, via brigade, division and even corps headquarters; in the case of other appliances, direct touch from front line to company headquarters and from company to battalion headquarters was the rule.

The most interesting portion of the evolutionary history of signal communication in the war finishes with this period, and the story

[1] Strictly, this applies only to corps and army headquarters, though before the war ended, it was the unofficial practice in most divisions also.

[2] The artillery still used both Morse and semaphore; infantry signallers at this stage of the war were trained in Morse only.

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of the remaining months of mobile warfare is that of the reversion to simple skeleton systems, based on the principle of the central route studded at suitable intervals with forward communication centres. No further radical reorganization took effect, the principal change being the gradual switching over from spark to continuous wave wireless for command intercommunication purposes.

(3) *Signals in Theatres of War other than France.*—While the greatest measure of evolution and adaptation naturally took place in the most important field and that nearest to the home sources of supply, almost every one of the outlying British theatres of war presented its special problems and emphasized the need of forethought and careful preparations, in respect of methods, personnel and stores alike, to suit local conditions, for instance in arranging for intimate coöperation with the intercommunication service of the navy in such operations as those of the Dardanelles, and the coastal operations of Sinai and Syria,[1] and in assigning an unusually large part to visual and wireless communications when a considerable water gap has to be spanned, as in the Dardanelles campaign. But perhaps the most significant lesson of experience in these campaigns was the greatly enhanced importance of wireless telegraphy relatively to other means of communication. Wireless plays a predominant part in such operations as those in E., W. and S.W. Africa, or those of the desert mounted corps in Palestine, which are conducted in vast, ill-developed theatres of war by comparatively small forces; for these frequently involve far-flung troop movements in the offensive, and tactical isolation of detachments in the defensive.

The sets in use in the British Expeditionary Forces engaged in outlying theatres were the 3-K.W. lorry set; the 1½-K.W. set mounted on a limbered wagon and drawn by teams of horses, bullocks, mules, or even men; and the Marconi pack set, a 0·5-K.W. set either carried in a limbered wagon, on pack horses or mules, or by bearers. The latter proved particularly valuable for work with flying columns of swiftly moving troops. All three types of set were spark sets deriving their energy from internal-combustion engines. In the future, these will doubtless be replaced by the more efficient continuous wave system of wireless, but they played their part well in the 1914–8 campaigns over ranges respectively of 120–100, 80, and 30–50 miles. The extreme case of isolation in the defensive is of course that of a garrison under prolonged siege, and as an example both of the utility of wireless telegraphy in this case and of the actual working output of even a small set, the case of Kut may be quoted. The only means of signalling possessed by the defenders of Kut for some weeks was a small wireless set. By means of this, touch was kept with the relieving forces until the surrender, 6,313 messages consisting of 434,861 words in 144 days being the final record of the set.

One other lesson learnt in the outlying campaigns may be mentioned—the special necessity, in the theatres far from home supply services, for standardization of implements and stores. This had only been partially carried out when the war ended, but since then a considerable reduction has been effected in the number of types of instruments in use.

(4) *Relation to other Arms.*—A subject of considerable importance is the relation between signals and other arms. Before the World War, the signal service was regarded by the general staff as an executive servant and by other elements of the army its existence and potentialities were too often slighted or ignored altogether. As the war went on, the importance of rapid, trustworthy, and copious intercommunication was emphasized more and more. The effect of this, in the gradual change in the status of the formation signal officer from the executive to the staff officer, has already been emphasized as one of the main features of the evolution of the service during the war period. Similarly, the relation of "signals" to intelligence, artillery, and even to infantry, has undergone a distinct change.

The intelligence service of all armies owes no small measure of its present effectiveness to the means provided by signals for tapping sources of enemy information. The listening sets; the position-finding wireless set; the interception wireless set; the aeroplane wireless compass, are all efficient means of making out enemy plans and dispositions. So-called "wireless camouflage"[2] and the dissemination of false information by all means of signalling are well-recognized strategems.

The relation between artillery and the signal service is still more obvious. Efficient artillery fire was never more dependent on good observation than it was in the position-warfare battles of 1915–7, and observation is useless without intercommunication. As has been noted earlier in this article, artillery signal communication has become one of the definite functions of the signal service.

With the infantry, the signal service, through the regimental signal personnel which it supervises, has an equally close connexion, though the personal comradeship which is the basis of true liaison was made difficult, in the war, by the inevitable demands made on infantry labour for the burying of cables.

Signal personnel have frequently proved their ability to give a good account of themselves in infantry fighting, but it cannot be too strongly emphasized that the employment of signallers as infantrymen whether in the battalion, brigade, division, corps, or army, is a mistake except as a very last resource. The signaller is a valuable technical tradesman and he cannot be trained in a few days or even a few months. More casualties have probably been caused by lack of signallers, and therefore of the efficient signal communications essential to the guidance of the battle, than can ever have been saved by their employment in the fighting line.

No small amount of the attention of signal units, especially in position warfare, is now devoted to serving the needs of other technical branches of the army. Tank corps, royal air force, and survey battalions all made special demands upon the intercommunication service.

(5) *Means of Intercommunication.*—Details of the means of intercommunication employed by the British army signal service will be found in the official Manual of the Corps of Signals, Parts I., III., IV., and V. Some of the details of more general interest are given in the following few paragraphs.

Telephone and Telegraph.—The standard instruments in use are the telephone No. 110 (magneto ringing), the fullerphone (buzzer call) and the telephone D Mk. III. (buzzer call). (In addition, a lineman's telephone is provided for the use of the intercommunication maintenance personnel which has both magneto ring and buzzer call.) Of the telephones, no special description is needed, their only peculiar characteristic being a robustness of structure and parts calculated to stand the rough usage of army life.

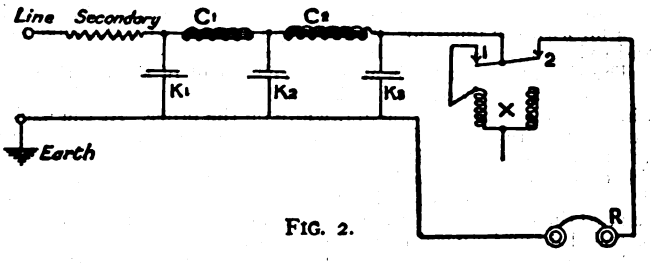

FIG. 2.

The fullerphone is an instrument of peculiar interest. The chief cause of the leakage from telegraph and telephone circuits was the electrical stresses set up within the earth by the rapidly alternating current used. The fullerphone is a telegraph instrument, the essential point of which is the changing at the receiving end of a steady current into an intermittent current of audible frequency, while at the same time the current in the line remains steady. A typical fullerphone receiving circuit is shown in fig. 2. The interrupter (X) may be driven by any means, either electrical or mechanical. In army patterns it is driven electrically, being operated by means of a local cell.

If a steady E.M.F. is applied between line and earth and the circuit is closed at the interrupter, a steady current will pass through the choke coils (C1, C2), contact 2 and receiver. If the circuit is broken at X the current cannot pass through the receiver but will flow into the condensers (K1, K2, K3). When the circuit is again closed at X the condensers partially discharge through the receiver.

When the interrupter is working we therefore get an intermittent current in the receiver which can be made audible by adjusting the interrupter to run at a suitable speed, while the line current alternately runs into the condensers or through the receivers and remains practically constant and continuous in the line. The dots and dashes sent by the single current Morse key at the end of the line

[1] It was doubtless owing largely to the experience of these campaigns that steps were taken towards the end of the war to harmonize the signal procedure of the navy, the army and the post-office, that is, the form and manner of sending messages, the checks in accuracy, the ensuring of priority, and suchlike matters of technical detail that, in fact, are as important to efficiency as the design of instruments and the principles observed in their employment.

[2] Manipulating the technicalities and the volume of traffic of one's own wireless so as to mislead the enemy's interception service.

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are therefore reproduced in the receiver as short or long notes. Readable signals can be obtained with about half a microampère, a main battery of one dry cell being sufficient. The employment of such an extremely small continuous line current eliminates danger of overhearing, induction being reduced to a minimum.

In the rear areas, simplex, duplex, and wheatstone telegraphy are all used in the offices of the higher formations, which in the case of the armies may contain several hundred telegraph instruments and telephone subscribers. Magneto exchanges are the rule as far forward as brigade headquarters. At brigade headquarters buzzer exchanges are also installed and at battery and battalion headquarters buzzer exchanges are the rule. Circuits are of galvanized iron or copper wire beyond the limits of frequent shelling. Forward of this, main routes are of buried armoured cable (2-, 4-, or 7-pair brass-sheathed or iron-armoured usually) or light field cables which are standardized in several sizes in both single and twisted twin circuits. Enamelled wire, that is, wire roughly insulated by a coating of enamel, was used by forward troops during the war, but is now obsolescent.

Wireless Telegraphy and Telephony.—In all formations down to infantry battalions continuous wave wireless is now practically the only means used. There are three standard sets. For use at, or in rear of, army headquarters, or for long distances in mobile campaigns, a set is provided with a maximum range of 400 miles. The set has two 70-foot masts and is fitted to be carried either in a box car or a limbered wagon. (This is the equivalent of the former "heavy motor set.")

For distances up to 200 m. a smaller set is provided which has two 40-ft. masts and can be carried as above or on pack animals. For divisional work, the old "Wilson" and "British Field spark" sets have been replaced by a portable set with a range of 12 miles. This has two 15-ft. masts, is worked from accumulators or by a hand generator, and carried on pack animals or by bearers.

Finally, the loop sets already mentioned earlier are retained for work within the battalion and battery if required, though they are likely to be replaced soon by short range and short wave C.W. sets of much greater efficiency. The power buzzer and 3-valve amplifier sets are also available for issue in case of position warfare.

Small portable wireless telephone sets for forward work have been devised, and similar sets were indeed used in the Air Force during the last months of the war. The sets are not yet standardized, but those in use have a range of some 2,000 to 3,000 yards.

Visual Telegraphy.—The visual instruments include the heliograph as used in pre-war days (*see* 13.223); the Lucas lamp; the shutter, and the flag. Of these, the heliograph has a range up to 100 m. or more, but is only of really extended use in a country with a large proportion of sunlight.

The very efficient and portable Lucas lamp is a powerful electric lamp with an 8-candle-power bulb set in the back of a cylindrical lampholder with a powerful reflector at its back. An 8-cell battery of ever-ready cells provides a current at an E.M.F. of 12 volts. The lamp has a range in daylight of 2 m. with the naked eye and 3 to 4 m. with the telescope, and at night of 6 m. with the naked eye and twice that distance with the telescope.

The signalling shutter is also a development of the position-warfare phase of the war. It consists of three flaps of American cloth which are black on one side and white on the other. At the back of the shutter are metal clips by which the device can be attached to an ordinary bayonet. The flaps are normally closed with the black side outermost, but by pulling on the operating cord they are pulled down and the white exposed. On releasing the cord the flaps spring back to their original position. When not in use the instrument can be rolled up and stowed in a canvas case.

Message-carrying Agencies.—Of these the most important are (*a*) despatch riders, mounted orderlies, or runners; (*b*) carrier pigeons; (*c*) message-carrying rockets; (*d*) dogs; (*e*) air craft.

(*a*) For use in rear of brigade headquarters the motor cyclist despatch rider is invaluable. A feature of the modern signal service is the organized D.R.L.S. which deals with all official correspondence too urgent for post and not sufficiently urgent for the telegraph. Within brigades, divisions, and in cavalry units and formations, mounted orderlies are often used for conveying messages and this is true of all formations in country impassable to motor cyclists. In the forward battle zone the runner is the last resource of the forward commander. His use should, however, be restricted to occasions when all other means of signalling have failed or are unreliable, for casualties amongst runners are many and men suitable for this duty are not too common.

(*b*) The pigeon has proved its value for position-warfare conditions during the war. The pigeon service is controlled from corps headquarters and messages from the trenches will usually reach the battalion via brigade or divisional headquarters. The employment of pigeons with tanks and artillery is an important branch of the pigeon service. New developments are their delivery to isolated or front-line posts by aeroplane and parachute, and the teaching of pigeons to fly by night. In the latter case the birds are kept in red light and are flown to a loft where the trap is illuminated by a powerful arc or acetylene light.

(*c*) Message-carrying rockets with a range of 2,300 yd. have been adopted as a standard means of signalling. Their course through the air is outlined by a trail of smoke and their position at the end of their flight by a coloured flare automatically lighted at the moment of impact with the ground.

(*d*) The use of the messenger dog is likely to be confined to position warfare. These dogs have done good service on occasion, but are likely to find their vocation only in stationary warfare or during a very methodical deployment for battle.

(*e*) In certain phases of a battle the aeroplane is the only trustworthy or even possible intermediary between troops and command. Apart from wireless telegraphy, messages can be communicated to the aeroplane by visual signalling, or if of a simple conventional character, by means of the ground panels used for the notification of positions, while, from the aeroplane to the ground, the most secure method yet discovered is to drop a written message, provided with long streamers, on to selected "dropping grounds" contiguous to the headquarters concerned.

Notification Signals.—Light and smoke signals are made use of as occasion directs and a plentiful supply will be held in store. These are used, under prearranged schemes, for such purposes as calling for barrage or protective fire; notifying positions of forward troops; answering one-way messages, etc. The manufacture of distinctive flares, and light signals generally, has been carried to a very high degree of perfection.

Acoustic signals have not been generally successful with the exception of the Klaxon horn in aircraft. Special sirens and horns for calling attention to gas attacks and other general alarms have been much used, but an attempt made by the French to signal by means of tuned acoustic horns was not very successful. The noises of a modern battle are such as to handicap this method of conveying information very greatly.

(6) *The French Signal Service.*—The French intercommunication service at the outbreak of war differed from the British in being in two separate compartments—a telephone system controlled by the engineers, and a runner and despatch rider service under entirely separate direction. In addition there existed a motor service with the maintenance of liaison between units as its chief duty. The absence of the telegraph in forward formations threw much extra work on the remaining personnel, and caused a consequent increase in the proportion of despatch riders, runners, and orderlies. Construction personnel was in the main kept in the rear and sent forward only when actually required, according to exigencies.

The greatest reliance was placed upon the ringing telephone even in the forward area, and this statement is true even for 1918, although time and again the forward telephone system had been swept away in hopeless ruin by the bombardments which preceded the great position battles. In the rear, the very complete telephone network with an excellent system of locality exchanges served all purposes very well, whether in the normal stationary warfare, in the pressure of traffic before or during an attack from a trench system, or in the hurry of an advance or retreat on a considerable scale. In the last-named case as the attacking armies very soon outran the major portion of their heavy artillery, these well-built lines stood well, and the French system of locality exchanges served the retreating divisions as well as it had served the corps and armies for which it had been originally built.

In the forward area the French signal service was faced with a somewhat different problem from that which confronted the British. Serving a professional staff and a conscript army, far more accustomed to mass manœuvres than the British armies, a relatively far greater proportion of attention could be paid to getting back information from the front than orders forward to the front. The absence of the telegraph had also taught the forward staffs to rely more upon the spoken word and to dispense to a great extent with those written explanations and confirmations of orders which were considered essential to the British staff procedure.

The British subordinate commander was often *able* to act upon his own initiative; his French equivalent was not only able but *expected* to do so to a much greater degree. The result was a far greater use of one-way working, and to this was perhaps due the fact that the power buzzer—essentially a one-way instrument—was first developed in the French army.

A further feature as regards signal policy and practice was a tendency to confine forward routes to front-to-rear routes only. All lateral liaison was by liaison officers, despatch riders, or runners. When a British division was working next the French, the position always involved responsibility for two lateral routes

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instead of one.[1] Not only did the French not employ lateral lines, but it was only under suasion that they would make use of them when provided.

The front-to-rear forward routes were mainly of buried cable, though shallow splinter-proof and traffic-proof trenches and narrow open trenches were also employed. "Comic" airline, that is airline built with improvised poles and other stores, which was an invention of the British army, was also adopted by the French, but the latter placed more reliance on fairly heavy routes of poled cable, especially of 7 or 8 cables slung together on pickets 3 to 4 ft. high, a method seldom employed in British divisions except when working in French areas, but which proved very satisfactory when used by a British corps in the advance from the Marne in July 1918.

A further divergence of practice was the concentration upon continuous wave wireless to the exclusion of spark wireless for forward command purposes which was the outstanding characteristic of the forward French wireless service. In 1918, continuous wave wireless was used for command purposes in armies, corps, and divisions and the wireless system achieved a considerable measure of success in the final advances of the autumn. This was the logical outcome of the fact that, on the Allied side, the French were throughout the pioneers of the development of the 3-electrode valve and its application to practical war problems. In no army were the research departments of the signal service keener or better directed. The chief triumph achieved was the designing of such a valve of a much more robust type than any previously produced. This valve, known as the "French" valve, became the standard equipment for the majority of the forward wireless and listening sets both in the French and British armies. (R. E. P.)

(7) *The German Signal Service.*—In the German army before 1914 the signal service formed part of the "Communication Troops" (*Verkehrstruppen*) which had been separated from the engineers for some years. Six Prussian, one Saxon and two Bavarian telegraph battalions existed, and these units, as well as the regimental signal personnel, were trained principally in the buzzer telephone. Wireless telegraphy was provided for by separate detachments, in principle destined for G.H.Q., army headquarters, cavalry formations, and important fortresses. The only other means in use by the signal service of the field army of 1914 was the visual apparatus (*Blinkgerät*), but this was not regarded as having any value in battle, for which the intention was to depend on good tactical and technical handling of the telephones. The strength of the signal service in peace was about 8,500, increased on mobilization to 26,000, and at its maximum in the winter of 1917–8 the establishment reached 192,000. This was nearly an eightfold increase in numbers, but as the number of formations provided with signal units had itself increased, it is more instructive to compare the signal personnel of an army of given strength in 1914 and 1917–8. In the former year, a German army of 12 divisions had about 1,900 signal personnel, and in the latter (nominally) some 9,300. Comparison of these figures with those given above for a British army of 6 divisions in 1914 and in 1918 shows that the German army was at the outset less well-provided than the British, as was indeed to be expected from the long tradition of colonial wars of the latter. At the end of the World War, however, the German signals were, nominally, slightly superior in numbers to the British, though in practice, as the German system assigned to signals certain duties that were not so assigned in the British organization, the strengths—or rather establishments—were about equal for a given force.[2]

In the first German operations in the western theatre in 1914, intercommunication was in principle by the telephones of the signal service from supreme command to brigade headquarters and by the telephones of the regimental signalling sections (at first, eight men per battalion) farther forward. The flag was also in use, but, as in the British service, it soon disappeared when tested by war. Between the supreme command and armies and cavalry formations, wireless telegraphy—especially in the later stages of the advance to the Marne, when the army telephone detachments failed to keep up with the march—was the principal means of communication and was supplemented by missions of staff officers carried in motor cars. It is admitted by all German critics that this liaison proved far too loose, and its defects are considered to have contributed very largely (some say, principally) to the defeat of the Marne. The forward telephones, on the other hand, in corps signal and in regimental charge, met the demands made on them, to the surprise, it appears, of the army generally, which at the outset had little faith in the utility of technical aids on the battlefield and believed the runner or despatch rider to be the only really trustworthy means of intercommunication. The reconnoitring cavalry was particularly well equipped with telephones, and used a light wire, enamelled to give some degree of insulation to the line in wet weather.

Common to all branches of the intercommunication service was the principle of building from front to rear. Army detachments were responsible for making connexion with the supreme command, corps detachments with army headquarters, and so on. The western campaign of Aug. and Sept. 1914 demonstrated almost at once that this principle was unsound, but only after the penalty for imperfect liaison had been paid.

In the eastern campaigns of 1914–5, and to some extent also in the Rumanian campaign of 1916, conditions imposed upon the Germans radical departures from pre-war regulations. Firstly, the signal units of Hindenburg's armies of 1914 were largely improvised, like many other services and even combatant troops in the East. Secondly, the sparseness of communications and the difficulty of movement compelled the German command from the first to manipulate its signal resources in accordance with the operations in hand or in prospect instead of attempting a schematic layout of lines to all formations alike. Thirdly, the initial mobile warfare conditions continued in the East for more than a year of constant campaigning, and at a later stage, the Rumanian campaign came to prevent the lessons of open warfare from being forgotten. Lastly, the operations began on friendly territory and the policy of the signal service was to build forward from the home telegraph system. These conditions led to (*a*) enhanced importance of wireless telegraphy, (*b*) economy of cable, and the use of airline close up to the front, (*c*) the return to telegraphy for work in rear of corps and even division headquarters, and consequently the development of quick-writing telegraph instruments,[3] and (*d*) the principle of concentrating both wire and wireless communication on a central route connecting a headquarters with a forward report centre (*Meldekopf*, report-head) in the region of the advanced guard, a principle which, for quite different reasons, came into honour later on the western front. The importance of wireless was again emphasized in the Balkan campaign of 1915 and the Rumanian campaign of the following year, in which also the visual apparatus rendered good service.

In the position-warfare campaigns of the West, evolution—speaking very generally—followed the same course on the German side as on the British, similar difficulties and problems naturally suggesting similar remedies. It has already been noted that the numerical growth of the signal service in relation to other arms was approximately the same in the two armies. As regards organization, an important difference was that on the German side the basis of classification was, to the end, the instrument used and not the formation served. Although the signal service branches were combined in one corps of *Nachrichtentruppen* in May 1917, this was subdivided at all échelons into telephone units, wireless units, and visual units. The first-named were responsible for telephones and telegraphs (the latter being largely employed from division headquarters rearward), the wireless detachments for wireless of all kinds and power buzzers, and the visual detachments for the *Blinkgerät*. Moreover, the listening sets, the pigeons and the dogs, were all organized administratively as separate sections of the corps. But in each headquarters, from supreme command to divisions inclusive, the *Nachrichtenkommandeur* was a member of the formation staff and was responsible not only for the command of his own units but also for communication arrangements and procedure generally within the formation, including regimental signallers of infantry, cavalry and artillery, in his capacity as a staff officer. The control and manning of aircraft wireless stations was also in the hands of the signal service, as well as wireless police and wireless intelligence, and (again in his capacity as a staff officer) the divisional signal commander performed many functions that in a British division were assigned to the intelligence officer.

The possibility of applying the recently discovered "audion," or 3-electrode valve, to the purpose of overhearing the opponent's telephone conversations was first realized by the Germans, and the success of this innovation may be said to have revolutionized signal practice on both sides during the war. It made closed metallic circuits in the forward lines and strict telephone discipline essential, and, further, from the listening set there came the "earth telegraph" (power buzzer) which played so important a part in the signalling of all armies in the last two years of the war. But, quite as important as these applications of the 3-electrode valve was its effect on wireless telegraphy through the air. It made possible the change from the spark to the continuous wave system, by providing (*a*) an intensifier for small, weak receivers such as those of trench and aeroplane sets, and (*b*) the means of very sharp tuning which allowed of many sets being employed together in a restricted area without mutual interference. Satisfactory trench wireless apparatus on the continuous wave system was designed in 1915 and used in

[1] With British formations amongst themselves the convention was for each to open and to maintain communication with its left-hand neighbour.

[2] Throughout this comparison, regimental signalling personnel is ignored.

[3] The Siemens *Schnellfernschreiber* is said to be capable of dealing with 1,000 letters a minute.

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the battle of Verdun in April 1916.[1] A further development, made necessary by the adoption of elastic defence tactics in lieu of holding defined trench lines, was the so-called "shellhole" set, which comprised aerial, receiver, transmitter and source of power in a unit weighing only 40 pounds. In elastic defence the visual apparatus also played a useful part.

In trench warfare proper, the Germans did not employ buried cable to the same extent as the British. Their remedy for constant cutting of lines was to put the cables in open trenches sufficiently deep to save them from traffic, and to devote the greater part of the available labour to providing thorough protection for offices, and especially for repair squads. Cable-throwing mortars and messenger dogs carrying reels of self-unwinding cable were occasionally employed to lay lines in conditions of special difficulty. An apparatus known as the "Utel," analogous to the British fullerphone, was evolved to meet the overhearing danger. The visual *Blinkgerät*, message-carrying projectiles and rockets, and especially pigeons, were used to supplement the telephone and the wireless communications, as in the armies of the Entente. Unexpectedly good results were obtained with messenger dogs, powerful and intelligent wolflike animals, specially trained and carefully bred.

For the great offensive battle of March 21 1918, the experiences both of the eastern and the western fronts were drawn upon. Between army and corps headquarters, and also between corps and division, the principle of the central route with a *Meldekopf*, to which all forward units made their connexion, was adopted. For the forward units special arrangements were made for transport and routes over the shellhole area. The wireless units were reorganized to permit of great subdivision, and the divisional wireless troop was equipped with its own transport. Visual apparatus was similarly made mobile and self-supporting, and a system of light, smoke, and other recognition signals completed the preparation for battle. In spite of losses and friction telephonic communication was successfully kept up as far forward as regimental headquarters during the first days of the offensive. Thereafter, however, the telephone system broke down owing to the inability of the sections to maintain their lines against the enemy's shell fire and even more the ceaseless movement of transport in the ever-deepening battle zone. Pigeons, even, could finally only be got to the front units by means of aeroplanes. Earth telegraphy failed for want of range; message-carrying projectiles and dogs for the same reason were only occasionally useful, and in the later rapid stages of the advance intercommunication from front to rear depended almost entirely upon wireless telegraphy and upon simple notification signals (such as panels shown to aircraft, light and smoke signals of agreed meaning) in the hands of the troops themselves. The wireless system was based on the divisional central route, which was maintained by two powerful units, each alternately keeping up communication between *Meldekopf* and headquarters and moving forward to a new, more advanced *Meldekopf*. The small wireless sets distributed in the front zone, the other reporting agencies, and the staffs, made their connexion with the head of this extending route wherever it happened to be at any moment, while the telephone units, largely reinforced by fresh units hitherto reserved at the disposal of the supreme command and aided by captured material, followed on with airline. This system served its purpose, and the efforts of the signal service were rewarded by special mention in the *communiqué* of March 26, but normal signal traffic did not become possible again till the advance had slowed down sufficiently to enable the telephone units to catch it up.

In their rearward signal communications, the Germans made much use of Pupin coils to bring their iron wire (adopted from motives of economy) up to the technical efficiency of copper wire, and also to increase the efficiency of the latter for long distance telephony. Direct telephonic communication between the German and the Turkish supreme commands was opened in 1917. The use of quick-writing telegraph instruments has already been alluded to.

(C. F. A.)

(8) *United States Army.*—In the United States army, the signal corps has been a separate organization for many years. The units into which it was organized in 1917–8, apart from those serving in the "S.O.S." or lines of communication in France, were of two main classes, field signal battalions and telegraph battalions. To an army were assigned two telegraph battalions and one field signal battalion; to each corps were assigned one telegraph battalion and one field signal battalion; and to each division, one field signal battalion. The telegraph battalions consisted of two companies each, while the field signal battalions each consisted of three companies, a wire company, a radio company, and an outpost company, the latter battalions including 470 men. The outpost company was responsible for communication at and in advance of infantry brigade headquarters working in four regimental sections in position warfare and in two brigade sections in mobile warfare. The radio company was equipped for all types of radio communication within the divisional area. The wire company constructed and operated the normal system of communications between the division headquarters and the artillery headquarters between the former and infantry regimental headquarters. The corps and army signal units were responsible for maintaining and operating lines forward to the next subordinate headquarters and to certain troops of their own respective headquarters.[2]

A distinct feature of the work of the United States army signal corps was the tendency for the preponderate use of the telephone over the telegraph and the very full and wide provision of telephone facilities. This characteristic is due to the fact that in the United States, the telephone organization is highly developed and the "telephone habit" wide-spread amongst all classes. Hence there would be a wider demand for such facilities, a greater familiarity in operating under circumstances of heavy traffic, and a greater manufacturing capacity for producing telephone equipment, than in the case of other countries.

The signal corps also included the meteorological, the pigeon and the radio direction-finding service and, until late in the war, the aviation service of the United States army.

SILESIA, UPPER.—It was provided in 1919 by the Peace of Versailles (Art. 88) that the inhabitants of Upper Silesia (pop. in 1919, 2,280,902) should be called upon to decide by a plebiscite whether they would belong to Germany or Poland (*see* PEACE CONFERENCE). It should be noted that for the purpose of the plebiscite the purely German districts of Falkenberg (pop. 37,526), Grotthau (pop. 40,610), Neisse (pop. 7,781), part of Neustadt (pop. 25,000) and Hultschin (pop. 45,552), situated in the northern and western parts of Upper Silesia and representing a total population of about 156,469, were excluded. Up to the day of the plebiscite the supreme authority in the plebiscitary area was to be vested in an Inter-Allied Commission, consisting of one representative of France, Great Britain and Italy respectively. In this commission France was represented by Gen. Lerond, England by Col. Percival, and Italy by Gen. de Marini. On Feb. 1 1920 Allied troops occupied the plebiscitary district. The local German officials were then subordinated to the Inter-Allied authorities. The German police (*Sicherheitspolizei*) was replaced by a special polling police (*Abstimmungspolizei*), which was composed half of German-speaking, half of Polish-speaking, Upper Silesians.

On the whole the collaboration of the Inter-Allied control and the German officials proved satisfactory; but various differences arose, such as that which led to a strike of judges in May 1920. Both the Poles (under Korfanty) and the Germans opened an active canvassing campaign; and under Polish pressure the Germans in the southern and eastern districts were subjected to oppressive treatment. On Aug. 19 1920 the Poles felt strong enough, indeed, to make an attempt to seize the country by force. On all sides bands of Poles, chiefly recruited from Congress Poland, usurped authority. A number of Germans were forcibly carried across the frontier into Poland, and many were killed. Several weeks elapsed before it was possible to quell this rising and restore order. In the autumn of 1920 there was an exchange of notes between Germany and the Entente relating to the manner in which the plebiscite should be taken. It had been suggested by the Entente that the non-resident Upper Silesians of the German Reich should vote outside Upper Silesia, at Cologne. Germany protested against this, and her protest was recognized as valid by the Entente. In Jan. 1921 the date of the plebiscite was fixed for March 20 1921. An immediate revival took place in the use of terrorism by the Poles, especially in the districts of Rybnik, Pless, Kattowitz and Beuthen. It reached its climax in the days preceding the plebiscite. Voters from other parts of the German Reich were frequently refused admission to

[1] The experiment was very successful, but the higher authorities for some time refused to allow the general adoption of trench wireless on the ground that it involved a reduction of infantry strength. But a stronger motive was no doubt the fear of interception.

[2] In comparing the strength of these organizations with those of other armies, it must be remembered that the United States army division was much stronger than the corresponding unit of other armies. It comprised two infantry brigades each of two 3-battalion regiments and one artillery brigade of two field and one medium artillery regiments besides other divisional troops.

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the polls; sometimes they were maltreated and even in some instances murdered; and houses where outvoters were staying were set on fire. The day of the plebiscite passed, however, without disturbance except at a few places, such as Rybnik and Pless.

The day after the plebiscite the Polish excesses recommenced, and from that date onwards continued without interruption; nor was the Inter-Allied Commission able as a rule to prevent them. The poll showed 717,122 votes for Germany and 483,514 for Poland. In 664 districts there was a German, in 597 a Polish majority. Practically all the towns voted for Germany. There was a Polish majority in the following administrative districts—Rybnik, Pless, Beuthen, Tarnowitz and Gross-Strehlitz. The decision of the Inter-Allied Commission as to the allocation of the disputed regions to Germany or to Poland was delayed on account of differences which arose within the commission itself; the French representative, Lerond, who had from the first been accused of tacitly supporting the Poles, wished to allot the whole of southern and eastern Upper Silesia to them, while the English and Italian representatives wished to apportion the industrial region to Germany. Protracted diplomatic negotiations between Paris, London and Rome did not lead to any result. At the end of April a report became current that the Council of Ambassadors at Paris had determined to give only the districts of Rybnik and Pless to Poland. In consequence of this rumour the first days of May witnessed a new Polish insurrection which assumed far greater proportions than the former one. Korfanty had secretly raised a well-organized Polish force which was provided with arms and munition from across the frontier, and was reinforced by large bodies of men from Poland. With these troops he occupied the whole south-eastern part of Upper Silesia, on a line extending from the S. of the district of Kreuzburg through Gross-Strehlitz to the Oder in the south. He nominated himself dictator of the districts under Polish occupation, took over the administration, and treated even the Allied officials with such scant consideration that they were obliged to withdraw to Oppeln and the regions that were not occupied by the Poles. It was only in the larger towns, where there was a German majority, that the Allied troops, supported by the German population were able to maintain themselves. A further advance on the part of the Poles was prevented by the German Defence Force (*Selbstschutz*) under Gen. Höfer, which was composed of Upper Silesians and Germans who poured in from other parts of the Reich. There was severe fighting between the German Defence Force and the Poles, especially in the districts of Ratibor and Gross-Strehlitz. Colonel Percival, the British representative, was obliged to resign owing to ill-health, and was succeeded by Sir Harold Stuart. Attempts on the part of the Inter-Allied Commission to put an end to the insurrection by negotiations with Korfanty were unsuccessful, and the Allies were compelled to despatch reinforcements of French and British troops, under the command of Gen. Heneker, to Upper Silesia. After lengthy negotiations with the German Defence Force, which refused to withdraw unless guarantees were secured that the Poles would first quit the field, an agreement was ultimately effected with regard to the evacuation. By June 20 the British troops had again occupied the larger towns, while the Poles had the upper hand in the rural districts. As a result of the difficulties in paying his men and providing them with food Korfanty now lost control over his followers. Independent bands were formed which plundered the villages, ill-treated the Germans, and murdered many of them. In the industrial districts work in many of the mines and iron works came to a standstill, because imports of raw material and exports of coal had become impossible. By the end of June the loss suffered by the industrial region was estimated at 3 milliard marks; and there seemed to be no prospect of the restoration of tranquillity.

The French adhered to their contention that the greater part of the industrial region should be assigned to Poland. Great Britain, on the other hand, firmly maintained the view that such a partition would, as Mr. Lloyd George publicly expressed it, be "unfair" to Germany on the basis of the Treaty of Versailles and the result of the plebiscite. There were at one time three rival proposals for partition: (*a*) the Korfanty line, the extreme Polish demand; (*b*) the Sforza line, a proposal put forward by the then Italian Foreign Minister; (*c*) and the British proposal giving Poland only the south-eastern corner with the towns and districts of Pless and Rybnik. France was ultimately left in a minority of one on the Supreme Council, Italy and Japan having adhered to the British view. After prolonged debates and open differences among the principal Allied Powers on the subject of the partition, it was at last arranged, at a Paris conference in Aug. 1921, that the solution should be entrusted to a Commission of the Council of the League of Nations. This commission was ultimately constituted by the representatives of Japan, Brazil, China, Spain and Belgium, with the Japanese representative, Baron Iishi, as chairman. (C. K.*)

On Oct. 20 1921, the text was published of the documents containing the award of the League of Nations on the partition

Upper Silesia Frontier, 1921

of Upper Silesia. The proposed new frontier line between Germany and Poland was as shown by the appended Map. The division here made in the industrial area, previously German, was such that the Council of the League of Nations declared it to be desirable, however, that measures should be taken to guarantee the continuity of the economic life of the region during a provisional period of readjustment, and to provide for the protection of minorities. It was recommended, therefore, that a general convention for this purpose should be concluded between Germany and Poland, so as to place Upper Silesia under a special regime during the transitional period, and that an "Upper Silesian Mixed Commission" should be set up as an advisory body, composed of an equal number of Germans and Poles, with a president of some other nationality to be designated by the Council of the League, together with an arbitral tribunal for settling private disputes occasioned by the temporary measures.

The provisional or transitional period was to be 15 years, and certain stipulations were laid down by the League of Nations for the economic arrangements during that period in the "plebiscite area." (1) Railway and tramway systems, privately owned or municipal, were to continue under the terms of their concessions, and the German State railways were to be put under a joint system of operation. Railway rates were to be uniform. The State insurance of employees in the Silesian railway system was to be undertaken by that system. A single Accounts Office was to be set up for the whole system. Expenses of new construction to be charged to a separate account, and borne by the State in whose territory it was carried out; the working capital for operation to be

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lent by the German State, and interest charged to the account of this system; profits or deficits to be divided between the two countries in proportion to the length of line and amount of traffic belonging to each. (2) The German mark was to be the only legal unit of currency, and Poland was to recognize the rights of the Reichsbank, for a period not exceeding 15 years, but by agreement the two Governments might modify this arrangement earlier. (3) While the German monetary system was maintained in the Polish zone, the postal telegraph and telephone charges should be in German currency. (4) The customs frontier would coincide with the political frontier, and the German and Polish customs law would apply, with certain exceptions. For 6 months, incoming goods from other countries, on which German or Polish duties had been paid previously to the partition, should cross the frontier without duty. For 15 years, natural products originating or coming from one of the two zones of the plebiscite area and destined for consumption in the other should cross the frontier free of duty. For six months, raw, half-manufactured and unfinished products of industrial establishments in one zone, destined for industrial establishments in the other, should cross free of duty; and this should continue for 15 years when the products, as finished, were intended for free importation into the country of origin. Natural or manufactured products originating in the Polish zone should, on importation into the German customs territory, be exempt from duty for three years from the date of the frontier-delineation. As regards export, the two countries should facilitate for 15 years the export of such products as were indispensable for industry in either zone. (5) Poland was to permit, for 15 years, the exportation to Germany of the products of the coal mines in the Polish zone, and Germany similarly to Poland in respect of the mines in the German zone. (6) For the 15 years, any inhabitant regularly domiciled or occupied in the plebiscite area should receive a "circulation permit" free of payment, enabling him to cross the frontier without other formalities. (7) Generally, the two countries should respect private rights.

SILVER (*see* 25.112).—Few subjects of economic importance present such a phase of the mysterious as silver, and the reason for this is perhaps not difficult to understand. In the case of the world's crops, not only are up-to-date and approximately reliable statistics daily available from the countries of production, but the countries of consumption see to it that they equally are in the foreground as to the daily progress of world's crops; and the manner in which statistics relating to these all-important subjects are now presented to consuming markets has become quite an art. For some reason the same attention unfortunately has not hitherto been—and is not even now—paid to the production of silver. Most excellent statistics are presented annually by the U.S. Director of the Mint, by the Government of India, and in pre-war days by the German *Metallgesellschaft*, but these unfortunately are what we may term "post date" figures, and, whilst of great value in informing the student as to what has been, they do not tell us what is going on at any given period.

This state of affairs is no doubt due to the great difficulty which has always been experienced in obtaining definite and conclusive data as to the production of silver, owing to the fact that the metal is now chiefly obtained as a by-product and not from mines worked solely for silver itself. Generally speaking the most important metals with which silver is associated are—gold, copper, lead and zinc. Gold and silver invariably occur together. Lead and zinc usually accompany one another, and the ores carrying these two metals—particularly where lead predominates—are frequently fairly rich in silver. Lead and silver usually form an especially marked combination, whilst copper is frequently associated with both gold and silver. These ores are generally described as silver lead, silver lead zinc, silver zinc and gold silver ores, and the mines producing these ores are not uncommonly spoken of as silver mines, overlooking the fact that the ores of the base metal have to be treated by smelting methods before the silver can be extracted. The quantity obtained in these ores ranges from about 2 to 50 oz. to the ton.

The production of silver, therefore, may now be said to be dependent upon that of gold, copper, lead and zinc; and consequently any causes which affect the production of these metals largely affects the production of silver as a by-product, and the world's demands for these metals will in a great measure control the future supplies of silver. Estimates from what are considered good sources give the percentage of the world's production of silver as ranging from 70% from base metal ores and 30% from precious metal ores.

Table 1.—World's Production, 1860–1919.

Year	Fine oz.	Year	Fine oz.
1860	29,095,428	1890	126,095,062
1861	35,401,972	1891	137,170,000
1862	35,401,972	1892	153,151,762
1863	35,401,972	1893	165,472,621
1864	35,401,972	1894	164,610,394
1865	35,401,972	1895	167,500,960
1866	43,051,583	1896	157,061,370
1867	43,051,583	1897	160,421,082
1868	43,051,583	1898	169,055,253
1869	43,051,583	1899	168,337,452
1870	43,051,583	1900	173,591,364
1871	63,317,014	1901	173,011,283
1872	63,317,014	1902	162,763,483
1873	63,267,187	1903	167,689,322
1874	55,300,781	1904	164,195,266
1875	62,261,719	1905	172,317,688
1876	67,753,125	1906	165,054,497
1877	62,679,916	1907	184,206,984
1878	73,385,451	1908	203,131,404
1879	74,383,495	1909	212,149,023
1880	74,795,273	1910	221,715,763
1881	79,020,872	1911	226,192,923
1882	86,472,091	1912	224,310,654
1883	89,175,023	1913	223,907,845
1884	81,567,801	1914	168,452,942
1885	91,609,959	1915	184,204,745
1886	93,297,290	1916	168,843,000
1887	96,123,586	1917	174,187,800
1888	108,827,606	1918	198,168,408
1889	120,213,611	1919	174,517,414

In order that an idea may readily be obtained of the centres from which production is now derived, the figures in Table 2, from the annual report of the U.S. Director of the Mint (1920), supplement those given in Table 1 for production itself.

Table 2.—Production of silver (10,000 oz.) by countries.

	1914	1915	1916	1917	1918	1919
United States	7,246	7,500	7,441	7,174	6,781	5,668
Canada	2,840	2,660	2,546	2,222	2,128	1,568
Mexico	2,754	3,950	2,284	3,500	6,252	6,268
Central and South America	1,320	1,660	1,818	1,781	1,846	1,751
Europe	924	1,010	847	651	687	490
Australasia	1,100	925	1,070	1,000	1,000	743
Asia	554	589	756	970	936	836
Africa	105	118	120	118	108	127
	16,843	18,412	16,882	17,416	19,738	17,451

United States.—The production of silver in the United States, the bulk of which comes from the western states, has always constituted a high proportion of the world's supply. Generally speaking the major portion of U.S. silver is obtained from gold, copper, lead and zinc ores mined in the States and metallurgically treated in that country. In addition large quantities of similar ores are imported from other countries—Mexico, Central America, Peru, Bolivia, Chile and Canada—for treatment, and the silver thus resulting goes to swell the U.S. figures of production of refined silver. The United States first came into prominence as a large producer in 1859 when operations on the famous Comstock lode in Nevada began. In 1860 the production was 116,019 oz., and in 1915 the output reached the high figures of 74,961,075 ounces. The preliminary official estimate of the production in 1920 was 56,564,504 oz., a reduction of 117,941 oz., as compared with that of the preceding year.

On April 23 1918 the Pittman Act became law in America, under which it is provided that: "The Secretary of the Treasury is hereby authorized from time to time to melt or break up and sell as bullion not in excess of $350,000,000, standard silver dollars now or hereafter held in the Treasury of the United States." This $350,000,000 represented about 270 mill. fine oz., of which the share of India was reported to have been 200 mill. fine oz., all of which was received in India between July 1 1918 and July 17 1919. The Act also provided that these sales were to be replaced by purchases of silver actually mined in the United States at the rate of $1. per oz. pure. The total purchases by the U.S. Treasury under this Act up to May 17 1921 totalled 54,120,197 oz., thus leaving 145,879,803 oz., still to be repurchased.

Mexico.—This country can safely be described as first among silver-producing countries of the world, in spite of the decreased output of recent years following upon the outbreak of civil war in 1913. The silver-bearing ores are widely distributed throughout the country; the mines and mining districts are exceedingly numerous, and many of the mines have been in continuous operation for hundreds of years. In 1911 the mine production of silver was reported as 79,032,440 oz.; in 1914, owing to the civil war, it dropped to 27,546,752

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oz., but subsequently the output steadily increased up to 1920. As to what the future Mexican production would be time alone could prove, but in 1921 good authorities did not hesitate to predict that, given a recognized and stable Government and a reasonable price, it would later exceed that of Mexico's palmiest days.

Canada.—The Canadian production of silver hitherto has occupied the third position in the world's list of supplies. The metal is found chiefly in Ontario, British Columbia, Quebec and Yukon. The Ontario silver has been almost entirely derived from the silver ores of Cobalt, which field, however—judged from a continually reduced output—would appear to be working out. The British Columbia, Quebec and Yukon supplies are derived mainly from silver, lead and copper ores. In 1920 reports were coming to hand of discoveries of further silver-bearing ores which promise important results. In 1900 the total Canadian production was given as 4,468,225 fine oz., of which 3,958,175 came from British Columbia; in 1910 the Canadian output had increased to 32,869,264 fine oz., of which Ontario accounted for 30,366,366, whilst in 1919 the output was reduced to 15,675,134 fine oz., and the 1921 production seemed likely to show a further reduction.

Central American States.—The silver produced in these States—mainly Honduras, Costa Rica and Panama—is chiefly derived from gold-silver ores; the production in 1914 amounted to 2,754,868 fine oz., and in 1919, according to figures supplied by the director of the Washington mint, to 2,800,000 fine ounces.

South American States.—The countries included under this category rank as fourth producers of the metal. In early days the true silver mines in Peru, Chile and Bolivia ranked amongst the most important in the world, but as in the case of the older mines of Mexico they appear to be no longer in operation, and the production is being chiefly derived from base metal ores—copper and tin. In 1917 the production of Peru was reported as 10,865,061 oz., and in 1919 as 9,781,734 ounces. Bolivia in 1902, according to the U.S. mint reports, gave 12,992,641 fine oz., whilst in 1919 the production had dropped to 2,435,000 fine ounces. Chile was reported to have reached 2,349,379 fine oz. in 1900 and 1,900,000 fine oz. in 1919.

Europe.—Prior to the World War Germany was looked upon as the largest producer in Europe, and according to the *Metallgesellschaft* reports, the silver which is chiefly derived from base metal ores reached a production in 1904 of 5,822,727 fine ounces. The major portion of the concentrates from which the silver was extracted came from the Broken Hill mines in Australia.

Spain.—Next in Europe to Germany as a producer comes Spain, whose output of silver is mainly obtained from her important lead and copper ores. In 1915 her output was given as 4,565,396 fine oz., whilst in 1919, according to U.S. mint reports, it was stated to be 2,900,000 fine oz.—probably an approximate estimate.

United Kingdom.—It is impossible to say what the refinery output of silver in Great Britain is. It may, however, be stated that it is practically all obtained from imported ores treated in the country. The proportion of domestic mined ores is far too small for consideration. The number of refiners engaged in this business is considerable, but as they never publish returns, the difficulties experienced in arriving at anything approaching a reliable figure will be appreciated. According to the "Census of Production" the total outturn in the United Kingdom in 1907 was given as about 43,979,000 oz., troy.

Australia.—New South Wales stands preëminent as the chief Australian producer, the silver being mainly obtained from the wealthy silver lead ores treated at the Broken Hill Works at Port Pirie. Their output for 1919 has been given as 6,304,818 fine ounces.

Africa.—The Transvaal, Cape Colony, and Natal provide the main output, and the 1919 production has been stated to be 891,304 fine oz., at the same time a not inconsiderable proportion of their gold-silver ores are shipped to and refined in England.

Asia.—The chief countries producing silver are Japan and India. The production of copper has made great strides in Japan of late years, and it is chiefly from these ores that her silver is obtained; the metal is also obtained from the gold ores mined in Formosa and Korea. Japan's output of silver in 1917 was reported at 6,844,500 fine ounces.

The Indian output is chiefly derived from the mines in Upper Burma belonging to the Burma Corp. Ltd., and the production from Jan. to Oct. 1920 amounted to as much as 2,014,261 oz., and it was said that 1,000,000 oz., per month would in the future be a very possible outturn. What India ultimately would be able to produce must remain problematical, but there is no question whatever about India's potential mineral wealth, which only requires time to develop.

Consumption of Silver.—Although great difficulties are experienced in obtaining definite data as to production, that problem is relatively simple in comparison with the consumption side of the subject. Briefly stated, consumption may be discussed from four standpoints—the respective world nations' coinages, their arts, and the requirements of India and China, and it is here that the absence of readily obtainable and reliable information is felt. In the case of America the admirable figures annually presented by the U.S. director of the mint, in so far as America is concerned, supply the following information:—

American silver coinage.

1918	35,004,450 fine oz.
1919	14,682,079 " "
1920	19,763,600 " "

Industrial arts.

	Silver consumed	Of which new material
1917	27,039,845 fine oz.	15,998,807 fine oz.
1918	36,252,596 " "	26,722,333 " "
1919	32,700,521 " "	26,237,519 " "

As regards the coinage requirements of other nations, a most remarkable reversal of conditions has arisen. Prior to the World War the annual requirements for such purposes probably amounted to 70,000,000 oz. at least. In 1921 that was all changed, and the spectacle was presented of a great number of countries demonetizing silver as quickly as possible, and / or reducing the fineness of their silver coinages. England had reduced hers from 925 to 500, and the Straits Settlements from 900 to 500. The quantity of silver which had already been placed on the market, though somewhat problematical, was probably 50,000,000 oz., with a fairly safe estimate of as much more to follow.

As regards the world's requirements for arts, it may be safe to say that the majority of European countries were in 1921 in far too impecunious a position owing to the war to become real factors under this heading for many years to come—in fact, the majority had been and still were sellers of silver ware.

Table 3.—Silver coin and bullion imported into and exported from British India, 1887–1919. (British standard ounces.)

Fiscal yr. ended March 31.	Imported	Exported	Net Imports
1887–8	37,877,141	5,994,542	32,782,599
1888–9	37,844,665	5,408,636	32,436,029
1889–90	43,940,659	5,296,885	38,643,774
1890–1	56,190,870	4,661,785	51,529,085
1891–2	38,177,580	5,829,142	32,348,438
1892–3	54,180,144	8,656,632	45,523,512
1893–4	60,328,296	5,999,323	54,328,973
1894–5	32,638,069	5,598,047	27,040,022
1895–6	34,082,810	7,064,731	27,018,079
1896–7	37,520,322	11,591,234	25,929,088
1897–8	68,535,612	24,250,995	44,284,617
1898–9	49,226,780	26,061,355	23,165,425
1899–1900	50,663,542	32,017,260	18,646,282
1900–1	64,746,549	15,311,385	49,435,164
1901–2	66,726,972	27,721,780	39,005,192
1902–3	75,569,185	32,294,876	42,274,309
1903–4	104,324,765	25,142,629	79,182,136
1904–5	98,118,908	23,769,313	74,349,595
1905–6	88,853,079	4,535,314	84,317,765
1906–7	125,878,008	7,679,151	118,198,857
1907–8	106,358,274	8,442,915	97,915,359
1908–9	85,048,761	11,308,630	73,740,131
1909–10	75,501,745	14,486,993	61,014,752
1910–1	69,272,319	14,396,030	54,876,289
1911–2	70,378,747	38,149,647	32,229,100
1912–3	107,190,427	16,112,785	91,077,642
1913–4	79,834,999	8,727,648	71,107,351
1914–5	64,160,128	8,394,005	55,766,123
1915–6	39,833,279	6,900,906	32,932,373
1916–7	116,959,115	24,765,309	92,193,806
1917–8	88,814,458	14,282,960	74,531,498
1918–9	241,747,806	4,719,187	

In studying the figures for British India (Table 3) very great care is necessary to discriminate between what represents Government and what private imports, as the Government figures are for coinage purposes entirely. The need for this will be apparent when it is realized that out of the figures given in Table 3 for the years 1912 to 1919 Government coinage requirements were:—

	Standard oz.
1912–3	56,057,978
1913–4	35,425,057
1914–5	169,342
1915–6	302,259
1916–7	109,522,499
1917–8	79,404,555
1918–9	237,189,080

As the stock of silver held by the Government of India in their currency reserve, according to the return dated May 22 1921,

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amounted to Rs. 66,41,00,000—against an average for the five pre-war years, 1910–4, of Rs. 21,99,00,000—it may safely be assumed that they were not likely to be purchasers of the metal for some years to come.

As regards China's consumption, it is an almost hopeless task to supply anything approaching reliable data. The figures in Table 4, however, taken from the Chinese Maritime Customs reports may be taken as approximately correct—they are, however, given in Haikwan taels.

Table 4.—China.

	Imports	Exports
1914	861,167 taels	13,861,917 taels
1915	818,827 "	18,211,040 "
1916	19,903,117 "	8,102,268 "
1917	13,871,778 "	5,024,575 "
1918	1,228,342 "	2,281,659 "
1919	51,078,643 "	9,896,429 "
1920	50,966,880 "	68,469,360 "

Imports into Hong Kong for the year 1920 were reported to be the equivalent of £7,049,700—the greater portion of which was probably dealt with by the mint in Canton. The stocks of silver held in Shanghai on Dec. 31 of the following years are shown in Table 5. The increase in stocks in 1920 over 1919—viz, taels 15,460,000, and dollars 18,420,000—represents the equivalent of an increase of about 31,030,820 ounces.

Table 5.—Stock at Shanghai.

	Taels	Dollars	Bar Silver
1917	21,760,000	14,640,000	357
1918	18,860,000	13,470,000	4
1919	19,140,000	11,260,000	242
1920	34,600,000	29,680,000	nil

Prices.—Table 6 gives the highest, lowest and average price of bar silver in London per oz., British standard—925 fine—since 1833, from which it will be seen that the highest quotation recorded since 1833 was 89½d. in 1920, the next highest being 79½d. in 1919, 62⅜d. in 1859 and 62½d. in 1864. Though the highest point reached was in 1920, the average quotation for that year was only 61 13/32d. against averages in 1859 of 62 1/16d. and 61⅜d. in 1864, which would point to more stable conditions existing in the silver market in the years 1859 and 1864 than in 1920. To the years 1902 and 1903 belong the honour of recording the lowest prices, viz. 21 11/16d., whilst the lowest average goes to 1915 with 23⅛d. followed by 1909 with 23 23/32d. When the Pittman Act became law in the United States, good authorities, not only in America but in England, made bold to assert that the result of this Act would be to stabilize the world's price of silver at not less than $1 per oz., for many years to come, whilst Senator Pittman went further and predicted that the world's price would range between $1—and $1.29—the parity of the American silver dollar—for the next 20 years. The spot price in London on June 1 1921, was 33½d., and the price in America on the same date for foreign mined silver was 60 cents nominal.

Table 6.—Highest, lowest, and average price of bar silver in London, per oz. (British standard 0.925) from 1833 to 1920.

Year	Highest pence	Lowest pence	Average pence
1833	59 7/8	58¾	59 3/16
1834	60¾	59¾	59 15/16
1835	60	59¼	59 11/16
1836	60¾	59⅝	60
1837	60⅝	59	59 9/16
1838	60⅛	59½	59½
1839	60⅝	60	60⅜
1840	60¾	60⅛	60⅜
1841	60⅜	59¾	60 1/16
1842	60	59¼	59 7/16
1843	59⅝	59	59 3/16
1844	59¾	59¼	59½
1845	59⅞	58⅞	59¼
1846	60⅛	59	59 5/16
1847	60⅜	58⅞	59 11/16
1848	60	58½	59½
1849	60	59 7/16	59¾
1850	61¼	59½	60⅛

Table 6.—*Continued.*

Year	Highest pence	Lowest pence	Average pence
1851	61⅝	60	61
1852	61⅞	59 7/8	60½
1853	61⅞	60⅜	61½
1854	61⅞	60⅞	61½
1855	61⅝	60	61 5/16
1856	62¼	60½	61 5/16
1857	62⅜	61	61¾
1858	61⅞	60¾	61 5/16
1859	62¾	61¾	62 1/16
1860	62⅜	61¼	61 11/16
1861	61⅜	60⅛	60 15/16
1862	62⅛	61	61⅞
1863	61¾	61	61⅜
1864	62½	60⅝	61⅜
1865	61⅝	60½	61⅛
1866	62¼	60⅜	61⅛
1867	61¼	60⅜	60 15/16
1868	61⅛	60⅛	60½
1869	61	60	60 1/16
1870	60¾	60¼	60 5/16
1871	61	60 3/16	60½
1872	61⅛	59¼	60 1/16
1873	59 15/16	57 7/8	59 3/16
1874	59½	57¼	58 5/16
1875	57⅝	55½	56 11/16
1876	58½	46¾	52¾
1877	58¼	53¼	54 5/16
1878	55¼	49½	52 1/16
1879	53¾	58⅞	51¼
1880	52 5/16	51½	52¼
1881	52⅞	50⅞	51 11/16
1882	52⅜	50	51⅛
1883	51¾	50 1/16	50 9/16
1884	51⅜	49½	50 11/16
1885	50	46⅞	48 9/16
1886	47	42	45⅜
1887	47⅛	43¼	44 11/16
1888	44 9/16	41⅝	42⅞
1889	44⅜	41 15/16	42 11/16
1890	54⅝	43⅝	47¾
1891	48¾	43½	45 1/16
1892	43¾	37⅞	39¾
1893	38¾	30½	35 9/16
1894	31¾	27	28 5/16
1895	31⅜	27 3/16	29 1/16
1896	31 5/16	29¾	30 3/16
1897	29 9/16	23⅝	27 3/16
1898	28⅜	25	26 5/16
1899	29	26⅝	27⅞
1900	30¼	27	28⅝
1901	29 9/16	24 5/16	27 3/16
1902	26 1/16	21 5/16	24 1/16
1903	28½	21 11/16	24¾
1904	28 9/16	24 7/16	26 11/32
1905	30 3/16	25 1/16	27 5/16
1906	33⅛	29	30 7/16
1907	32 7/16	24¼	30 3/16
1908	27	22	24 11/32
1909	24⅞	23 1/16	23 23/32
1910	26¼	23 3/16	24 11/32
1911	26⅛	23 5/16	24 11/32
1912	29 5/16	25 1/16	28 1/16
1913	29⅜	26 1/16	27 9/16
1914	27¼	22 1/16	25¼
1915	27¼	22 5/16	23 5/16
1916	37⅛	26 11/16	31 3/16
1917	55	35 5/16	40 9/16
1918	49½	42½	47 11/32
1919	79⅛	47¾	57 1/32
1920	89½	38⅞	61 11/32

(W. E. P.)

SIMON, SIR JOHN ALLSEBROOK (1873–), British politician and lawyer, the son of a Congregational minister, was educated at Fettes, and at Wadham College, Oxford, where he was a scholar and was eventually elected an hon. fellow. He became pres. of the Union in 1896, and took a first-class in *Lit. Hum.* in the same year, being subsequently elected fellow of All Souls. He went to the bar, became Barstow Law scholar in 1898, and was called in 1899. His manifest abilities and the persuasiveness of his advocacy soon brought him into notice; he was chosen one of the counsel for the British Government in the

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arbitration on the Alaska Boundary in 1903; and he rapidly attained so considerable a practice that he was able to take silk in 1908. Meanwhile he had gone into politics, and was elected as an advanced Liberal for Walthamstow at the general election of 1906. At first, probably owing to his absorption in his legal work, he did not command nearly so much attention in Parliament as his Wadham contemporary and fellow-lawyer, Mr. F. E. Smith (afterwards Lord Birkenhead). But he gradually made his way, and was appointed by Mr. Asquith solicitor-general in 1910, and Attorney-General with a seat in the Cabinet in 1913. On the outbreak of war in 1914, his resignation, along with those of Lord Morley and Mr. Burns, was confidently expected; but he finally decided to remain with his chief and the bulk of his colleagues. When the first war Coalition Government was formed in May 1915, he was offered the lord chancellorship, but he declined the greatest prize of his profession as he preferred a political career in the Commons. Accordingly he accepted the home secretaryship, and gave up his legal practice, by means of which he had acquired a comfortable fortune. Early, however, in the following year, owing to his inability to accept the Government bill for compulsory military service, he resigned his office and led a fruitless opposition to the measure in the House; and then went out to the front in France as a major in the R.A.F. He subsequently resumed practice as a barrister, and immediately regained his position in the front rank of his profession. On the break between Mr. Asquith and Mr. Lloyd George, Sir John Simon adhered to the former. He lost his seat in Parliament at the general election in Dec. 1918, subsequently taking an active part in political work outside the House in the interests of the Independent Liberals. He was twice married—in 1899 to Ethel M. Venables, who died in 1902, leaving a son and two daughters, and in 1917 to Kathleen Manning.

SIMS, WILLIAM SOWDEN (1858–), American naval officer, was born at Port Hope, Ont., Canada, Oct. 15 1858. In childhood he removed to Pennsylvania and was graduated from the U.S. Naval Academy in 1880. Then for eight years he served on board various ships in the N. Atlantic. During 1889–93 he was with the nautical school ship "Saratoga," and then was transferred to the Pacific Station, and later to the China Station. From 1897 to 1900 he was naval attaché to the American embassy, first at Paris and afterwards at St. Petersburg. In 1900 he returned to the Pacific Station. Convinced of the inadequacy of American methods of target practice Lieutenant Sims wrote numerous letters to the Washington officials urging changes. Meeting with no response he finally addressed a personal letter to President Roosevelt, which led to his recall to Washington. In the end he was enabled to arrange for a gunnery test and proved his claims. In 1902 he was assigned to the Bureau of Navigation, serving for the next seven years as inspector of target practice, which was remarkably improved under his guidance. Meanwhile in 1907 he was made commander and appointed naval *aide* to President Roosevelt. With this rank he was placed in charge of the battleship "Minnesota" in 1909. The following year, during a visit of the Atlantic Fleet to England, Commander Sims caused a stir by certain indiscreet remarks made at a dinner at the Guildhall, London, where he said: "Speaking for myself, I believe that if the time ever comes when the British Empire is menaced by an external enemy, you may count upon every man, every drop of blood, every ship, and every dollar of your kindred across the sea." A semi-official protest against this utterance was made at Washington by the German Government, which took offence at it, and there was some talk of Sims being dismissed from the service, but the incident ended in a severe reprimand from the Secretary of the Navy. In 1911 he was promoted captain and for two years was a member of the staff of the Naval War College, Newport, R.I. During 1913–5 he was in command of the Atlantic Torpedo Flotilla and then returned to Newport as president of the Naval War College. When America entered the World War in April 1917 he was chosen to command American naval operations in Europe. In Jan. he had been promoted rear-admiral, and early in April, when war was imminent but before its formal declaration, he sailed in disguise to England in a merchant vessel. In May he was made vice-admiral. In 1916 he had urged construction of battle cruisers, arguing their supremacy over submarines as shown in the battle of Jutland. In his book *The Victory at Sea* (1920, in conjunction with Burton J. Hendrick) he shows how the convoy system, used in transporting 2,000,000 American troops, frustrated the submarines. In 1919 he criticised the manner in which naval honours had been awarded; in particular, he held that "the commanding officer of a vessel that is sunk by a submarine should not receive the same reward as the commanding officer of a vessel which sinks a submarine." This criticism was obviously directed against the Secretary of the Navy for having decorated his own son-in-law, whose boat was sunk. He himself refused the D.S.M. In 1920 he made a formal report to the U.S. Senate, and charged the U.S. Naval Board with serious errors in the conduct of naval operations during the war. His English sympathies and his admiration for the British navy were openly expressed—too openly for the liking of some of his critics.

SINCLAIR, MAY (–), English author, was born at Rock Ferry, Cheshire, and educated at the Ladies' College, Cheltenham. She began her career by writing verse and philosophical criticism. In 1895 she published her first short story, followed in 1896 by her first novel *Audrey Craven*. *Mr. and Mrs. Neville Tyson* appeared in 1898 and *Two Sides of a Question* in 1900. But it was not until she published *The Divine Fire* in 1904 that she became widely known. It was followed by *The Helpmate* (1907); *Kitty Tailleur* (1908); *The Creators* (1910); *The Combined Maze* (1913); *The Three Sisters* (1914); *Tasker Jevons* (1916); *The Tree of Heaven* (1917); *Mary Olivier* (1919) and *The Romantic* (1920), as well as one or two volumes of short stories. In *A Defence of Idealism* (1917) Miss Sinclair published acute criticisms of modern philosophic theories, and in a *Journal of Impressions in Belgium* (1915) she gave her experiences in the autumn of 1914 as a member of an advance field ambulance.

SINHA, SATYENDRA PRASSANO, 1ST BARON (1864–), Indian statesman, was born of an ancient Kayastha family in the village of Raipur, Birbhum district, Bengal, in June 1864. Matriculating at 14 he held a scholarship at the Presidency College, Calcutta, and in 1881 came to London to join Lincoln's Inn, where he won many prizes and scholarships, and was called to the bar in June 1886. In practice at Calcutta he rapidly rose to a leading position, and was appointed standing counsel to the Government of India in 1903. He was the first Indian to be appointed advocate-general of Bengal (1908), and the first to become a member of the Government of India. He held the law portfolio from April 1909 to Nov. 1910, up to the retirement from the viceroyalty of Lord Minto, who testified to the success of what some English critics regarded as a dangerous experiment. Sinha resumed his lucrative practice at the bar, presided at the Indian National Congress session at Bombay in 1915, and was again appointed advocate-general of Bengal (1916). He and the Maharaja of Bikaner were the first Indians to participate in Empire deliberations in London, for in 1917 they jointly assisted the Secretary of State at the meetings of the Imperial War Cabinet, and were members of the Imperial War Conference. Sinha joined the Bengal Executive Council in the same year, but returned to England in 1918 as a member of the Imperial War Cabinet and Imperial War Conference. Immediately on getting back to India he was called to London and Paris as an Indian member of the Peace Conference. Knighted in 1915, in 1918 he was made K.C., a distinction not previously conferred upon a barrister of Indian birth or practice. When the Coalition Government was recast at the beginning of 1919 he established further records for an Indian by being appointed to the Ministry as Under-Secretary for India, and being raised to the peerage as Baron Sinha of Raipur. He was the second Indian to be sworn of the Privy Council. He skilfully conducted the Government of India Act, 1919, through the House of Lords, and when dyarchy was initiated at the close of 1920 was appointed governor of Bihar and Orissa, being the first Indian to preside over a British province.

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SINN FEIN: *see* IRELAND: *Political History.*

SKEAT, WALTER WILLIAM (1835–1912), English author (*see* 25.168). died at Cambridge Oct. 6 1912.

SLATIN, SIR RUDOLF CARL VON (1857–), Anglo-Austrian soldier and administrator in the Sudan (*see* 25.212). For his capable and gallant services in the Sudan Slatin Pasha had been created K.C.M.G. and had received the thanks of both Houses of Parliament in 1899. In 1906 he was created a baron of the Austrian Empire and was made an Austrian privy councillor in 1904. The same year he married Baroness Alice von Ramberg of Vienna (d. 1921). In 1912 he received the G.C.V.O. from H.M. King George. On the outbreak of the World War, Slatin, who was on leave in Vienna, was prevented, by the Austrian mobilization, from returning to his appointment in the Sudan, and in this difficult position he voluntarily took up work as head of the Austrian Red Cross, and in charge of prisoners-of-war, and would accept no remuneration for his services. In this capacity he did much to ameliorate the conditions of imprisonment, and was largely responsible for the humane treatment of the Allied soldiers in Austrian hands. The German Government (through Bethmann Hollweg) offered him a high post which he refused. Subsequent to the signing of the Armistice, he was selected as a member of the Austrian delegation to discuss the terms of peace in Paris.

SMILLIE, ROBERT (1859–), British labour politician, was born in Belfast in 1859 of Scottish parents. He was sent to a primary school but left at the age of 14 years to work in a shipyard at Govan. Two years later he went into the mining industry of Lanarkshire and worked underground for 16 years. From 1878 onwards he was an active trade unionist, although in the earlier years of this period he was earning only 18s. 6d. a week. In 1890 he was elected paid organizer for the Larkhall district and owing to his activity the Lanarkshire Miners' Union soon reached a membership of 30,000. He took a prominent part in the formation of the Scottish Coal Trade Conciliation Board and its satisfactory results were largely attributable to his efforts. His abilities as a leader caused him to rise steadily from the chairmanship of the Scottish Trade Union Congress to the first presidency of the parliamentary committee of the Scottish Trade Union Congress and in 1894 he became permanent president of the Scottish Miners' Federation. In 1912 he was elected to the presidency of the Miners' Federation of Great Britain and the building up of this body has been the great work of his life. Politically his success has not been so great as on the industrial field and although he stood as a candidate for Parliament seven times he was never elected. His greatest poll was 3,847 in a three-cornered fight at Mid-Lanark in 1910. In 1885 he was elected a member of the district school board for Larkhall, a position which he filled for 20 years. His work on the Coal Industry Commission from March till June 1919 brought him into greater prominence, but he became very ill in Nov. 1919. In March 1920, as his health was no better, he tendered his resignation from the presidency of the Miners' Federation, but the Federation refused to accept it and gave him leave of absence instead. In March 1921 ill-health compelled him to resign from the Federation and retire from public life.

SMITH, ALFRED EMANUEL (1873–), American politician, was born in New York City, Dec. 30 1873. The son of humble parents, his father being a truck driver, he was educated in the St. James parochial school and for several years was employed in the Fulton Fish Market. He was very popular with his associates and at the age of 29 was offered the Democratic nomination for the N.Y. State Assembly by the Tammany leader of the district in which he lived. He was elected for 1903 and by reëlection served for 12 years. In 1911 he became Democratic leader in the Assembly and was appointed vice-chairman of the Factory Investigating Committee which made a searching inquiry into industrial conditions in the state, resulting in remedial legislation. In 1913 he was speaker of the Assembly. In 1915 he was chosen a delegate to the State Constitutional Convention, taking an active part in its proceedings. He opposed the constitution as finally revised, one reason being that it contained a provision designed to prevent New York City from having a majority of legislators. He "stumped" the state against its adoption and it was overwhelmingly rejected. The same year he was elected sheriff of New York county, then a lucrative post because of the system of fees (later abolished), and in 1917 president of the Board of Aldermen of New York City. In 1918 he was elected governor of New York, defeating Charles S. Whitman. As a member of the Assembly he had been a strong supporter of woman suffrage, and in June 1919, as governor, called a special session which ratified the woman suffrage amendment to the Federal Constitution. In 1920 he was again the Democratic nominee for governor, but was beaten in the overwhelming Republican landslide of that year; he lost, however, by only 73,000 votes, whereas the Democratic candidate for president was at the same time defeated by a million votes in New York state—a remarkable testimony to his own personal popularity.

SMITH, ALFRED HOLLAND (1863–), American railway official, was born in Cleveland, O., April 26 1863. He began work on the New York Central railway system as a messenger-boy in 1879. After serving as a foreman of construction and in various capacities in the engineering department, he was in 1890 appointed superintendent of the Kalamazoo division of the Lake Shore & Michigan Southern railway. He was successively division superintendent, assistant general superintendent and general superintendent of the Lake Shore road. In 1902 he became general superintendent of the New York Central railroad; in 1906 vice-president of the New York Central system; and in 1914 president. When the American railways were taken over by the U.S. Government Dec. 27 1917, he was appointed assistant director-general and it was he who worked out the form of central and regional administration under which the railways of the country were managed during the 26 months of Government operation. His aim, in which he succeeded, was to keep the management of the roads with their 2,000,000 employees, nearly all voters, in the hands of practical railway-men and, above all, out of politics. He divided the country into two regions and later into seven, each region being in charge of a railway officer of experience and reputation, he himself taking charge of the most important region, the Eastern. These regional directors had complete authority and only broad matters of policy and inter-regional questions were handled by the central (political) administration at Washington. In this way the railways were conducted throughout the war without great blunders or disorganization. On the completion of this important national service he was reëlected president of the New York Central Lines in June 1919. It was largely due to him that the New York Central Lines were greatly strengthened in operating efficiency and financial credit.

SMITH, FRANCIS HOPKINSON (1838–1915), American author, artist and engineer (*see* 25.260), died in New York City April 7 1915. His later writings included *Kennedy Square* (1911); *The Arm-Chair at the Inn* (1912); *Charcoals of New and Old New York* (1912); *In Thackeray's London* (1913) and *In Dickens' London* (1914).

SMITH, SIR GEORGE ADAM (1856–), British divine (*see* 25.261), was knighted in 1916, and from 1916 to 1917 was moderator of the general assembly of the United Free Church of Scotland. His later works include *The Early Poetry of Israel* (1912); *Atlas of the Historical Geography of the Holy Land* (with J. G. Bartholomew, 1914) and *Syria and the Holy Land* (1918).

SMITH, THEOBALD (1859–), American pathologist, was born at Albany, N.Y., July 31 1859. He was educated at Cornell (Ph.B. 1881) and at the Albany Medical College (M.D. 1883). In 1884 he was appointed director of the pathological laboratory of the Bureau of Animal Industry, in Washington, where for 11 years he investigated infectious animal diseases. At the same time he was professor of bacteriology at Columbian, later known as George Washington, University. From 1895 to 1915 he was director of the pathological laboratory of the Massachusetts State Board of Health, and after 1896 was professor of comparative pathology at Harvard. In 1915 he was appointed director of the department of animal pathology of the Rockefeller Institute for Medical Research, New York. He

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made important contributions to the relation between human and bovine tuberculosis.

His numerous scientific papers include *Investigations into the Nature, Causation, and Prevention of Texas or Southern Cattle Fever* (1893); *Investigations Concerning Bovine Tuberculosis with Special Reference to Diagnosis and Prevention* (1894); *Investigations of Diseases of Domesticated Animals* (1897); *The Agglutinative Affinities of Related Bacteria Parasitic in Different Hosts* (1903) and *Certain Aspects of Natural and Acquired Resistance to Tuberculosis and Their Bearing on Preventive Measures* (1916).

SMITH COLLEGE (*see* 25.273).—Between 1910 and 1921 Smith College added to its equipment Burton Hall for biology, and the number of dwelling houses for students increased from 16 to 33. The library in 1920 contained 82,000 volumes and the Hillyer Art Gallery had increased its endowment to $100,000 and added largely to its collections. The college abandoned the system of admission by certificate and all students enter by examination. In 1919–20 there were 181 teachers and 2,001 students, of whom 31 were graduate students, and the endowment was $3,157,000, the total assets being over $6,000,000. A campaign for increased endowment was carried on in 1920, with the result that, when the promises were realized, the assets of the college would be over $9,000,000. The college publishes, besides its permanent bulletin, the *Smith College Studies* in history, modern languages and classics, and contributions of the department of biology. President Seelye was succeeded in 1910 by Marion LeRoy Burton (b. 1874), a graduate of Carleton College, Northfield, Minn., and Yale Divinity School, who resigned in 1917 and was succeeded by William Allan Neilson (b. 1869), a graduate of Edinburgh and Harvard Universities. In the World War the Smith College Relief Unit, the pioneer among American college women's units overseas, worked in 16 villages in the Somme, France, affiliated with the American Fund for French Wounded, and later with the Red Cross, from July 1917 until April 1920, with the exception of the period after the retreat of March 1918 until the following Jan., when the unit operated clubs and canteens and assisted in the hospitals at Beauvais and later behind the American front at Château-Thierry, at Nancy, and in the Argonne. A small group of the Relief Unit worked with the refugees at Orléans in the autumn of 1918. Three Smith Canteen Units were organized and operated under the Y.M.C.A. in France. Another small group worked as a Smith Unit with the Near East Relief in Armenia.

(W. A. N.)

SMITH-DORRIEN, SIR HORACE LOCKWOOD (1858–), British general, was born May 26 1858. He joined the army in 1876, took part in the Zulu war and in the Egyptian campaign of 1882 and, attached to the Egyptian army, served at Suakin in 1884 and afterwards on the Nile in 1885–6, for which he was given the D.S.O. He took part in the Tirah campaign of 1897–8 and, showing conspicuous skill in handling troops, was rewarded with a brevet lieutenant-colonelcy. Immediately afterwards he was summoned to the Sudan to take part in the final advance to Khartum; for this he was promoted brevet colonel. He went out to the Cape in command of his regiment in 1899 and was shortly afterwards given a brigade and promoted major-general; he remained in the field in S. Africa, taking part in numerous operations, until the end of 1901, when he was appointed adjutant-general in India. From 1903 to 1907 he acted, first as a district, and afterwards as a divisional commander, being promoted lieutenant-general in 1906. He was then brought home to take up the command at Aldershot, an appointment which he filled with marked success until 1912, when he was transferred to the Southern Command; he was promoted general that year.

On the death of Gen. Grierson in Aug. 1914 while the Expeditionary Force was still assembling in France, Sir H. Smith-Dorrien (who had been given the G.C.B. in 1913) was appointed commander of the II. Army Corps. At Mons, and during the subsequent retreat, the brunt of the enemy's onsets fell upon his troops, and when hard pressed near Le Cateau he found himself obliged to halt and to give battle; by his resolute action he effectually checked pursuit, although his losses were somewhat heavy. He subsequently commanded his corps at the battle of the Marne, on the Aisne, and during the severe fighting in Flanders in Oct. and Nov. On the splitting up of the Expeditionary Force into two armies he was appointed to the command of the II., receiving the G.C.M.G. for his services. This position he occupied until April 1915, when he returned to England and was placed in charge of one of the Home Defence armies. In the following Nov. he was chosen to take charge of the operations against German East Africa, but he fell ill on the voyage out, was unable to take up the command, and had to return home. He was appointed lieutenant of the Tower in 1917 and in 1918 became governor and commander-in-chief at Gibraltar.

SMOOT, REED (1862–), American politician, was born at Salt Lake City, Utah, Jan. 10 1862. He was educated in his native town and at the Brigham Young Academy, Provo, Utah. He amassed considerable wealth as a banker and woollen manufacturer. In 1895 he was appointed one of the presidency of the Utah Stake of the Church of Jesus Christ of Latter Day Saints (Mormon), and in 1900 was made an apostle. He was elected to the U.S. Senate from Utah in 1902 and reëlected in 1908, 1914, and 1920. In 1903 attempts were made to prevent his entering the Senate because of his connexion with the Mormon church, and on the charge that he personally favoured polygamy and even that he himself was a polygamist. He was allowed to take his seat; but the matter was placed in the hands of the Senate Committee on Privileges and Elections for further investigation. In June 1906 the Committee by a vote of 7 to 5 recommended that he be unseated; but as the personal charges against him had not been proved the Senate in Feb. 1907 by a vote of 42 to 23 refused to remove him. In 1919 he was chairman of the Republican Senatorial Campaign Committee. In 1921 he was a leading advocate of the adoption of a sales-tax, but failed to obtain its acceptance by the Senate, though the movement was widely favoured in business circles.

SMUTS, JAN CHRISTIAN (1870–), S. African statesman, of Dutch descent, was born at Cape Town in 1870, the son of J. A. Smuts, member of the Legislative Assembly for Malmesbury, Cape Colony. He was educated at the Victoria College, Stellenbosch, at the Cape University, and then went to Christ's College, Cambridge, where he took a "double first" in the Law Tripos in 1894. In 1895 he returned to Cape Town and practised as an advocate of the Supreme Court of the Cape till the end of 1896, when he went to Johannesburg to practise as an advocate there. The rapidity of his success is shown by his appointment as State Attorney to the Transvaal Republic in 1898. Thus before he was 30 his remarkable ability was acknowledged and, though he was opposed to the policy of President Kruger, his hand is to be recognized in the State documents of the Transvaal during the critical period which ended in the sending of the ultimatum to Great Britain and the outbreak of the S. African War of 1899–1902. During that war Smuts served throughout with Boer forces, rising during its latter period to the rank of general, and to the authority among his own people of one who had shown the possession of gifts as a leader in the field as brilliant as those which he was known to possess in the realm of the law. Thus when the negotiations for peace began Smuts stood out as one of the recognized Boer leaders.

With Gen. Botha, he threw his influence during the negotiations into the scale for peace, and when, in 1907, responsible government was granted to the Transvaal, Smuts became the right-hand of Gen. Botha, the first Prime Minister of the Transvaal, in the Ministry which he then formed. As colonial secretary the bulk of the administrative work of the new Ministry fell to him, and his success as an administrator was then proved beyond subsequent doubt. He brought to his task an intellect of the first calibre—keen, quick, penetrating. His industry was untiring. Already a man of the world, he commanded the admiring devotion of his subordinates. These gifts would have secured for Smuts a position of great influence in any Ministry. They were no more than one of Smuts' many claims to such a position in the Botha Cabinet. He showed at once that he had high parliamentary ability. His rapid brain made him a master in debate. The complexities of legislation had no diffi-

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culties for him. His mind had a natural bent towards compromise on unimportant points, and he showed again and again an almost uncanny gift for producing at a moment's notice the form of words that would give body to such compromises. His loyalty to, and affection for, Gen. Botha strengthened an influence thus already very strong, and when in 1909 the S. African National Convention met to draft an instrument for the union of the four S. African colonies, Smuts went to it as a delegate from the Transvaal with a reputation for ability and capacity second to that of no other delegate. High as it was, this reputation was enhanced by his work at the Convention. He had gathered round him a staff of experts, had thought out a scheme of union, had worked out its details, was prepared to put this framework before the first meeting. Such foresight had its reward, the more because it was buttressed during the debates of the Convention by the same readiness in debate, the same clear recognition of essentials, the same natural disposition towards compromise on details, and the same quickness in producing verbal formulae, as Smuts had already shown in the Transvaal Parliament.

When union was accomplished Smuts became for S. Africa what he had been for the Transvaal—the right-hand of Gen. Botha, the first Prime Minister of the Union. His success, both administrative and parliamentary, in the Transvaal was repeated as a minister of the Union. As Minister of the Interior, of Mines, and of Defence, he bore the lion's share of the early administrative work of the Union. His Defence Act, passed in 1912, was a model of organization, and the speech in which he moved its second reading in the Union House of Assembly established his reputation throughout S. Africa.

Thus on the outbreak of the World War in 1914, when Gen. Botha declared for the most loyal support of the British Government, the bulk of the burden of organizing the military forces of the Union fell upon Smuts. It was sustained with complete success. The expedition against German S.W. Africa, and the crushing of the rebellion in the Union in 1914, both bore testimony to his capacity as an organizer of victory. He took command of the Union columns invading German S.W. Africa from the S. and carried through that part of the campaign with great boldness of strategy and complete success. Then Botha and Smuts turned to other fields of war. Expeditionary forces were organized against German E. Africa and to take part with the Allies in the fighting on the western front in Europe. In Feb. 1916 Smuts was appointed by the British Government commander-in-chief of the Imperial forces operating in German E. Africa. He had been offered the appointment in Nov. 1915, but had then declined. When he took command, the operations against German E. Africa had reached a state of stalemate. He conducted his campaign with great vigour, exacting from his troops heavy sacrifices of long marching in that trying climate, and before the end of 1916 he had reduced the German forces to the position of fugitive bands. Then another duty called him away from E. Africa. At the end of 1916 Mr. Lloyd George became Prime Minister of Great Britain and at once summoned the Imperial War Cabinet. General Smuts went to it as the representative of S. Africa. So useful did he prove himself to be in that position that he became the only permanent Dominion member of the Imperial War Cabinet. With Botha he represented S. Africa at the Peace Conference in Paris, and returned to S. Africa after peace was signed, only to lose Botha almost immediately and to find himself, by the sudden death of his leader and close friend, Prime Minister of the Union in Sept. 1919.

The political position in S. Africa was menacing. The Nationalist agitation, led by Gen. Hertzog, had grown among the Dutch-speaking people during the war. Resentment at being involved in the quarrels of Europe had fed it. The old passion of the Dutch of S. Africa for peaceful isolation had revived in full strength. Smuts speedily made up his mind that the sense of the country must be tested by a general election. It took place in the spring of 1920 and left Smuts and his party without the semblance of a clear majority in Parliament. Smuts held office by the grace of the Unionists. He had no doubt as to the needs of his position. S. Africa required an established Government; it must be formed by combination between his followers and one of the other parties. His natural impulse was for reconciliation with the Nationalists, and he sought reconciliation with them, but on one clear condition. They must repudiate their Republican aims; and S. Africa must remain willingly a state of the British group of nations. This condition the Nationalists refused. Then Smuts turned to the Unionists, who throughout the war had supported the Botha Ministry as the one safeguard of membership for the S. African state of the British Commonwealth of Nations. With ready self-sacrifice the Unionists accepted his invitation. The two parties were joined into one, the Unionists becoming members of the S. African party, which had been Botha's party and was now led by Smuts. The general election of March 1921 followed, and gave the new party a decisive victory at the polls and a clear and substantial majority in the Parliament of the Union. (B. K. L.)

SMYTH, ETHEL (1858–), English musical composer, was born in London on April 23 1858, the daughter of Gen. J. H. Smyth. She began her musical studies at Leipzig in 1877, becoming a pupil of Heinrich von Herzogenberg, then conductor of the Bach Verein, whose wife was an intimate friend of Johannes Brahms. She was thus thrown from the first into a highly intellectual musical society. Her earliest works, principally chamber music, were performed at Leipzig; her first orchestral works being produced by (Sir) August Manns at the Crystal Palace concerts and the symphony concerts started in 1886 by (Sir) George Henschel. She also produced a Mass, performed in 1893 at the Albert Hall. Subsequently she turned her attention to opera, her first work in this direction being *Fantasio*, based upon a book by De Musset (produced at Weimar 1898 and revived at Karlsruhe 1901). This was followed by *Der Wald*, produced at Dresden in 1901 and at Covent Garden, London, in 1902, and New York 1903; and *The Wreckers*, produced under the title "Strandrecht" at Leipzig and Prague in 1906, at His Majesty's theatre, London, in 1909, and at Covent Garden in 1910. Her opera, *The Boatswain's Mate*, written for a German theatre, but, owing to the war, not produced there, was produced in London in 1915, and was revived in 1918 and met with considerable success. She also published in 1907 a series of songs with instrumental accompaniment, and in 1913 four orchestral songs. Miss Smyth, who received the degree of Mus. Doc. from Durham University in 1910, became known as a leading militant suffragette, and, besides other music written for the cause, produced *The March of the Women* (1911). In 1919 she published two volumes of brightly written autobiography and reminiscences under the title *Impressions that Remained*, and in 1921 another book, *Streaks of Life*. On Jan. 1 1922 she was created D.B.E.

SMYTH, HERBERT WEIR (1857–), American classical scholar, was born at Wilmington, Del., Aug. 8 1857. He was educated at Swarthmore (A.B. 1876), Harvard (A.B. 1878), Leipzig, and Göttingen (Ph.D. 1884). During 1883–5 he was instructor in Greek and Sanskrit at Williams College, and then for two years was reader in Greek at Johns Hopkins. From 1887 to 1901 he was professor of Greek at Bryn Mawr. In the latter year he was called to Harvard as professor of Greek and in 1902 was appointed Eliot professor of Greek literature, succeeding William Watson Goodwin. During 1899–1900 he was professor of the Greek language and literature at the American Classical School at Athens. From 1889 to 1904 he was secretary of the American Philological Association and editor of its *Transactions* and in 1904 was elected president. He became a fellow of the American Academy of Arts and Sciences, a member of the American Philosophical Society and vice-president of the Egypt Exploration Society.

His works include *The Sacred Literature of the Jains* (1894, a translation); *The Ionic Dialect* (1894); *Greek Melic Poets* (1900); *Greek Grammar for Schools and Colleges* (1915); *Greek Grammar for Colleges* (1920). He was also author of *The Greek Language in its Relation to the Psychology of the Ancient Greeks* (read before the Con-

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gress of Arts and Sciences at the St. Louis Exposition in 1904); "Aspects of Greek Conservatism" (in *Harvard Studies in Classical Philology*, 1906); "Greek Conceptions of Immortality from Homer to Plato" (in *Harvard Essays on Classical Subjects*, 1912) and various contributions to philological journals. He was editor of the *Greek Series for Colleges and Schools* (20 vols.).

SNOWDEN, PHILLIP (1864–), British Labour politician, was born at Cowling, Yorks, July 18 1864. He was educated partly privately and partly at a board school, and in 1886 entered the Civil Service. In 1893 he retired, and devoted himself to journalism and lecturing, becoming well known for his ardent advocacy of extreme socialistic views. He unsuccessfully contested Blackburn in 1900 and Wakefield in 1902, and in 1903 he became chairman of the Independent Labour party. He held this position until 1906, and in that year was returned as Socialist member for Blackburn. He sat on various royal commissions, including those on the Civil Service and Venereal Diseases, and from 1917 to 1919 was again chairman of the Independent Labour party. Mr. Snowden made himself extremely unpopular during the World War owing to his pacifist opinions, and was one of the Socialist members of Parliament who lost their seats at the general election of 1918. He had married in 1905 Miss Ethel Annikin, who became well known as a speaker and writer on social subjects. In 1920 she went to Russia as a member of one of the various Labour delegations invited to inspect Soviet conditions of government. She published on her return an account of her experiences, under the title of *Through Bolshevik Russia* (1920).

SOCIALISM (*see* 25.301*).—Socialism is at once a theory, or rather a whole body of theories, and a movement, or rather a number of movements more or less closely connected. The name has been used during the past century to describe many different social theories, in all of which a common character has been perceived. In recent times it has come to be used less with reference to any definite theory than for the purpose of describing the movements in various countries which have adopted the name or have declared their adhesion to Socialism. It is thus possible, in setting out to give a summary account of Socialism, to describe it either by its connotation, that is to say, in terms of the ideas for which it stands, or by its denotation, that is, in terms of the groups and parties which profess allegiance to it. But neither of these methods of description is by itself satisfactory, nor is it possible by either, or even by a combination of both, to arrive at a satisfactory or adequate definition of Socialism. The word is used, and has been used increasingly in recent years, in a number of different and frequently overlapping senses. It has changed its meaning with time: but the changes have not served to clarify it, but rather to increase the number of different senses in which the term is used.

It would be well to begin by ruling altogether out from the scope of this article certain popular uses of the term which have been current especially during the past generation. The well-known phrase, "We are all Socialists now," and the constant references to "socialistic legislation," only serve to obscure the real meanings which attach to the word. When it is said that, "We are all Socialists now," all that is meant is that everybody nowadays is prepared to agree that a greater measure of governmental intervention both in industry and in the affairs of society generally is necessary than was currently regarded as necessary or even possible 100 years ago.

The phrase "socialistic legislation" again is frequently used to cover almost any extension of governmental activity in the sphere either of industry or of provision under the State or under local government auspices for the needs of the people. The phrase "socialistic taxation" is used, with a greater approximation to accuracy, in reference to those forms of taxation which aim not merely at producing revenue for the public authorities, but at bringing about an actual readjustment in the distribution of income in the community, arrived at by the unregulated operation of capitalist economic forces. Again, almost any extension in the sphere of local government action, such as the taking over of a tramway system or the establishment of banking or insurance facilities by a local authority, is frequently referred to as "municipal socialism," even if the public body which inaugurates this policy does not consist of members who profess any allegiance to, or have any sympathy with, the doctrines of any Socialist party or group. All these and similar uses of the word "Socialism" are here ruled out of consideration.

The word "Socialism" first came into use in the third or fourth decade of the 19th century in England and France. The first-known literary reference to it occurs in the "Poor Man's Guardian" in 1833; but it is believed that the word was occasionally used at an earlier date in both France and England. In Great Britain it was most frequently used during the first half of the 19th century in reference to the doctrines associated with the name of Robert Owen and his disciples, and to the theories of the anti-capitalist economists, such as W. Thompson, who were largely affected by Owenite teaching. In France the name similarly attached itself to the doctrines of thinkers of whom the most important were followers of St. Simon and Fourier. Its use then spread much more rapidly on the continent of Europe than in Great Britain, and it was mainly in connexion with the growth of continental Socialist movements (Louis Blanc in 1848; the First International Working Men's Association in the 'sixties and the Paris Commune of 1871) that it was used by English writers, until it was reimported into Great Britain as the name applied to a constructive body of doctrines in the early 'eighties, especially under the auspices of H. M. Hyndman and the Democratic Federation (subsequently the Social Democrat Federation).

It is important to realize that in all its modern meanings the word "Socialism" refers definitely to doctrines and movements which owe their rise to the growth of large-scale production and the capitalist system in industry. It is, indeed, sometimes applied to theories and Utopian speculations, such as those of Sir Thomas More, which have no direct reference to any particular stage of social evolution and are merely attempts to outline the structure of an ideal commonwealth. But, although such Utopias as those of Plato and More may present features of resemblance to the doctrines of modern Socialism, there is no real connexion between these and the theories or attitudes towards property which are sometimes comprehended under the terms "mediaeval Socialism" and "mediaeval Communism." Socialism, as a body of doctrine and as a movement applicable to modern conditions—and these are the senses of the term which matter to the student—made its appearance when the changes in methods of production and transport, which are usually described as the "Industrial Revolution," had created the modern working class or "proletariat," and had caused this class to make the attempt to organize for common protection against the the evil effects of new industrial conditions.

Modern Socialism, although it has claimed many adherents belonging to other classes, is thus essentially a working-class or "proletarian" movement, in that it is based upon and directly due to the rise of the "proletariat" as a distinct social class capable of independent class organization and suffering under a sense of injustice and inhibition. The Socialism of the Owenite period serves in certain respects very clearly to reveal this essential character of the movement. Owen himself has indeed been described by subsequent social thinkers—by Marx, for example—as a "Utopian" Socialist; but the rise of the Owenite movement is very clearly and directly traceable to the actual economic conditions of the early 19th century. It was out of his experience as a factory manager and owner at New Lanark and elsewhere that Owen developed his Socialist doctrines; and, in the minds of most of his followers even more than Owen himself, these doctrines possessed always a close and definite relation to the rise of the working class to social consciousness and to the possibility of social power. Thus, while Owen was expounding his doctrine of ideal Coöperative or Socialist communities, and endeavouring to demonstrate by practical experiment possibilities of achieving Socialism by the foundation of such communities in the midst of a rapidly developing capitalist environment, many of those who were most affected by his doctrines were engaged either, as economists, in developing their critique of the current economic theories based on capitalism, or,

** These figures indicate the volume and page number of the previous article.*

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as leaders in the new-born working-class movement, in endeavouring to organize the "proletariat" for the winning of control over industry and over the machinery of Society. The Grand National Consolidated Trades Union, in which Owenite ideas played so large a part, was organized by men who were aiming not merely at the protection of the working class in face of the adverse conditions created by the new factory system, but at a definite transformation of the industrial order and the winning of control over industry for the "productive classes." This aim was even more clearly defined in the other great "Owenite" union of the period, the Builder's Union, and its abortive plan of 1833 for the formation of a Grand National Gild of Builders. The Chartist movement, which was largely influenced by Owenite and Socialist ideas, was definitely aiming at the conquest of political power by the organized working class with a view to social transformation.

Socialism in Great Britain thus came into existence as: (1) a challenge to the orthodox economic theories of Ricardo and other writers; and (2) an attempt to win power in Society for the organized working class. It was, however, left for later thinkers, and above all for Karl Marx (1818–83), to take up where they had been dropped by the original English pioneers both the anti-capitalist economic teachings and the endeavour to build up the working-class movement into a constructive force aiming at the transformation of the social order. The Socialism of Karl Marx is frequently contrasted with the Socialism of previous thinkers as being "scientific," whereas their Socialism was "Utopian." But, in fact, Marx's Socialism was very largely based upon that of the earlier thinkers and working-class leaders, although he for the first time formulated into a definite system the views and the policy which they had only suggested and sought after.

All modern Socialism, even that of the schools which repudiate or at least profess no allegiance to Marx, has been profoundly influenced by him. This applies even to those schools of Anarchist Communists and French and Italian Syndicalists who seem to have least in common with Marxian teaching; for, even in their case, many Marxian ideas have blended with the ideas which they have derived from other Socialist and *quasi*–Socialist thinkers, such as P. J. Proudhon; and, although they have interpreted the Marxian teaching differently, a great deal of it has found its way into their systems and policies.

Marx's first important contribution to Socialist thinking, *The Communist Manifesto* (1847), which was drafted jointly by him and Friedrich Engels, is generally recognized as the starting point of the modern Socialist movement. His *Das Kapital*, of which the first volume was published in 1867, is the working-out into a system of the most vital ideas originally presented in *The Communist Manifesto*. These works have, of course, been translated into practically all European languages, and their ideas have generally passed into the common stock of European Socialist thought. This has hitherto been true of Great Britain in a less degree than of any other important industrial country; but even English Socialism began in the 'eighties on an essentially Marxian foundation, and, although Marx fell into disfavour with British Socialists in the 'nineties and in the earlier years of the present century, there has recently been an important revival of the study of his works among the more radical section of the British working-class movement. In other countries the organized Socialist movement is in practically all cases definitely Marxian, and bases its thinking and its propaganda throughout on Marxian terminology and Marxian ideas. Thus we find that, as divergent currents have again and again appeared in European Socialism, the name of Marx and his fundamental conceptions have been invoked, for the purpose of justifying widely divergent policies and conceptions. During the past few years, for example, a great pamphleteering controversy has been proceeding between Nikolai Lenin on the one side and Karl Kautsky on the other, representing two very different tendencies in European Socialism. Each of these writers bases his contentions on an almost theological reverence for the words of Marx, and seeks to justify his position by copious quotations from Marx's books and manifestos.

In the criticism which has been directed against Marx by orthodox economists in many countries, attention has been paid mainly to his theory of value, and only in a considerably less degree to his theory of history. This is unfortunate; for there is no doubt that the theory of value has played a quite secondary part to the so-called "materialist conception of history" in the influence which Marx's teaching has exercised on the modern working-class movement. The theory of value, as it was presented by Marx, and his attempt to build a theoretical economic system on the idea of labour as the source of value and exploitation as consisting in the appropriation by a privileged class, the owners of the means of production, of the surplus value created by labour, was mainly a criticism and inversion, to suit Socialist ends, of the current economics of Marx's own day. Like Thompson and the earlier English economists to whom he owed so much, Marx took the Ricardian theory of value and drew from it conclusions by no means acceptable to orthodox economic theorists. Undoubtedly his ideas of "surplus value," and exploitation resulting from the individual appropriation of "surplus value," played an important part in creating the sense of injustice and oppression among the workers; but by themselves they would never have sufficed to give Marx his dominant position as the theorist of modern Socialism.

This position depends far more on his theory of history, the effect of which was to give to those members of the working class who encountered his teaching the sense of possessing a mission and of having on their side the great world forces of social transformation. Interpreting historical changes as the result of the operation of economic forces, Marx insisted that to each stage in the evolution of the means of production there corresponds an evolution in the forms of political society and in the class structure of society. The industrial system of the 19th century, he claimed, had called into existence a new social class, the property-less, wage-earning "proletariat"; for, although there had been capitalists and wage-earners in earlier stages of social evolution, the economic structure of Society had not before been based upon the dominance of the capitalists as a class. Nor had the "proletariat" been called into existence as a class, confronting the possessing capitalists throughout the industrial system in all the countries of the world which had reached the capitalist phase. The next stage in social evolution, according to Marx, would be the rise to power of the "proletariat," and, just as the capitalists had risen to power and displaced or absorbed the privileged classes with which social authority had previously rested, so the "proletariat" under the system of large-scale industry would improve its organization and increase its strength until it was able to do battle with, and to overthrow, the capitalist class. In expounding this theory of "economic determinism" or the "materialist conception of history," Marx made a number of prophecies concerning the actual future of capitalist industrialism which have not thus far been at all completely verified. The progressive elimination of the small capitalist, the aggregation of the control of capital into fewer and fewer hands, the progressive "misery" of the "proletariat," which Marx prophesied, are forecasts in which truth and falsehood are intertwined. But these prophecies concerning the actual course of events are in no sense vital to his central idea, which is that of the gradual rise to power of the "proletariat" or working class, and the conquest by it of economic authority, resulting necessarily in the transformation of the political structure of Society and in the abolition of social classes.

It is easy to see that this doctrine was bound to exercise a strong fascination over the minds of those men and women of the working classes who were brought into contact with it. Whereas, without some such theory they were conscious only of the enormous strength of the forces to which they were subject, and of their manifest weakness as almost property-less wage-earners, living in constant insecurity, at the mercy of trade fluctuations which resulted periodically in widespread unemployment, Marx gave them the sense of fulfilling an historic mission, and of having on their side a world-force far more powerful than the huge economic and political strength which seemed to be in

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the possession of the ruling classes of the day. It is this one thing, and one thing only, that explains the veneration in which Marx is held throughout practically the whole Socialist movement. It was he, who, more than anyone else, gave the working class a sense of power, and imported into their efforts towards organization and concerted resistance to the evils to which they found themselves subject a conscious purpose not merely of combating capitalism, but also of replacing it.

In the earlier article some account was given of the rise of Socialist parties in various European countries. This rise continued at an increasing pace in later years, a great impetus having been given to the Socialist forces in almost all parts of Europe by the circumstances of the World War.

There was in 1921 in every industrialized country at least one Socialist party, possessing in the majority of cases a considerable representation in its national Parliament. Indeed, in many countries there had come into being more than one Socialist party; for the process of unification of Socialist political forces which had been proceeding steadily up to the outbreak of the war gave place to a separatist tendency, which resulted in a regrouping of forces in most of the countries in which the movement was strong. The first cause of these divisions was the attitude of Socialists towards the outbreak of the World War. In almost all belligerent countries the Socialist parties became divided over the issues of the war. In some cases these divisions of opinion resulted in actual cleavages within the various parties; in others the parties held together, but acute divisions of opinion continued inside them. These differences were greatly accentuated by the Russian revolutions of 1917, which inevitably exercised a very powerful influence on Socialist opinion throughout the world. Just as, in its earlier days as an organized political movement, Socialism always tended to look back to the Paris Commune of 1871, it now even more definitely looks back to the Russian revolutions of 1917, upon which the most acute divisions of opinion in the world of Socialism to-day are based. Any attempt, therefore, to analyze the forces at work in the Socialist movement of the various countries in 1921 must begin by taking into account the new alignment of opinion caused by the Russian revolutions.

The first Russian revolution of 1917 was universally acclaimed by Socialists throughout the world. It meant for them the overthrow of Tsardom and the destruction of the most powerful and complete absolutist monarchy left in the world. Moreover, refugees from Russia had played an important part in the Socialist movement in almost all countries in which it had become organized. It was not the first of the Russian revolutions but the *coup* of Nov. 1917 that divided acutely the Socialists of the various countries. Everywhere the left wing of the Socialists acclaimed the Bolshevik Revolution, while the right wing was hostile to what it regarded as the overthrow of the "democratic" institutions which had been introduced under the Kerensky regime.

During the following years, from 1918–21, the differences within the Socialist ranks resulting from the Bolshevik Revolution were steadily accentuated. Under the auspices of the Russian Bolsheviks, or Communists as they now call themselves, with a definite reference back to *The Communist Manifesto* of 1847, a new international organization of Socialism, the Third or Moscow International, was inaugurated, and an appeal was made to the "proletariat" in all countries to rally to this new body, of which the fundamental ideas were the overthrow of the capitalist regime by the intensive prosecution of the class war, involving the use of force, and the assumption by the "proletariat" of dictatorship over Society during the "transitional period," which would be necessary both for the combating of the attempts of the "counter-revolution" to regain power, and for the laying of the foundations of a Socialist or Communist society free from class distinctions. During the years after the Bolshevik Revolution these Communist doctrines gradually spread over Europe, and resulted in the formation in most countries of Communist groups and parties of varying degrees of importance. Sometimes these began by working as groups within the existing Socialist parties, and sometimes they succeeded in winning over to their side a majority of the older Socialist parties, which thus became Communist. In other cases, however, the Communists, unable to command a majority in the Socialist parties in other countries, founded new and rival parties of their own.

Thus in 1921 the position of European Socialism was extraordinarily complicated, as a reference to the state of affairs in a few of the principal countries will readily indicate. In France the Communists had succeeded in securing a majority in the ranks of the French Socialist party, and it had thereupon changed its name to the French Communist party. The minority, which refused to accept the change in name and policy, thereupon reformed the Socialist party as a coalition of right wing and central elements. In Italy the Socialist party, which was throughout opposed to Italian participation in the war, at first affiliated to the Moscow International; but subsequently differences arose as to the strategy to be adopted, and these led to a split in the ranks of the party, the extreme Communists, who were in a minority, seceding and forming a Communist party of their own, while the right and centre, including many Communists, held together as the Italian Socialist party. In Germany the Social Democratic party split during the war. A majority section of the party supported the German Government in the prosecution of the war and voted war credits. Gradually a minority party formed, and finally the anti-war elements left the Social Democratic party and formed the Independent Socialist party. After the Bolshevik Revolution in Russia two small Communist parties were also formed in Germany. In 1920 the majority of the Independent Socialist party resolved upon adhesion to the Moscow International and united with the Communist factions to form the German Communist party. The right wing of the Independent Socialist party continued in existence under the old name; and there were thus in Germany, in 1921, three distinct parties, Social Democrats or Majority Socialists, Independent Socialists, and Communists. In Great Britain the position was somewhat different; for political action was taken through the Labour party, a federation of trade unions, Socialist societies and kindred bodies. Of the Socialist societies, the British Socialist party, the direct descendant of the Social Democratic Federation, the earliest Socialist body in Great Britain, affiliated to the Moscow International and became the nucleus of a Communist party which applied for affiliation to the Labour party, but was refused. The Independent Labour party, which, unlike the Labour party as a whole, was hostile to participation in the war, nevertheless remained affiliated to the Labour party. There were thus only two groups undertaking political action in Great Britain—the Labour party, including the Independent Labour party, on the one hand, and the small, but militant, Communist party on the other.

These instances, drawn from a very much larger number, serve to illustrate the general character of the divisions which had arisen in the world Socialist movement since the Russian Revolutions of 1917. As the movement has been divided nationally, so a division has taken place in the international organization of Socialism. Before the war most of the Socialist parties of the world were loosely held together by the Congresses of the "Second International," of which the first was held in 1889. Out of the Congresses developed the International Socialist Bureau, which was formed in 1900. The Bureau was unable to function effectively during the war, both because communications were to a large extent interrupted, and because of the differences of opinion between and among the various national sections. Various attempts were made to secure united action by all the national Socialist parties; but, in face of the opposition of the Governments and of internal differences, these produced little result, the attempt to call an International Socialist conference at Stockholm in 1918 breaking down. The Socialist parties of the Allied countries, however, held a number of conferences, and drew up a declaration of war aims, which exercised a certain influence. Immediately on the conclusion of hostilities steps were taken to convene a full International Socialist conference; and an attempt was made to reform the pre-war Socialist International. The reformed body, however, known as the "Second International," never became, in face of acute differences

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of opinion, at all fully representative, and during 1919 and 1920 there were numerous secessions from it, until it came to consist principally of the British Labour party, the German Social Democratic party (Majority Socialists), and the Socialist parties of a number of small countries such as Sweden, Poland, Belgium and Holland. A number of Socialist parties held aloof both from the Second and from the Third International, and these bodies in 1920 formed a provisional International "Working Union," of which the aim was the reconstitution at a later stage of a fully representative and inclusive Socialist International. This provisional body, sometimes known as the "Vienna International," includes the British Independent Labour party, the German Independent Socialist party, the French and Swiss Socialist parties, and a number of others. The Italian Socialists were in 1921 unconnected with any of the three Internationals.

There can be no doubt that the division of opinion in the Socialist ranks which is reflected in these divisions in national and international organization is very profound. With the growth of parliamentary representation, the political Socialist parties of the various countries have been becoming steadily more moderate and constitutional in their outlook. But the Moscow revolution, accomplished by insurrectionary methods and by "proletarian" direct action, represented a challenge to the constitutional political attitude of the more orthodox Socialist parties. Those which have rallied to the call of Moscow profess to be the only true inheritors of the Marxian tradition and the legitimate successors of the International Working Men's Association, or "First International," of 1864. It is still impossible in 1921 to forecast the result of the conflicts between this section and the older Socialist parties; but it seems likely that the divisions which have come into existence will be to a considerable extent permanent, even if the ultimate point of cleavage has not yet been discovered.

James Bonar on p. 301 of vol. 25 defines Socialism as "that policy or theory which aims at securing by the action of the central democratic authority a better distribution and, in due subordination thereunto, a better production of wealth than now prevails." It will be clear from what has been said above that this definition is certainly no longer adequate or correct in 1921, even if it could be regarded as adequate at the time at which it was made. It is as true now as then that all schools of Socialism are united in seeking a better distribution and also a better production of wealth; but it cannot be assumed that this is sought solely or even mainly "through the action of the central democratic authority," or that many Socialists would agree that any such body as a "central democratic body" exists in the community as it is organized to-day. Any present-day definition of Socialism would certainly have to emphasize the fact that it seeks not merely a better distribution and production of wealth, but a fundamental reorganization in the whole system of organized Society, political as well as economic. At the time when Bonar wrote, Socialists, especially in Great Britain, were largely engaged in combating the still prevalent doctrines of *laissez-faire* politicians and economists, and in seeking to emphasize the necessity for a greater measure of collective regulation of the social and economic life of the community. In Great Britain, more than elsewhere, many Socialists came to regard the political State, or machinery of government, as the principal instrument of this regulation, and to look forward to the transition to Socialism mainly through the nationalization, or transference to State ownership, of all vital industries and services, together with an extension of municipal ownership in the sphere of local public-utility services. This idea of the form of the transition to Socialism fitted in well with the stress which was laid, during the 'nineties and the earlier years of the 20th century, upon political action. This period witnessed the formation, first of the Independent Labour party, and then in 1900 of the Labour Representation Committee, which subsequently became the Labour party. It was also the period during which the Fabian Society, with its propaganda of political permeation, largely influenced British Socialism, and diverted it from the Marxism of its earlier development in the 'eighties.

But from 1910 onwards new currents of opinion were increasingly affecting these accepted dogmas of Socialism, both in Great Britain and elsewhere. Important, in this connexion, is the rise of the Syndicalist movement in France, which was at its zenith in the earlier years of the 20th century, and of the Socialist Labour party and the Industrial Workers of the World in the United States of America. There were important differences between the standpoints of French Syndicalism, which was derived largely from the semi-Anarchist doctrines of Proudhon and his school, and American Industrial Unionism, based by Daniel De Leon and his followers upon the large-scale and "trustified" American capitalist system. But they were alike in stressing rather the economic than the political character of the transition to a Socialist system, and in demanding more aggressive action by the workers in the industrial field. In Great Britain and in other European countries these doctrines, although they were not accepted in their completeness, exercised a powerful influence, seen especially in Great Britain in the rise of the Guild Socialist movement after 1912 (*see* GUILD SOCIALISM).

Whereas Syndicalism and, in some of its forms, Industrial Unionism directly challenged the utility of Socialist political action and demanded an exclusive concentration upon the industrial field, the Guild Socialists never took up this attitude, but sought, without disparaging political action, to secure an intensification of industrial activity, and in particular a change in the attitude of Socialists towards the problem of industrial control. Their influence in this direction has extended far beyond their own ranks, and it is not too much to say that the effect of the various movements possessing largely an industrial character —Syndicalism, Industrial Unionism, Guild Socialism, etc.— has been to bring about a revolution in Socialist thinking on this question. It is no longer assumed by Socialists that nationalization is necessarily desirable, or that the transference of industry to the State, even if it be accomplished by a political victory of Socialists, furnishes an adequate solution of the industrial problem. Most Socialists are agreed in desiring, in a greater or less degree, as an integral part of any Socialist system, the control of the administration of industry by the organized workers by hand and brain who are engaged in it.

Nor has this change in the attitude of Socialists towards the problem of industry been without its effect in other spheres of policy. As Socialism passed from its earlier revolutionary into its middle purely constitutional and political phase, it came gradually to be assumed that the realization of Socialism would involve only the capture of political power by the Socialist parties and the use of the existing machinery of Society—modified perhaps in certain particulars, but remaining essentially the same—for socialist instead of for individualist ends. There is now acute division of opinion on this question; but most Socialists are far more ready than in 1910 to agree that the realization of Socialism would involve not a mere conquest of political power and the assumption of control over the machinery of government by the workers, but also a profound transformation in the machinery of government itself. By Lenin and the Communists (see Lenin's *The State and Revolution* for the best statement of this point of view) the State is regarded as purely a "capitalist organ," the tool of a dominant class in Society. In the words of *The Communist Manifesto*, they regard the State as "an Executive Committee for administering the affairs of the whole governing class." Such an instrument, essentially coercive in its character, will in their view become unnecessary with the realization of Socialism. During the transitional period of "dictatorship" the "proletariat" will indeed require an instrument fully as coercive as the capitalist State. But the Communist view of the existing machinery of the State cannot be adapted for this purpose, but must be destroyed and replaced by a "quasi-State" based definitely and exclusively upon the power of the workers themselves. Gradually, as the realization of Socialism comes nearer, they hold that this "quasi-State" will "wither away" and give place to a free organization of Society in which "government," which they understand to imply a system based on coercion, will be replaced by "administration." Even among those Socialists

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who do not accept this Communist view, keen criticism has been directed in recent times upon the structure of the present-day State and upon the conception of political democracy which was almost universally accepted in the 19th century. Universal political suffrage is no longer held to furnish any adequate basis, or even necessarily any basis at all, for truly democratic institutions; for it is pointed out that, as long as great inequalities of wealth and power exist in the community, and as long as the industrial system is based on an acute division of classes, this "political democracy" is in fact inoperative, since the power and wealth of the few can be used in order to prevent the will of the people from finding expression, and, indeed, to prevent the people from developing any conscious or clearly formulated will of its own. By the Guild Socialists and by many others of the newer schools of Socialist thought, stress is laid upon the importance of securing a system of democratic self-government in the industrial sphere as the necessary condition of democracy in politics or in Society as a whole.

These changes in the conception of Socialist aim and method have resulted in a much closer relationship between Socialist ideas and the definitely economic forms of working-class organization, such as Trade Unionism and Coöperation. No longer basing their hopes of Socialism entirely upon action in the political sphere, Socialists are driven more and more to rely on the development of the organizations created by the working classes themselves for the protection of their interests and standard of life under capitalism. Whereas the earlier Socialists appealed to Trade Unionists and Coöperators to realize the necessity for Socialism and to embark upon political action, the newer schools of Socialism are endeavouring also to influence the policy of the Trade Unions and of the Coöperative movement in the direction of Socialism applied to industry—that is, of the development and expansion of working-class industrial control (*see* TRADE UNIONISM and GUILD SOCIALISM).

The organization of the Socialist movement in Great Britain is often exceedingly bewildering to those who approach it for the first time. There are a large number of bodies of varying degrees of importance, and often with names which bear a close resemblance one to another. The Labour party, which is by far the largest political body, may be regarded as definitely Socialist in the sense in which the majority of continental European Socialist parties are Socialist. Its annual conference has repeatedly pronounced, in general terms, in favour of Socialism, and its policy on the whole coincides with that of the "right wing" Socialist parties of Europe. At the same time, its main strength is drawn from the trade unions. In 1920 it consisted of 126 affiliated trade unions with a total affiliated membership of 3,511,000. In addition it included the Independent Labour party and the Fabian Society and one or two smaller Socialist bodies. Locally it was organized in several hundred Local Labour parties, which in their turn consisted mainly of affiliated branches of trade unions, Socialist societies and kindred bodies. These Local Labour parties, under the new constitution of 1918, also admit individual members who accept the aims of the party. There is a very considerable individual membership enrolled in this way; but no figures are available. In 1920 the Labour party had 66 members in the House of Commons.

Apart from the Labour party, although in some cases affiliated to it, are the various Socialist societies, of which the largest is still the Independent Labour party, which has been mentioned above. This party had in 1920 35,000 members organized in local branches throughout the country. It had returned five members as Independent Labour party members to the House of Commons; and these sat as members of the Labour party. In addition a considerable number of members who were returned under the auspices of the trade unions, affiliated to the Labour party, belonged to the Independent Labour party.

Next in point of size stands the Communist party of Great Britain, formed in 1920 by a fusion of the British Socialist party with a number of local Communist organizations. This party is affiliated to the Third or Moscow International. It was gaining adherents in 1921. Its total membership, however, certainly did not at that date exceed 10,000. Of minor Socialist parties the following deserve mention. The Social Democratic Federation, formerly the National Socialist party, is the result of a split which took place during the war in the British Socialist party. A section of the British Socialist party, including H. M. Hyndman, the veteran Socialist leader, and many of the older members of the earlier Social Democratic Federation, resigned from the British Socialist party as a protest against its anti-war attitude and formed a separate body of their own. The Social Democratic Federation (the name was again assumed at the end of 1920) is affiliated to the Labour party. It is very small, its membership in 1920 being returned as 2,000.

The Fabian Society, founded in 1883–4, has been principally associated with certain intellectual leaders of the right wing of British Socialism, especially Mr. and Mrs. Sidney Webb and Mr. Bernard Shaw. It had about 2,000 members in 1920 and was affiliated to the Labour party. Its pamphlets and other propagandist work exercised a powerful influence on the formation of Socialist opinion during the period from 1889 to 1910, but it has since ceased to count as an effective influence; for, although Mr. and Mrs. Webb and other leaders remained active, they had transferred their main activities to other bodies, such as the Labour party itself.

The Socialist Labour party is an offshoot of the American "De Leonite" Socialist Labour party. It gained considerably in membership and influence during the war, when its leading members took a prominent part in the shop-stewards' movement, and in other rank-and-file trade-union and anti-war movements. Most of its more active members, however, passed over to the Communist party in 1920; and it then ceased to exercise any considerable influence. The Socialist party of Great Britain is a very small and unimportant body of rigid Marxians of the extreme left wing. The National Guilds League, the propagandist organization of the Guild Socialists, is described in the article GUILD SOCIALISM.

It will be seen from the foregoing account that the Socialist movements of the world were in 1921 in a state of unrest and transition, due largely to the events of the war and to the revolutions in Russia. It is impossible to forecast what will be the ultimate result of this ferment of forces and ideas, or in what manner the Socialist parties and societies of the world will eventually regroup themselves. Two clearly defined tendencies can be seen in the movement. The first is a constitutionalist and parliamentary tendency, expressing itself in the activities of the Majority Socialist parties of many countries. Its adherents repudiate for the most part recourse to revolutionary methods save under quite exceptional circumstances. At the other extreme is the tendency represented by Communism and the Communist parties which have arisen in most countries in recent years. Its adherents favour the use of political as well as industrial action, but regard the transition to Socialism essentially in terms of force to be generated by the uprising of the "proletariat." They envisage the transformation of Society by a catastrophic overthrow of the existing political and economic system, and the substitution for it of a new system based on the "dictatorship of the proletariat." Between these two extremes there is no equally definite central body of opinion extending to a number of countries; but in almost every country there are "centrist" groups and tendencies, bearing in some cases a closer resemblance to the constitutionalist right wing (*e.g.* the Independent Labour party in Great Britain), and in others to the revolutionary left wing (*e.g.* the Socialist party in Italy).

The Guild Socialists and, in a less degree, the French *Syndicalistes* stand to a considerable extent in a different position, since in their case the main stress is laid neither on revolution nor on constitutional political action, but on the extension of the industrial power of the workers towards control over industry.

A marked feature of the more recent developments of the Socialist movement has been the growing closeness of the relationship between it and the economic organizations created by the workers for the defence of their interests and aspirations as producers and consumers. It has become far more manifest

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in the later years of the 19th and the early years of the 20th century that Socialism is not solely, or even mainly, a political movement, but at least equally an industrial movement, aiming at a fundamental transformation not simply in the ownership, but also in the control and administration of industry, and in the motives upon which the industrial system depends. This is, indeed, to some extent a harking back to earlier conceptions of Socialism, such as those of Robert Owen in Great Britain and of Louis Blanc in France. It has resulted in a far closer affiliation between the Socialists of all schools, "right wing," "left wing" and "centre" alike, and the trade-union movement; and the struggles between the rival schools of Socialism now largely reproduce themselves in the industrial sphere, as the various Socialist sections seek to influence the policy and to secure the allegiance of the trade-union organizations. This is true to a less extent of the coöperative movement; but it is becoming increasingly true in this case also.

Based, as it is, mainly upon the organized working-class movement, Socialism has necessarily, to a large extent, an economic basis; but it is important to realize that a great deal of its driving force comes from the fact that it is not only an economic movement, but also a movement based on certain clear and definite ideas which are largely shared by Socialists of all schools.

The differences between Socialists are far more differences as to method than differences as to ideal. Thus all Socialists are agreed that the carrying-on of industry on a basis of private profit produces anti-social results, and that the idea that the interests of the whole are best served by the enlightened pursuit by each private citizen of his own interests is fundamentally wrong. Although they differ widely as to the structure which a Socialist society should assume, and as to the forms of industrial administration which would best express the new community spirit, Socialists are agreed in demanding that all important industries and services should pass over from private hands into some form of social ownership and control, whether into the hands of the State or of local authorities, or of self-governing guilds, or of the coöperative movement, or of other forms of organization designed to express the communal spirit. They are agreed in believing the individual ownership of the means of production, distribution and exchange to be undesirable, and in holding that both the extent and the character of production should be determined, not by any anticipation of individual profit, but by considerations of social need. Moreover, all Socialists insist that with the change from the system of private ownership and control in industry to social ownership and control must go a change in the motives which operate in the industrial system. They hold that, if industries and services are conducted under forms of organization designed in the interests of the whole community, the motive of public service, which is at present thwarted and inhibited by the existence of capitalism, will be brought into play, with the result that the members of the community will be more ready to render willing and efficient service. They are also increasingly of the opinion, first strongly urged by the Guild Socialists, that in order to bring this motive of social service into play it will be essential to democratize the industrial as well as the political system, by providing for a large measure of self-government in industry by the "workers by hand and brain."

The charge used to be brought against the Socialist parties and groups of dwelling almost exclusively upon the economic concerns of Society, and of caring little or nothing for other questions of social and political policy. This charge can hardly be made nowadays; for the Socialist and Labour parties of the world have in almost all cases been led to formulate inclusive programmes and policies, and to take an active part in furthering social reorganization in all spheres of both national and international policy. Perhaps the best exposition of the national and international policy of Socialism of the constitutional type is contained in the pamphlet *Labour and the New Social Order*, issued by the British Labour party in 1918. This pamphlet has had an important international influence. The Communist wing, more fully preoccupied with questions of revolution than with plans for reform under the existing system, has not issued any quite comparable declaration of its aims; but the new *Communist Manifesto* of the Third (Moscow) International furnishes the clearest indication of its aims and policy as an international movement.

BOOKS ON SOCIALISM.—*A., General.*—There is no really good account of Socialism as a whole. The handiest text-books in English are: T. Kirkup, *History of Socialism* (new ed. revised by Edward R. Pease, 1913); and Werner Sombart, *Socialism and the Social Movement* (translated by M. Epstein (1909); R. C. K. Ensor, *Modern Socialism* (1907), is a useful collection of extracts from writings of Socialists of all countries. Max Beer's *History of British Socialism* (2 vols., 1919 and 1920) is indispensable. For the growth of the movement in various countries see Robert Hunter, *Socialists at Work* (1908), and the *Labour International Handbook*, prepared by the Labour Research Department (1921). Of books hostile to Socialism the best known are O. D. Skelton, *Socialism: a Critical Analysis* (1911), and W. H. Mallock, *A Critical Examination of Socialism* (1907); Hartley Withers, *The Case for Capitalism* (1920), may also be consulted. Other useful general books include: E. Bernstein, *Evolutionary Socialism* (1909); Robert Blatchford, *Merrie England* (1895); Fabian Society, *Fabian Essays* (1889); J. Bruce Glasier, *The Meaning of Socialism* (1920); Laurence Gronlund, *The Coöperative Commonwealth*, edited by Bernard Shaw (1891); J. Ramsay MacDonald, *Socialism, Critical and Constructive* (1921); William Morris and E. Belfort Bax, *Socialism: its Growth and Outcome* (1893); Bertrand Russell, *Roads to Freedom* (1918); Emile Vandervelde, *Collectivism and Industrial Evolution* (1907); *Le Socialisme contre l'État* (1919); W. E. Walling, *Socialism as it is* (1912); H. G. Wells, *New Worlds for Old* (1908, rev. 1914). See also the innumerable pamphlets published by the various Socialist bodies.

B., Marxism.—Karl Marx's *Capital* (English translation, 3 vols. 1887–1909) is, of course, the foundation of most modern Socialist thinking. Of Marx's other works the most important for Socialist theory are: *The Communist Manifesto*, written in collaboration with Friedrich Engels (1847); *The Critique of Political Economy* (English translation, vol. ii. 1907); *The Civil War in France* (1871, reissued 1921); *Revolution and Counter-Revolution* or *Germany in 1848* (Eng. 1896); *The Poverty of Philosophy* (Eng. 1900). Of the works of Engels the most important are: *Socialism, Utopian and Scientific* (Eng. 1892), and *Landmarks of Scientific Socialism* (Eng. 1907). Karl Kautsky, the leading exponent of political Marxism in Germany, can be best studied in *The Erfurt Program* (Eng. 1910); *The Social Revolution* (Eng. 1902); and in his attack on Bolshevism, *Terrorism and Communism* (Eng. 1920). For the Communist exposition of Marxism see N. Lenin, *The State and Revolution* (Eng. 1919), and other works. Of books on Marx and Marxism the most important are: Max Beer, *The Life and Teaching of Karl Marx* (Eng. 1921); Achille Loria, *Karl Marx* (Eng. 1920), and for a hostile criticism: E. von Böhm-Bawerk, *Karl Marx and the Close of his System* (Eng. 1898). Georges Sorel's *La Décomposition du Marxisme* (1908) and Benedetto Croce's *Historic Materialism and the Economics of Karl Marx* (Eng. 1914) are important detached studies. A much fuller bibliography will be found in *What to Read on Social and Economic Subjects* (Fabian Society, new ed. 1920); and reference should be made to the bibliographies at the end of the articles on COMMUNISM, GUILD SOCIALISM, SYNDICALISM. There is, of course, a very large literature of the subject in almost every European language.

(G. D. H. C.)

SODEN, HERMANN, FREIHERR VON (1852–1914), German biblical scholar (*see* 25.339), died Jan. 15 1914.

SOLDENE, EMILY (1840–1912), English singer and actress, was born at Islington, London, in 1840. She had made her debut in 1864 on the concert stage, and in 1871 appeared in *Geneviève de Brabant*, her favourite rôle, and in *La Fille de Madame Angot* in 1872. Her successes were mainly in opera-bouffe, and she retired young from the stage. She published one novel, *Young Mrs. Staples* (1896), and *My Theatrical and Musical Recollections* (1897). She died in London April 8 1912.

SOLF, WILHELM (1862–), German colonial politician, and, at the time of the revolution, Secretary of State for Foreign Affairs, was born Oct. 5 1862 in Berlin. He made a special study of Sanskrit and Oriental languages, and, after a long sojourn at Calcutta, returned to Germany in order to study political science. He then entered the German Colonial Service and, after having been employed in a judicial post in German East Africa, was sent to Samoa, first as president of the municipal council (1899) at Apia under the old "condominium" of Great Britain, Germany and America and afterwards as governor of German Samoa (1900). In 1911 he was appointed German colonial secretary and achieved considerable success in the reform of the German colonial administration. When Prince Max of Baden's Ministry

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of desperation was formed towards the end of the World War, Solf was appointed Secretary of State for Foreign Affairs on Oct. 3 1918. In this capacity it fell to his lot to conduct the negotiations for the Armistice, first with President Wilson and then with the Allied and Associated Powers. He continued to hold this office as an "expert" under the revolutionary Socialist Government of the Commissioners of the People, and did not resign till Dec. 17 1918. In 1920 he was appointed German chargé d'affaires and afterwards ambassador to Tokio. He was the author of *Weltpolitik und Kolonialpolitik* (1918) and of *Kolonialpolitik, Mein politisches Vermächtniss* (1919).

SOMALILAND (*see* 25.378).—The territorial division of Somaliland between Abyssinia, Great Britain, France and Italy, except for a comparatively slight readjustment of the Italo-Abyssinian frontier, remained unchanged during the period 1910–21. However, Italy obtained from Great Britain the promise of the addition to Italian Somaliland of part of the Jubaland province of British East Africa (Kenya Colony). Italy also desired to acquire the port of Jibuti (French Somaliland), but failed to do so (*see* AFRICA: *History*).

BRITISH SOMALILAND.—From 1910 to 1920 the mullah Mahommed bin Abdullah, popularly known in Britain as the "Mad Mullah," continued to dominate the interior of the protectorate. In March 1910 the British troops were withdrawn to the seaports and a policy of "strict coastal concentration" adopted. Officially arrangements had been made to enable the friendly tribes to defend themselves from attack by the Mullah; in fact the "friendlies" were not only systematically raided by the dervishes, but also quarrelled among themselves. At the end of 1912 a camel constabulary, 150 strong, was raised and under R. C. Corfield checked inter-tribal fighting. In Aug. 1913 Corfield, acting against instructions, engaged a raiding party of some 200 dervishes at a place called Dolmadoba, 110 m. S.E. of Berbera. In the action Corfield was killed, his little force of 109 men had over 50% casualties and was compelled to fall back. G. F. Archer, the acting commissioner, rode out from Burao (40 m. distant) with an escort of 20 Indian troops and covered the retreat. The dervishes proceeded to occupy some of the chief grazing ground of the "friendlies" and the Mullah built strong forts at Jidballi and Shimber Berris—places in the S.E. part of the British protectorate, Jidballi being 220 m. S.E. of Berbera. In March 1914 dervish raiders reached the coast and fired into the town of Berbera. Archer, who in May 1914 became commissioner of the protectorate[1] in succession to H. A. Byatt, urged that duty should compel Britain to safeguard the tribes in the protectorate and further operations were authorized. Sheikh and Burao were reoccupied and on Nov. 23 Maj. (local Lt.-Col.) T. A. Cubitt defeated the dervishes at Shimber Berris. Cubitt having returned to Burao, the dervishes reoccupied Shimber Berris. Here they were again attacked by Cubitt on Feb. 3–4 1915, and after severe fighting, partly in caves, were driven out and all their forts destroyed. There was no means of following up the Mullah, nor any belief that his power had been crushed, though for over a year after the destruction of Shimber Berris he remained quiescent. His headquarters were at Tale, towards the Italian frontier, where, under the direction of Arab masons from the Yemen, his followers built elaborate stone fortifications of great strength.

Subsequently the Mullah again overran the centre and east of the protectorate, building more forts and making many raids on the "friendlies." This state of affairs lasted until 1920, when carefully planned and ably executed operations resulted in the complete destruction of the Mullah's forces. The Mullah had, in Sept. 1919, suddenly moved northward from Tale to Jidballi with most of his fighting men, establishing his own camp in the hills at Medishe, 12 m. N.W. of Jidballi. This move, occasioned by the hostility of the Mijertin Somalis, proved advantageous to the British plans. The main attack was made from the air, the force employed being one flight of DH9 aeroplanes under Group-Capt. R. Gordon. The ground troops were a King's African Rifles contingent (700 rifles), the Somaliland Camel Corps (700 rifles) and the 1st 101st Grenadiers, Indian Army (400 rifles). Lt.-Col. G. H. Summers was in command, the whole operations being, apart from the initial attacks by the air force, under the personal direction of Archer. Hostilities began on Jan. 21 with an aerial attack on the Mullah's camp at Medishe and ended on Feb. 12 with the flight of the Mullah, his eldest son, a brother and four or five followers. The rest of his followers were killed or captured, together with all his stock and property of every kind. The killed included 7 of the Mullah's sons; the captured, his 5 wives, 6 of his sons, 4 daughters and 2 sisters. The British casualties were very slight—3 natives killed and 8 wounded. The cost of these operations was about £84,000. Their success was primarily and mainly due to the Royal Air Force. The dervishes, good fighting men, were demoralized from the start by the attacks from the air and offered no serious opposition. They appeared not to know the character of aeroplanes; when the first attack was made on Medishe the Mullah is reported to have regarded the appearance of the machines in the air as a divine manifestation. It is known that on their approach he collected his people around him and awaited their coming under the white canopy used on state occasions. The first bomb killed an uncle of the Mullah's, who was standing by his side, and singed the Mullah's clothing.

When the British captured Tale (Feb. 9) the Mullah was already in flight, and he succeeded in eluding pursuit with the small following named. He crossed the Haudh to Galadi. News was received in the summer of 1921 that the Mullah had died at Imi in the heart of the Ogaden country the previous Feb., deserted and destitute. The Mullah's defeat was regarded in Somaliland as marking the deliverance of the country from 21 years of dervish oppression. Archer, to whose persistent advocacy this result was due, was created a K.C.M.G.

The World War and the high prices prevailing in 1918–20 had a marked influence on trade, the Somalis exporting large numbers of sheep and goats for the Aden Field Force and many thousands of camels for the Egyptian Expeditionary Force. Apart from this the most valuable export was skins and hides, the Somali skins being of very high quality. The great majority of the skins, especially the sheepskins, went eventually to the American market. The chief imports—American grey sheeting, dates, rice, sugar and tea—showed a heavy decline in quantity during the war, but an increase in value. Trade with Abyssinia continued, but the Zeila route could not compete beyond Harrar with the railway-borne traffic through Jibuti. In 1910–1 the total value of imports was £267,000 and of exports £247,000. In 1919–20 the figures were: imports £754,000, exports £346,000 (of which £134,000 was the value of hides). External trade was mainly in the hands of Indians and Arabs.

Revenue was mainly derived from customs and was inadequate to meet the cost of administration. The figures for 1910–1 were: revenue £30,000, expenditure £99,000; for 1919–20 revenue £81,000, expenditure £322,000. Deficits, incurred mainly for military purposes, were met by Imperial grants in aid. There was evidence to show that, with internal peace and a reasonable development of the resources of the country, the protectorate would become self-supporting. It was known to contain oil-fields, favourably reported upon by experts as long ago as 1914. A step towards opening the interior was taken in 1920 when a motor road was made from Berbera (the capital and chief port) to Lower Sheikh and from Upper Sheikh to Burao.

See R. E. Drake Brockman, *British Somaliland* (1917); H. F. Prevost Battersby, *Richard Corfield of Somaliland* (1914); A. H. E. Mosse, *My Somali Book* (1913); A. Hamilton, *Somaliland* (1911); and the annual Colonial Office reports on the protectorate. The account of the final overthrow of the Mullah is given in a supplement to the *London Gazette* of Nov. 1 1920.

FRENCH SOMALILAND.—Situated on the western shores of the Bab-el-Mandeb, French Somaliland is important as possessing the only French port on the Suez Canal route and as being the main artery of trade with Abyssinia. The pop. in 1917 was estimated at 206,000. Jibuti, the port and capital, had 13,608 inhabitants, of whom 294 were Europeans (107 French).

The resources of the country, which is largely arid, are limited. Date palms have been planted in the desert round Jibuti. Cotton-growing was tried in the same neighbourhood but was abandoned. On the higher ground there is rich grassland, on which the natives —Somali and Danakil—have herds of camels, goats and black-faced sheep. The Bahr 'Asal has been exploited since 1912 for its immense deposits of salt; in 1918 the export was 11,500 metric tons. There is also a considerable fishing industry, and mother-of-pearl figures among the exports.

Jibuti is regularly visited by French, British and Italian steamers and has a local service to Aden. In 1917 the steamers entered at

[1] In Oct. 1919 the title was changed to that of governor.

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Jibuti numbered 272, with a tonnage of 643,000. About 90% of its trade is the transit of goods to and from Abyssinia, the railway from Jibuti to Addis Abbaba being owned by a French company. In 1913, before the railway had reached Addis Abbaba, the value of the transit trade was £1,636,000. In 1918, with the railway completed, the imports destined for Abyssinia were valued at £1,433,000 and the exports from Abyssinia at £2,622,000. There is also a trade in supplying passing ships with coal, previously imported. Textiles, foodstuffs and coal are the chief imports; the exports are the characteristic produce of Abyssinia—coffee, live stock, hides and skins, ivory, rubber, beeswax, etc.

The colony is administered by a governor assisted by a council composed equally of official and non-official members. The budget for 1919 was balanced at 2,370,000 francs. Relations between the Somali and Danakil and the French proved satisfactory, the tribes being very lightly administered. A small military force was maintained for the security of Jibuti and the railway. The colony was on good relations with its Italian, British and Abyssinian neighbours, save for differences with the Abyssinian customs officials, whose valuation of dutiable goods passing inwards was often arbitrary. Some anxiety was caused in 1917–8 by the presence of Lij Yasu, the deposed Emperor of Abyssinia, in the Danakil country, and by his threats to the railway. His effort to raise the tribes against the French failed.

See the *Côte Française des Somalis* (annual reports by the French Colonial Ministry), and *L'Afrique Française* (monthly).

ITALIAN SOMALILAND.—The efforts of Italy in Somaliland during 1910–21 were concentrated upon the southern part of their protectorate. By a royal decree of July 1910 this southern region, Benadir and its hinterland, was constituted a Crown colony, administered by a civil governor resident at Mukdishu (*Ital.* Mogadiscio), and divided into four "commissariats." This region included the fertile valleys of the lower Juba and Webi Shebeli and the good grazing land on the plateau between those rivers. Dura was the main crop, but cotton and rice plantations were formed along the Juba and aid given to Italian colonization companies. The result was not great; the Somalis preferred a nomadic life, while the agricultural classes, negroes or semi-negroes, were few in number. This paucity of labour was the most serious problem confronting the administration.

By the occupation of strategic posts and the building of roads the Italians secured the safety of Benadir, and with this security a considerable trade developed with Abyssinia, chiefly via Lugh, on the Juba. But the absence of any harbours—all the ports are open roadsteads—proved a great drawback, and to remedy this difficulty Italy had obtained facilities at the harbour of Kismayu, in British East Africa (Kenya), some little distance south of the mouth of the Juba. That river formed the Anglo-Italian frontier. On Dec. 24 1915 an agreement was reached for the appointment of a permanent mixed commission to deal with customs, transit, conservancy, navigation, irrigation and other purposes in the Juba region. Italian desires in respect to the Juba were, however, of a wider character. It was believed that with complete control of the lower Juba—spoken of as a second Nile—the economic future of the colony would be assured, and in the treaty with the Allies which preceded her entry into the World War Italy secured *inter alia* a promise of the rectification of her Somaliland frontier. Formal negotiations to that end were entered upon in 1919, when Great Britain agreed to the cession of Kismayu and of a strip of land which would give Italy both banks of the Juba.

The northern part of Italian Somaliland remained under the rule of Somali chiefs, of whom the most important was the Sultan of the Mijertins, whose territory included the coast facing the Gulf of Aden. The Mijertins, who number approximately 100,000, possess large numbers of camels, sheep and cattle, and their country, as also Obbia and the Nogal territory, abounds in plants which furnish gum-arabic, myrrh, frankincense, etc. The Mijertins were near neighbours of Mahommed bin Abdullah, the "Mad Mullah," who between 1905 and 1909 was settled in the lower Nogal region. The hostility of the Mijertins finally drove out the Mullah, who established himself at Tale, in the southeast corner of British Somaliland. The continued and unwelcome attentions of the Mijertins induced the Mullah in 1919 to remove farther into the British protectorate, while in 1920 the Mijertin Sultan, Osman Mahmoud, assembled his warriors to prevent the Mullah's reëntry into Italian territory.

Italian relations with Abyssinia were satisfactory. Following the Italo-Abyssinian convention of 1908 the frontier was delimitated in 1911, tribal boundaries rather than physical features determining the line chosen. In the north, where the frontier reaches the southern limits of British Somaliland, the Italo-Abyssinian frontier was fixed at 48° E., instead of 47° E., as provided in the 1908 agreement. This gave to Abyssinia the small portion of Ogaden tribal lands which had been in the Italian protectorate, including Galadi.

The external trade, valued at £174,000 in 1908–9, had risen to £326,000 in 1912–3, and was £800,000 in 1918. Throughout this period imports greatly exceeded exports, the exports in 1918 for example being valued at £243,000 only. Imports are chiefly cotton goods from Italy and food-stuffs. Skins form, in value, 75% of the exports. The expenses of administration exceed revenue; the Italian grant in aid (£119,000 in 1910–1) was £186,000 in 1920–1, when the budget was balanced at £440,000. Of the expenditure one-fifth was for the military force, some 3,000 strong, sent from Eritrea, the men being Abyssinians.

A 1920 estimate put the total pop. as high as 650,000. Mukdishu had 14,000 inhabitants. Besides a few hundred Europeans there are at the coast towns settlements of Arab and Indian traders. Mukdishu was, in 1915, connected with Massawa by a high-power wireless station. Surveys for railways had been made, but no construction had begun up to 1921. There were in that year some 1,500 m. of road in southern Somaliland.

See G. de Martino (sometime governor of the colony), *La Somalia Nostra* (1913), and *Italian Somaliland*, a British Foreign Office handbook, with bibliography (1920). (F. R. C.)

SOMERSET, ISABELLA CAROLINE [LADY HENRY SOMERSET] (1851–1921), English philanthropist, was born in London Aug. 3 1851, the eldest daughter and co-heiress of the 3rd and last Earl Somers. She married in 1873 Lord Henry Somerset, son of the 8th Duke of Beaufort, at one time comptroller of Queen Victoria's household, from whom she later separated. She became well known as a temperance reformer and interested herself deeply in the reclamation of inebriate women, with this end in view founding the Duxhurst Farm Colony, near Reigate, the first settlement of the kind in England. In connexion with it she established a home for destitute children and a "children's village" for saving infant life. Lady Henry Somerset was for many years president of the National British Women's Temperance Association, and made a reputation as an able speaker. In 1894 she founded the *Woman's Signal* in the interests of women's work, becoming its editor, and she was also the author of various children's books and many pamphlets and articles on social work. She died in London March 12 1921.

SOMME, BATTLES OF THE.—Under this heading it is proposed to deal with the principal battles which took place in Picardy and southern Artois during the World War. The geographical limits in which these battles took place may be roughly defined as the Scarpe on the N., the Oise on the S., the line Cambrai–La Fère on the E., and the line Amiens–Creil on the W.

The strategic geography of this region is governed by the course of the Somme between St. Quentin and Amiens; in the upper part of this course it runs S.–N., in the lower E.–W., and in that general course it continues to the sea. Thus from Péronne, the point at which the river bends through the right angle, to Abbeville, a water barrier divides opposed armies that face N.–S., and separates each into well-defined tactical theatres if they are operating towards the E. and the W. The upper (or strictly the middle) Somme (Péronne–Ham) prolonged to the Oise by the Crozat Canal, on the other hand separates the E.–W. adversaries and either protects or hampers those operating in N.–S. direction. Thus the operations which took place in the region, profoundly influenced by the alignment of the Somme and its tributaries, are in spite of their dissimilarity, properly designated "battles of the Somme."

In the first phase of the war, this region was traversed by the German I. Army, and a number of local combats took place between it and the forces that Joffre gathered, little by little, to form his VI. Army and outflank the Germans in their wheel.

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More severe and continuous fighting took place between the Oise and the Scarpe during the development of the opposed northern wings in the "Race to the Sea."

Of this the battles of Lassigny, Roye, and Albert, which led up to and even into, the battle of Arras (*see* ARTOIS, BATTLES IN) formed the first phase.

In each locality or area the effort of each side to hold the other frontally, while outflanking him to the N., produced an ever-extending frontal battle that, after see-sawing to and fro, produced the line of stabilization characteristic of the trench warfare period.

In 1915 the line of stabilization between the Oise and the Scarpe was relatively quiet. And apart from a combat in Jan. 1916, in which the French lost possession of Frise, the line, as it was left at the close of the "Race to the Sea" in 1914, was the starting line of the great offensive of July 1 1916.

I. BATTLES OF JULY–NOVEMBER 1916

The four months and a half of almost continuous fighting which began with the great attack of July 1 1916 mark a turning-point in the World War in more than one respect. With July 1 1916 began that period of sustained and systematic Allied pressure upon the enemy which, though interrupted in the spring and early summer of 1918 by the desperate German counter-offensive, in the end wore his resistance down. Before July 1916 the Allied offensives had been relatively brief interludes in a long period of stalemate; from that date onwards it was the periods when active operations were in abeyance which formed the interludes. Further it is clear even from the grudging admissions of the German commanders that this great struggle materially affected the strategical situation as no earlier Allied offensive had, that the strain which the maintenance of their defence imposed on the resources and the *moral* of the German armies exercised an important influence on the course of the struggle. The actual gains of ground made by the Allies between July 1–Nov. 19 1916 were not large, but in making them they established a moral ascendancy over their enemy and brought home to the Germans the probability of defeat. And in this struggle the British army had for the first time to bear the major part: the French who fought on Sir Douglas Haig's right with so much gallantry and efficiency played a part of the greatest importance in the battle, but one as distinctly subordinate to the efforts of the British as the British attacks in May and Sept. 1915 had been to those of the French.

To speak, as is the common habit, of "the battle of the Somme" in 1916 is to fall into a natural but serious error. The operations were a series of great battles, each surpassing all those of previous wars in magnitude and intensity, parts of a common whole but still definite and separate operations for distinct purposes. It is possible to distinguish four main phases in the operations: first the winning of a position on the southern edge of the main plateau between the Somme and the Ancre, a matter of three weeks' hard fighting, embracing two attacks on a large scale and many lesser intermediate operations; in the second phase, which lasted till the middle of Sept., nearly two months, the operation took the shape of a contest for this main ridge and for the extension of the footing which the Allies had gained upon it so as to enable them to develop their offensive on both flanks as well as straight to their front; in the third phase the Allies pushed forward across the ridge and down its farther side, only to have their progress arrested by the persistent bad weather which set in about the beginning of Oct. and prevented anything like a general attack upon the rearward system of defences which covered Bapaume and Péronne; the fourth phase of the operations, extending from the beginning of Oct. till Nov. 18, saw a series of smaller efforts against particular points and strongholds, culminating in a bigger attack on Nov. 13 astride the Ancre which completed the reduction of the main ridge and captured ground of vital importance on the right bank of the Ancre. But the main rearward system was not penetrated, thanks largely to the mud which hampered every movement of the attackers and made the performance of the normal administrative services for the troops in the advanced position a task of the greatest difficulty. The devastating effects of the repeated bombardments made themselves felt over the whole area: houses and whole villages were reduced to ruins; woods were represented by a few shattered stumps and a tangle of broken trunks and branches; roads were rendered impassable till the battlefield became a dreary wilderness of mud and water-logged shell craters. To maintain trenches in defensible condition was all but impossible, to consolidate a captured position, difficult even in dry weather, became practically out of the question. The middle of Nov., therefore, saw active operations broken off and two months elapsed before anything more than quite minor operations became possible. The operations during the two months which preceded the German withdrawal to the Hindenburg line, including as they did a systematic advance up both banks of the Ancre on Bapaume, were essentially the continuation and completion of those of the last phase of the operations of the autumn, and it would be not unreasonable to treat them as yet another stage of "the Somme." They had brought the British practically within striking distance of the last line which covered Bapaume and Péronne when in the middle of March the German retreat anticipated its enforced evacuation.

First Phase.—The German positions astride the Somme and Ancre attacked on July 1 1916 were strong by nature and had been made doubly formidable by every device known to the military engineer. Their line represented the positions taken up in Oct. 1914 by the German VI. Army in the course of that "Race to the Sea" which culminated in the desperate fighting of Oct. and Nov. 1914 for Ypres and the Yser. The line then established had remained substantially unchanged, for neither side had since then attempted any operations of importance in this quarter where the British III. Army had relieved the French in front of Albert in July 1915. Hence the Germans had had ample time to develop their defences to the highest degree; villages and woods had become fortresses; two elaborate trench systems, each comprising several lines, had been dug, the second from two to three miles in rear of the first, "switches"—communication trenches—connected them up and greatly complicated the task of the attacker who should happen to penetrate any part of the front. Deep dug-outs, to the construction of which the chalk country lent itself admirably, gave shelter to the trench garrisons during bombardments; deep belts of barbed wire protected the different trenches, and most careful and skilful arrangements had been made for enfilade and supporting fire from numerous machine-guns; positions of special tactical value had been secured by formidable redoubts, while a well-placed and ample artillery was ready to support the defenders. Moreover, the advantage of the ground lay with the Germans, whose facilities for observation were excellent.

The frontage selected for the attack extended from just N. of Lihons on the extreme right to the Somme at Curlu, a distance of about nine miles, crossed the Somme and ran as before from N. and S. to Maricourt, another 3,000 yards. Here the French front ended, and the line turned sharply and ran W. for 7,000 yards. Here it turned N. again, making a sharp salient at the village of Fricourt. Thence to the Ancre, approximately 10,000 yards, the line ran over several spurs which jut S.W. from the ridge which formed the backbone of the German position. This ridge runs roughly N.W. from Péronne, dividing the valley of the Somme from the basins of the Scarpe and Scheldt. After crossing the Ancre the German line continued in a generally N. direction in front of Beaumont-Hamel and Serre, this last village forming the N. end of the front to be attacked, though a couple of miles farther N. a subsidiary attack was to be made against the pronounced salient at Gommecourt. The total frontage was over 25 miles, exclusive of the Gommecourt operations.

Against this frontage the British had available the five army corps of Sir Henry Rawlinson's IV. Army, which put into the front line eleven divisions keeping another nine in reserve, while two divisions of the III. Army (Sir E. Allenby) were to be employed against Gommecourt. On the German side some six divisions were holding the line to be attacked by the British.

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Opposite the French, where they do not appear to have been expecting an attack, they were proportionately weaker, having three divisions in the line on a front of eleven miles.

Relatively to the numbers engaged in the Loos offensive, the British army was not employing in its first attack any greatly increased force of infantry. Where its preparations had altogether outstripped those of Sept. 1915 was in artillery, and it was on this arm that its chief hopes rested. For the six days' preliminary bombardment the heavy guns available were so numerous that it was difficult to find good positions for them all. Indeed the artillery personnel engaged in the first attack came to nearly half that of the infantry, and in weight as well as in number of guns the Allied artillery were able to establish a predominance over the enemy. This was largely due to the success with which the Royal Flying Corps was at the time contending against the enemy's aircraft; the mastery of the air which it had established ensured to the Allies—when weather conditions permitted—observation of artillery fire and denied to the enemy this important advantage and the opportunity of gaining information of movements behind the lines. Ammunition, too, if not as unlimited as it was to be in 1918, was plentiful. The careful economy which had been a painful necessity during the winter and spring had allowed the accumulation of large reserves, and although the great development of munition-making in England, undertaken in the summer of 1915, was only just beginning to produce its effects, its influence was already apparent in the effective bombardment to which the German positions were subjected for the week preceding the attack.

In one way the bombardment was almost too effective. The destruction was in some places so complete that it proved far more difficult to consolidate captured positions and to hold them against counter-attacks than to carry them. But to a large extent the German defences proved capable of withstanding even the tremendous shelling to which they had been subjected. Many nests of machine-guns had escaped intact, in places there were still stretches of uncut wire and the German artillery were able to make a most effective reply. North of the Ancre in particular German counter-battery work had much to do with the failure of the 31st Div. (VIII. Corps), the left of the main attack, to capture Serre. On its right the 4th Div. penetrated some way into the German position N. of Beaumont-Hamel, but found its flanks exposed by the check to the 31st Div. and by the failure of the 29th Div. against Beaumont-Hamel itself, one of the very strongest parts of the German line. It was counter-attacked and driven out after a stubborn resistance.

Immediately S. of the Ancre the X. Corps fared little better than the VIII. Its left division, the 36th (Ulster) began well and pressed forward N. of Thiépval. But Thiépval itself, another formidable fortress, defied the attacks of the 49th and 32nd Divs., with the result that the very success of the 36th contributed to its undoing. Its advanced detachments were cut off and overwhelmed, and in the end it was forced to evacuate its captures. South of Thiépval, however, at the angle known as the Leipzig Salient a slender foothold was gained and maintained despite the vigour of the German counter-attacks. On the right of the X. Corps, the 8th and 34th Divs. of the III. Corps had two very difficult places to attack in the strongly fortified villages of Ovillers and La Boisselle. Neither of these was captured, but the III. Corps managed to penetrate the German lines on either side of them, very slightly N. of Ovillers, rather more deeply between that and La Boisselle, and very much deeper S. of La Boisselle. Here also the 21st Div. of the XV. Corps, flanked on its right by a brigade of the 17th Div., made substantial progress N. of Fricourt, which village was in danger of being cut off, as E. of it the 7th Div., also of the XV. Corps, was most successful, storming the German front lines and penetrating as far as the village of Mametz. To the right again the XIII. Corps (18th and 30th Divs.) made great progress, reaching all its objectives from Montauban, W. to Mametz and E. to the Briqueterie. Thus, despite the failure of the British left and the limited success of the centre, the right had made a promising opening.

The reverse on the left may be in part explained by the exceptional strength of the German defences N. of the Ancre, and by the concentration of the German artillery in that quarter where they both expected and especially feared an attack. Had Beaumont-Hamel and Thiépval gone the German position on the main ridge would have been more seriously endangered than it was by the British success between Fricourt and Montauban. But if the Germans were less well prepared for an attack on this frontage, opposite the French they were certainly neither expecting one nor ready for it; and this, together with the ample artillery support available and the superior experience of the French gunners, contributed to the complete success of General Foch's attack. On both banks of the Somme his infantry mastered the German front system and made their way deep into their positions, reaching the outskirts of Hardecourt and Curlu N. of the river, while S. of it they progressed even farther, taking Dompierre and Foy. Exploiting their victory, the French pressed on, and by July 4 not only penetrated into the second system of German defences, but captured it over a length of six miles from Estrèes N. to the Somme at Buscourt. Some 6,000 prisoners fell into their hands, with many guns, and as S. of the river they were well forward of the line reached on the right bank they were able to enfilade the German positions from across the river.

While General Foch's troops were exploiting and increasing their gains the British IV. Army was similarly employed, though on a frontage shorter than that originally attacked. Recognizing the futility of renewing the attempt on the formidable positions astride the Ancre, Sir Douglas Haig decided to concentrate his efforts on pushing home the success of his right. Divisions which had lost particularly heavily, like the 8th and 36th, were withdrawn and replaced by others from the reserves. Four days of hard and continuous fighting substantially extended the lodgment gained on July 1. The 7th and 17th Divs. joined hands behind Fricourt, cutting off that village; then, supported by the 23rd, they pressed forward against Contalmaison while the 19th Div. on their left reduced La Boisselle and made headway towards Ovillers. Advancing from Montauban after repulsing several strong counter-attacks the XIII. Corps captured Caterpillar and Bernafay Woods. With this the hostile front system over a front of six miles was secured and consolidated, but before a footing could be gained on the main ridge it was necessary to cross the valley which runs N.E. from Fricourt, to gain more ground towards Contalmaison, and to reduce Ovillers.

On July 7 therefore a second stage of the first battle started, the 12th and 25th Divs. assailing Ovillers while the troops who had cleared Fricourt and La Boisselle pushed on against Contalmaison and the 38th (Welsh) Div. attacked Mametz Wood. This last proved difficult to reduce but was finally cleared by the 21st Division. By July 13 Contalmaison also had been taken, and after some desperate fighting by the 9th, 18th, and 30th Divs. important gains had been made on the British right, Trones Wood (which changed hands repeatedly) being the scene of the fiercest contests. Meanwhile the French had cleared Hardecourt and advanced their line S. of the Somme to Biaches.

During all this fighting the German resistance had been stiffening. The stubborn fights which had been put up for Ovillers and Contalmaison and Trones Wood had given time for the arrival of strong reinforcements and the reorganization of the defence. The divisions on whom had fallen the brunt of the bombardment and of the first attack had been relieved by fresher troops; artillery had been shifted to meet the requirements of the new situation. Moreover, as the Allies advanced over the area devastated by the bombardment their administrative difficulties increased at each step; the advance of the guns to new positions meant new arrangements for ammunition supply, roads had to be repaired or improvised, and the feeding and watering of the advanced troops were laborious and troublesome. All these circumstances added to the difficulties of the next step, the assault upon the enemy's second system of defences on the S. crest of the main ridge. This system, though hardly as strong as that stormed on July 1, was formidable enough, and, like it, was supported by the fortified villages Longueval, Bazentin le Grand, and Bazentin le Petit and by several woods. To get within assaulting distance

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the troops had to advance under cover of darkness for about 1,000 to 1,400 yards in order to line up below the crest. This operation was a severe test for the troops; most of them had no experience of anything but trench warfare, but they acquitted themselves most creditably and the attack, launched just before dawn on July 14, met with great success. The 18th Div. finally cleared Trones Wood. Longueval and the two Bazentins were carried, the former by the 9th Div., the others by the 3rd and 7th Divs., while farther W. the 21st Div. cleared Bazentin le Petit Wood, and more ground was gained on that flank by the 1st and 34th Divs., though here the success was less complete.

For a time indeed even more substantial, almost decisive, results seemed within reach, for, after some counter-attacks on the British centre had been repulsed, it proved possible to push the 7th Div. forward to the top of the ridge to occupy High Wood. But the divisions on the flanks could not get up level with this, and though all the next day the detachment in High Wood held its ground, the position was untenable and had to be evacuated on the evening of July 15. The Germans, indeed, realizing the critical nature of the situation, spared no efforts to stop the further progress of the British and developed a series of counter-attacks against which the captured positions were only maintained with the greatest difficulty. Thus, though the attack had given the British the Bazentin Ridge on a front of 6,000 yards, and had incidentally led to the complete isolation and surrender (July 17) of Ovillers, which allowed a substantial advance to be made toward Pozières, it was followed by a phase of the battle in which the Allied progress was disappointingly small and seemingly out of all proportion to the efforts made and to the casualties incurred.

Second Phase.—The battles of July 1–12 and July 14–17 had left the Allies in a tactical situation not altogether advantageous. The check to the British left centre had left the Germans in possession of Thiépval which with Pozières about two miles S.E. of it presented serious obstacles to any progress towards the Ancre and threatened to enfilade any further advance straight to the front. Pozières must be mastered before the British centre could get forward. Even more important was it to improve the position round Longueval, where the advance of July 14 had created a sharp salient with its apex at Delville Wood, N.E. of the village. From this point the British line ran almost due S. to join the French at Maltzhorn Farm S.E. of Trones Wood, being continued thence S.W. of Maurepas to the Somme at Ham. It was imperative that the British right and the French troops N. of the Somme should make a substantial advance in order to reduce the sharpness of the salient at Delville Wood, a point which was extremely difficult to maintain, being subjected to a concentric artillery fire from the N. and E. as well as repeatedly counter-attacked. The wood had been captured on July 15 by the S. African Brigade of the 9th Div., but had been promptly counter-attacked by the 10th Bavarian Div. and then by the 7th and 8th Divs., picked troops all of them, and its possession continued in dispute for weeks. Longueval in like manner changed hands several times, the 2nd, 3rd, 5th and 18th Divs. in addition to the 9th being at one time and another engaged in the struggle for these key positions, the scenes of fighting as desperate as any in the long struggle of "the Somme."

And when at last Delville Wood had been cleared the task of debouching from its ruins presented great difficulties. In Ginchy and Guillemont, E. and S.E. of it, the enemy had positions of great strength, the fortifications of which formed a formidable support to their second system of trenches which ran S.E. by Maurepas towards the Somme. Maurepas proved a similar stumbling-block to the French; they reached it on July 30, but not till Aug. 24 was it completely in their hands, and they had to pay heavily for it. And behind Maurepas lay Le Forest with Rancourt and Frégicourt yet farther back.

The last week of July and all Aug. passed without any advance like that of July 14. The Germans fought stubbornly and counter-attacked persistently and resolutely, while, as over addition to the use of the bomb had sadly reduced the standard of musketry of the British infantry, their counter-attacks escaped the punishment they would have received in 1914. It was a time of constant and desperate fighting, of small advances, of many repulses and disappointments. Guillemont in particular was attacked on July 23 and July 30, on August 8 and August 16, but without more success than the capture and retention of the railway station on the outskirts of the village. But despite all these checks the line crept forward: to a considerable extent on the French front where, during Aug., it got within assaulting distance of Combles, Le Forest and Clery, and nearly 3,000 prisoners were taken; to a smaller extent on the British right; to a rather larger extent in the British centre, where the 33rd Div. won a foothold in High Wood and the 5th and 7th gained ground between that point and Longueval, while W. of High Wood a series of minor operations gradually advanced the British line up the crest. Farther to the left again, there was hard fighting by the troops of the Reserve or V. Army. This had been formed after July 1 by putting Sir Hubert Gough in command of the left wing of the IV. Army, in order to allow Sir Henry Rawlinson to concentrate his attention on the attack to the E. of the Albert–Bapaume road. The capture of Pozières was urgent as an indispensable preliminary to any advance over the watershed, and when this was accomplished (July 25) by the 1st Australian Div., flanked by the 48th, an important gain had been secured. But the German resistance in this quarter was very determined, and though some progress was made towards Thiépval from the Leipzig salient on the S. and from Pozières, Mouquet Farm E. of Thiépval proved a stumbling-block. Bad weather, too, with much rain and frequent cloud which impeded aerial observation of artillery fire, hampered the attackers, and the Germans, now thoroughly alive to the importance of holding up this advance, brought up fresh divisions with great rapidity. By the end of August five times as many German divisions as had been in the line on July 1 had been located on the British front. However, by Ludendorff's own admission, the strain on the Germans was tremendous; the need for constantly relieving exhausted divisions taxed their resources in men, artillery was so short that batteries were constantly kept in the line when their relief was due, the ammunition supply was beginning to cause anxiety, and worst of all, the resistance of the German infantry was weakening under the pressure of the Allied infantry attacks and of the Allied superiority in artillery and aircraft. The supersession of General von Falkenhayn as chief of the general staff by Field-Marshall von Hindenburg, with Ludendorff as his chief assistant ("First Quartermaster-General"), which took place on Aug. 27, may be in part attributed to the effects of the Somme, and was promptly followed by "the momentous order for the cessation of the offensive at Verdun." Pressed as they were on the Somme the Germans could no longer continue attacking elsewhere. If the immediate Allied gains on the Somme seemed small their offensive there had already relieved Verdun.

With September the second phase of the struggle was reaching its final stage. This took the shape of a general attack, extending almost as far as that on July 1, even N. of the Ancre, where the V. Army once again assaulted Beaumont-Hamel. Most success fell to the French, who not only attacked and took Le Forest and Clery but attempted more S. of the Somme than on any occasion since the middle of July. Besides pressing on against the Berny–Vermandovillers line which they had then reached they extended their attack as far S. as Chaulnes, storming the old German front line on a front of three miles. Their success here, which brought over 7,000 prisoners with many guns, did not as immediately affect the fortunes of the main struggle as did the capture of Le Forest and Clery, which was a considerable help to the British right as well as threatening Combles and the Péronne–Bapaume line, where the Germans were already busy on a rearward system of defences; still, it increased the area on which the Germans had to keep on the alert, and it was a great encouragement to the French, so lately strained to the utmost to retain Verdun, to be recovering more territory from the German grip.

To the British, Sept. 3 was a day of more qualified success. Once again the Beaumont-Hamel position proved impregnable, the efforts of the 49th Div. against Thiépval met with no success,

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and though in the British centre between High Wood and Delville Wood ground was gained, German counter-attacks recovered most of it. But the right fared better. The 20th (Light) Div., assisted by a brigade of the 16th (Irish) Div., at last mastered Guillemont, the obstacle which had held up so many attacks and cost so many casualties. The 7th Div. reached Ginchy, but after desperate fighting was thrust out of it again, while on the extreme right three days of hard fighting gave the 5th Div. Falfemont Farm and brought it to Leuze Wood. Here, therefore, the original German second system, which had so long held back the British right, was at last pierced and when on Sept. 9 this success was followed up by the capture and retention of Ginchy by the 16th Div. and the advance of the 56th (London) Div. up to Bouleaux Wood, the great stumbling-block to the advance of the British centre was at last so far removed that it could now push forward without putting itself at a grave disadvantage from enfilade and reverse fire. Thus the battles for Guillemont and Ginchy (Sept. 3 and 9) mark a very definite stage in the Allied progress. The forward crest of the main ridge was in their hands over a front of five miles and more. It was now possible to plan a general advance against the villages on the northern slopes of the watershed. Such an attack, if successful, would bring the British up against the rearmost of the enemy's original systems of defence, and would make the position of the Germans on their old front line S. of the Ancre and immediately N. of it a pronounced salient.

Third Phase.—The next attack, therefore, opened a new phase in the offensive. Special preparations were made for it, and a week's pause after the taking of Ginchy allowed of many reliefs. Thus the ten divisions of the IV. Army employed in the attack of Sept. 15 included several which had not yet taken part in the operations, among them the Guards, the 6th, one of the original units of the 1914 "B.E.F." and the New Zealand. Similarly in the V. Army the Canadian Corps had replaced the Australians, who had since their capture of Pozières made considerable gains N. of the Albert–Bapaume road. In addition to these fresh troops it had been decided to employ in this attack a new weapon from which much was expected. Despite the great increase in the available artillery and ammunition and the great improvements in the methods for directing, controlling and observing artillery fire, barbed wire and machine-guns were still the chief assets of the defence and had held up attack after attack. The evolution of the "tank" had been a long process. The idea of an armoured motor-car capable of defying both machine-guns and barbed wire had occurred to many people from the earliest days of the deadlock set up by the extension of the trench line from Switzerland to the North Sea. To translate this idea into practical shape, to produce a machine capable of accomplishing what was wanted, had been the work of months of ingenuity, experiment, devotion and skill. Not the least remarkable feature had been the success with which secrecy had been maintained. The tanks at their first venture hardly fulfilled their designers' hopes and expectations—it would have been extraordinary if they had—but they did quite well enough to encourage the Allies and to shake the *moral* of the German infantry, to whom they came as an effective surprise.

The frontage included in the British attack stretched from just S. of Courcelette to just W. of Combles. That strongly fortified position itself was not to be attacked, as the capture of the high ground on either side of the valley would determine its fate, and S.E. of the valley the French, who had already on Sept. 12–13 attacked and taken Bouchavesnes with 2,000 prisoners, were ready to coöperate.

The attack proved a great if not a complete success. On the left the Canadians not only captured their objectives S. of Courcelette but exploited their success so well that the village itself, not part of the original objective, was carried and consolidated. To their right the 15th (Scottish) Div. captured Martinpuich, High Wood was at last completely cleared by the 47th Div. and farther to the right again the New Zealand and 41st Div., with some assistance from tanks, captured Flers and pushed some way beyond it. On the right the success was less pronounced. A strong work between Ginchy and Morval known as the Quadrilateral held up the 6th Division. The tanks detailed to attack this point broke down and the gallant efforts of the infantry were unavailing. This check prevented the Guards Div. reaching their final objective, Lesboeufs, though they stormed their first and second objectives on the ridge S.W. of that village and maintained their position against counter-attacks. But with Lesboeufs and Morval, the objective of the 6th Div., still in German hands, the centre of the attack could not push forward without creating the same sort of situation as had prevailed on the right after the attack of July 14, and any further exploitation of the success was out of the question. Still, a big success had been achieved, a strong position had been broken into on a six-mile front, 4,000 prisoners had been taken, and the troops had the encouragement of having crossed the ridge and being able to see what lay on the farther side of the crest it had cost so much to gain.

The days that followed had to be occupied in reducing the Quadrilateral and in straightening out the line between Martinpuich and Flers. The 6th Div., not to be denied, pressed hard upon the Quadrilateral and after another unsuccessful attempt captured it on Sept. 18. But it is significant of the intensity and costliness of this fighting that the Quadrilateral had cost the 6th Division over 3,500 casualties. Its capture, however, allowed the line to be pushed forward within 1,000 yards of Morval and Lesboeufs, against which a new attack was in preparation.

Bad weather, however, delayed the delivery of this attack until Sept. 25. On this day the frontage attacked started at the Albert–Bapaume road but reached as far as the Somme. The French had, since capturing Bouchavesnes, improved their position S. of the Somme considerably by completing the reduction of Vermandovillers, Berny and Deniécourt, and they had on Sept. 20 successfully repulsed a strongly pressed counter-attack, N. of the Somme. Their objectives on this occasion included Rancourt and Frégicourt, Combles being dealt with indirectly by the capture of the heights on either side of it.

The "battle of Morval"—the official title for the attack of Sept. 25—was one of the most successful of the separate incidents of the Somme offensive. Except in the British centre at Guedecourt all the objectives were reached and carried before nightfall. On the left the 50th, 1st, New Zealand and 55th Divs. carried the line forward down the slopes N. of Flers and Martinpuich clearing two lines of trenches; on the right the Guards and 6th Divs. carried Lesboeufs and the 5th Div. took Morval, while Guedecourt also was captured next day (Sept. 26) by the 21st Div. assisted by a tank. The French were equally successful, and early on Sept. 26 British and French met in Combles, which was found full of stores and of German dead and wounded, the garrison having withdrawn just in time. Over 1,500 prisoners were captured by the British and nearly as many by the French, while signs were not wanting that the Germans were no longer putting up the stout resistance they had offered in the long struggles round Delville Wood and Guillemont. At several points large numbers of Germans surrendered or evacuated their positions almost without fighting. The strain of the continual bombardments and of the steady advance of the Allies was beginning to make itself felt.

The substantial success of Sept. 25 on the Allied right and centre was promptly followed up by victory in another quarter. Since July 1 there had been only one serious effort to renew the direct attack on the British left and the attempt of Sept. 3 had been a failure. Thiépval and all N. of it remained untaken. What progress had been made in this quarter had been from the S. and E. and it had not been rapid. The first real gain had not been made till the last half of Aug. when the scanty foothold already secured in the Leipzig salient directly S. of Thiépval had been enlarged by the 48th Div. This had been followed up by the capture (Aug. 24) by the 25th Div. of a trench known as the "Hindenburg trench." A violent counter-attack by a Prussian Guard Div. was successfully beaten off and minor gains had followed. Finally, on Sept. 14, a formidable redoubt known as the "Wonderwork," and situated just S. of Thiépval, was

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stormed by the 11th Division. Meanwhile the progress of the Australians beyond and W. of Pozières had greatly increased the prospects of success in attacking Thiépval.

From Thiépval a trench ran E. towards Courcelette known as the Zollern trench, halfway along which and N. of Mouquet Farm was the Zollern redoubt. North of Thiépval was the strongly fortified Schwaben redoubt from which the Stuff trench ran E. to the Stuff redoubt S. of Grandcourt, being continued beyond the Stuff redoubt as Regina trench. The capture of this second line would allow the British to overlook the Ancre valley and would make the position of the Germans N. of the Ancre most precarious. It was natural, therefore, that the Germans should cling with great pertinacity to the Thiépval position, but despite a stubborn resistance the V. Army's attack (Sept. 26) achieved a conspicuous success. The Canadian Corps on the right carried their objectives and brought their line within striking distance of Regina trench. The 11th Div. stormed the Zollern redoubt, the 18th on the left had the satisfaction of capturing Thiépval itself with over 1,000 prisoners from a Württemberg regiment, which had held that stronghold for nearly two years and believed it impregnable. These successes were promptly exploited and the capture of the Stuff redoubt by the 11th Div. and of part of the Schwaben redoubt by the 18th (Sept. 27–28) left the Germans with only a scanty foothold on the main ridge.

Simultaneously with the success at Thiépval, lesser but useful gains had been made by the IV. Army, including the capture of Destremont Farm, S. of Le Sars (Sept. 29). This was followed up by the taking after a stubborn fight of Eaucourt l'Abbaye (Oct. 3), though a gallant effort by the Canadians against Regina trench (Oct. 1) proved unsuccessful.

Fourth Phase.—It was at this moment, when the enemy's fourth system of defences had been reached and the Allies seemed about to accomplish a break-through (for the new lines on which he was at work still farther to the rear were not to be compared in strength or completeness with those already overcome), that a long spell of bad weather set in. Nothing could have been more unlucky for the Allies. As has been said, the German infantry were no longer fighting with their old resolution, their counter-attacks were not pressed with the old devotion and determination. But the constant rain and the cloudy days, which formed almost the only intervals in the rain, prevented adequate observation of artillery fire and turned the already damaged battle area into an impassable quagmire. The troops already engaged in the Somme offensive had had ample experience of hardships and difficulties; those encountered in Oct. and Nov. altogether surpassed what had gone before. The state of the ground was appalling: it had become a sea of mud, through which even lightly equipped runners found movement almost impossible, much more men laden with rifle, equipment and ammunition. In these conditions ordinary trench relief was an achievement, to attack across such ground a hopeless undertaking. It is easy now to argue that the attempt to continue the attack in such adverse circumstances was a mistake, and could achieve nothing commensurate with the casualties and sufferings which it entailed. But it must not be forgotten that to suspend the offensive meant relaxing the pressure on the Germans, on whom the strain of fighting under these conditions was scarcely less severe and meant also giving them time to convert their incomplete new lines into defences scarcely less formidable than those the Allies had so painfully slowly pierced. At the beginning of Oct. the Germans had been pressed back to their last really strong positions, and behind the line that ran from Sailly–Saillisel past Le Transloy and in front of Bapaume they had not had time to develop anything elaborate or formidable. The anxiety of the higher command to pierce the Le Transloy line without delay was natural enough.

The situation after the capture of Thiépval was that on the British left the Germans retained a precarious footing on the heights above St. Pierre Divion and Grandcourt, but that any substantial advance by the British centre, now almost down into the Ancre valley N. of Martinpuich and Guedecourt, would turn the German positions lower down the Ancre. As before, however, the centre could not push on far with safety unless the right came forward level with it, and it was in front of the right that the German positions were most formidable. Their Sailly–Saillisel-Le Transloy line, itself strong, was covered by a long spur running in a N.W. direction and separating Lesboeufs and Guedecourt from Le Transloy and Beaulencourt. To capture this spur was indispensable before the Le Transloy line could be attacked. But a successful attack on the Le Transloy line was needed to open to the Allies the opportunity for an advance on a wide front in a N. and N.E. direction. Such a stroke would not merely outflank the Beaumont-Hamel position but the whole German position from Arras to the Ancre would be taken in rear. A dry Oct. might well have seen this hope realized and in Oct. 1916 there was no "Hindenburg Line" to bring an Allied advance to a standstill.

But with the weather as it was Oct. was a month of disappointment and scanty progress. The fighting was constant and costly. Trenches were difficult to take but much more difficult to consolidate or defend. The operations may be divided into three groups; on the right the French attacked and took Sailly-Saillisel but could make little progress N. and E. of it. In this quarter the repeated British efforts against the spur in front of Le Transloy resulted in the establishment of their line on its crest of the spur. In the centre, after the capture of Eaucourt L'Abbaye (Oct. 3) the chief gain was that the 23rd Div. secured Le Sars on Oct. 7. But to the N.E. of Le Sars the Allied progress was arrested by the gentle rise on which stands the mound known as the Butte de Warlencourt. This position was not particularly formidable in itself and in dry weather would not have held up the advance for long, but between the difficulty of accurately observing the fire of the supporting artillery and that of moving up the muddy slope on which the Butte stood attack after attack failed. The 47th Div. on Oct. 7, the 9th and 13th on Oct. 12, the 50th on Oct. 25 all found the Butte impregnable, though between Oct. 18 and 20 the 9th Div. did secure an advanced position in Snag trench, halfway up the slope, after a savage struggle.

The failure to take the Butte de Warlencourt or to make any substantial progress farther to the E. was to some degree compensated for on the left. Despite more than one repulse the line of Regina trench from the Courcelette–Pys road W. was stormed on Oct. 21 by the 15th, 18th, 39th and 4th Canadian Divs., and on Nov. 10 the Canadians extended their success by capturing the E. part of the trench on a front of half a mile.

By this time a sufficient improvement had taken place in the weather to allow of an operation on a larger scale than anything attempted since the battles of Morval and Thiépval. The more ambitious schemes for an advance across the Upper Ancre could not be put into force, but the German hold on the Beaumont-Hamel position had been weakened by the capture of Thiépval and it was decided to renew the attack in this quarter, the only portion of the frontage originally attacked which was still in German hands.

After a bombardment covering two days, the attack was delivered about an hour before daybreak on Nov. 13. South of the Ancre the 19th Div. cleared the German trenches N. of the Schwaben and Stuff redoubts and the 39th Div. took its farthest objective at St. Pierre Divion with remarkable ease and rapidity. North of the river the 63rd (Royal Naval) Div. fought its way forward to Beaucourt sur Ancre and held on tenaciously though in advance of the troops on its left. These, the 51st (Highland) Div., had been stoutly opposed at Beaumont-Hamel but had finally mastered the village, N. of which the 2nd Div. had carried the right portion of its objective. On the left, however, where the ground was specially heavy, the 3rd and 31st Divs. had been less successful; Serre had once again proved impregnable. But on the following day the success was exploited, Beaucourt was captured and the 51st and 2nd Divs. pushing forward along the spur N. and E. of Beaumont-Hamel established themselves on a line which secured Beaucourt on the N. and W. With this important gain of ground over 7,000

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prisoners were taken, and to the Germans the quite unexpected loss of the long impregnable Beaumont-Hamel "was a particularly heavy blow" (Ludendorff). Advantage was taken of this victory to deliver a successful attack on a front of three miles against the German trenches on the slopes above Pys and Grandcourt (Nov. 18), but then the return of bad weather finally stopped the prosecution of active operations.

General Aspects.—The Allied offensive on the Somme had not yielded all the results that had been hoped for or that had at times seemed within reach. It was only natural that in some quarters the heavy cost at which the watershed between the Somme and Ancre had been mastered should be looked upon as altogether disproportionate to the gains, and that those who had not studied war sufficiently to realize that decisive victory is not to be had without a heavy price, and that it is not in achieving but in exploiting victory that the more tangible and spectacular gains are reaped, should be so disappointed as to overlook the substantial results which had been achieved. The Allies had begun the offensive with three main objects: to relieve the pressure on Verdun, to pin the enemy's main forces down to the western front, and, lastly, to wear down his powers of resistance. All these had been achieved, and of the three, the last, if the least tangible, was far from the least important. The 40,000 prisoners taken by the British and the 30,000 taken by the French might seem trifling in comparison with the vast captures made by both sides on the eastern front, but in quality the Germans taken on the Somme were very different from the half-armed Russians and the unenthusiastic mixture of nationalities who formed the Austro-Hungarian armies; and the decline of the German *moral*, admitted as it is by Ludendorff, outweighed in importance their losses in prisoners or material, considerable as these latter were. An eye-witness of the battle of Malplaquet wrote of that action, "the enemy was so advantageously posted that when the battle was over we wondered how we had surmounted the difficulties." Those who had been through the Somme might well have echoed his words, and despite the punishment they had received and the hardships they had endured the British and French had ample reason to be encouraged by their achievements. If the flower of the "new armies" of Great Britain and her Dominions overseas had been expended on the Somme, the Allies ended the year 1916 with a moral ascendancy over their enemies and with well justified hopes. It is only necessary to compare the strategical situation of Dec. 1916 with that of July 1 to see what a change had come over the war. On July 1 the Germans were certainly not contemplating attempting to negotiate a peace through the good offices of a neutral. And where had the change been brought about? Not on the eastern front, where Rumania had collapsed and the Russian offensive come to a standstill; not in Macedonia, where the capture of Monastir had been powerless to assist Rumania; not in the more distant theatres of war, where Kut was still in Turkish hands and the British had not yet reached the eastern frontier of Egypt; not in Italy, where the Austro-Hungarians were still holding up the Italian offensive across the Isonzo. Bad weather had prevented the immediate exploitation of the success earned in the struggles of July, Aug. and Sept.; changes of command and of plan were to throw away much of what the Allies had in their grasp early in 1917, but the change in the situation was the work of the Allied forces on the Somme. (C. T. A.)

II. German Offensive of March–April 1918

As soon as the general military situation towards the end of 1917 seemed to offer the Germans a possibility of conducting the war in the western theatre by means of attack, preparations for this were set on foot by the Supreme Command. The first German move was to fetch up all the troops from elsewhere that could be spared and establish—at least temporarily, until the strong American reinforcements were added to the Allies—a balance of forces in the western theatre of war, or, if possible, a preponderance on the German side. This would obtain the necessary time for rest and training. To this end German division after division, and battery after battery, had been rolling up since the end of 1917 from Italy and the East into France. A number of heavy Austro-Hungarian batteries were also brought up. Finally 62 divisions and 1,706 batteries were made available for the main attack. For a second simultaneous attack in a different place these forces were not enough.

Systematic training for the attack was begun simultaneously behind the whole German front. Side by side with following out the instructions issued by the Supreme Command, the whole body of men had to be brought to exchange the defensive idea with which they had been living for the idea of the attack. The troops had to be taught the full use of machine-gun fire, guns and *minenwerfer*, and the support which airmen could give to infantry. They had to be trained to the utmost mobility and uplifted morally. The idea of surprise, which offered the only chance of the successful execution of a break-through operation, had also to be worked out in tactics.

Hand in hand with the equipping of the division chosen for the attack with horses and utensils of every kind went the collecting of munitions, supplies, building and sanitary materials, as well as the erection of railways, roads and battery positions.

Only a limited number of divisions could be equipped for the attack owing to the shortage of draft and horses. The building preparations were extended along the whole of the W. front so as to veil tactical purposes as long as possible.

At the end of Dec. 1917 the German Supreme Command had arranged for the mounting of quite a number of attacks. Although it was admitted that, for want of forces, the whole Allied front could not be attacked at once in order to find the suitable point for a break-through according to the Schlieffen idea, it was intended to keep the enemy as long as possible in ignorance of the German Supreme Command's actual intentions.

The decision as to which attack should actually be carried out was arrived at from a tactical point of view, strategical considerations being put aside. "Tactics had to be considered before purely strategical objects," writes Ludendorff, "which it is futile to pursue unless tactical success is possible. A strategical plan which ignores the tactical factor is fore-doomed to failure." Starting from this point of view Ludendorff decided to carry out the so-called "Michael" attack against the projecting southern sector of the British front. The attack was aimed at the British only, because they were still exhausted from the fighting of 1917 and it was desirable on general grounds to beat them first. It was to be executed at an early date independently of weather conditions. The sector to be attacked was thinly held and insufficiently fortified. It therefore seemed probable that the attack would succeed and that strategical use could be made of the break-through. It was unavoidable that the attack should take its course over the ground destroyed in the "Siegfried" retreat and the battle of the Somme.

The plans for the great attack were issued by the Supreme Command on Jan. 24 1918. The following individual attacks were to be prepared:—"Mars" (left wing) and "Michael I.," towards the N.E. past Bapaume, by the XVII. Army; "Michael II.," to the N. of the Omignon brook, by the II. Army; "Michael III.," on both sides of St. Quentin, by the XVIII. Army; "Archangel," south of the Oise, by the VII. Army. The "Michael" attack was proposed for March 20. The "Mars" and "Archangel" attacks were to follow a few days later, after the regrouping of the "Michael" artillery. The main attack was to break through the enemy front, and then, in conjunction with "Mars" left wing, to push on through Péronne–Arras. The XVIII. Army was to reach the line La Fère–Péronne. The "Archangel" attack was conceived merely as a diversion. The preparation of the attacks on Ypres–La Bassée (George I. and II.) was to be continued, the Hector-Achilles operations in the Argonne and Champagne were to be kept simmering. In case the Michael attack stopped short there was to be an attack by the III. Army. Instructions for demonstration actions were kept in reserve.

Rupprecht's group of armies, which, according to this plan, were to carry out the main assault with the XVII. and II.

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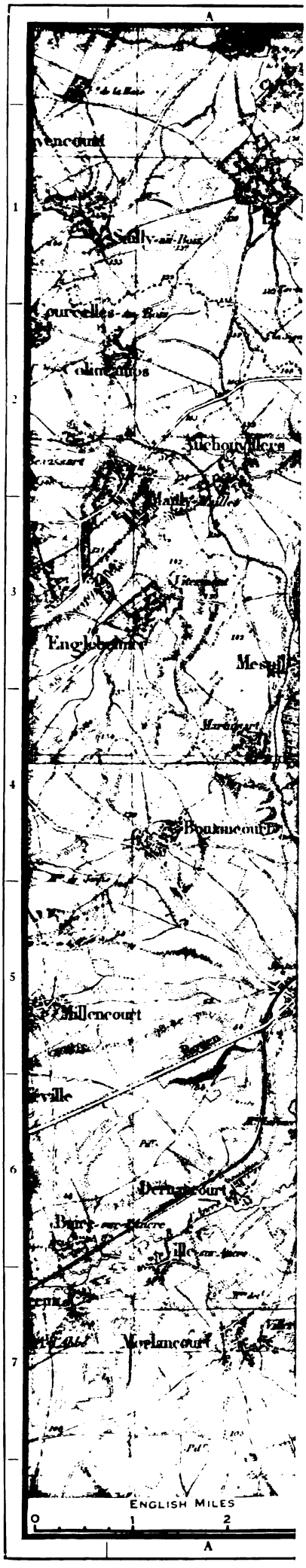

SOMME, BATTLES OF THE (Péronne)

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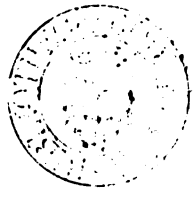

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Armies, were instructed to aim first and foremost at cutting off the British in the Cambrai bend. The armies were to advance with strong inner wings, the XVII. on Ypres and the II. on Equancourt. Subsequently the XVII. army was to deliver an assault in the direction of Arras–Albert and gradually roll up the adjacent British front, the II. Army to push forward in a westerly direction with the left wing on the Somme.

In the German Crown Prince's group of armies the XVIII. Army had to conquer the Somme and the Crozat Canal and eventually to extend to Péronne. If the II. Army should encounter any considerable resistance the XVIII. Army was to advance strong forces through Beauvois–Tertry to cut off the opponent in front of the II. Army. The Mars attack S. of the Scarpe was to follow the Michael attack as soon as possible and amplify the Michael operation. Farther N. preparations were also made to profit by it (Mars, N. Walkürenritt).

The forces provided for the break-through were 15 attack divisions and 2 position divisions for the XVII. Army, 15 attack divisions and 3 of position for the II. Army, and 19 attack divisions and 5 of position for the XVIII. Army. Besides these, 3 divisions were retained by the Supreme Command for disposal, first at Bouchain, then at Denain. As regards artillery, 950 field batteries, 701 heavy and 55 heaviest batteries were called up. Added to these were a few Austro-Hungarian heavy batteries, inadequately supplied with munitions.

In the prolonged preparations now carefully made, the attack front was kept as lifeless as possible, with the troops unchanged and the day-traffic kept down. Detrainments went on a long way to the rear on a wide front, and all movements of importance were held over until night time.

In March, each of the four groups of armies executed a first attack. In the Crown Prince Rupprecht's group the preparations were so elaborate in the region of Ypres and Armentières that even the troops themselves and their leaders were convinced that a great attack was really imminent. The German Crown Prince's group made a show of preparing an attack in the neighbourhood of Reims. From the 14th onwards reconnaissance attacks, bombardment of the enemy headquarters, bombing by airmen and the bringing up of reinforcements, set in. The increased artillery activity continued until March 24. Gallwitz's group of armies carried out a great attack on Verdun systematically up to the stage when the infantry should have come in, with several days of artillery preparation, a gas attack, and the bombardment of railway stations behind the lines. Duke Albrecht's group feigned an attack on the Lorraine front, and carried out a heavy artillery battle from March 20 to 24.

The result of these German operations was to intensify the opponents' suspense to the utmost. The British put themselves in a position of defence against a great attack between Armentières and La Bassée and between Arras and St. Quentin, and shifted forces from Flanders to the south. The French evidently expected an attack at Reims. New defensive works arose everywhere in the chief opponents' lines. They reinforced their batteries and sought by increased activity on the part of the airmen and patrols, to penetrate the obscurity which enveloped the German mode of procedure.

In the front of the actual attack the Germans counted upon having, in front of the XVII. Army, 15 strong British divisions of the III. Army (General Byng), and in front of both armies 23 divisions of the V. Army (General Gough). The Germans assumed, further, that the leader of the combined operations of the Entente, General Foch, would have in readiness strong reserves, mainly French, somewhere in the region of Meaux behind the centre of the enemy front. The majority of the British reserves were supposed to be behind the centre of the British front. No signs of withdrawing were seen on the enemy's part. A restricted foreground was counted upon.

The actual forming up for deployment of the attacking armies began on March 10 with the munitioning. The artillery deployment followed, and the attack divisions next moved into their positions at the front. Everything passed off smoothly and without any great counter-measures being taken by the defence. All the difficulties due to compressing within a narrow space great masses of human beings and piles of utensils and contrivances were easily overcome. The divisions were organized in groups, usually three lines deep, the first line being made the strongest in order to ensure rapid results at the beginning. The first line advanced close up to the front trenches on March 20, the second standing at a distance of 3–5 km. and the third 7–10 km. behind. The hindermost lines were looked upon as reserves for the higher command. They were not simply to follow up the others but to be fetched up according to the needs of the tactical situation.

The Supreme Command held in readiness, besides the above mentioned three divisions at Denain, other reserves behind the remaining army fronts, and reserved to itself the right of withdrawing forces from the front line when necessary.

On March 20 the attack divisions, protected by aircraft, were drawn up behind the position from which the assault was to be made. The deployment of the artillery and *minenwerfer* was complete and the munitions in readiness. Only the order to advance had still to come. But here the weather threatened to upset all plans, for the direction of the wind was such as would spoil the effect of the artillery's gas, and the fog would make the attack movement difficult for the infantry. By 12 at midday the weather conditions had so far improved, however, that it was decided to carry out the attack on March 21. On that day, accordingly, at 3:30 A.M., the gassing of the Allied batteries began. This was followed by a 3-hours' preliminary bombardment of the British positions by the German artillery and minenwerfer. At 9:40 A.M. the German infantry dashed forward to the attack. The mass of artillery then made a barrage, which, creeping gradually forward, was to pave a way for the infantry into the depths of the opposing trench system.

The attack itself turned out very differently at different points. In the XVII. Army, commanded by Otto von Below, the coöperation of infantry and artillery was not without its hitches. The barrage "ran away from the storming infantry," who only reached the opponent's first position and found itself in the evening before the strongly occupied second position. At Vaulx Vrancourt and to the N. of it, as also at Doignies, the British put up strong counter-attacks, to repel which several 2nd line German divisions had to be put in. The British defended themselves here with great stubbornness against the obvious danger of being shut off on the Cambrai bend.

The II. Army, commanded by von der Marwitz, pushed through to the line Gonzeaucourt–E. of Epéhy–Templeux le Guérard–Le Verguier. Their main battle raged around the high-perched village of Epéhy, which the XXIII. Reserve Corps failed to take in spite of heroic efforts. With this army only a small portion of the second line divisions needed to be brought up. There were no serious counter-attacks.

The greatest success was achieved by the XVIII. Army, commanded by von Hutier. Its right wing pushed through the second British position and took the Holnon Wood. The centre got through beyond Savy, Dallon, Fontaine les Clercs, and the left wing took Urvillers, Essigny le Grand and Beney, and forced the Oise crossing. The XVIII. Army also took the most booty.

On the whole a great initial success had been achieved. Everything depended upon whether it could be successfully developed.

The German Supreme Command was determined to order the continuation of the attack according to the results of the first day's fighting. It allotted the first reinforcements brought up to the XVIII. Army and the left wing of the II. Army, directing the XVIII. to ease the advance of the II. by pushing forward on Tertry. The II. Army was likewise to put its weight upon the left wing. On the second day the fighting was heavy, the chief burden falling on the infantry. A systematic preliminary bombardment was impracticable on account of the progress made on the first day, and it was a difficult matter to pull the batteries through the obstacles and shelled areas. The heaviest and most thankless task was once more allotted to the XVII. Army. Its infantry penetrated the second British positions time after time, only to be forced back just as often by strong count-

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er-attacks assisted by tanks. Not until the afternoon did they succeed, with considerable losses, in taking Croiselles, Vaulx Vrancourt and Morchies, and entering Hermies. To do this they had to be assisted by large portions of the third line. In the evening the army found itself once more up against another strongly held British position on the line Béhagnies, Beugnâtre–Beugny.

The II. Army had also had more hard battles to win. It took Epéhy and pushed forward as far as Fins–Longavesnes–Marquaix–Coulaincourt, capturing considerable booty. It was not able to interfere with the British evacuation of the Cambrai bend, owing to the slow progress made by the XVII. Army.

The XVIII. Army made a good advance encountering only slight resistance. It stormed Feuquières and forced a crossing over the Crozat Canal between Jussy and Tergnier. For March 23 General Ludendorff ordered an attack by the XVII. Army in the direction of Bapaume, to supplement the success of the II. Army, and an advance on both sides of the Somme by the II. and XVIII. Armies.

This day at last brought the reward of their heavy labour. The XVII. Army met with sharp opposition even now from newly put in divisions, but was able to take Monchy, Driencourt, St. Leger, Beaumetz, Lebucquière and Havrincourt.

The II. Army encountered heavy resistance on the right wing only, and was able to reach the line Neuville–Etricourt–E. of Bouchavesnes–E. of Péronne–the Somme at Brie, with only slight opposition. The XVIII. Army took the Somme crossing at Béthencourt by fighting, stormed Ham and crossed the Crozat Canal. Its left wing corps (the IV. Reserve) repelled the counter-attacks of 3 French divisions that were being hurried up as reinforcements in a bloody battle.

For the next two days the scene remained unchanged. The XVII. and II. Armies advanced towards the Ancre, fighting violently, the II. being more and more hindered by the shelled area of the Somme battle. But gradually a new front arose on the Ancre in front of these armies, stretching southward to the Somme. In the region of Albert the British executed one counter-attack after another, though with heavy losses.

The centre and right wing of the II. Army had, by March 26, reached Thiépval, Beaumont-Hamel, Mametz, Cornoy, Albert and Braye sur Somme. Certain portions veering in from the N. opened a way of advance for the lagging left wing, which was thus able to come up with the rest of the army on March 27 on arriving at Ville sur Ancre–Sailly. Meanwhile the resistance was visibly growing, and it was possible to calculate the point at which it would be equal to the decreasing pressure of the attacking forces.

The XVII. Army had been steadily fighting its way forwards through village after village. In proportion as the opponent's fighting power waned new forces were put in. He seemed determined that there should be no question of rolling up or breaking through his front at Arras under any circumstances. In spite of this the army managed to take Bapaume on March 24, Béhzgnies, Sapignies, Grévillers and Irles on the 25th, and to reach Boiry, Becquerelle, Hamelincourt, Achiet le Grand and Achiet le Petit on the 26th. The attacking power of the army was now exhausted. On the 27th it did no more than capture the village of Ablainzeville and repel the counter-attacks of new British forces with powerful artillery.

The II. Army progressed in much the same way. The XVIII. Army maintained its almost unbroken advance throughout the days from March 23 to 27. By the evening of the 25th it had reached Nyencourt, Curchy, Nesle, Hattencourt–Beaulieu-Bussy, and on the 27th was in possession of Pierrepont, Montdidier, Boulogne la Grosse and Lassigny.

At this point the great battle came temporarily to a close. General Ludendorff had, on the evening of March 26, shaped his plans with the view of dividing the British and French by a gradual left-wheel advance of the II. and XVIII. Armies against the French. To this end the Somme at Amiens, and the Avre had to be reached, and the operation continued towards the S.W. The original plans had thus undergone a complete change in the course of its execution. It would now very soon be shown whether the tactical break-through could still be brought off in spite of the waning of the Germans' strength and the increase of the Allied resistance.

The course of events on March 27 did not come up to Ludendorff's arrogant expectations. It was impossible for the attacking force to know that in the direction of Amiens—the decisive point—the Allies had only very weak forces at their disposal on that day. In this case, as in every break-through, the difficulty of accurately estimating the exact effect presented itself. The difficulties of provisioning, too, made themselves increasingly felt in the shelled area of the Somme battlefield. The supply of munitions ceased, and the establishment of rearward communications had not kept pace with the advance of the attack. From certain signs it was evident that the German troops were not everywhere at their highest level of achievement and endurance. The losses, particularly those of the XVII. Army, exceeded what under the circumstances was the legitimate number.

Ludendorff therefore changed his intention once more on March 27. The XVII. Army was ordered to close down the attack. The XVIII. and the left wing of the II. were to renew their attack on the now isolated French on March 30 between the Somme and the Oise. This attack resulted in the filling out of the German line where it curved in S. of the Somme, and the taking of the localities Aubercourt, Démuin, Moreuil, Sauvillers, Hargicourt, Contigny, Anainvillers, and Rollot—the so-called bridgehead of the Avre. But while the break-through at Amiens failed, the Germans were able to repulse the violent, though disconnected, French counter-attacks in every case. By April 4 the right wing of the XVIII. Army had still been able to take the heights W. of Moreuil. The II. Army reached the western border of Hamel and pushed forward almost to Villers Bretonneux and Hangard. The battle then ceased.

Later repetitions of the attack in the direction of Amiens had no better results. An assault on April 24 by the II. Army in the neighbourhood of Villers Bretonneux, in which tanks were used, made good progress at first but could not hold the ground gained. The battle ended therefore without any clear decision. Certainly the Germans had achieved an initial success such as had been denied to the Entente during the preceding 3½ years of hard struggle in spite of the masses of men and material put in; they had more than made good the ground lost in 1916, and had captured—apart from enormous booty—90,000 prisoners and 1,200 guns. The British army was heavily shaken; 20 French divisions had been drawn into the battle; but the war had not been won, and neither the transition to a war of movement, nor the separation of the French and British had been achieved. In the course of the battle 90 German divisions—almost half of the western army—had suffered more or less heavy losses. New and great efforts would be required for the fulfilment of Ludendorff's great aim.

Battles of Arras and the Oise.—An attempt was next made to extend the front of the attack on both sides. To this end Rupprecht's group of armies had been preparing since March 22 to carry out the Mars N. attack at an early date, and had allotted to the XVII. Army three divisions standing behind the VI. Army in view of this. To replace them four divisions of the IV. Army were sent to the VI. The group of armies hoped at last to break the British lines by delivering two attacks on their front—this one and the Walkürenritt by the VI. Army—while the II. and XVIII. Armies profited by their early success on the British right wing. But this plan had for the moment to be pushed aside as the Supreme Command placed all the pressure on the left wing of the Michael operation. Not until March 25 did Ludendorff revert to the extension of the attack on the British. He settled that the Mars attack should take place between the Loretto height and the Scarpe on March 28, together with a secondary attack south of that stream. The Walkürenritt attack on the Loretto height was to follow closely.

For this attack 7 German divisions were placed N. of the Scarpe, under the general command of the I. Bavarian Reserve Corps, and 4 S. of it under the general command of the III.

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Bavarian and IX. Reserve Corps. But no success was obtained, although the divisions were mainly fresh ones. The work of attacking was hampered by the indistinct nature of the country and the endless maze of trenches. The British opposed the attack with fresh forces, and, particularly by the skillful use of their machine-guns, impeded the advance of the attacking force. North of the Scarpe the 1st line divisions, after some insignificant successes at the start, met with strong British counter-attacks, which threw back the attackers for the most part to their starting positions. Only the two localities, Gravelle and Roeux, remained in German hands. The Command did not put in any reserves.

South of the stream the localities of Neuville and Ayette yielded to the bold assaults of the German divisions fighting in that quarter, but no decisive success was attained. The taking of several thousand prisoners, and heavy losses on the Allied side, were the only positive results of the Mars attack, which had failed for two reasons—it was obviously on too narrow a front and had not been launched as a surprise.

The Supreme Command now gave up the VI. Army attack on the Loretto height, and ordered the XVII. Army, including its right wing, to stand on the defensive.

The extension of the attack S. of the Oise had no such wide operative aims. It was designed in the first place to protect the projecting left flank of the XVIII. Army and the road running behind it through La Fère–Chauny–Nayn, which was indispensable for bringing up drafts. To ensure this the Ailette line, which cut off the reëntering angle between the XVIII. and VII. Armies, had to be won. The task was entrusted to the general commands of the VIII. Army Corps and the VIII. Reserve Corps under the leading of the 7th Higher Army Command. The attack was led from the N.E. in view of the difficult Oise crossing. The attacking force, on April 6, took the French—who were apparently in no great strength—obviously by surprise, and pushed through South Chauny and Amigny to Marizelle and Barisis railway station. On April 7, after a short preliminary bombardment, the attack was continued, and Pierremande and the Coucy Wood were reached with only slight opposition. On the 8th the VIII. Army Corps advanced to the Ailette, S. of Le Bac d'Arblincourt, and stormed Champs. The VIII. Reserve Corps captured Coucy le Château, and reached the road Coucy–Landricourt–Arizy at nightfall. Finally on the 9th the two corps won the Oise–Aisne Canal along the whole front.

In a 4-days' struggle the problem had been smoothly solved. The victors held 2,300 prisoners. The front had been considerably shortened, and the possibility of successful attacks even against French defenders had been established. (W. M.–Lo.)

III. The Battle of Amiens, Aug. 8–22 1918

At the beginning of the fourth week in July, the German offensive on the Marne and in Champagne, which had been intended by their Higher Command as decisive, had been brilliantly repulsed by an Allied counter-blow, which had not only thrown back the enemy over the Marne but was forcing him back to the Vesle. Gen. Foch was resolved to follow up the advantage thus gained and assume the offensive on all his front as soon as possible; but it was essential before so doing to clear the main railway lines running laterally behind his front, several of which were menaced or blocked by the enemy. The most important of these was the Paris–Amiens line, and it was therefore decided that the first measure should be the freeing of this railway by a joint Franco-British attack on a wide front E. of Amiens. This operation was discussed first at a council of the four Allied commanders-in-chief, held at Bombon, near Melun, on July 24 1918 and further in a conference between Gen. Foch and Sir D. Haig on the 26th, and was finally embodied in a directive issued by the Allied Generalissimo on the 28th. It was therein laid down that the offensive should be conducted by the IV. British and I. French Armies, under the command of Field-Marshal Haig; that covered by the Somme, it should be pushed as far as possible in the direction of Roye, and that the road from Amiens to that place should be the dividing line between the two armies. The date fixed, at first Aug. 10, was later advanced to Aug. 8.

Preparation for the British Attack.—An operation similar to that ordered had for some time been contemplated by the IV. Army, and preparations for it were therefore pressed on from July 26 onwards. At this date the army, under Gen. Rawlinson's command consisted of the Australian (Monash) and III. Corps (Butler), (8 infantry divisions and one cavalry division), on the front Albert–Villers–Bretonneux. By the date of the attack it had been reinforced by the Canadian Corps (Currie) (4 infantry divs., another Australian infantry div., and 2 cavalry divs.), while the artillery was brought up to a total of over 2,000 guns, the aircraft to 28 squadrons and the tanks to 456 machines, 96 being whippets. The difficulties of effecting the concentration of these masses of troops and material, while keeping it secret from the enemy, were successfully overcome by means of elaborate precautions surpassing even those taken by the Germans before their spring and summer offensives. The cavalry, whippet tanks and part of the artillery were moved into the IV. Army area by road, the remainder (far the larger proportion) of the troops and material, being brought up in the period Aug. 1–8 in some 300 special trains. It was regarded as of the utmost importance to keep secret the arrival of the Canadians; in order to deceive the enemy, the troops themselves were deceived; Canadian units were sent from Arras into the trenches in Flanders, and the corps was actually brought into line, only a few hours before the attack, relieving the right of the Australian Corps, which had by Aug. 1 taken over the front from the French as far as the Amiens–Roye road. The precautionary measures taken were entirely successful in their object of ensuring that no warning of the attack should reach the enemy.

The front of the IV. Army attack extended from the Ancre S. of Albert to the Amiens–Roye road, a frontage of some 13 m.; three successive objectives were assigned, at distances, respectively of about 2-2½, 3-5, and 6-8 m. from the original starting line, which would bring the army eventually on the line of the "Amiens outer defences," on the front Le Quesnel–Harbonnières–Morcourt. The country, open rolling downland, was favourable for the operations of all arms; the enemy's defences were not formidable. The hostile forces believed to be available to oppose the British, consisted of the LI., XI. and XIV. German Corps (seven divisions in first line and eight in support and reserve) belonging to Gen. v. der Marwitz's II. German Army.

By the morning of Aug. 8 all preparations for the battle had been successfully completed and the British forces were, all unsuspected by the enemy, about to enter on the first stage of their march to the Rhine.

The British Offensive on Aug. 8.—Punctually at 4:20 A.M. on the morning of Aug. 8 the British infantry and tanks, under cover of a powerful barrage, debouched to the assault. Thick ground-mist veiled their advance from the eyes of the Germans, who were completely surprised and in an instant overwhelmed with little resistance. The Canadian Corps sector extended from the Amiens–Roye road to the Amiens–Chaulnes railway; 156 tanks coöperated in the attack of this corps. Opposed to them was the 119th German Div., which was in process of being relieved by the 117th Division. The 3rd Canadian Div. on the right of the line, making light of the difficult task of debouching from a narrow bridgehead on the S. bank of the Luce river, set foot on the plateau between that stream and the Avre, captured Hangard and Démuin, and by noon had carried its front forward to the second objective, between Cayeux and Mezières. Thenceforward the 3rd Cavalry Div. took up the advance, followed by the 4th Canadian Div.; the cavalry, after taking Beaucourt, were held up by machine-gun fire, and though the infantry when they arrived succeeded in pushing forward, it was not found possible to reach Le Quesnel, the final objective, which at fall of night was still strongly held by the enemy. The centre and left Canadian Div., and the 1st and 2nd, attacked each on a front of one brigade, employing a separate brigade for each successive objective; the 1st Div. met with little serious

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opposition as far as the first objective, which it reached at 6:20 A.M. but the 2nd Div. only attained it an hour and a half later, having had heavy fighting at Marcelcave. At 8:20 A.M. the advance was resumed, and again the 1st Div. had the easier task, the German machine gunners putting up considerable resistance against the 2nd Division. Two brigades of the 1st Cavalry Div. now passed through to the front, and drove far into the hostile territory, capturing Caix, and attaining the final objective, in conjunction with the Canadian infantry, which moved behind them clearing up the ground already passed over by the cavalry. By 5:35 P.M. the Canadian Corps had, with the exception already noted on its extreme right, carried out its appointed task; it had penetrated the enemy's defences to a depth of over 8 m., capturing 12 villages, over 6,000 prisoners and 160 guns.

The Australian Corps advanced between the Amiens–Chaulnes railway and the Somme against the 41st, 13th and parts of the 108th and 43rd German Divs. The Australians had their 2nd and 3rd Divs. in first line and their 5th and 4th in support, the 1st Div. being in reserve N. of the Somme; 168 tanks were attached to the corps. The corps was drawn up by its commander in such a manner as to necessitate a double "leap frogging" of its divisions, while equalizing the exertions demanded of them and the distances to be traversed by them; and this complicated manœuvre was carried out with entire success. The 2nd and 3rd Divs., assisted effectively by the tanks, carried Warfusée and Cérisy, and then relinquished the attack to the 5th and 4th Divs. which pushed forward beyond Baronvillers and Morcourt, despite heavy flanking fire from the German artillery on the N. bank of the Somme. On the second objective being reached at 10:30 A.M. a brigade of the 1st Cavalry Div., with 16 whippet tanks, passed forward to Harbonnières, and an armoured car battalion raced forward down the Amiens–Brie road, scattering death and destruction far to the E. in the enemy's back areas. Behind them the Australians, throwing back their left to face the enemy on the N. bank of the Somme, pushed forward their centre and right to the final objective, just W. of the line Vauvillers–Proyart, where they found the cavalry held up. In the space of under six hours, between this opening of their attack at 6:20 A.M. and the attainment of the above line about midday, the Australian Corps had occupied seven villages, and taken over 8,000 prisoners, 173 guns and much other booty too numerous to mention.

On the N. of the Somme the operations of the III. Corps had not, however, met with the expected measure of success. It had been intended to advance with the 58th, 18th and 12th Divs. to a river from the line W. of Etinehem to W. of Morlancourt, thus securing the left flank of the main attack S. of the Somme; 34 tanks were detailed off to assist this attack. The programme of attack was disarranged by a partial advance of the enemy on Aug. 6 which forced back the 18th Div., and from the first moment difficulties were met with. Sailly Laurette was carried after stiff fighting by the 58th Div. and eventually the first objective was reached along the whole corps front. The further advance of the 58th Div. broke down against the resistance of the enemy holding the Chipilly spur and the 18th Div., which succeeded for a time in gaining ground farther to the N., were counter-attacked and forced to fall back. The enemy on the III. Corps front was not surprised, and fought well, and the attacking infantry were unable to find much support from the tanks, for which the ground was unsuitable in many places; 2,400 prisoners were taken by the III. Corps, together with 40 guns.

The results of what had undoubtedly been the most successful day's battle waged hitherto by the British army in the World War, and one of the finest British victories of all time, were the complete defeat of 11 German by 11 British divs., a gain of ground to an average depth of 6 to 7 m. on a front of 8, and the capture of close on 17,000 prisoners, 373 guns, several thousand machine-guns, and quantities of ammunition and stores. Most important of all, the battle revealed to the enemy Higher Command weaknesses hitherto unsuspected in their army, and destroyed the last hope of German victory. "It was," says Ludendorff, "the black day of the German army in the war. It was the worst experience I had to go through. It marked the decline of our fighting strength and destroyed our hopes of a strategic improvement. To continue would be a gamble. The war would have to be ended."

Operations of I. French Army around Montdidier (Aug. 8–11). The plan of Gen. Fayolle, commanding the French reserve group of armies, involved not only the participation of Gen. Debeney's I. French Army in the British operations N. of Montdidier but a subsequent extension of the attack to the S. of that town by the right wing of that army and eventually as far as the Oise by the French III. Army (Gen. Humbert). Gen. Foch sanctioned this scheme on Aug. 3, and it was decided that the attack S. of Montdidier should take place on the 9th and that of Humbert's army on the 10th.

The French I. Army at this time held a line from the British right flank near Domart to Castel on the Avre and thence along the W. bank of that stream to Courcelles, S.E. of Montdidier, whence the French III. Army continued the line to the Oise. Debeney had under his command the XXXV., X., IX. and XXXI. Corps (in line in that order from right to left) and the II. Cavalry Corps in reserve, in all 12 infantry and 3 cavalry divisions. In face of him stood the 2 left divisions of the German LI. Corps, of von der Marwitz's II. Army, as far as Moreuil, and 7 divisions in line with 2 in reserve, belonging to Von Hutier's XVIII. Army, from Moreuil southwards. The enemy on this front had recently withdrawn his line behind the Avre as a result of several small French operations on the W. bank and was therefore well on the alert.

Debeney's plan for the forthcoming operations consisted first of an advance by his two left corps in the angle between the Luce and the Avre in conjunction with the British right, followed by the passage of the Avre and the Trois Doms and a rapid advance to the plateau around Hangest on both sides of Montdidier by his centre and right, and the capture of that place. The whole army was then to push forward astride the Avre in the direction of Roye.

This programme was carried out without a hitch. The French bombardment commenced at 4:20 A.M. on the 8th, the hour of the British attack, and the infantry and tanks of the XXXI. Corps debouched between the Luce and Moreuil at 5:5 A.M. The German LI. Corps on this part of the front, was, contrary to expectation, taken unawares and put up little resistance; many prisoners were captured while engaged in cutting corn in the fields. Moreuil was taken and the way cleared for the IX. Corps farther S., which about 9 A.M. began to cross the Avre on foot-bridges thrown under cover of darkness early that morning. Here there was stiff fighting, and it was not till late in the day that the tanks were got across the river and cleared the way for the infantry, which at nightfall had reached the line Fresnoy–Plessier. Behind the IX. Corps, the X. was passing the Avre, and preparing for its S.E. advance on the morrow to encircle Montdidier from the N., while the XXXV. Corps was about to execute a similar manœuvre from the south.

The second stage of the operations commenced early next morning, the 9th. In order to secure the left of the X. Corps in its advance on Montdidier the XXXI. Corps attacked Hangest and occupied it about 11 A.M. The X. Corps, passing the Avre and the Trois Doms in its turn, took over the IX. Corps, and, assisted by the latter's artillery as well as its own, pushed forward to the E., meeting with considerable resistance, while the XXXV. Corps, debouching against Assainvillers at 4 P.M., took the enemy by surprise and advancing some 3 m., reached and cut the Montdidier–Roye road near Raverolles. The garrison of Montdidier, their retreat threatened from two sides, fell back hastily under cover of darkness by the road to Guerbigny, leaving behind a rearguard which fell into the hands of the French X. Corps on their entry into the town on the morning of the 10th.

Debeney, urged by Foch in a personal letter "to push forward towards Roye and there join hands with the French III. Army" (which was due to open its attack between Courcelles

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and the Oise on the 10th), decided, now his army was successfully reunited astride the Avre, to press his advantage in conjunction with the British on his left. The disaster to the German II. Army in the N. had rendered the position of the XVIII. Army, which was facing Debeney, so difficult that it had to throw back its right flank to W. of Roye—a movement which was carried out on the night of the 9th. By the evening of the 10th the I. Army following up the retiring enemy had reached the line Andechy–Bus, and on the next day a further slight advance was made on either wing of the enemy, Lechelle and Tilloloy being taken by the XXXI. and XXXV. Corps.

By now the German XVIII. Army, although its attention was distracted by the advance of the French III. Army against its centre and left, was reconstituting a solid line in the old French zone of 1916. Von Hutier, whose forces had been increased from 15 to 18 divisions by the 11th, established them in depth on two successive lines of trenches, with a strong belt of wire in front, all lines of approach being swept by direct and indirect machine-gun fire. A continuation of the rapid advance of the French I. Army was under these circumstances out of the question, and it was necessary to resort to slower and more thorough measures for overcoming the German resistance which was day by day hardening in proportion as further fresh reinforcements arrived.

Continuation of British Advance (Aug. 9–11).—It was decided by Gen. Rawlinson that the IV. Army should on the 9th continue its advance to the line Roye–Chaulnes–Bray–Dernancourt. The main attack was entrusted to the Canadian Corps which was to push S.E. to the line Roye–Hallu, while the Australian Corps was to secure its left between the latter place and Méricourt, and the III. Corps to advance to Etinehem and form a strong defensive flank on the N. bank of the Somme.

The Canadian attack, on the 9th, failed to attain all its objectives. Assisted by the 2nd Cavalry Div., it none the less effected a deep advance of some 4 to 6 m., secured eight more villages, and halted for the night on the line Arvillers–Rosières. To its left the Australians advanced their front between the Chaulnes railway and the Amiens–Brie road as far as Lihons hill, W. of Lihons village, and Framerville, after stubborn fighting. The III. Corps, reinforced by an American detachment, carried all its objectives for the day, clearing the Chipilly spur and taking Morlancourt. The German II. Army, still much disorganized, had been reinforced by six additional divisions from the XVIII. and IX. Armies, sent up by train and lorry and thrown straight into battle, often without their artillery, and its resistance had noticeably stiffened.

The British advance was continued on the 10th. The Canadians, now opposed by fresh troops from the XVIII. German Army, succeeded in attaining with its left the front assigned to it at Hallu and Fouquescourt but failed to get its right forward to Roye, the western suburbs of which were stoutly held. The Australian Corps which had now extended its left astride the Somme, in order to secure effective coördination of the operations on both its banks, had severe fighting on Lihons hill and was held up by determined German counter-attacks. Operations were undertaken on both banks N. of the Somme under cover of darkness, the plan being to encircle the hostile positions in the Etinehem and Méricourt bends by drawing a cordon across the bases of these bends. Etinehem and all its garrisons were easily taken, but the attack on Méricourt was broken up by hostile bombing planes and had to be completed on the 11th.

The IV. Army orders for this day's operations were that the Canadians and Australians should continue their advance to the line of the Somme and secure the crossings from Offoy (E. of Ham) to Bray. During the 10th and 11th, however, 8 more German divisions had come into line and delivered a series of vigorous counter-attacks which had the effect of putting a stop to any real British advance. The Canadian attacks were cancelled and the Corps had hard work to hold its ground. The Australians captured and held Lihons but could get no farther.

In fact, it was now clear that to push the offensive further would lead to disproportionate loss with little corresponding gain. The German II. Army had reformed its front, shattered on the 8th, with fresh troops drawn from the XVIII. and IX. Armies and from Prince Rupprecht's group in Flanders, and settled itself on the edge of the area devastated in the Somme battles of 1916, where a maze of old trenches, wire, and shell holes rendered defence easy and rapid advance impracticable. The British IV. Army had engaged all its 13 divisions, and its units were tired and in need of a breathing space. Gen. Rawlinson therefore decided on the 11th to allow his troops a few days' rest, while preparing for a renewal of the attack on the 15th. The units in the line were relieved and the tired infantry together with the cavalry were withdrawn into reserve.

French I. Army's Operations (Aug. 12–22).—On Debeney's front also during this period, minor activity took place, resulting in merely local advantages to the French. On the left of the I. Army, the line was drawn closer to Roye on the N.W. and W., while on the right the XXXV. Corps took Reuvraignes on the 20th. In this area, however, the German XVIII. Army had put into line no less than 10 divisions, while on the whole front between Roye and Lassigny a total of over 20 divisions were engaged between Aug. 9 and 22 against the French I. Army. Thanks to the employment of these strong forces, and to the increasing facilities for defence afforded by the shattered and intersected country into which the battle line had now been carried, the German XVIII. Army was enabled to maintain its ground to the W. and S. of Roye until the pressure of events elsewhere compelled its withdrawal in conformity with the armies on either flank at the end of August.

The operations of the French I. Army since Aug. 9 had resulted in the reconquest of an area of ground to a depth of 10–15 m. and the capture of some 12,000 prisoners and over 100 guns, besides much other material and stores.

British Operations (Aug. 12–22).—The IV. Army offensive planned for the 15th did not take place and only partial actions were carried out on its front during the period from the 12th to the 22nd. British attacks alternated with German counter-attacks with no great change resulting in the situation. Thus on the 12th the Australians took Proyart, while on the 15th the Canadians secured Damery and Parvillers. On the 17th Sir D. Haig decided that the next large-scale attack by the British should take place on the I. and III. Army fronts; the Canadian Corps left the IV. Army, the French taking over its sector as far as S. of Lihons and the remainder of the IV. Army line, which on Aug. 22 ran from Damery by Lihons and Proyart to Dernancourt, was left to the 12 divisions of the Australian and III. Corps. Facing them the German II. Army had available 26 divisions, of which, however, only 16 were in good fighting trim.

During the period from Aug. 8 to Aug. 22 the IV. Army had forced back the Germans to a depth of 12 m., had defeated or engaged with its own 13 divisions no less than 27 of the enemy's, had taken from him 23,000 prisoners and 400 guns and had killed and wounded more than an equivalent number of his men at a cost to itself of some 27,000 total casualties.

Offensive of French III. Army (Aug. 10–22).—In accordance with the scheme of Gen. Fayolle, already mentioned, the attack of the French III. Army was launched on the early morning of the 10th. The XXXIV. and XV. Corps (7 divs.), on a front of 14 m., from Courcelles to the Oise, were opposed by 7 German divisions in line and one in reserve, forming the centre and left of the German XVIII. Army. The objective of the French offensive was assigned as the line Lassigny–Noyon. The nature of the ground in front of Humbert's right, a tangled and broken mass of wooded hills, known as the "Petite Suisse," forbade any rapid advance in that quarter, and recourse was had therefore to an enveloping movement by the left (XXXIV.) Corps of the III. Army, which was directed to turn the highland by the north. At 4:20 A.M. on the 10th the attack commenced without artillery preparation; little resistance was met with at first, and before noon a penetration of some 3 to 4 m. had been effected, the infantry reaching the front Onvillers–Macqueglise. The advance was continued during the afternoon against the high ridge of Boulogne, while French aeroplanes carried out a bombing raid

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on Lassigny, and by nightfall the XXXIV. Corps was on the line Onvillers–Boulogne–La Neuville.

On the 11th the XV. Corps on the right of the army was put into the attack directly against the front of the "Petite Suisse," while the XXXIV. continued to progress to the N. of it. The resistance of the XVIII. German Army, reinforced by an extra division, stiffened appreciably during the day, and all along the line there was hard fighting. Hostile machine gunners ensconced in the broken country made the advance slow and painful; every foot of ground had to be fought for and the French could only advance step by step. After a week's fighting, the "Petite Suisse" still remained partly in German hands, while the French left wing was not yet in possession of Lassigny. The German XVIII. Army which, as already mentioned, had brought back its right flank to Roye on the evening of the 9th and was now also withdrawing its left along the Oise, fought stubbornly to secure time for the evacuation of its artillery and material Nevertheless the French III. Army made daily headway.

It was not, however, till the offensive by the French X. Army on the E. of the Oise threatened by its rapid progress to imperil the retreat of the Germans in the "Petite Suisse" that Humbert's troops could finally force them from their stronghold. On the morning of the 21st the German XVIII. Army fell back all along the line; the French infantry occupied Lassigny and cleared the wooded highland and by the 22nd had reached the line of the Divette, where they were halted to regroup and prepare for a renewed advance.

In the thirteen days' fighting Humbert's 7 divisions had driven from their strong vantage ground 8 enemy divisions and had taken from them 5,000 prisoners and 100 guns.

General Results of the Battle of Amiens.—The course and results of the fortnight's fighting between Aug. 8 and 22 may be summed up as follows:—The three Allied armies engaged (IV. British, I. and III. French), with 32 divisions, had attacked and defeated the II. and XVIII. German Armies, in all 42 divisions. Of these 42 divisions 30 were originally in line or reserve at the moment of the attacks, and 12 were put in from other parts of the front, being drawn from seven different German armies, belonging to three different army groups. The Allies advanced to a depth of between 6 and 14 m. on a front of 47, taking a total of 40,000 prisoners, 600 guns, thousands of machine-guns, quantities of ammunition, *matériel* and stores of all kinds. A wide breach had been made in the German front, susceptible, as events showed, of being rapidly widened to either flank by further Allied attacks. A shattering blow had been dealt to the *moral* of the German army and the German Higher Command, from the effects of which neither was destined to recover. The Battle of Amiens was the first page in the story of the Allied victory of 1918. (X.)

IV. Battle of Bapaume–Péronne, Aug. 21–Sept. 2

The first conception of the battle of Bapaume–Péronne was laid down in a directive from Marshal Foch to Field-Marshal Haig, written on Aug. 10—that is at the moment when the battle of Amiens had just been crowned with a brilliant success, and the enemy was retiring E. along the whole front from the Ancre to the Oise under the pressure of the British IV. and French I. and III. Armies. In this directive it was enjoined that "enterprises of the British III. Army in the general direction of Bapaume and Péronne should be prepared as soon as possible," while "the action of the British IV. Army should be pushed in the direction of Ham." Further instructions for the enlargement of the battle towards the N. to take place simultaneously with its extension to the S. by the advance of the X. French Army between the Oise and the Aisne (timed for Aug. 20), were sent to Haig on the 12 and it was finally decided that the advance of the III. Army should commence on the 21st and be followed by a general offensive on the front of that Army and the IV. Army two days later.

The general scheme of the operations between the Somme and the Scarpe was based, according to Lord Haig, on the following considerations:—

"The enemy did not seem prepared to meet an attack in this direction and owing to the sucess of the IV. Army, he occupied a salient, the left flank of which was already threatened from the south. A further reason for my decision was that the ground N. of the Ancre river was not greatly damaged by shell fire and was suitable for the use of tanks. A successful attack between Albert and Arras in a S.E. direction would turn the line of the Somme S. of Péronne and gave every promise of producing far-reaching results. It would be a step forward towards the strategic objective St. Quentin–Cambrai. This attack moreover would be rendered easier by the fact that we now held the commanding plateau S. of Arras about Bucquoy and Ablainzeville, which in the days of the old Somme fighting had lain well behind the enemy's lines. In consequence we were here either astride of or to the E. of the intricate systems of trench lines which in 1916, we had no choice but to attack frontally, and enjoyed advantages of observation which at that date had been denied us. It was arranged that on the morning of Aug. 21 a limited attack should be launched N. of the Ancre to gain the general line of the Arras–Albert railway, on which it was correctly assumed that the enemy's main line of resistance was sited. The day of Aug. 22 would then be used to get troops and guns into position on this front and to bring forward the left of the IV. Army between the Somme and the Ancre. The principal attack would then be delivered on Aug. 23 by the III. Army and the divisions of the IV. Army N. of the Somme, the remainder of the IV. Army assisting by pushing forward S. of the river to cover the flank of the main operation. Thereafter if success attended our efforts, the whole of both armies were to press forward with the greatest vigour and exploit to the full any advantage we might have gained."

The line of the British IV. Army at the date of the opening of the new battle on Aug. 21 ran from Fransart by Chilly, Proyart and Dernancourt to Albert. The right of this line as far as the Bray–Corbie road was held by the Australian Corps (Monash) with five divisions (from the right, 4th Canadian, 4th Australian, 32nd, 5th Australian and 3rd Australian) in line and three (1st Canadian, 1st Australian and 2nd Australian) in reserve. To the left of this the III. Corps (47th, 12th and 18th Divs. in line and 58th in reserve) continued the line to the army boundary northward of Albert on a front running along the W. bank of the Ancre as far as Beaucourt and thence W. of Puisieux, Bucquoy and Moyenneville to the Cojeul. The III. Army held the line in order from the S. with the V. Corps (Shute) with the 38th and 21st Divs. in line and the 17th in reserve, from N. of Albert to Beaucourt; the IV. Corps (Harper) with the 42nd, New Zealand and 37th Div. in line and the 5th and 63rd in support, extending as far as opposite Ablainzeville; and the VI. Corps (Haldane) (2nd Guards, 56th and 52nd Divs. in front line, with the 3rd in rear), as far as the army boundary.

Facing these troops the German II. Army (v. Marwitz) held the front opposite the IV. British Army, from N. of Roye to N. of Albert. This army, after its battering on Aug. 8 and succeeding days, held its front with 16 divisions, retaining 7, mostly exhausted and reduced in numbers, in reserve. The XVII. Army (Otto v. Below) was on the right of the II. extending as far as Avion, S. of Lens. On the eve of the attack this army had 11 divisions in first line and 2 in reserve. Both of these armies, together with the IX., to the left of the II., belonged to the newly-formed Army Group of von Boehm, whose area of command thus extended from N. of the Scarpe to the Aisne.

First Stage of III. Army's Advance (Aug. 21–26).—The main attack on the front of the British III. and IV. Armies was timed for Aug. 23 and the two previous days were to be in some sense only a prelude. The operation to be undertaken on Aug. 21 consisted of an advance by the IV. and VI. Corps on a front of 9 m. from opposite Miraumont to Moyenneville, while the left division of the V. Corps secured the right flank of the attack along the Ancre. The general objective was to be the line of the Arras–Albert railway, the attainment of which involved a penetration of the hostile front to a depth of 2 to 3 miles.

The attacking infantry, supported by tanks and covered by a strong barrage, moved forward at 4:55 A.M. The enemy was fully aware of the probability of an offensive on his XVII. Army sector and had adopted his well-tried system of defence in depth, the positions forward of the railway being lightly held by weak forces. These were rapidly driven in along the whole front of attack, their task being rendered difficult both by thick mist and smoke thrown out to cover the advance of the assaulting infantry.

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While the 21st Div. of the V. Corps pushed forward along the right bank of the Ancre as far as Beaucourt and set to work to prepare a passage over the flooded and marshy stream at St. Pierre Divion, the 42nd, New Zealand, and 37th Divs. of the IV. Corps carried their first objective, the high ground E. of Bucquoy and Ablainzeville, and then gave place to the 5th and 63rd Divs., which carried the line up to the final objective W. of the railway. Further to the N. the 2nd and Guards Divs. of the VII. Corps, assisted by the 3rd Div., which was leap-frogged over the 2nd for the last stage of the advance, also carried out their allotted task, and though the fog, which had at first favoured the attacking troops caused some little confusion and loss of direction, succeeded not only in reaching but in crossing the railway E. of Courcelles and Moyenneville. Over 2,000 prisoners were captured along the front of attack, of which 1,400 fell to the lot of the IV. Corps.

The German XVII. Army, in view of the loss of its forward positions, requested permission to retake them by a counter-offensive, which was delivered in force on the 22nd, and drove in parts of the new line both in the IV. and VI. Corps sector. It failed however to gain any decided advantage, as the Germans themselves admit, and meanwhile the preparations for the general advance on the whole of the IV. and III. Army fronts on the 23rd were being rapidly completed. At the point of junction of the armies the 38th Div. of the V. Corps, in coöperation with the III. Corps, carried out a series of operations which had as their result the occupation of Albert, and the seizure of points of passage which rendered it possible to throw strong forces to the E. bank of the Ancre in preparation for the morrow.

The main phase of the III. Army's operations began in the morning of Aug. 23, the various formations attacking at different hours along the whole front of 16 m. from Albert to the Cojeul. The enemy resisted with determination, but considerable progress was made all along the line. On the right the V. Corps, still acting in close conjunction with the III. Corps to the S. of it, pushed out its right, the 38th Div., E. and N.E. from Albert and completed its occupation of the hills overlooking the town. By the end of the day this division held a line from just W. of La Boisselle to Aveluy, while its left brigade had thrown parties across the marshes E. of Hamel, where they held on all night in face of repeated German attacks. On the front of the 21st Div., on the left of the V. Corps, only small attacks took place, but the IV. Corps to the N. of the Ancre, commencing its advance at 11 A.M., with the 42nd, New Zealand, 5th and 37th Divs., carried the railway, the enemy's main position, from N. of Miraumont to Achiet le Grand, and pushing forward further on the left, reached a line from Bihucourt to Loupart Wood, whence the front at the end of the day ran sharply westwards N. of Irles and N. and W. of Miraumont. On the VI. Corps the attacking divisions, from right to left were the 2nd, 3rd, Guards, 56th and 52nd. The 3rd Div. opened the advance at 4 A.M. with a successful attack on Gomiécourt, after which at 11 A.M. the 2nd Div. passed through on either side of the village to continue the advance, its objective being the line of the Arras–Bapaume road between Sapignies and Ervillers. The right of the attack made little progress, but on the left Ervillers was taken early in the afternoon. Farther N. the Guards, after seizing Hamelincourt, had also established themselves across the main road, and Boyelles and Boiry Becquerelle also fell into the hands of the VI. Corps before the end of the day, which resulted in the capture of 5,000 prisoners and a number of guns.

In view of the success gained during the day, it was decided to renew the advance at 1 A.M. on the morning of the 24th, the moon being then at the full. This decision was fully justified by the excellent results achieved all along the line. On the V. Corps front, it was projected to carry the strong position on the Thiépval plateau by means of a converging attack from S. and W. by the two wings of the 38th Div. While the right brigade stormed the high ground of La Boisselle and Ovillers, the left brigade, wading across the Ancre at Hamel under cover of its detachments thrown over the previous day, pushed forward as far as Pozières, thus turning the defences of Thiépval from the north. In the afternoon and evening the V. Corps, of which the central and left Divs., the 17th and 21st, had pushed forward through Grandcourt, by dint of heavy fighting, attained the general line W. of Contalmaison–Martinpuich–Courcelette. The IV. Corps had also been highly successful; the 42nd Div. pushed its front by way of Miraumont, where the enemy resisted with unusual stubbornness, to Pys, while the 5th, New Zealand, and 37th Divs., farther N., advanced to the line Grevillers–Avesnes–W. of Behagnies–Mory. The VI. Corps on the left of the army occupied St. Leger and Henin-sur-Cojeul but were held up by a determined defence in front of Croisilles and in St. Martin-sur-Cojeul.

The attack was vigorously pushed on the 25th despite the fact that the troops were becoming weary and the enemy's line heavily reinforced, showed signs of stiffening. The main advance was in the centre; the V. Corps on the right advancing over the old battlefields of 1916 where the ground afforded good facilities for the defence could get on but slowly, and the enemy's prepared fortifications gave him every advantage in the VI. Corps area, where little progress could be achieved. In the centre however, N. of Bapaume, the IV. Corps cleared up the hostile resistance at Sapignies and Behagnies and pushed on in the evening to the line Favreuil–Mory, thus seriously menacing the line of retreat of the defenders of Bapaume.

In fact, at this moment the situation on the front of the XVII. German Army was regarded as "extremely critical." It was believed that the offensive against it was bound to continue and the difficulty of getting up reserves and supplies was enhanced by the lack of communications across the desolated area of the old Somme battlefields. The Army Group of von Boehm was accordingly instructed to retire the line of the XVII. Army to a position already reconnoitred and partly prepared running from Quéant E. of Bapaume and Combles. The withdrawal took place at once in accordance with orders, and was completed by the morning of the 27th under cover of strong rearguards which fiercely contested the advance of the British III. Army.

Conclusion of III. Army's Advance (Aug. 26–Sept. 1).—During the 26th the V. Corps gained the fruit of its hard struggles of the previous days in a deep advance over the Somme battleground, which carried it forward to the western outskirts of what had once been the villages of Longueval, Flers, and Le Sars. The IV. Corps continued to swing round to the N.E. of Bapaume, occupying Beugnâtre, but the garrison of the town still held out. The next few days were taken up with bitter and strenuous fighting along all the front of the army, which grew stiffer as the advancing British drew nearer to the new prepared positions of the enemy. A new British Corps, the XVII. (Ferguson), took over the three left divisions (56th, 52nd and 57th) of the VI. Corps on the evening of Aug. 25, and undertook the hard task of overcoming the German resistance around Croisilles and in the Hindenburg line to the E. Croisilles was not finally secured until the 28th when the enemy garrison, finding its retreat menaced from both flanks, abandoned it early in the morning and from that date for four successive days the XVII. Corps was engaged in to-and-fro fighting in the maze of trenches and dugouts around Bullecourt and Hendecourt which were finally secured by the 52nd and 57th Divs., respectively, on the morning of Sept. 1. The line was established E. of Riencourt by the evening. The part of the XVII. Corps in the brilliant operations of the I. Army against the Drocourt–Quéant line on Sept. 2 does not come within the scope of this narrative.

Further to the S. by the evening of Aug. 29 the Germans, though still holding their ground stubbornly before the VI. Corps, had left Bapaume to the New Zealand Div. of the IV. Corps, and retired before the V. Corps to the eastern edge of the devastated area on the general line Morval–Beaulencourt. Following up their advantage the IV. Corps pressed their advance on Aug. 30 and 31 to beyond Riencourt, Bancourt and Frémicourt, thus rendering it possible for their neighbours on the right and left to resume their progress which had for the moment ceased. While the V. Corps on Sept. 1 drove the enemy from Beaulencourt, Morval and Sailly-Saillisel and on the 2nd from Le Transloy, Rocquigny and Barastre, the VI. Corps finally

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made itself master of the bitterly contested villages of Ecoust and Vaux Vraucourt and pushed forward to Noreuil. The IV. Corps in the centre, keeping pace with its comrades reached the front Villers au Flos–Beugny on the evening of Sept. 2.

During the 13 days' fighting the 14 divisions of the III. Army had engaged 23 hostile divisions, taken from them 11,000 prisoners, many guns and much material of war, and had driven them back to a depth of from 8 to 13 m. on a front of 20, besides inflicting on them heavy losses in killed and wounded.

IV. Army's Advance to Upper Somme (Aug. 22–30).—It has already been stated that the left of the IV. Army N. of the Somme had successfully coöperated in the main advance being carried out by the III. Army on its left during all the period under review from Aug. 22 onward. At the same time, other offensive operations were also carried out by the centre and right of Gen. Rawlinson's line astride and S. of the river, which had the effect towards the end of Aug. of forcing the Germans to retire to the line of the Somme above Péronne.

The attack of the III. Corps, delivered on the morning of Aug. 22, had for its objective the capture of Albert and the crests E. and S.E. of it in order to afford a crossing-place for the V. Corps (the right corps of the III. Army) over the Ancre valley. The 18th, 47th and 12th Divs., as also the 3rd Australian Div., were entrusted with the operation, which involved an advance of some 2,000 to 3,000 yd.; the 58th Div. was held in reserve. Despite the fact that all the precautions taken failed to ensure secrecy and that hostile counter preparations began at 4 A.M., 45 minutes before the attack was timed to commence, considerable progress was made on the whole front. The 18th Div. cleared Albert and joined hands E. of Méaulte with the left of the 12th Div., which together with the 47th on its right, had reached practically all its objectives before noon. The 3rd Australian Div. on the extreme right of the attack had also fulfilled their allotted task as early as 8:30 A.M. But in the afternoon a heavy German counter-attack, put in against the centre of the new British line, recovered much of the lost ground in that quarter, and inflicted such severe losses on the 47th Div. that it had to be relieved during the course of the next day by the 58th Div. from reserve.

This untoward incident somewhat disarranged the army plan for the 23rd, which had originally involved an advance on the whole front from Albert to Chaulnes. It was now decided that only the 18th Div. on the extreme left of the III. Corps should attack in conjunction with the Australians S. of the Somme. Accordingly, on the morning of the 23rd, the 18th Div., acting together with the V. Corps of the III. Army on its left, completed its operations of the previous day by the capture of the ridge immediately E. of Albert. The Australian attack to the S. was more ambitious and equally successful. It was carried out on a front of 4 m. by the 32nd Div. on the right and the 1st Australian on the left and involved an advance of some 2,000 yd. in depth, right up to the edge of the area laid waste in 1916, on the approximate line Herleville–Chuignes–Cappy. The divisions debouched at 4:45 A.M., assisted by 45 tanks and covered by an excellent barrage. The 32nd Div. early seized Herleville and the 1st Australian Div. also successfully carried out the first two stages of its advance, but met with unexpected difficulties in the last phase, which were only overcome after severe and gallant fighting. As a result of the day, 3,000 prisoners and 23 guns remained in the Australian Corps' hands.

Gen. Rawlinson decided, as a result of the day's operations, to go on with the attack N. of the river, and by way of variation to the usual methods an advance was carried out just after midnight of the 23rd by the whole of the III. Corps (47th, 12th and 18th Divs.) and the 3rd Australian Division. With the aid of the brilliant moonlight, good progress was made by all these formations, and despite violent hostile reaction, the ground lost on the 22nd was entirely recovered and La Boiselle, Bécordel and Bray all taken and held. The same good success attended the continuance of the advance next day, Fricourt and Mametz being both seized.

It had by now become evident, in fact, that the German resistance on the IV. Army front, partly owing to the vigorous pressure exercised throughout the last four days, partly owing to the successes of the III. Army farther N., was beginning to weaken, and that only strong rearguards were being encountered fighting to gain time for the retirement of the main body behind the line of the Somme above Péronne. The German Higher Command, as already mentioned, on the 25th, ordered von Boehm (who had about the middle of Aug. been appointed to the command of a new Army Group consisting of the II., XVIII. and XI. Armies, between the Ancre and the Aisne) to fall back to the line of the river Somme–Ham–N.E. of Noyon, and the movement was carried out on the 26th and 27th. During these days the progress of the IV. Army was rapid, being opposed mainly by long range artillery fire and strong machine-gun detachments. By the evening of the 27th the Australian Corps, which had handed over part of its line, as far N. as beyond Lihons, to the French I. Army on the night of the 24th, had reached the front Vermandovillers–Fontaine–Vaux, while the III. Corps which had been severely tested by the resistance of three fresh enemy divisions newly put into line on its front had cleared Trones Wood and Longueval. The German II. Army had now reached its chosen positions of defence between Morval and Pargny but had apparently, at the desire of the Army Group which considered it important to retain the possibility of flanking movement from in front of Péronne against any eventual British advance in the open country to the N., decided to retain its hold on the W. bank of the river in that quarter. Accordingly, the resistance in that area, where the left of the Australian Corps was operating, grew stiffer during the 28th and 29th; while the 32nd Div. on the right of the corps reached the W. bank of the Somme astride the Amiens–Brie road without severe fighting early on the 29th, the 5th and 2nd Australian Divs. only established themselves on the river line after heavy fighting and thanks largely to the coöperation of the 3rd Australian Div. on the N. of the Somme. By the evening of the 30th the Australian line ran along the W. bank from Cizancourt in the S. to Biaches and thence over the river to Clery and was continued by the III. Corps along the western edge of Marrières Wood to Priez Farm and E. of Combles. The Germans in this latter area had also fought stubbornly during the past two days and it became evident that they were here standing on a chosen line of defence. In view, however, of the small prospect of success afforded by any attempt to force the strongly held Somme line above Péronne, the IV. Army Command decided that the next operation must be a strong advance by the centre and left in order to turn that line to the N. and orders to this effect were issued on the evening of the 30th.

Forcing of the Somme Line by IV. Army (Aug. 30–Sept. 2).—The plan for the IV. Army's further operations involved the turning of the Somme line, to which the German II. Army had retired, by means of an advance N. of Péronne to the high ground around Nurlu. The III. Corps was to carry out the frontal attack from the W. against the German line northwards from Péronne, while the Australian Corps covered the southern flank of the attack and coöperated in the main operation by pushing forward against Nurlu from the S.W. Before this could be done, however, it was necessary to occupy Péronne and the key to it, the commanding height of Mont St. Quentin. This in itself was a most formidable task, for the position, strong both by nature and by art, dominated all the country to N. and W., and all the river passages by which it could be approached. The German High Command fully realized its importance, and had committed its defence to the picked troops of the 2nd Guard Div. with orders to hold it at all costs.

Sir John Monash, the Australian Corps commander, had already on the 29th formulated his plans for the attack of this stronghold. On this date the line of the corps was held from S. to N. by the 32nd, 5th, 2nd and 3rd Divs., the last-named being N. of the Somme. The idea was to bring over the 5th and 2nd Divs. to the N. bank, for the attack of Péronne and Mont St. Quentin respectively. The seizure of a bridgehead on the N. bank S.E. of Clery, an essential preliminary, was carried out by the 2nd Australian Div. during the course of the 30th, and the

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bridge at Ommiecourt was ready for use by before-dawn on the morrow. On this same night the 32nd Div. on the corps right extended its front to the N., relieving part of the 5th Div. which in turn took over part of the front of the 2nd Div., thus liberating the necessary forces for the assault.

This was opened at 5 A.M. on the 31st by the 5th Bde., of the 2nd Div. which moved off under cover of a strong barrage and making good progress had attained by 7 A.M. both Feuillaucourt and Mont St. Quentin villages; the right of the brigade however was held up in front of Anvil Wood. To the left of the brigade also the attack of the 3rd Australian Div. had failed to keep pace and a heavy German counter-attack, flung in against the front and left of the troops holding Mont St. Quentin village, compelled them to relinquish it. They rallied again, however, on the western edge and there held their ground till nightfall. Feuillaucourt had also to be abandoned later in the day. Meanwhile the 6th Bde. (also of the 2nd Div.) crossed the river behind the 5th and part of it pushing forward on the right of its comrades, seized Halle and established itself on a line beyond. The remainder halted S.E. of Clery. The 14th Bde. of the 5th Div., also effected a crossing at that place and collected E. of that village, pending the moment when the further advance of the 2nd Div. should allow it to advance against its assigned objective Péronne. By nightfall the 1,200 fighting men of the 5th Bde. had already broken the back of their task. Despite the difficulties which faced them, they had penetrated the formidable hostile positions to a depth of some 2,000 yd., and though reduced in numbers to some 600 rifles had held out on a wide front of 4,000 yd. against reiterated and desperate counter-blows by a foe in every way worthy of their steel. Their single feat of arms was rightly judged one of the finest in the war, and was to receive full fruition on the morrow.

The 6th Bde. of the 2nd Div., assembled S.E. of Clery, was assigned to complete the capture of Mont St. Quentin, passing through the sorely tried 5th Bde., its units already in the front line S.E. of Halle being relieved by the 14th Bde. of the 5th Div., which now undertook the attack on Péronne. While this last-named brigade swept forward through Anvil Wood and Ste. Radegonde, forced its way into Péronne and got possession before noon of practically all the town with the exception of the north-eastern suburbs, the 6th Bde., despite strong opposition from parties of the enemy still at large behind the 5th Bde. front on the Péronne–Bapaume high road, reached the line of that road and after a short preparation by artillery stormed Mont St. Quentin village and wood and established itself on a line from there N. to near Allaines and S. to the E. edge of Péronne. The night of Sept. 1 thus saw the Australian Corps, the 3rd Div. of which on the extreme left had taken possession of the ridges S. of Bouchavesnes, in possession of all its objectives, after completely defeating the enemy opposed to it.

Further to the N. the III. Corps also had done most creditable, if less spectacular work, during these two days of battle. The 58th Div. on the right had cleared Marrières Wood on the 31st, while the 47th Div. made progress towards Rancourt, repulsing a hostile counter-attack. On the morrow these successes were continued and completed by the capture of Rancourt and Bouchavesnes, while the 18th Div. on the left of the corps in a brilliant series of attacks seized in turn Priez farm, Frégicourt and Saillisel, inflicting serious losses on the enemy, who afforded a stubborn resistance.

Sept. 2 saw the completion of the successful operations of the IV. Army in the battle of Péronne, the Australian Corps occupying Allaines and the III. Corps St. Pierre Vaast and Vaux woods. The results of the battle were imposing enough even in mere figures. In the period between Aug. 22 and Sept. 2 the IV. Army's 9 divs. had engaged and defeated 23 hostile divs. and taken from them over 23,000 prisoners, many guns and vast quantities of material. The strong line of the Somme had been turned and rendered untenable by sheer hard fighting in which the attacking troops had shown themselves capable of meeting and defeating the best of the German divisions which, thrown in piecemeal and in the utmost haste and confusion as they arrived on the field, had been unable to hold for long even the strongest natural and artificial defences.

General Results of the Battle of Bapaume–Péronne.—In the battle described above the British III. and IV. Armies, consisting of five corps (23 divs.) in all, had fought and defeated the German XVII. and II. Armies, consisting of five corps (46 divs.), had forced them to fall back to a depth of from 6 to 13 m. on a front of 28, and had captured from them a total of 34,250 prisoners and 270 guns, without reckoning other material of war too various to recapitulate. The whole area of the Somme battlefields, which had cost the British five months' bitter fighting in 1916, had been conquered in less than a fortnight; more than half the area gained by the great German advance of the spring had been recovered; the only good natural line of defence available for the enemy to the W. of the Hindenburg system had been broken asunder; and the moral and material superiority of the British over the German fighting machine had become patent to the world. (X.)

SONNINO, SIDNEY, BARON (1847–), Italian statesman (*see* 25.416). During the debates on Giolitti's Steamship Subsidies bill in the spring of 1909 it was Baron Sonnino who conducted the most vigorous attacks against the Government, exposing the radical defects of the measure, and when Giolitti resigned on Dec. 2 it was Sonnino who was called upon to form a ministry, for the second time. But he did not enjoy the favour of the still Giolittian Chamber, and his Cabinet was defeated over the new shipping bill. On March 21 1910 he resigned, again after 100 days of office. He continued to take an active part in the debates in the Chamber, and was a stern but just critic of Giolittian political methods, although during the Libyan war he generally abstained from opposition for patriotic motives. In the autumn of 1914, after the death of the Marquis di San Giuliano, the Premier Salandra assumed the Foreign Office for a short time, but when he reconstituted his Cabinet on Nov. 5 he offered that portfolio to Sonnino, who accepted it. His conduct of the Foreign Office was characterized by sincerity of purpose, high principles, unswerving patriotism and a wide knowledge of international politics. He had not, moreover, a free hand. He was still Foreign Minister, under Orlando's premiership, during the Peace Conference, which he attended as second Italian delegate from Jan. 18 to June 19 1919. On the fall, however, of the Orlando Cabinet (June 19 1919) Sonnino retired into private life. The irritation of the whole of Italy against the policy of the Allies towards Italy at the Peace Conference reacted to some extent against the nation's representatives at Paris, and Sonnino himself came in for a large share of unpopularity, although the more intelligent and better informed part of public opinion realized the great difficulty of his task and the insufficient support afforded him by Orlando, as well as the value of his actual achievements. He did not stand for Parliament at the elections in Nov. 1919, but was subsequently made a senator. In spite of what was regarded as his failure to overcome the obstacles of the Peace Conference, he enjoyed the reputation of being the greatest Minister for Foreign Affairs that Italy had had since Cavour, with the possible exception of Crispi, while as a financier he ranked very high. He was also a man of wide reading and culture, and a distinguished Dante scholar and bibliophile.

SOROLLA Y BASTIDA, JOAQUIN (1863–), Spanish painter (*see* 25.434), was engaged for practically the whole of the decade 1910–20 on work for the Hispanic Society of America. It includes a series of portraits of Spanish writers, and a "Panorama of the Forty-nine Provinces of Spain" consisting of forty-nine immense compositions, each representing views, costumes and customs of a different province. This great undertaking was completed before paralysis brought the artist's painting to an end. Important exhibitions of his work were held at the Grafton Galleries, London, 1908; in New York, 1909; in Chicago, 1913; and he was represented by two typical works in the 1920–1 Exhibition of Spanish Paintings at Burlington House.

See Hispanic Society of America, *Eight Essays on Joaquin Sorolla y Bastida*, 1909; A. de Beruete y Moret, *Sorolla y Bastida*, 1920.

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SOUND (*see* 25.437).—The increase in our knowledge of the subject of acoustics (the science of Sound) during recent years has been largely associated with the war conditions which prevailed from 1914 to 1918. As a consequence of the war the development of this science has been abnormal,[1] and research has been directed towards the rapid realization of practical acoustic devices and methods for immediate use in warfare, both on land and sea. A general survey of the work done shows that the advances consist of applications of well-established principles, rather than the discovery of new phenomena. Generally, the observations made have proved to be in accordance with previous theoretical investigations, mainly due to the late Lord Rayleigh.[2] This war work falls naturally under two headings, viz. (1) the detection and perception of direction of sounds in air, and (2) the detection and perception of direction of sounds in water. Theoretically, these two problems have much in common, but, practically, there are important differences which make it desirable to treat them in separate sections. A special section (3) is devoted to the important advances recently made in auditorium acoustics, and the remaining section (4) deals briefly with miscellaneous outstanding features of modern work on sound, not essentially military in character.

1. Detection and Perception of Direction of Sounds in Air[3]

Detection.—The human ear itself is a remarkably sensitive detector of the air vibrations which constitute sound. It is still much superior in this respect to any mechanical device which has yet been produced for recording the vibrations visually. Thus the perception of feeble sounds of necessity depends upon the limitations of audibility, either indirect listening, or with the ear aided by the intervention of an electrical device such as a microphone. The audibility of a feeble sound can be very largely augmented by making use of the principle of resonance, provided that the sound itself approximates to a pure tone. This can be secured, for example, by the use of a Helmholtz resonator applied to the ear in the case of direct listening, and in addition, by tuning the diaphragm receiver when microphonic listening is adopted. It has happened fortuitously that one of the chief sounds in air which it is important to be able to detect, viz. those emitted by aircraft, do contain predominant notes which enable the application of resonance, as above indicated, to increase largely the range of audibility. Typical predominant frequencies (apparently due to engine exhaust) are given in the following table, which relates to the engine running at the usual speed:—

Aeroplane engine	Frequency (vibrations per second)
S. E. 5	130
R. E. 8	90
F. E. 2B	70
Avro	90
Gotha	80

The following frequencies have been detected in the sounds from the Maybach engines of a Zeppelin airship:—

Slow speed—27, 54, 108, 135, 243.
High speed—57, 114, 171, 228.

The operation of the *Doppler effect*, arising from the relative motion between the aircraft and the observer, prevents the possibility of the identification of the machine by means of the observed frequency, this being liable to change by as much as 20%, according to the speed and direction of flight. An interesting observation which has been constantly made is that the notes of low pitch continue to be heard at ranges where those of high pitch have ceased to be audible. This is in accordance with the theoretical expectation that damping increases with frequency.

The determination of the direction whence a sound arrives is theoretically possible by a variety of methods dealt with below, several of which have been tried in aircraft localization.

(*a*) *Binaural Listening.*[4]—Lord Rayleigh's experiments (*Collected Papers*, vol. 5, p. 347) have shown that low-pitched sounds are determined in direction by the observation of the phase difference between the vibrations arriving at the two ears. This principle has been applied in direction-finding, and the effect has been exaggerated by increasing the distance between the two points of reception. The sound is received by two equal trumpets or horns rigidly connected together and capable of rotation about an axis perpendicular to the line joining them. Separate and exactly equal tubes lead from the trumpets to the two ears, respectively, and the apparatus is rotated until the sound under observation appears to come from directly in front. The line joining the sound receivers is then perpendicular to the incident sound stream. An alternative method which dispenses with the necessity of rotating the apparatus is to use a *compensator* or *phase-measurer*, which consists of tubes, adjustable in length, inserted between the sound receivers and the appropriate ears, so as to provide a path difference equal to that between the distant source of sound and the two receivers. Adjustment of the tube lengths is made until the impression received is that the sound is neither to the right nor to the left, and the determination of direction is then a matter of simple geometry. In practice the compensator is graduated to give direct angular readings.

The practice of binaural listening has verified theoretical conclusions in several important respects. It has been found that it is easier to perceive the direction of a mixed sound, or noise, than a pure note. Apparently it is necessary that the wave train should contain more or less isolated special characteristics whereby the phase difference can be readily appreciated. In the regular sine wave corresponding to a pure tone each vibration is exactly like those which immediately precede and follow it, and the ears are unable to identify corresponding displacements. It is apparently also necessary for successful binaural listening that the two portions of the incident wave which enter the two receivers should be free from subsequent distortion; in particular, that the sound receivers should be as nearly as possible non-resonant for the vibrations in question. Any amplification of the sound which depends upon resonance, therefore, such as the use of Helmholtz resonators already referred to, is incompatible with efficient direction-finding by observations of phase difference.

The construction and arrangement of the receivers used has varied very much in practice. As a typical system, that commonly used in the British army may be quoted, namely, circular cones, 2 to 4 ft. long and of semi-angle 20°, as receivers, placed about 7 ft. apart—a distance which proved to be sufficient for attaining nearly the maximum practical accuracy of setting.

The method is subject to many errors, chiefly those arising from the motion of the sound source, refraction due to temperature inequalities in the air, and the effect of winds. The necessary corrections are tabulated for use in practice.

(*b*) *Sound Mirrors.*—Some success has been attained in direction-finding by means of concave sound reflectors. The chief limitations have arisen from the question of size, and, consequently, of

[1] Owing to the abnormality of the conditions, it is impossible to follow the usual practices in writing the present article. Experiments on sound, with military ends in view, have been carried out in nearly all the belligerent countries. Comparatively few of the results have found their way into the recognized scientific journals, largely by reason of the secrecy which is still frequently enforced by the various Governments, under whose control most of the work was done. In the circumstances it is not safe to attempt to assign credit to particular investigators, nor is it possible to give adequate references. The present article has been drawn up, therefore, upon broad general lines which, since they fulfil censorship conditions, form necessarily a by no means complete survey; and names have been avoided as far as possible.

[2] Lord Rayleigh's work is contained in his *Collected Papers* (No. 6, 1920). His contributions were numerous between 1911 and 1919, when he died.

[3] The information contained in this section is largely drawn from a manual entitled *Development of Sounds*, kindly placed at the writer's disposal by the British Munitions Inventions Dept.

[4] This method of perception of direction has been largely used also in a connexion which scarcely justifies treatment in a separate section. The *geophone* is an instrument for direction-finding of sounds proceeding through the earth, and its particular use during the war was for localizing the sounds of picks, etc. used in tunnelling and land mining. It consists of two hollow boxes connected by equal tubes to a stethoscope arranged so that the sounds proceed from the two boxes to separate ears. The boxes are laid upon the ground a few feet apart, and moved about until the sounds of the pick appear to come from straight ahead. It is then known that the sound source is on a line perpendicular to that joining the two geophone receivers, since the sounds arrive through the earth in synchronism. By combining several pairs of geophones separated by considerable distances, the actual position of the pick can be estimated, for it lies at the intersection of the several perpendiculars above specified.

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portability. In optics the size of mirrors commonly in use is very great in comparison with the wave-lengths of the light; in the corresponding problem in acoustics it is almost impossible to make them so; and yet this is a necessary condition for the geometrical laws of reflection to apply with accuracy. In the largest sound mirrors—perhaps 20 ft. in diameter—the size is at most only a few wave-lengths for the aircraft sounds under investigation, with the result that the image of a distant sound obtained at the focus proves to be an area much larger than that corresponding to optical calculations. There is therefore no advantage secured by making the mirror paraboloidal instead of spherical, and considerable roughness of the surface is not detrimental. The mirrors were usually made of concrete, and listening was effected either by means of a small horn receiver placed in the focal plane and connected by a tube to the ears, or by means of a microphone placed in a similar position. If, as was more usual, the mirror was fixed, the direction of the sound source could be found by determining the position of maximum intensity in the focal plane. It may be noted that in this method of direction-finding amplification is obtained on account of the area of the mirror, and that further augmentation is attainable by using resonators, to which the same objections do not apply as in binaural listening. The accuracy of the determinations vary very much with frequency, being much greater for notes of high pitch than for low, as would be anticipated from considerations of wave-length.

(*c*) *Interference and Diffraction Methods.*—There have been many attempts to apply the principle of interference as a substitute for binaural listening, *i.e.*, by ultimately mixing the sounds entering the two receivers, instead of leading them to different ears, and adjusting the compensator until the total sound heard is as loud as possible. Theoretically this will occur when there has been provided in the compensator a difference of path equal to the path difference outside the receivers. The method has not proved very successful, for a variety of reasons, some of which are obscure. We shall not elaborate them here.

On the other hand, remarkable results have been obtained by the application to sound waves of a phenomenon well known in the *diffraction* of light. A small distant source of light gives in the middle of the shadow of a small circular obstacle a luminous region, called the "white spot," arising from the diffraction of light round the edges of the obstacle. The same phenomenon is observable in sound under suitable conditions. Thus a large horizontal disc, at least 20 ft. in diameter, and made of material which either reflects or absorbs sound, will give below itself a sound shadow of a sound source, such as an aeroplane, above it. Near the centre of the shadow, in a position depending on that of the source, there is a region where the sound heard is comparatively loud—in many cases much louder than it would be if the disc were absent. The relation between the direction of incidence of the sound and the position of maximum intensity has been calculated, and the method provides, perhaps, the most reliable means of perceiving the direction of air-borne sounds.

(*d*) *Sound Ranging.*—This special military aspect of the localization of sound sources, viz. those arising from gun-fire and shell bursts, is dealt with in the article RANGE-FINDERS.

2. DETECTION AND PERCEPTION OF DIRECTION OF SOUNDS IN WATER[1]

Of all the methods practised for the detection of submarines that depending on the sounds which they emit has been of the widest application. The question of detection has been, of course, of nearly equal importance in the opposite sense, viz. the hearing of surface ships by the crew of a submerged submarine. The sounds created in the sea by a screw-propelled ship are of a very complicated character, arising partly from the interaction between the propeller and the water, and partly from the vibrations of the machinery which are transmitted through the walls of the ship into the sea. They vary greatly from ship to ship, even of the same class; and, in the later stages of the war, submarines had been constructed which, when cruising submerged at certain slow speeds, emitted practically no noise at all. In many ways the detection of submarines in the sea is more difficult than that of aircraft in air. Normally, listening in air takes place at stations which are fixed; in submarine listening the stations were most frequently ships, which for tactical reasons connected with their safety, had to be constantly on the move. Their own machinery noise and the acoustic disturbances arising from their motion through the water were very apt to drown the noises proceeding from more distant sources. The noise of the sea, too, even in weather not at all stormy, interfered greatly, and the range at which a submarine could be heard varied much from day to day. A serious additional limitation was that recourse could not normally be had to the reflection of ordinary sounds (as is possible in air) chiefly by reason of the great size of the necessary reflectors. For the speed of sound in sea water is more than four times that in air, so that the wave-lengths are larger in the same ratio. This necessitates a corresponding increase in the linear dimensions of the sound mirror, if equal efficiency is to be obtained.

Hydrophones.—Hydrophones, or under-water sound detectors, were already in use before the war for signalling purposes, being carried by ships for listening to submarine bells operated by Trinity House as warnings in foggy weather. They consisted of small, metal, water-tight cases of which one face was a metallic diaphragm operating an enclosed microphone. The electrical disturbances of the microphone caused by any vibration of the diaphragm arising from sound pressure waves in the sea, were conveyed to telephone receivers on the ship, where listening took place. It was usual to suspend the hydrophones in water-filled tanks attached inboard to the outer shell of the ship, which, owing to the fact that steel in water transmits sound almost completely, does not diminish appreciably the intensity. Normally the hydrophone diaphragm was tuned so that its natural frequency in water[2] approximated to that of the signalling bell, and so that increased range could be secured by depending on resonance.

The earlier hydrophones used for naval purposes were of much the same type, although the resonant diaphragm proved to be by no means an unmixed advantage. All sounds containing a component corresponding to the diaphragm frequency were distorted in reproduction, and what was gained in sensitivity was liable to be lost in the difficulty of recognition, or, in other words, failure in discrimination between genuine noises due to a submarine and other noises inevitably present in the sea. Appeal to resonance is only really advantageous when the sound under observation has a predominant note, as in the case of an aeroplane; and submarines do not display this characteristic. Ultimately hydrophones of a non-resonant character came to be preferred, and were frequently used in practice. These consisted most usually of enclosures made of rubber, sufficiently thick to withstand the pressure of the sea at the usual depth (about 15 ft.), and having natural frequencies *below* the limit of audition.

An alternative type of hydrophone consisted merely of a hollow enclosure without a microphone, sometimes with a metallic diaphragm, and sometimes simply a rubber tube, filled with air and connected by long tubes to stethoscopes applied to the ears. These are operated by the transference of the pressure vibrations from the sea to the air cavity and thence to the ears. Electrical hydrophones have the advantage over non-electrical ones that their sensitivity can be readily augmented by various means, *e.g.*, by the use of thermionic amplifiers (*see* WIRELESS TELEGRAPHY).

In cases where the hydrophones had to be used by ships in motion, they were sometimes fitted into the hull of the ship; or themselves consisted of fish-shaped bodies towed at a considerable distance behind the ship. The former precaution, *i.e.* making the shape stream-like, aimed at diminishing the vibrations created by the passage of the hydrophone through the water; the latter had in view the partial elimination of the disturbances arising from noises in the towing ship. Even so, it frequently became necessary to stop the engines temporarily, and listen with the towed hydrophones while the momentum of the ship continued to carry it forward. This proved to be only feasible at comparatively slow speeds.

Directional Hydrophones.—All the hydrophones so far described are of a non-directional character, *i.e.* the intensity of the sound heard in them is practically independent of the orientation of the sensitive receiving diaphragm with respect to the position of the source of sound. The limitations of dimensions necessitated by considerations of portability, etc., are such as to render the instruments much too small to give an effective "sound shadow." The reason for this has already been mentioned, viz. the great wave-lengths corresponding to audible sounds. At a frequency of 500 per second, for example, the wave-length in water is nearly ten feet.

Differential Hydrophones.—Curiously enough, however, one type of directional hydrophone, called here for distinguishing purposes a *differential* hydrophone, did, in fact, depend upon the small differences of pressure operating upon its two sides; and it met with considerable success. It was made in various forms, the simplest of which consisted of a circular metal diaphragm, bearing at its centre a water-tight box containing a microphone, and clamped round its rim to a heavy metal ring. When placed in the sea so that the plane of the diaphragm passed through the position of the sound source, the pressure variations on the two sides are the same both in amplitude and phase, with the result that the diaphragm and therefore

[1] The following publications should be consulted, although, for reasons already given, they form by no means adequate references:—H. C. Hayes, *Engineer* (1920), p. 491; C. V. Drysdale (Kelvin Lecture), *Journ. I.E.E.* (1920); W. H. Bragg, "Submarine Acoustics," *Nature*, July 1919; F. L. Hopwood, "Submarine Acoustics," *Nature*, Aug. 1919.

[2] This is considerably lower than the natural frequency in air, on account of the additional loading by the water.

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the microphone, has no motion imparted to it, and the sound heard is a minimum. If, however, the diaphragm faces the sound source, there are, apparently, differences in the pressures on the two sides (probably in both amplitude and phase), and a small differential vibration takes place, with consequent sound in the receiving telephones. Actually, as the hydrophone is rotated through 360° about a vertical axis, two maxima and two minima of sound intensity are observed. In this form, therefore, the instrument is what is called *bi-directional*, *i.e.* it is unable to distinguish between sources in *front* and *behind*. The desirability of obtaining a *uni-directional* instrument led to the introduction of the so-called *baffle-plate*, the behaviour of which has not yet been explained satisfactorily in terms of orthodox theory. The essential characteristics of a baffle appear to be that it should be made of non-resonant material and have air cavities within it. Such a plate, fixed at a small distance (which has to be determined by trial) from one face of a bi-directional hydrophone, transforms it into a uni-directional instrument. A single sound maximum is now obtained upon rotation, occurring when the sound source and the baffle plate are on opposite sides of the diaphragm; and a single minimum,—this when the baffle lies between the sound source and the diaphragm. The "edge-on" minima, observed when the baffle is absent, now disappear.

Binaural Listening.—The principles underlying this method of direction-finding have been described already. In the present case the main difference is that the sound receivers have to be submerged hydrophones. It has been found to be equally necessary for success that these should be as completely as possible non-resonant. The simplest arrangement used in practice was two rubber cavities placed several feet apart horizontally, and joined by separate equal tubes to the two ears. The device could be rotated about a vertical axis, usually passing through the hull of the operating ship. As in the case of air listening, compensators were often used in order to avoid the necessity of rotating heavy apparatus. An arrangement much preferred was to tow two or more fish-shaped hydrophones in known positions (about 12 ft. apart) behind the ship. Here electrical transference of the acoustic disturbances had to be adopted, and this necessitated great care in the choice of the microphones and telephone receivers so as to avoid selective resonance. (The behaviour of microphones in this respect was often unsatisfactory, and telephone earpieces, or magnetophones, were frequently substituted for them. This results in diminished sensitivity, but the binaural effects are much improved.) The telephone receivers delivered the sound into the compensator, and the phase difference was measured in the usual way; allowing, of course, for the difference of speed of sound in the sea and in the air channels of the compensator. In using a compensator with two sound-receiving units only, there remains an ambiguity of estimated direction, *i.e.* one cannot distinguish between the angles θ and $\pi+\theta$. The introduction of a third unit, so that the three form a triangle of known dimensions,—the units being capable of use in pairs with the compensator—ensures the correct choice between the alternative angles.

Other Methods of Direction-finding.—Several other methods of perception of direction, not easy to classify, have found application in practice. One of these consisted in fitting in the shell of a ship, on opposite sides, two diaphragms with microphones attached, arranged so that the hydrophones thus formed were of as nearly as possible equal sensitivity. These were listened to alternately by means of a reversing switch. The ship, on account of its considerable size, was capable of giving a marked sound shadow. Thus the starboard hydrophone would give greater response than that on the port side if the sound source were to starboard, and vice versa. By steering the ship so that the responses were equal, it could be inferred that the course was directed towards the cause of the sound. The limitations of the method were mainly those arising from local noises; and the speed had to be small while listening took place.

In other cases large numbers of sound receivers, usually simple diaphragms whose function was to transfer the vibrations from the sea to the air inside, were inserted in the ship's hull. Good results were obtained by an arrangement of this kind, called the Walser gear, in which the sound receivers were disposed at regular intervals on a large bulge, in the shape of a spherical segment, incorporated in the hull on either side towards the bows. The system acted as a sound lens, a sound focus occurring at a point where the "sound paths" by alternative routes were equal. Application of the laws of geometrical optics enabled the relation between the position of the focus and the direction of incidence of the sound wave on the ship's side to be determined.

1. *Sea Sound-Ranging.*—The methods hitherto mentioned for perceiving sound direction would all fail when the sounds are abrupt in character, because they all require an appreciable time for carrying out the necessary tests. To determine the position of an exploding submarine mine or torpedo we require, therefore, a different device. A suitable method is one identical in principle with that practised on land. The main variations in applying the device to the sea are that the microphones must be in submerged hydrophones, and that a correct knowledge of the velocity of sound in sea water must form the basis of the calculations. Ordinary non-directional hydrophones of the type first mentioned have proved to be quite sufficiently sensitive. Indeed, the greatness of the distances at which explosions in the sea have given unmistakable impressions on the recording film has been surprising. Small detonators serve at distances of several miles, while the explosion of 40 lb. of gun-cotton is operative more than 100 m. from the receiving hydrophones. Many experiments have been carried out by the British Admiralty with hydrophones disposed in suitable positions on the East coast of Britain, and the installations promise to be useful, not only for locating mine and torpedo explosions in circumstances of war, but also for navigational and surveying purposes. A ship in fog, for example, could ascertain its position by exploding (with due notification by wireless to the sound-ranging station) a small charge near itself in the sea; the station could within a few minutes inform the ship—again by wireless—of its position.

Sea sound-ranging has necessitated the accurate redetermination of the velocity of sound in sea water. This has been accomplished by the inverse of the process just mentioned, viz. by exploding charges in the sea, and measuring by the recording string galvanometer the time intervals between the reception of the first shock by hydrophones submerged in accurately known positions. The observed velocity depends on several factors, including tidal flow, temperature, and salinity, which vary from place to place. The following table gives some of the results obtained, corrected to a standard salinity corresponding to a specific gravity of 1·026 and a temperature of 10° C.:—

Date	Place	Corrected Velocity in ft. per sec.
16· 5· 18· .	Dover	4,882
6· 11· 18· .	"	4,921
18· 7· 18· .	"	4,924
26· 7· 17· .	Culver (I. of W.)	4,962

The effect of tide, apparently, has not been allowed for. It would amount, at most, to a few feet per second.

3. Auditorium Acoustics

The acoustics of public buildings have recently been put on what approximates to an exact scientific basis, largely as a result of the work of W. C. Sabine (*Frank. Inst. J.*, 179, p. 1, 1915). For good hearing three conditions are necessary and sufficient. The sound heard must be *loud enough;* the simultaneous constituents of a mixed sound must preserve their *relative intensities;* and the successive sounds must *remain distinct and in the correct order*, and be free from extraneous noises. The extent to which these conditions are fulfilled depends on the construction of the auditorium, its shape, its dimensions, and the materials of which it is composed. In already finished buildings radical alterations of the first two are not often feasible, but great improvements can be secured solely by suitable changes in the internal features.

The main difficulty arises from what has been called *reverberation*, due to the multiple reflection of sound at different parts of the room. If the reverberation is prolonged, it means that the rate of absorption of the sound is slow. Thus, in a lecture room at Harvard, where these experiments were commenced, the rate of absorption was so small that a single spoken word continued to be audible for 5½ seconds. Successive syllables thus had to be heard and appreciated through a loud mixed sound due to the reverberation of many previous syllables, and the conditions of hearing were intolerable. Great reduction of the multiple echoes constituting reverberation can be made by increasing the rate of absorption of sound. It is apparent that, in the space of several seconds, the sounds travelling at 1,100 ft. per sec. will have suffered many successive reflections, and will, therefore, have penetrated to practically all parts of the room. The sound will have become diffuse radiation, and absorbing material introduced almost anywhere will be equally effective in reducing reverberation. An open window proves to be a complete absorber, in the sense that it permits the egress of the maximum possible quantity of sound radiation (*cf.* the properties of a small aperture in an isothermal enclosure in heat radiation). The introduction of cushions, carpets, wall hangings and people also largely diminishes reverberation, because of their considerable absorbing powers. Sabine has made a systematic study of the coefficients of sound absorption of various materials by the inverse method of measuring their effect in reducing the duration of reverberation. Typical results are given in the following table. These apply to the frequency an octave above middle C.

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Material	Coefficient of Absorption
Open window	1·000
Linoleum, loose on floor	0·12
Oriental rugs	0·29
Plaster on wood lath	0·034
Glass, single thickness	0·027
Plain ash chairs	0·008
Upholstered chairs	0·30
Hair felt, 2·5 cm. thick, 8 cm. from wall.	0·78

Other measurements indicated that an audience gave an absorption equal to 44% of that due to an equal area of complete absorber, thus accounting for the improved hearing conditions known to exist in well-filled buildings.

The absorption of sound can thus be adjusted with precision, but it must not be carried too far, otherwise the *sound intensity* is too much diminished. The ear is able to disregard, or even to take advantage of, reverberation which is not too prolonged, and the extent of absorption has to be adjusted to the appropriate amount. Too many apertures such as open windows or doors must be avoided.

Sabine has also made examination of the exact manner in which sound is reflected in an auditorium by constructing scale models of the latter, and photographing the sound waves at various instants after creation, using the beautiful method due to Toepler (*Annalen der Physik*, 127, p. 556) and elaborated by R. W. Wood (*Physical Optics*, 2 ed., 1911, p. 94). By this means the positions of the sound waves, both incident and reflected, are capable of observation at all instants and at all points in the model room, and they provide data upon which can be based correct architectural construction from the acoustic point of view.

4. Miscellaneous Advances

Absolute Measurement of Sound.—A. G. Webster (*Nat. Acad. Sci. Proc.*, 5, p. 173, 1919) has advanced to a considerable extent the methods of absolute measurement. For this purpose it is impossible to rely upon audition, handicapped as it is by the vagaries of the ear. What is required is a reliable mechanical device, the performance of which is constant, to record the sound vibrations with sufficient magnification. Webster has made an exhaustive study of the properties of various materials, and has constructed from those most suitable for the purpose two instruments which he has called the *phone* and *phonometer* respectively. The phone provides a means of creating a simple tone of intensity and frequency which are under control and capable of exact measurement. The phonometer is an instrument for measuring absolutely the vibrations received by it. It consists of the combination of a diaphragm and a resonator, both of which are adjustable in frequency. The motion of the diaphragm is observed by making it a reflector and part of a Michelson interferometer, so that the amplitude is measured in terms of the wave-length of suitable monochromatic light. In practice the interference fringes are photographed on a moving film upon which they appear as wavy lines. Against this instrument, which is regarded as a standard, other portable phonometers can be calibrated, these depending on the simpler process of the deflection of a beam of light set into angular oscillation by the receiving diaphragm. With such instruments, and also with D. C. Miller's *phonodeik* (referred to later) L. V. King has carried out an elaborate investigation on the propagation of sound in air and fog-signal efficiency (*Phil. Trans.*, 218, p. 211, 1919) in the region near Father Point, Quebec. King, in this paper, also describes a modification of the siren called the *diaphone*, used as a standard source of sound in his research.

Analysis of Sound.—Webster's phonometer described above is a resonant instrument, and, therefore, unsuitable for the analysis of mixed sounds. Much progress has been made, however, in the analysis of such sounds, using non-resonant recorders, for example, D. C. Miller's *phonodeik*. This instrument, which depends on the motion imparted to a tiny mirror by the operation of a vibrating diaphragm, is described in Miller's *Science of Musical Sounds* (1916), where also will be found the results of the analysis of various sounds. Similar work has been carried out by C. V. Raman, in relation to the vibrations of bowed strings and instruments of the violin family (*Indian Assoc. for Cultivation of Science*, Bull. No. 15, 1918). In these cases the sound record is of the ordinary type and consists of the trace on a moving photographic film of a spot of light vibrating at right angles to the motion of the film, thus forming a transverse wave. Records of a different type have recently been obtained (A. O. Rankine, *Proc. Phys. Soc. Lond.*, 32, p. 78, 1919) in which the sounds are caused to vary the *intensity* of a narrow beam of light, which gives on a moving film a line image perpendicular to the motion. The record thus consists of a negative film of varying transparency along its length. It is not so suitable as transverse records for direct analysis of the component frequencies, but it has the advantage that it admits of *reproduction* of the sound by means of a selenium cell, such as is used in photo-telephony. This arrangement constitutes a novel type of phonograph operated by light, first invented by Ernst Ruhmer in 1900, but hitherto little known. (A. O. R.)

SOUTH AFRICA (*see* 25.463).—On the conquest of German S.W. Africa by the Union forces in 1915 the whole of S. Africa, except for the Portuguese possessions S. of the Zambezi came under British administration. Excluding the Portuguese territory (for which *see* Delagoa Bay and Portuguese East Africa), S. Africa was in 1921 divided politically as follows:—

1. The Union of S. Africa, a self-governing dominion of the British Empire formed in 1910 and consisting of the former colonies of the Cape, Natal, Orange River (Free State) and Transvaal.
2. The S.W. Protectorate (ex-German S.W. Africa), administered under mandate as an integral part of the Union.
3. The native protectorates of Basutoland, Bechuanaland and Swaziland, administered by the British Colonial Office.
4. Rhodesia, consisting of two separate administrations, S. Rhodesia and N. Rhodesia; both under the rule of the British S.A. Company.

Area and Population.—Including both Rhodesias the area of S. Africa is approximately 1,650,000 sq.m., of which some 125,000 sq.m. are Portuguese. The total pop. in 1921 was little over 11,000,000, of whom some 700,000 lived in Portuguese territory.

The following table shows the white population in the Union and in Rhodesia at the censuses of 1911, 1918 and 1921:—

	1911	1918	1921
Union of S. Africa	1,276,242	1,421,781	1,521,635
S. Rhodesia	23,606	..	33,621
N. Rhodesia	1,497	..	3,585
Total	1,301,345	1,421,781	1,558,841

The increase per cent. in the Union in the period 1911–21 was 19·23, masculinity (the number of males to 100 females) decreased from 115·92 to 106·14.

The next table gives particulars of area and pop. of British South Africa at the 1911 census:—

	Area Sq. m.	Pop. 1911 White	Native and Coloured	Total
Union of S. Africa:				
Cape Province	276,995	582,377	1,982,588	2,564,965
Transvaal Province	111,196	420,562	1,265,650	1,686,212
Natal Province (includes Zululand)	35,371	98,114	1,095,929	1,194,043
Orange Free State Province	50,392	175,189	352,985	528,174
Total Union	473,954	1,276,242	4,697,152	5,973,394
Territories:				
S. Rhodesia	148,575	23,606	747,471	771,077
N. Rhodesia	290,000	1,497	821,102	822,599
Total Rhodesia	438,575	25,103	1,568,573	1,593,676
Protectorates:				
Bechuanaland	275,000	1,692	123,658	125,350
Basutoland	10,293	1,411	402,434	403,845
Swaziland	6,536	1,083	98,876	99,959
Total Protectorates	291,829	4,186	624,968	629,154
Total British S. A.	1,204,358	1,305,531	6,890,693	8,196,224

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Compared with the census of 1904 the increase in the white pop. was 172,390. Of this increase 123,285 was in the Transvaal. In Rhodesia the white pop. had nearly doubled in the seven years. The increase in the native and coloured pop. was 885,660. With respect to the coloured pop. two important factors must be remembered. (1) The Cape province total of native and coloured includes 391,000 persons with a marked strain of white blood, officially classed as "mixed"; the total "mixed" pop. being 435,000. (2) The Natal province total of native and coloured includes 133,000 Indians. There were also 10,048 Indians in the Transvaal, the total Asiatic pop. being 152,000.

The following table gives particulars of the white pop. of the Union by provinces at the censuses of 1911, 1918 and 1921:—

	1911		1918		1921	
	Males	Females	Males	Females	Males	Females
Cape Province	301,268	281,109	311,312	307,513	329,934	321,620
Natal	52,495	45,619	62,745	59,186	70,624	66,834
Transvaal	236,913	183,649	260,840	238,507	284,952	258,529
O. F. S.	94,488	80,701	93,969	87,709	97,971	91,171
Total, Union	685,164	591,078	728,866	692,915	783,481	738,154

The coloured pop. of the Union in 1921 was in round figures 6,000,000, that of S. Rhodesia 744,000 and of N. Rhodesia about 1,000,000, that of the native protectorates 750,000, that of S.W. Africa 240,000, or a total of about 8,750,000.

There were in 1918 five towns with a white pop. of over 20,000 and eight towns with a white pop. between 10,000 and 20,000. The following list of the five chief towns gives the total pop. at the 1911 census with the white pop. in 1918 in brackets:—Johannesburg 237,104 (137,166), Cape Town 161,759 (99,683), Durban 89,998 (48,413), Pretoria 57,674 (41,690), Port Elizabeth 37,063 (23,339). Outside the Union the only considerable towns in S. Africa were Bulawayo and Salisbury in Rhodesia, Swakopmund and Windhuk in the S.W. Protectorate and Lourenço Marques (Delagoa Bay) and Beira in Portuguese territory.

The Union of South Africa

The Union of S. Africa came into being on May 31 1910. Minor amendments were made in the constitution during the next 10 years, but its main features (*see* 25.467) remained unaltered. In accordance with the electoral provisions—the basis of representation being the number of European male adults as ascertained by census taken every fifth year—the Transvaal province obtained nine additional seats in 1915, and four more seats were added in 1920. The seats allotted in 1920 were Cape 51, Transvaal 49, Natal and Orange Free State 17 each.

No alteration was made in the franchise laws. In the Cape province in 1919 out of a total of 186,000 voters, 33,000 were "other than European." In Natal the voters numbered 32,000, of whom 348 were "other than European." In the Transvaal (140,000 voters) and Orange Free State (47,000 voters), "Europeans" only, possess the franchise.

Agriculture.—The progress made in agriculture (including pastoral occupations) was in many respects the most encouraging feature in the economic development of S. Africa between 1910–21. The establishment in the Transvaal during the period of Crown Colony Government, of an agricultural department on scientific lines had given an impetus to the adoption of modern methods by the farmers, and the fusion, at the Union, of the agricultural departments of the four former colonies led to greater improvements. By withdrawing the control of agriculture from the provinces the Union Government was able to coördinate the work and to disregard artificial boundaries. Much of the progress was due to Gen. Botha "who with his instinct for things that really mattered" had held the portfolio of agriculture together with the premiership of the Transvaal, and in the Union was also for a considerable period minister of Agriculture as well as prime minister. General Botha gave full encouragement to the technical and scientific staff. Schools of agriculture—there were five in 1921—and experimental stations were established on large farms situated on main railway lines. A two years' course of instruction was provided as well as shorter courses and up to 1920 some 5,000 students had passed through the schools. Of the 300 experts in the department in 1921, over one-third were ex-students. Up to that year £1,000,000 had been spent on buildings and equipment.

The veterinary service did invaluable work in investigating the diseases of stock, discovering the causes of East Coast fever, and other diseases, some of which were eradicated. Its work rendered possible the keeping of animals in many districts where it had not previously been possible, and made profitable the importation of high-class live stock. In 1920 it was estimated that the value of the live stock in the country, chiefly cattle and sheep, was over £100,000,000. The entomological and botanical divisions were also active, one notable achievement being the ridding—at least temporarily—the country from locust plagues. This was done by tracking the locusts to their breeding places and as soon as the young were hatched (when they crawl, but do not fly) sprinkling them, and the surrounding veld, with a mixture of arsenic and molasses, a plan devised by a Natal farmer. This method proved so effective that in 1918–20 no swarms of locusts were reported in the Union.

New crops and plants were introduced, among them *teff* grass from Abyssinia, very valuable for hay, which in 1920 was grown on 234,000 acres. The general result of the Agricultural Department's work, backed by the rise in prices during the World War, was to make S. Africa almost self-supporting as regards food-stuffs, while in 1919 agricultural and pastoral exports were valued at £33,000,000, and in 1920, a year of depression—especially in the ostrich feathers trade—at £27,000,000. In the back-veld farming had been "transformed from what was little more than nomadic grazing to an organized industry and throughout had been placed on a higher plane."[1]

Of pastoral industries the breeding of woolled sheep is the oldest and most important. The number of woolled sheep in the Union was 21,842,000 in 1911, 26,490,000 in 1916 and 23,548,000 in 1919. The number of other sheep, 8,814,000 in 1911 had, however, declined to 4,943,000 in 1919. These figures did not include sheep in native locations, which in 1919 numbered about 2,250,000. The wool exported from the Union reached 176,971,000 lb. in 1913 and was 115,634,000 lb. in 1918. The World War sent up prices, the average price per lb. in 1913–4 being 7·95d. and in 1917–8 20·78d. In 1918–9 when the average price was 20·08d. the value of the wool exported was £14,648,000. Wool worth £5,678,000 went to the United Kingdom, £5,209,000 to the United States and £2,786,000 to Japan. France and Canada were the next largest customers. There is also a considerable trade in sheepskins; the value of the skins exported was £594,000 in 1911 and £1,329,000 in 1918.

South Africa produces more than half the world's supply of mohair. The Angora goats in the Union in 1918 numbered 5,278,000, mohair exported that year was 19,645,000 lb., valued at £1,641,000. The trade in mohair is subject to wide variations, and the limit of production in S. Africa is that of successful competition with Turkey for the supply of the Bradford market. In 1920 the value of mohair exported fell below £500,000, chiefly owing to lessened demand for yarn from Bradford by Poland and Germany.

The number of cattle in the Union rose from 5,796,000 in 1911 to 7,255,000 in 1919. The steady progress of the cattle industry is seen in the figures of imports and exports of meat.[2] Up to and including 1913 imports greatly exceeded exports. Thus in 1913 the quantity of meat imported was over 11,000,000 lb., and that exported but 1,387,000 lb. In 1917 the imports had fallen to 23,000 lb., while the exports had leapt to 47,250,000 lb. (valued at £1,043,000). This was an exceptional war-time condition, but in 1919 while there were no imports the exports reached 44,408,000 lb. In 1916, for the first time, sufficient butter and cheese were made in the Union for all local requirements and something left over for export. The total export of butter in 1918 was 1,316,000 lb., of cheese 424,000 lb. In 1919 butter exports fell to 452,000 lb., but that of cheese increased to 1,546,000 pounds.

Large areas of S. Africa are well adapted to horse-breeding; in general, horses do well wherever conditions are best suited for sheep. The numbers of horses in the Union in 1919 was 695,000, of mules 81,000, of asses 498,000. These figures do not include horses, etc., in native locations.

Ostrich-farming suffered severely through the World War. In 1913 the industry had attained unprecedented success, when feathers weighing 1,023,000 lb. valued at £2,953,000 (an average value of £2 17s. 9d. per lb.) were exported. In that year there were 776,000 ostriches in the Union (757,000 of them in the Cape province). Over-production and the effects of the war in five years brought about an almost total collapse of the feather trade; the export fell by three-fourths and prices to 15s. a lb. Many breeders took up other branches of farming and by 1920 few persons were wholly dependent on ostriches for their living. The stock of birds was greatly reduced (it was 314,000 in 1918), only those of finest plumage being retained.

The pig and bacon industry is a development wholly post-Union. Pedigree animals were imported but the industry had barely got beyond infancy in 1920. The total production of bacon in the Union in 1917–8 was slightly over 7,000,000 pounds.

Among cereals the most important crop is maize. The maize belt covers a large area in the eastern portion of the Union, chiefly in the Transvaal and Orange Free State. There is an expanding home market for maize and an assured overseas market. The quantity of maize exported was 356,000,000 lb. in 1910 valued at £693,000 and 509,000,000 lb. in 1918, valued at £1,600,000. Kaffir corn, grown chiefly by natives, specially valuable for fodder in

[1] Consult a paper on S.A. Agriculture by F. B. Smith, sometime secretary of the S.A. Agricultural Department, read at a meeting of the Colonial Institute, May 31 1921.

[2] The figures relate to beef and mutton but the quantity of mutton exported is small, 62,000 lb. in 1910 and 46,000 lb. in 1919.

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regions too dry for maize, was also an increasingly valuable crop. The area under wheat is mainly in the western part of Cape province; the production, 362,000,000 lb. in 1911, rose to 608,000,000 in 1917–8, but fell the next year to 478,000,000 lb. Of oats 48,454,000 lb. were exported in 1919.

Sugar plantations are confined to Natal and Zululand. The area under sugar in 1916–7 was 163,000 ac., the production that year being 114,000 tons and the value £3,134,000. In 1919–20 the output was approximately 180,000 tons, of which over 30,000 tons were exported. The cultivation of tea declined, sugar yielding greater profits; the yield for 1916–7 was 1,747,000 lb., compared with 2,681,000 in 1903, the year of highest production. Tobacco production did not show great variation in quantity during 1910–20, the yield being 15,000,000 to 17,000,000 lb. yearly, but there was considerable alteration in the class of tobacco grown, due to the increased demand for light and medium varieties. Cigarettes from locally grown Turkish tobacco became very popular.

Fruits of many varieties are produced for which there is a very large home demand, especially in the mining areas. The export trade, in fresh, bottled, canned and dried fruit and in jams showed a fair amount of extension and in 1919 was valued at £125,000.

Plantations of black wattle for the production of tan-bark cover about 250,000 ac., of which 160,000 are in Natal. Before the World War the bark was taken by Germany; factories for the production of the extract were erected in Natal in 1919 and the extract sent to Great Britain. The value of the exports increased from £269,000 in 1916 to £412,000 in 1918.

Irrigation.—Considerable progress was made in local irrigation schemes, but no great project had been undertaken by the Union Government up to 1922. The opposition of vested interests stood in the way of an adequate water law for the whole country, but in 1912 an Irrigation and Conservation of Waters Act was passed and an Irrigation Department created. Provision was made for irrigation loans to private persons and to irrigation boards, and for hydrographic surveys, etc. The government expenditure on irrigation increased from £276,000 in 1912–3 to £573,000 in 1917–8. By 1920 schemes involving an expenditure of £2,500,000 had been approved. The Sunday river, Cape province, irrigation works were the largest then under construction and were designed to bring 42,000 ac. under cultivation.

Mining.—Despite appearances the most valuable mineral in S. Africa is coal. The position was put succinctly in 1920 by Mr. U. P. Swinburne, Chief Inspector of Mines, when he wrote in the *Official Year Book of the Union* "S. Africa has made its name through the production of gold and diamonds, but it is mainly due to the existence of cheap coal that the large output of gold and diamonds has been made possible. On the Witwatersrand proper only a few mines would be working at the present time if a plentiful supply of cheap steam coal was not available." Opinions of experts on the life of the gold mines on the Rand differ; the report of the Union Economic Commission, presented early in 1914, estimated that 550,000,000 tons of payable ore remained in the mines then working. This figure was very much less than had been expected. Since that year new mines on the Far Eastern Rand have been developed. Mr. P. A. Wagner, in his presidential address in 1918 to the S.A. Association for the Advancement of Science, hazarded the conjecture that £1,200,000,000 worth of gold remained to be extracted and that 50 years ahead some of the mines might still be profitably worked. But gold production on the Rand is so costly that a slight rise in costs has on many mines a disastrous effect.

With regard to diamonds their abundance is unquestioned, and a policy of limiting supplies to keep up prices is adopted. Even so most of the diamond mines were shut down in 1920–1, a striking example of the economic depression prevailing, S.A. being the only considerable source of the supply of diamonds in the world. Depression in prices led also in 1918 to the closing of the copper mines in Namaqualand, Cape province.

Since 1912 the gold industry has become increasingly dependent on the development of the Far East Rand. Thus in 1918 the dividends paid from the Far East Rand mines amounted to £3,344,000, compared with £1,929,000 from all other Rand mines. The value in sterling of the gold output from the Transvaal mines rose from £31,973,000 in 1910 to £39,489,000 in 1916. This was considered the high water mark.[1] The value in 1917 was £38,306,000, in 1918 £35,758,000, in 1919 £35,389,000 and in 1920 £34,652,000 (for the first half of 1921 the output was £16,671,000).

The statistics of the output of diamonds reflect the purchasing power of the public. The market is strictly controlled by the producers and the only diamond field of importance which was outside the Union—that of ex-German S.W. Africa—as a result of the World War came into line with the other S.A. mines. In 1914, shortly before the war began, a conference of representatives of the diamond industry was held in London with the object of regulating the output from each mine. Though no binding agreement was then made such an arrangement is virtually in force. The value of the diamonds extracted in 1910 was £8,746,000, in 1913, the last full year before the war, £11,389,000. In 1915 diamond mining almost ceased, the total output that year being valued at £399,000. The mines restarted in 1916, when the value of the output was £5,728,000. In 1918 the figure was £7,114,000 and in 1919 had risen to £11,734,000, thus exceeding the record of 1913. The year 1920 began well and ended badly; the market was overstocked and purchasers few. The overstocking of the market was attributed by the De Beers Co. to the sale of diamonds by the Russians—by the Soviet Government to obtain goods and by private individuals who had lost other means of subsistence. The Rhodesian output of diamonds is very small; the De Beers Co. has the right to dispose of all diamonds found in the territory. In the Premier mine, Transvaal, the system of open working still prevailed in 1921. In Sept. 1917 a fine stone of 442 carats was found in the Dutoitspan mine, Kimberley.

A very marked development of coal mining took place between 1910 and 1921. The mines of the Cape province, which yield only poor quality coal, were nearly all abandoned as the richer deposits in Natal and the Transvaal were opened up. The output from the Cape exceeded 100,000 tons for the last time in 1909, in which year the Natal fields first yielded over 200,000 tons. The total output from the Union rose from 7,112,000 tons valued at £1,869,000 in 1910 to 10,382,000 tons valued at £3,275,000 in 1917 and was 10,266,000 tons in 1919. Besides supplying cheap fuel for the gold and diamond mines and other purposes, the coal is in great demand for bunkering ships and for export to India, E. Africa and S.A. ports. In 1919 Union coal bunkered was 1,427,000 tons; coal exported 1,092,000 tons (half of these exports going via Delagoa Bay).

The output of tin, mined almost entirely in the Waterberg and Olifants river districts, Transvaal (3,672 tons in 1913 valued at £436,000), had dropped in 1918 to 1,900 tons valued at £277,000.

Copper output increased with the opening of the railway in 1913 to the Messina mines on the Limpopo. These with the Namaqualand mines represented the copper output of the Union, which in 1916 with 22,800 tons reached a value of £1,137,000. In 1919 the output sunk to 4,900 tons valued at £208,000.

Trade and Shipping.—The following table gives the total of imports and exports to and from the Union for 1911, the first complete year after the Union had been established, for 1915, the year of the greatest restrictions of trade owing to war conditions, and for 1919. The exports include diamonds and gold, the imports government stores and specie:—

Year	Imports	Exports	Total Trade
1911	£38,035,000	£57,308,000	£95,343,000
1915	£33,833,000	£35,012,000	£68,845,000
1919	£50,791,000	£104,561,000	£155,352,000

Trade in 1920 was conditioned by the world depression, which did not become marked till the second half of the year. Imports in the first six months showed a large increase, being £48,000,000 against £28,000,000 in the corresponding period of 1919, and for the whole year exceeded £90,000,000. Exports for the first six months of 1920 showed a comparatively small decline, being £51,000,000 as against £58,000,000 for Jan.–June 1919, but for the whole of 1920 the total was only £72,000,000.

The distribution of trade by countries was as follows in 1910 and 1919:—Imports (1910) United Kingdom 59%, (1919) 46%; other British lands (1910) 11%, (1919) 17%; United States (1910) 8%, (1919) 24%; other countries (1910) 22%, (1919) 13%. Exports (excluding gold) United Kingdom (1910) 80%, (1919) 61%; other British lands (1910) 1%, (1919) 8%; United States (1910) 17%, (1919) 24%; other countries (1910) 17%, (1919) 15%.

Nearly all the external trade of the Union passed through Durban, Cape Town, Port Elizabeth and East London. The only non-British port which had a share in the trade of the Union was Delagoa Bay. In 1913 Delagoa Bay had 12% of the trade, in 1918 only 8% (*see* DELAGOA BAY). Of neighbouring countries the chief trade was with Rhodesia, Portuguese E. Africa and the Belgian Congo. The exports to British E. Africa (Kenya Colony) increased from £19,000 in 1913 to £396,000 in 1918; in the same period the imports from British E. Africa rose from £16,000 to £139,000. Of foreign countries outside Africa and excluding the British Empire and the United States, France and the Argentine were the chief traders with the Union. As to overseas carrying trade the British proportion of cargo shipped in 1918 was 79·85% and the Japanese 7·51. Of cargo landed the British proportion was 69·17% the Japanese 10·12% and the American 9·43%.

The value of the preferential treatment accorded certain articles of merchandise imported into the Union from the United Kingdom, Canada, Australia and New Zealand is shown by the following figures:—In 1913 on imports valued at £22,498,000 the amount rebated was £628,000; in 1918 on merchandise worth £25,158,000 the rebate was £698,000.

The number and tonnage of vessels entered at Union ports (including the coastwise trade) was as follows in the years named. The figures represent the gross number of vessels using the Union ports, *i.e.* the same vessel, if it called and cleared at Cape Town, Port Elizabeth and Durban, would be entered three times. The tonnage

[1] The total value of gold mined in British S. Africa in 1916 was £43,416,047: of this total £3,859,111 came from Rhodesian mines, £31,726 from the Tati goldfields, £1,336 from Natal and £132 from Cape province. The Natal mines in 1915 had yielded over £10,000,

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of vessels cleared is not given, it corresponds closely to the figures of tonnage entered.

Year	No. of vessels entered	Net tonnage British	Net tonnage Total
1913	4,349	10,586,000	12,939,000
1915	3,322	7,298,000	7,937,000
1917	3,888	7,682,000	9,252,000
1919	3,060	6,642,000	7,608,000

The number of German ships entering Union ports in 1913 was 230, of 723,000 net tonnage.

Communications.—Nearly all the railways in the Union are state owned. Railways and harbours are under the control of a Board, whose finances are independent of the other revenue departments. The mileage of railways open in 1910 was 7,586, of which privately owned lines had a mileage of 545. In 1919 the mileage open was 10,049, of which government lines had 9,542 mileage. It will be seen that development was rather slow, an average of 246 m. a year in a period of 10 years. The total expenditure on new lines in these 10 years was £9,113,000. The principal new line, that from Prieska to Kalkfontein connecting the Cape and S.W. Protectorate systems, was built for military purposes. The extension in 1913 of the railway from Krugersdorp via Zeerust to Mafeking brought Johannesburg and Bulawayo within 680 m. of one another (instead of 975 m. via Fourteen Streams) and made Mafeking the business centre for the western Transvaal. The opening, also in 1903, of the Messina railway, afforded the opportunity, by the building of a connecting line to W. Nicholson in S. Rhodesia of putting Bulawayo in direct communication with Delagoa Bay. But, up to 1921, the needed link had not been built (*see* RHODESIA). In the Cape province the completion of the Mossel-Bay–George–Oudtshoorn line gave a much more direct connexion between Cape Town and Port Elizabeth reducing the distance from 910 m. (via de Aar) to 684 m. (the distance by sea between the two ports is 436 nautical miles). The adoption of electricity on a number of lines, including the main line from Durban to Glencoe was recommended in 1920 by the government's consulting engineer. The scheme was adopted by the ministry for the Cape Town–Simon's Bay line and for the Natal main line from Durban as far as Maritzburg. With the electrification of the Durban–Maritzburg line a new alignment was undertaken as part of a scheme for rebuilding the whole line from Durban to the Rand.

The Railways and Harbour Board after the World War took over control of the railways in the S.W. Protectorate. The total railway mileage in the Union and Protectorate at the beginning of 1920 was 11,334. Up to March 31 1920 the capital expenditure on Government railways was £96,408,000. The gross earnings in 1919–20 were £19,169,000 and working expenses 78·9% of the gross earnings.

The use of motor vehicles greatly increased from 1913 onwards (when over 4,000 cars were imported), farmers having by then learned their value. In 1919 over 16,000 vehicles were licensed. Nearly all the cars came from America (United States and Canada), but heavy motor lorries were imported from England. Notwithstanding this development of motor traction the trek ox was still employed though in decreased numbers.

The extension of the telegraph system kept fair pace with the needs of the community, and wireless stations were erected at Durban, Cape Town and (in 1921) at Port Elizabeth. These were not of high power, the guaranteed range (at night only) not exceeding 1,500 miles. Wireless telephonic stations were added in 1921.

With respect to the mail service to England no improvement in speed was made. A contract to run for 10 years from Oct. 1 1912 was entered into with the Union Castle Co. for a weekly service to and from Southampton, the duration of the voyage to be 16 days 15 hours. The subsidy paid was £171,000 yearly, of which £21,000 was in consideration of the mail steamers beginning and ending their voyages at Durban instead of Cape Town. The contracting parties were on the one hand the steamship company and on the other hand Great Britain, the Union, Southern Rhodesia and the Bechuanaland Protectorate. Postal communication with Australia, India and the Far East was maintained by private ships as opportunity offered. A steamship service between Holland and S. Africa, subsidized by the Netherlands Government, was established in 1920, and in 1921 a direct service between S. Africa and Vancouver was started by the Canadian Government. While some £10,000,000 or more a year was spent on harbour works except at Durban (*see* DURBAN) the facilities for shipping were not greatly extended, and Cape Town suffered from lack of adequate dock accommodation.

Air travel developed slowly. The first aeroplane flight was made in 1910 in a Voisin biplane. Little progress was made in civil aviation until after the World War, when, in 1919, aerodromes were laid out at Wynberg, Bloemfontein, Johannesburg and other places as stages on the cross-Africa route. The first flight from Cairo to Cape Town was made in 1920 by two S.A. military pilots. In the same year an Aero Club for S.A. was formed at Cape Town.

Education.—"Education, other than higher education," which definition in practice was held to include all education other than university, is controlled by the provincial councils. The standards and methods differ in each of the four provinces but in general provision is made for a sound training of white and coloured (as distinct from native) children. A matter which aroused acute dissensions before and in the two years immediately following the establishment of the Union was the question of the medium of instruction. By law the English and Dutch languages were in a position of equality. An attempt to favour Dutch was made in the Transvaal schools, while in the Free State the education authorities tried to enforce bi-lingualism, insisting that English-speaking children should be taught in the medium of Dutch. Eventually all four provinces adopted the principle recommended by the Union Parliament in 1911, namely that the medium of instruction up to standard IV. should be in the "home" language of the scholar, and that above that standard freedom of choice should be left to the parents. The compromise worked and in June 1912 the private schools which had been opened by the English speaking residents in the Free State in 1910 as a protest against compulsory bi-lingualism were handed over to the provincial administration. The subject of religious instruction presented little difficulty. The practice in each province in all public schools is for school to be opened with prayer and a reading from the Bible. Scripture teaching, subject to a conscience clause, is generally provided; sectarian teaching under certain conditions is allowed in the Cape province by an ordinance passed in 1913. The number of schools in the Union for white children increased from 3,873 in 1910 to 4,846 in 1918; in the same period the schools for coloured children increased from 1,999 to 2,877. The number of white scholars in 1910 was 163,200, in 1918 the number was 283,100. The coloured scholars had increased in the same period from 136,000 to 220,100. The teachers had increased from 10,912 to 18,301, and the expenditure from government funds had grown from £1,597,000 to £3,631,000. Private schools were not numerous; there were 270 in the Union in 1918, of which 96, the oldest dating from 1880, were in the Cape province. There were then in the Union 135 private schools founded since 1910.

State and state-aided schools for natives are provided in all the provinces, and in Natal and the Transvaal there are special schools for Indians. The expenditure on native schools rose from £81,000 in 1911 to £137,000 in 1918. In Natal in 1918 the government established an institution for training the sons of chiefs and *indunas* in the special duties they are called upon to perform. The education of the natives remained, however, very largely in the hands of missionary societies, though there was a growing inclination, among the natives, particularly in the Transkeian territories, to secularize education and to obtain a larger direct share in its management. Of the 23 principal institutions which in 1919 provided higher education for natives—literary, commercial, industrial, agricultural and training for the ministry—12 were in Cape province, the largest and most comprehensive being the famous Lovedale College. The most important step in regard to higher education of natives was the establishment in 1914 of the S.A. Native College on a site at Fort Hare, Cape province, given by the United Free Church of Scotland. To this college the natives and the missionary societies, Presbyterian, Anglican and Wesleyan, contributed; the Union Government gives an annual grant. The college aims at providing education of university standard and is open to coloured and Indian students.

The system of higher education was reorganized in 1918, after much heated controversy (*see* below § *History*). Under the new scheme the university of S. Africa, with headquarters at Pretoria, which replaced the university of the Cape of Good Hope, is an examining body, having the following constituent colleges:—Grey University College, Bloemfontein, Huguenot College (for women), Wellington, Natal University College, Pietermaritzburg, Rhodes University College, Grahamstown, South African School of Mines, Johannesburg, and Transvaal University College, Pretoria. The new university of Cape Town provides for the residence as well as the teaching of students (men and women). A special feature of the new Stellenbosch University is its agricultural faculty (the Transvaal University College has also an agricultural faculty). The number of university students in the Union increased from 1,171 in 1910 to 2,069 in 1918. In the last-named year the expenditure on higher education in the Union was £240,000.

Finance.—The unitary system of government adopted in 1910 was strongly marked in the financial provisions made. All public revenues were payable to the Union Government, and the funds needed to carry on the administration of the provinces were provided by grants from the Union Exchequer. By the Financial Relations Act which came into force in April 1913 the Union Parliament assigned the revenue derived from transfer duties, liquor licenses and native pass fees in Transvaal labour districts to the provinces, but gave the provinces no power of legislation in regard to such revenue. Other sources of revenue, such as education fees, trading and professional licenses were assigned to the provinces with power of legislation in regard thereto. A subsidy from Union funds of one half the ordinary expenditure of the provinces was also made, plus additional subsidies to Natal and the Orange Free State whose funds were shown to be inadequate to meet the necessary expenditure. The provinces are not allowed to borrow from any other source than the Union Treasury.

All trust moneys, (*e.g.* post office savings bank moneys) are handed over for investment to the Public Debt Commissioners. Any yearly surplus of revenue over ordinary expenditure is paid to the Commissioners and by them applied to the redemption of debt.

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Revenue and expenditure of the Union is divided into two distinct funds, the ordinary or general, and the railway and harbours.

The following table shows the ordinary revenue and expenditure, for three typical financial years:—

	1913–4	1916–7	1920–1
Revenue	£15,980,000	£18,617,000	£28,381,000
Expenditure	£14,289,000	£15,490,000	£28,890,000

The chief sources of revenue for the year 1919–20, were as follows: customs, £5,010,000; interest, £4,277,000; income, super, and dividend taxes, £4,050,000; posts, telegraphs and telephones, £2,031,000; excise, £1,228,000, and mining revenue, £1,023,000. The native poll and hut taxes produced altogether, £830,000. Among the main items of expenditure for the same period were: public debt, £6,940,000; provincial administrations, £3,520,000; justice, £3,209,000; postal, etc., services, £2,144,000; defence, £1,575,000; pensions, £1,200,000; interior, £1,019,000; agriculture, £861,000, and public works, £614,000.

Railway and harbour finance is controlled by a board presided over by a cabinet minister. The management of harbours and railways is required to be upon business principles. The following table shows receipts and expenditure for these services in the years named:—

	1913	1916	1918–9
Harbours (receipts)	£1,039,000	£1,031,000	£939,000
" (expenditure)	£900,000	£656,000	£479,866
Railways (receipts)	£12,388,000	£13,257,000	£11,680,000
" (expenditure)	£8,964,000	£8,891,000	£15,282,000

The war expenditure of the Union was met out of loan funds, the total charge on such funds amounting on March 31 1920 to £29,736,000. At the same date the public debt of the Union was £173,905,000.

The South-West Protectorate

After the surrender, in July 1915, of the German forces in S.W. Africa Gen. P. S. Beves was appointed military governor of the protectorate.[1] None of the German inhabitants was then repatriated and while the regular troops were placed in internment camps the civilians were allowed to return to their homes and continue their ordinary business. Mr. (afterwards Sir) E. H. L. Gorges, Secretary of the Interior in the Union, who had at Gen. Botha's request already drawn up a scheme for the future administration of the protectorate was made chief civil secretary. On Oct. 30 1915, on Gen. Beves's departure the two offices named were abolished and the functions of both taken over by Mr. Gorges with the title of Administrator. This post he retained until nearly the close of the military occupation period, which lasted till the end of 1920. Martial law remained in force but in a mild form and the administration was on civilian lines. At the beginning of 1917 it was found necessary to send an expedition to Ovamboland, the northern and most populous part of the protectorate, where German authority had been very slight. A chief named Mandume proved recalcitrant and two battalions, the first and the fourth of the S.A. Mounted Riflemen, together with a composite regiment of military constabulary were sent against him, Col. de Jager being in command. The expedition, despite fever, flood and dense forest, as well as the opposition of the natives, was successful. Excellent relations were afterwards established with the Ovambo.

In the rest of the protectorate S.A. rule was from the first welcomed by the natives, and the Germans gave no serious trouble. Until nearly the close of the World War they believed that the British occupation was temporary, being confident in the ultimate victory of Germany. This was evidenced by the fact that the German banks and traders maintained a rate of exchange of 24 marks to the £ sterling until Nov. 1918—the month of the Armistice. Instances were known of farmers selling their stock for sterling and converting it into paper marks. Where the artificial rate of exchange broke down serious losses followed. The Germans, however, continued to entertain false hopes, and after the Armistice they wrote to President Wilson asking his help on "self-determination" lines. They desired, they said, to become an autonomous republic leagued to the German republic, and this solution, they gratuitously added, would, they believed, meet the wishes of the natives. In 1919 the German soldiers—about 5,800 in all—together with some 600 "undesirables" were repatriated. This still left, according to official figures, over 9,000 Germans in the protectorate. These German settlers continued hostile to Union rule, and obnoxious to authority. Lord Buxton, then governor-general of the Union, who visited Windhuk, the capital, in Oct. 1919, took occasion to inform them that the severance from Germany was irrevocable, and that the protectorate would in future form an integral part of the Union. Gen. Smuts when on an official visit to the territory in Sept. 1920 used similar language. The Germans had informed him that the country should be administered as "an independent province," and that the German civil code should continue, arguing that the introduction of the Roman-Dutch law would be "a retrogression of centuries." They also asked for the recognition of German as an official language, and the maintenance by the State of the German schools, but were refused.

By the treaty of Versailles Germany had renounced sovereignty over the protectorate, and in accordance with its provisions the Supreme Council in May 1919 assigned the mandate for the territory to the Union of S. Africa. An Act was passed by the Union Parliament in Sept. 1919 to give effect to the mandatory powers; finally the mandate was confirmed by the Council of the League of Nations on Dec. 17 1920. On Jan. 3 1921, martial law was withdrawn and Mr. Gysbert Hofmeyer, who had succeeded Sir Howard Gorges as Administrator in Oct. 1920, was given a nominated advisory council of six members. This council met for the first time on Feb. 2 1921.

Settlers and Industries.—In general the laws in force in, and the economic policy of, the Union was applied to the protectorate from the early days of Sir Howard Gorges's rule. Walfish Bay, the only good harbour on the S.W. coast, had languished. It had formed a small British enclave in what was German territory, and without hinterland, served only the purpose from which it got its name—a whaling station. Swakopmund was an artificial and poor port. The Union authorities built a line (22 m. long) from Walfish Bay to Swakopmund, and thus gave the protectorate its natural sea outlet. The whole length of the line from Walfish Bay to Windhuk was relaid on the standard S.A. gauge of 3 ft. 6 inches. In 1921 the Railways and Harbour Board undertook the construction of a line (132 m. long) eastward from Windhuk to Gobabis.

While no crown lands were alienated up to 1921 temporary licenses were granted and many members of the army of occupation on demobilization settled in the country with their families. A fairly large British-Dutch population soon grew up, evidenced sufficiently by the fact that in 1920 there were 975 children attending Government schools.[2] The new settlers were chiefly engaged in stock raising and farming; the copper, tin, and diamond mines were already in beneficial occupation, largely with British capital. The Otavi mines in the years 1916–8 produced 100,000 tons of copper ore, valued at £600,000. The expectation that the Lüderitzbucht (Luderitz Bay) diamond fields would be thrown open to all comers was not realized. At the end of 1915 some of the companies on the diamond field were allowed to resume work; between Oct. 1915 and Jan. 1919 diamonds valued at £1,900,000 were obtained. Later the whole diamond field came under the control of one company, which entered into a working arrangement with De Beers and other diamond mining companies in the Union. The depression in trade led, in 1921, to the temporary closing of the mines. Depending upon diamonds for prosperity, was, declared Mr. Hofmeyer, like building on sand.

Trade and Revenue.—During the war external trade was all overland with the Union, trade being facilitated by the line built in 1915 from Prieska to Kalkfontein to connect the two railway systems. Customs duties were those in force in the Union, with free trade between the Union and the protectorate. During 1918 the value of imports was £1,031,000, about one half being S.A. produce. Of the total imports £409,000 represented the value of food and drink, and £181,000 cotton goods. The value of exports in 1918 was £817,000. The chief items were, diamonds £652,000, copper ore £55,000, cattle and small stock £57,000, horns, hides and skins £35,000.

The revenue of the protectorate in the financial year 1917–8 was £295,000; and in 1918–9 £377,000, of which £275,000 was from the tax on diamonds. The expenditure for the two years named was £650,000 and £744,000; as to more than three-fourths the expenditure was on the upkeep of the garrison.

Native Affairs.—Nowhere else had German methods of dealing with the natives been more ruthless than in S.W. Africa. The result of an examination of German judicial and administrative methods and documents was made public in 1918. It showed that not only

[1] For earlier events *see* German South-West Africa.

[2] The German settlers had separate schools. Efforts were made in 1921 to induce them to abandon these schools. They were offered "mother-tongue" instruction up to standard VI., coupled with the compulsory learning of either English or Dutch.

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during the Hereró and Hottentot wars but in peace time the natives were systematically subjected to brutalities and robberies, by the Government as well as by the settler. One consequence was that, apart from Ovamboland, where the Germans had little authority, the native population had decreased from some 130,000 in 1904 to 37,000 in 1911. In 1920 it was estimated at 80,000. To reconstruct, as far as practicable, tribal organization, Sir Howard Gorges established native reserves (over 4,000,000 ac. in all) controlled by hereditary chiefs, when such survived, or by an elected or nominated headman. To these men small salaries were given. Rules to protect natives in the railway and other public departments and in European private service were enforced.

The Native Protectorates

No change was made in the political status of the native protectorates—Basutoland, the Bechuanaland protectorate and Swaziland—in the period 1910–21. They remained under the control of the Colonial Office, represented by the High Commissioner for S.A. and were administered by resident commissioners. They form in whole, or in greater part, native reserves, and the Basuto and Bechuana showed marked disinclination to incorporation in the Union of S. Africa. All three protectorates prospered.

Basutoland.—At the 1921 census the people numbered 500,544 (of whom 1,615 were whites and 155 Asiatics) compared with 403,845 in 1911 and 348,848 in 1904; of the total pop. in 1921 males numbered 224,435 and females 276,109. Maseru, the capital and largest town had (1920) approximately 900 native and 500 white inhabitants. Outside Maseru, the white residents are nearly all officials or missionaries. Ownership of land by whites is forbidden. Some 20,000 male Basutos are normally employed outside the country—mostly on the Rand gold mines. Agriculture and stock raising are the chief occupation of the people.

Education is in the hands of the missionary societies, except for four small Government schools. In 1919 there were in all 344 schools with 28,500 scholars, most of the schools being maintained by the French Protestant Mission (the Paris Evangelical Society). Grants in aid are made by the administration (£25,000 in 1920–1). Serious crime is rare and the drinking habits of the people, which once threatened their destruction, have been very largely abandoned under missionary influence. About one-fourth of the Basutos prefers Christianity. Trade is almost exclusively with the Cape and Free State provinces; the Basuto export grain, cattle, wool and mohair, and horses; and import mainly clothing, ploughs, saddlery, iron and tin ware, and groceries. The value of imports increased from £239,000 in 1908 to £1,137,000 in 1919. In the same period the value of exports rose from £193,000 to £1,380,000—in part due to inflated prices obtained for wool and mohair.

Financially Basutoland is self-supporting. Revenue is obtained from customs, licenses and, principally, from the poll tax on natives. This tax was substituted in 1911 for the hut tax previously enforced. A tax of £1 per annum on adult males was then put in force, but if a Basuto had more than one wife, he paid £1 per annum for each wife, up to a maximum of £3 for himself and his wives. This tax yielded £92,000 in 1913 and £106,000 in 1918–9. Total revenue increased from £145,000 in 1910–1 to £199,000 in 1919–20; the corresponding figures for expenditure were £134,000 and £202,000.

The system of government which under a resident commissioner allows a measure of home rule to the Basutos continued to work well. The *pitso* or national council meets yearly, 95 out of its 100 members being nominated by the chiefs and the other five by the administration. It has advisory powers only, but its advice is often taken. Sir H. C. Sloley who had been resident commissioner since 1901, and who earned the full confidence of the people, was in Dec. 1917 succeeded by Lt.-Col. E. C. F. Garraway. Letsie II., who had been paramount chief since 1905, died in Jan. 1913. He was a great grandson of Moshesh, the founder of the Basuto nation and dynasty, and was succeeded by his brother Griffith. When the World War began Griffith and his people offered to raise regiments for combatant service. The offer was declined, to the grief of the Basutos, to whom service with the labour contingent did not appeal. However, 1,400 Basutos served with the S. A. Native Labour Contingent in France, and many were employed in S.W. and E. Africa. The Basuto also contributed £50,000 to war funds. In 1921 the new High Commissioner, Prince Arthur of Connaught, visited Maseru, and the presence of a member of the royal house was made the occasion for a national tribute by the "Sons of Moshesh"—as the Basutos call themselves—to their loyalty to the British throne and their wish to remain directly under imperial control.

Bechuanaland.—The Bechuanaland protectorate is a much poorer country than Basutoland and the Bechuana are a less virile race than the Basuto. Bathoen, paramount chief of the Bangwaketse, died in July 1910 and Sebele, paramount chief of the Bakwena, died in Jan. 1911. Montsioa, chief of the Baralong, died in April 1911. All these chiefs were noted men in the early struggles between the Boers and British for the possession of Bechuanaland, Sebele being a son of the chief Sechele, the friend of David Livingstone. Khama, the chief of the Bamangwato, and a Christian from his youth, still survived in 1921 and had then ruled over his people with undisputed authority for some 50 years.

The Bamangwato are the largest tribe, numbering about 40,000. The people grow maize, kaffir corn and other crops but their chief wealth is in cattle, and cattle hides and skins are the chief exports. Firewood and timber for mining props are also exported. In 1917–8 exports to the Union included 23,600 horned cattle and 36,000 sheep and goats. The chief markets are Kimberley, Mafeking and Johannesburg. For customs purposes the protectorate is dealt with as part of the Union and no statistics as to value of imports and exports are kept. Revenue, £52,000 in 1910–1, first exceeded expenditure in 1915–6, when the figures were revenue £70,000, expenditure £68,000. In 1919–20 revenue was £81,500, expenditure £91,600. Deficits were made good by grants from the Imperial Exchequer. The seat of the administration is Mafeking, in the Cape province. Mr. J. C. Macgregor became resident commissioner in 1917. Khama's headquarters are at Serowe (pop., 1920, about 25,000).

Swaziland.—At the 1921 census the inhabitants numbered 113,772, of whom 2,203 were whites. Of the total pop. 54,702 were males and 59,070 females. The state of chaos into which Swaziland had fallen owing to the indiscriminate grant of concessions (*see* 26.181) was ended by 1914. The partition of rights between the European concessionnaires and the Swazis was completed in 1911, and those natives who were required to move from properties held by whites by July 1914, did so voluntarily—such as did move, for many natives made terms with the concessionnaires and remained on their farms. Out of a total area of 4,274,000 ac. 1,635,000 ac. were set aside as Swazi reserves; in addition the Swazis bought 77,000 acres. The Swazis raise maize and other crops and own large stocks of cattle while 7,000 to 10,000 Swazis are usually at work on the Rand mines. The whites engage in agriculture, including fruit farming and cotton and tobacco growing and in mining. The gold mines, which produced 6,497 oz. in 1915–6, were closed down as unprofitable in 1917. Tin of a total value of £346,000 was produced in the years 1915–20. The large coal deposits in the protectorate had not been exploited up to 1921. No separate statistics of Swaziland trade are kept. Revenue which in 1910–1 was £58,000 had risen to £91,800 in 1919–20. Expenditure in the same period rose from £62,000 to £87,000. The settlement of the concessions' questions cost £182,000.

The administration is under the charge of a resident commissioner, with headquarters at Mbabane, a small, picturesquely situated hill village (altitude 4,000 ft.) overlooking the middle veld. The paramount chief and other chiefs exercise jurisdiction in all civil cases in which natives only are concerned. Naba Tsibeni, the "queen regent," a well-known figure in Swazi history acted for many years as paramount chief, until the coming of age of her grandson Sobhuza (born about 1900). Education is mainly in the hands of missionaries; Sobhuza was educated at a Government school established at Naba Tsibenis Kraal. Mr. De S. M. G. Honey who had served in Swaziland since 1904 became in 1917 resident commissioner.

History

The 12 years (1910–21) following the establishment of the Union of S.A. were marked by political, racial and industrial crises which profoundly affected the future of the country. The most urgent issue was raised by a powerful section of the Dutch community, which revived a narrow Nationalism and developed a demand for the separation of the Union from the British Empire. Coupled with this conception went strong opposition to action against Germany, or any share in the World War. But this Nationalist section, whose greatest figure was ex-President Steyn and whose mouthpiece was Gen. Hertzog, was unable to control events. The policy of Gens. Botha and Smuts of "building up a new State on non-racial lines" and as an equal member of the British Commonwealth prevailed.

Besides this main issue the growth of an organized Labour party, which found its chief stronghold on the Rand and put forward an advanced socialistic programme, presented perplexing problems to a community new to such manifestations. The position of Indians in the Union, and the resolve of the white races to prevent further immigration of Asiatics was another problem which caused acute controversy, only partially silenced by the ultimate assent of the Government of India to the policy of exclusion. And behind all these questions was the ever-present problem of the relation between the white and native races. Signs multiplied that the Bantu peoples, gaining in knowledge and an increasing factor in industry, had acquired a sense of race solidarity and would not rest satisfied with their existing economic, social and political status.

While these racial and political questions held the field they were accompanied by a steady development of the material

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resources of the country and of trade. The progress in agriculture and in mining was marked; a beginning was made in manufactures. The benefit of unification in this respect was apparent. That benefit was even more apparent in the relations of S.A. with the outside world; she spoke with one voice and as a powerful unit. The new position which S.A. had acquired, in common with the other British Dominions, was seen when as a separate entity she was represented at the Peace Conference in Paris and her delegates signed the Treaty of Versailles.

Outside the Union the period under review was chiefly noticeable for two things: the disappearance of German sovereignty accompanied by the transfer of the administration of ex-German S.W. Africa to the Union, and the decision to terminate the government of Rhodesia by the Chartered Company, in response to the demand of Rhodesians for self-government.

The Union had been brought about by the recognition by the leaders of the Dutch and British communities that S.A. was one country, not several, and that in every part of it the interests of the two races were so intermixed that they could not be separated without harm to both. Lord Gladstone, the first governor-general of the Union, had called upon Gen. Botha, the Prime Minister of the Transvaal, to form the first Ministry under the Union.[1] This Gen. Botha had done and this Ministry came into existence on May 31 1910, the day on which the Union was proclaimed (being the eighth anniversary of the close of the Anglo-Boer War). General Botha's Ministry was formed from members of the expiring Cabinets of the various colonies, but while it included Natal ministers and strong Boer partisans it was not a coalition ministry. The first general election, held on Sept. 15 1910, was fought on party lines and was hotly contested. It resulted in a majority for the "South African" party, that led by Gen. Botha, of 13 over all other parties, though Gen. Botha himself was defeated at Pretoria East by Sir Percy Fitzpatrick and a seat had to be found for him by means of a by-election. In the first session of the Union Parliament (opened by the Duke of Connaught on Nov. 4) Gen. Botha had the support not only of his own party, but of that of the four Labour members elected by Rand constituencies and of several of the Natal members of whom 13 out of 17 had been returned as Independents. The opposition, known as the Unionist party (and mainly British) was led by Dr. Jameson, who was created a baronet in Jan. 1911. Owing to ill health Jameson resigned the leadership in April 1912, and was succeeded by Sir Thomas Smartt, an ex-Cape minister and, like Jameson, a medical man. In Oct. 1912 Jameson resigned his seat for Albany (Graham's Town) and retired from Parliament.

Botha's First Ministry.

General Botha's Cabinet was of a rather heterogeneous character. Among its members were Gen. Smuts, Mr. H. C. Hull, Mr. Jacobus Wilhelmus Sauer, Mr. Henry Burton, Mr. Abraham Fischer and Gen. Hertzog. They were divided on personal and provincial as well as progressive and retrogressive lines. General Smuts, Minister of the Interior, did not at first figure very prominently, but was the Prime Minister's right-hand man. Mr. Hull (b. 1860), after being in the Cape civil service, had practised at the bar, served in the war of 1899–1902 and was afterwards Treasurer of the Transvaal, and he entered the Union Cabinet as Minister of Finance. Mr. Sauer had been 30 years a member of the Cape House of Assembly and had frequently held office. In Gen. Botha's Cabinet he was Minister of Railways and Harbours and chairman of the Railways and Harbours Board, and thus head of the largest revenue producing department of State. Mr. Fischer and Gen. Hertzog represented the extreme element among the Boers. They were both from the Orange Free State, of which (as the Orange River Colony) Mr. Fischer had been Prime Minister. In the Union Cabinet he became Minister of Lands and Gen. Hertzog Minister of Justice.

The first session of Parliament was devoted mainly to putting the Union machinery into working order. It was not until towards the close of 1912 that Gen. Hertzog publicly abandoned the principles on which the Union had been established, though there was no doubt of his belief that the Dutch community had a prescriptive right to dominance in S. Africa. The most controversial issue considered in the 1911–2 session arose out of the Education Acts of the former Orange River Colony (*see* 20.160), where, during its brief period of self-government, Gen. Hertzog as Minister of Education had enforced bi-lingualism in the state schools. By the Act establishing the Union education "other than higher education" had been left in the control of the provincial councils for a period of five years, after which Parliament was free to take what action it pleased. In the meantime it could only advise. A select committee on which the S.A. and Unionist parties were equally represented considered the subject and on April 17 presented a majority report recommending that instruction up to Standard IV. should be given in and through the "home language," with the optional use, on the demand of parents, of the other language, and that above Standard. IV. freedom of choice in the medium of instruction should be left to the parents; also that teachers should be free to qualify in either language (English or Dutch). This was a reversal of Gen. Hertzog's policy, but though he disliked this compromise it was accepted by the Union Parliament (April 24). During 1911–2 the provincial councils of the Transvaal, Free State and the Cape passed ordinances adopting the compromise, though with some modifications in favour of Dutch. This virtually ended the language controversy as far as schools were concerned, and the provincial councils taking a liberal view of their duties, their control over elementary and secondary education was continued even after the lapse of the five years provided in the Union Act. But Gen. Hertzog's position was much shaken during the controversy over the medium of instruction. The success of an action for slander (Aug. 1911) brought against him by Mr. Wm. Fraser—Free State inspector of schools whom Hertzog had dismissed in 1909—caused much scandal, which was intensified by the success (Nov. 1911) of another slander action brought against him, the second plaintiff being Dr. Ward, president of the O.F.S. medical council. The situation was rendered piquant by the fact that Hertzog was Minister of Justice. He tendered his resignation, but Gen. Botha, not wishing to alienate the Boer extremists, refused to accept it.

Education Controversies.

Having brought about a settlement of the language question in elementary schools the Union Parliament was called upon to deal with higher education. The only university in S.A. at the time of the Union was that of the Cape of Good Hope, founded in 1873, with its seat at Cape Town. It was an examining body, with affiliated colleges. Demands for teaching universities had grown up and the Union Government had to deal with an offer of £500,000, half of this sum being a bequest by Sir Julius Wernher, the other half being given by Messrs. Alfred and Otto Beit. This money it was desired should go to establish a national university on the Groote Schuur estate, near Cape Town. A bill to give effect to this proposal was introduced into Parliament in the session of 1913. It met with much criticism and was withdrawn, a strong University Commission being appointed in Nov. 1913 to enquire into the subject. Its report, issued in 1914, is a valuable document, dealing fully with the lines of possible development, though the Commission was fain to acknowledge that the many vested interests constituted an "almost insolvable" problem. It recommended two universities—one at Cape Town and one at Pretoria, to one or other of which the existing university colleges would be attached. This recommendation provoked almost as much criticism as had the bill of 1913,

[1] Mr. J. X. Merriman, as Prime Minister of the Cape, the oldest colony in S.A., had some claim to be called upon to form the first Union Ministry, but his claims were passed over. He declined to serve under Gen. Botha. It appears, however, from the biographies of Jan Hofmeyr and of ex-President Steyn that both Botha and Merriman were prepared to serve under Steyn. Steyn was an invalid, and his doctors forbade him to entertain the idea of taking office. The ex-President was against a coalition Ministry, among other reasons because he feared that had Dr. Jameson been in the Cabinet he would have pressed for the inclusion of Rhodesia in the Union. While Steyn had favoured the Union movement he was not prepared even in 1910 to accept its full consequences. *See* J. H. Hofmeyr's *Onze Jan.* (1913) and Van der Merwe's "Life" of Steyn (in Dutch 1921).

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The Dutch community strongly opposed the proposal that Victoria College, Stellenbosch, founded in 1866 as the Stellenbosch Gymnasium and mainly attended by Dutch students, should be incorporated in the Cape university. A solution of the difficulty was reached in 1916 when Parliament passed Acts establishing three universities: the university of South Africa, the university of Cape Town, and the university of Stellenbosch. The two last were to be teaching universities and the seat of the Cape Town University was to be at Groote Schuur. It was formed by incorporating the South African College (founded at Cape Town in 1829) and to it the £500,000 of the Wernher-Beit bequests accrued.

The university of South Africa took the place of and was the legal successor of the university of the Cape of Good Hope, headquarters being removed from Cape Town to Pretoria. The new university, like its predecessor, was a federal organization with examining functions. Its first chancellor was the Duke of Connaught. The changes became effective on April 2 1918.

Defence.

In the 1911–2 session of Parliament an attempt was made to grapple with the relations of the white and Kaffir races, the position of Asiatics in the Union and with national and imperial defence. General Botha with two of his colleagues (Sir David de Villiers Graaff and Mr. F. S. Malan) had attended the Imperial Conference held in London in May and June 1911, when the Asiatic question and defence had been considered. The Union Government decided that S.A. should provide for its own internal defence, and a Defence Act was passed in June 1912, creating a citizen force at a cost of about £500,000 a year; this is in addition to a permanent force of five regiments.[1] The Act provided for the military training of 50% of the young men between 18 and 21; the other 50% being compelled to join rifle clubs and similar associations. The 50% for training are obtained in the first place by voluntary enlistment, but if sufficient numbers are not forthcoming by this method, then by ballot. (Recourse to the ballot had not been necessary up to 1922.) Members of the Citizen Force with the colours are paid. Provision was made for artillery, cavalry, infantry, engineer and transport units, uniformity with the units of the other overseas' dominions being aimed at. General C. F. Beyers, one of the Transvaal commandants in the Anglo-Boer War, was appointed commandant-general, while the Council of Defence created by the Act consisted of Gen. Schalk Burger (Transvaal), Col. (afterwards Sir) Charles Crewe (Cape), Gen. de Wet (Orange Free State), and Col. Sir Duncan Mackenzie (Natal).

Objections to the Act came chiefly from the "back-veld" Boers who entertained strong dislike to compulsory service. The force being established, the reduction of the strength of the British imperial forces in S.A. from 11,500 to about 7,000 was announced in Nov. 1912. With regard to naval policy practically no progress was made. General Botha was fully alive to its importance and sought to educate his followers on the subject in several speeches. But in 1920 the situation remained as it was in 1910. The British Admiralty continued to use Simon's Town as headquarters of the Cape and East Coast Squadron. In 1921, however, the Government adopted the principle of the formation of a S.A. navy for home defence.

The Indian Question.

The policy to be adopted with respect to Asiatics had two aspects: (1) the treatment of Asiatics already in the Union and (2) whether or not to permit further immigration. On the second question there was a determination on the part of the great majority of white S. Africans to prohibit the further entry of Asiatics alike on racial and economic grounds. They had the black man ever with them and they were determined as far as in them lay not to add another racial and disturbing factor. But there were already 150,000 Asiatics in the Union, and except for some 2,000 Chinese they were all British Indians. Of these fully four-fifths lived in Natal. They had gone thither at the invitation of that colony, where the sugar and tea plantations depended upon coolie labour. Indeed almost the only dissidents in the Union from the exclusion policy were the Natal planters. On the question of immigration the Government of India, however, took a step which eased the situation. It was a vigilant champion of the rights of Indians settled in other parts of the Empire and it had been for years dissatisfied with the treatment of the coolies in Natal. In 1908 it had decided to prohibit the further importation of indentured Indians into Natal and it was at the request of the Natal authorities that it permitted the system to continue until July 1911, when it finaly ceased. This left untouched the question of voluntary immigration, which among the coolie class was never great. The position in the various provinces of the Union differed. In the Orange Free State as a result of a rigid exclusion policy constantly enforced there was no Indian question; in the Cape province Indians enjoyed equal rights with whites—political and municipal, not only in theory but in practice. But comparatively few Indians were attracted to the Cape and in that province the question was not acute. The Cape Immigration Acts of 1902 and 1906 sufficiently guarded the province from the influx of undesirable elements. In Natal the matter was much more pressing. There the Indians considerably outnumbered the whites and besides the coolie class included many Bombay Mohammedans (often misnamed "Arabs" in S.A), keen and enterprising traders. Measures restrictive of Indian enterprise had been passed by Natal and in that province they had no political rights. They however possessed the municipal franchise and, as in the Cape province, had unrestricted rights to own and occupy land. In the Transvaal the Indians had neither political nor municipal rights nor were they allowed to own land, save in specially assigned locations. The Indians in that province were mainly Moslem traders, who had found a favourable field for their activities in the development of the country which followed the discovery of the Rand gold mines. For years the Indians in the Transvaal had been subjected to many restrictions; it was in this province that feeling against them was most bitter and the agitation against them most strong. The position held by white S. Africans was plainly stated by Gen. Smuts at the Imperial Conference of 1917. What he then said was strictly applicable to the situation in 1911 when the Union Parliament first took up the subject.

> In S.A. there has been this fundamental trouble [he said], that the white community has been afraid of opening the door too wide to Indian immigration. We are not a homogeneous population. We are a white minority on a black continent, and the settlers in S.A. have for many years been actuated by the fear that to open the door to another non-white race would make the position of the few whites in S.A. very dangerous indeed. It is because of that fear . . . that they have adopted an attitude which sometimes has assumed the outward form, although not the reality, of intolerance.

Save that among many of the whites in the Transvaal the outward form of intolerance was also its reality, this was a fair statement of the position of white S. Africans. They feared, or a considerable proportion of them feared, being swamped by Asiatics, and, especially in the Transvaal, they greatly feared Indian competition in trade. On its part the Government, of India, when the Union began legislating on the subject was ready to acquiesce in an exclusion policy, but sought in return to secure fair treatment for the Indians already in the Union. And by "fair treatment" the Government of India meant in the long run political and municipal rights—weapons by which the Indians would have effective means of self-protection. In 1911 and again in 1912 Immigration Restriction bills were introduced into the Union Parliament, but the bills were dropped, a wider measure being announced for 1913. In Oct. 1912 Mr. G. K. Gokhale, one of the most influential of Indian politicians, visited S.A. on "a mission of peace" and in Nov. went to Pretoria as the guest of the Union Government to confer with them on the forthcoming legislation. Mr. Gokhale's object was primarily to secure concessions for the Indians already in S. Africa. This was also the main object of Mr. M. K. Gandhi, who had first gone to S.A. in 1893 to conduct a law suit, but had stayed there and become the leader of the Indians in Natal and the Transvaal.

In June 1913 the Union Parliament passed an Immigrants Regulation Act, the chief purpose of which was to prevent the

[1] Only persons of European descent were allowed to become members of the Defence Force.

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further entry of Asiatics into the Union. This was done not *eo nomine* but by ministerial certificate. Wives and young children of domiciled residents were allowed to enter, and also registered Indians who might be temporarily absent from S. Africa. The Act further restricted Asiatics to the province in which they were resident. This restriction of movement, and the poll tax of £3 levied on all ex-indentured Indians in Natal—a tax unequal and uncertain in its incidence—caused great dissatisfaction among the Indian community. Under Mr. Gandhi's leadership (Mr. Gokhale had returned to India) they adopted an attitude of passive resistance, but this was succeeded by strikes at Durban and at the collieries and plantations. Then, to assert the right of Indians to move from one province to another, Mr. Gandhi put himself at the head of some 2,700 Indians who started to march past Majuba to Johannesburg. About 500 were stopped at the Natal border, the rest got some distance into the Transvaal before they were turned back. Mr. Gandhi was arrested and convicted on several charges, *e.g.* he was sentenced to nine months' imprisonment for abetting a strike of coal miners. But the situation could not be met simply by repressive measures. An Indian Inquiry Commission was appointed and, on its recommendation, the Natal poll tax was abandoned and certain concessions made as affecting the recognition of Indian marriages. These changes were made operative by the Indian Relief Act, 1914. More important was the so-called Smuts-Gandhi agreement of the same year. General Smuts as Minister of the Interior was in charge of the legislation affecting Indians, and, seeking a statesmanlike solution of the difficulty, he approached Mr. Gandhi. The negotiations succeeded and the arrangement reached was set forth in letters exchanged between Mr. Gorges (then secretary to the Ministry of the Interior) on behalf of Gen. Smuts, and Mr. Gandhi and dated June 30 1914. The essence of the agreement was the assurance by Gen. Smuts that existing laws would be administered "in a just manner and with due regard to vested rights." This was at the time interpreted by the Indians, by the Government of India and by many of the whites in S.A. to mean that the rights which Indians were entitled to exercise under the laws as existing in 1914 could not be restricted by fresh legislation. Mr. Gandhi, conceiving his mission in Africa ended, returned shortly afterwards to India.

It is convenient here to summarize later developments of the Indian question before turning to the main stream of S.A. history. Mr. Gandhi in a farewell letter, published in the *Rand Daily Mail* of July 20 1914, had assured the Indians that the settlement then reached did not preclude them from fresh agitation for the removal of other disabilities: for their part a large section of the whites agitated for further restrictions upon Indian activity. Friction inevitably arose, but during the World War untoward incidents were avoided. A definite settlement of the immigration question was reached at the Imperial Conference of 1918 when a reciprocity resolution was accepted which declared it to be "an inherent function of the governments of the several communities of the British Commonwealth, including India, that each should enjoy complete control of the composition of its own population by means of restriction on immigration from any of the other communities." In accepting this resolution on behalf of the Union Mr. Burton declared, justly, that S. Africans had found the Indians "good, law-abiding, quiet citizens" and that it was the duty of the Government to see that they were treated "as human beings, with feelings like our own, and in a proper manner."

What was the "proper manner" was still a point of contention. After the Smuts-Gandhi agreement Indians applied for and obtained new licences to trade, and in the Transvaal formed private companies with limited liability for the purpose of acquiring land and fixed property—the Transvaal law of 1885 which prohibited individual Indians from acquiring land not applying to corporate bodies. This action by the Indians was denounced by the white community in the Transvaal as a flagrant violation of the Smuts-Gandhi compact, to which the Indians replied that it was one of their vested rights and that such companies had been formed before the agreement was made. There were in fact three such companies in 1913; by March 1919 the number registered had grown to 370, with a total capital of £479,000. Early in 1919 the Krugersdorp municipal council brought the matter to an issue, nominally on the trading question, by obtaining an interdict from the Supreme Court at Pretoria, prohibiting Indians from occupying a certain trading "stand" in the town. This led to the appointment of a parliamentary select committee. As the result of its investigations an Act (No. 37 of 1919) was passed by the Union Parliament which, while confirming the right of Indians to the occupation of land for trading purposes which they then held, prevented the further acquisition of land by Indians through private companies.

The Act of 1919 pleased neither party. It was noteworthy that in the Transvaal, where numerically the Indians were few, feeling against them was much stronger than in Natal, with its large Indian population. The explanation was to be found in the fact that whereas in the Transvaal nearly all the Indians were traders—many of them merchants owning large businesses and formidable competitors with white traders—in Natal the great bulk of the Indians were Madrassi of the agricultural and labouring classes, and save in fruit and vegetables did not enter largely into trade. Moreover, large numbers of the Indians in Natal were S.A. born and could hardly speak any Indian language. The agitation in the Transvaal against the "Asiatic menace" led in Feb. 1920 to the appointment of the Asiatic Inquiry Commission specifically charged to consider the question of trading rights and land ownership by Indians. The sittings of the Commission were held in public, the Government of India being represented throughout by Sir Benjamin Robertson, a man with unrivalled knowledge of the history and facts relating to Indians in S. Africa. The Commission issued an interim report in May 1920 recommending that steps be taken to aid the repatriation of as many Indians as desired to leave the country, and some few thousands did return to India. The final report of the Commission was issued in March 1921. The chairman was Sir J. H. Lange, a judge of the Supreme Court, and all the commissioners were men of experience, animated with the wish to do justice. Their inquiry had the merit of bringing out the facts and dispelling the belief that the Transvaal was menaced, numerically, by an Asiatic invasion. They also made clear the fatuity of the proposals put before them for the compulsory expropriation of the whole Indian population, or of "squeezing them out" by multiplying restrictions on their activities. Their recommendations were however significant of the strength of white feeling on the subject. They proposed alterations in the law which would secure Indians from being refused trading licences arbitrarily or on the ground of race; they opposed compulsory segregation, but advocated a system of voluntary separation by "attraction" to desirable residential and trading areas. They opposed the repeal of the Act of 1919 and went further by proposing that in Natal the right of Asiatics "to own land for farming or agricultural purposes should be confined to the coast belt, say 20 to 30 m. inland." On this last point Mr. Duncan Baxter, one of the four commissioners, dissented, describing it as retrograde and a breach of the conditions of recruitment. The Government of India also at once lodged a protest against this recommendation, holding that it was not only a breach of the conditions under which Indians were recruited but also a breach of the Smuts-Gandhi agreement. The Union Government took no action on the Commission's report in the 1921 session of Parliament, but Mr. Patrick Duncan, who had become Minister of the Interior, indicated his sympathy with a proposal to allocate separate and distinct areas for occupation by the Indians of Natal.

The Government of India, while still seeking the removal of particular grievances, adhered to its wider view that only by the grant of equal rights could Indians in the Dominions be fully protected. At the Imperial Conference held in June–Aug. 1921 the Indian delegates pressed for the recognition of this principle and it was accepted by the representatives of Canada, Australia and New Zealand. But the S.A. delegates, of whom the chief

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were Gen. Smuts and Sir Thos. Smartt, declined to subscribe to the resolution which declared that it was desirable that "the rights to citizenship" of Indians lawfully domiciled in other parts of the Empire "should be recognized." They regretted "their inability to accept this resolution in view of the exceptional circumstances of the greater part of the Union." Direct negotiations between the Governments of India and of S.A. to reach a more satisfactory position were not precluded. That the Union delegates rightly interpreted the feeling of most white South Africans was shown by an ordinance passed at this time by the Natal provincial council to prevent any Indians in the province acquiring in future the municipal franchise. This ordinance was disallowed by the Union Government. At the Cape at the same time an Indian, Dr. Abdurrahman, a well-known member of the Cape Town municipality, was also a member of the provincial council.

The first step taken by the Union Government in regard to the relations between the white and native races was the decision that the control of all regulations made by local authorities affecting natives should be exercised not by the provincial councils but by the Government through the Native Affairs Department, a decision tending towards a much-needed uniformity of policy. While the Government were considering what principles should guide their action public attention in 1911–2 was chiefly focussed on one aspect of the question, assaults by Kaffirs on white women. On the Rand in the first half of 1911 three Kaffirs were shot by white women whom they had attempted to assault. This shooting followed the commutation, in Jan. 1911, by the High Commissioner (Lord Gladstone) of a death sentence on a Rhodesian native convicted of an attempt to assault a white woman. This action roused much indignation against the High Commissioner who, however, met his critics fairly and won their respect. But feeling was intensified by the acquittal in Aug. 1911, by a Rhodesian jury, of a white man who had shot dead a Kaffir. (This led to the making of a special jury list for the trial of such cases, the ordinary jury not being trusted to administer impartial justice.) In all during the year ending March 31 1912, there was in the Union alone (*i.e.* Rhodesia excluded) 85 cases of outrages upon Europeans by natives, as compared with 69 during 1910. On the Rand the evil was attributed in part to illicit liquor selling and in part to the fact that the mine labourers were without their women-folk, and a petition signed by 52,000 Rand residents (presented to Parliament May 1912) asked *inter alia* for the provision of compounds in which natives should be permitted to keep their wives, as well as for facilities for training native female servants and for the importation of European domestics.

The Natives and the White Races.

A commission, appointed in June 1912 on the motion of Sir Thomas Smartt, enquired into the prevalence of sexual assaults, and the extent to which they were attributable to economic and social factors. This commission was presided over by Mr. Melius de Villiers, ex-chief justice of the Free State and included four ladies, one from each province. On its report remedial measures were taken, such as provision for wives in the compounds. It was shown that one cause of the evil was the undue familiarity with which many white women treated male natives employed by them as domestic servants. The measures taken had a good effect, and assaults of the character stated became fewer.

On the larger question as to the place which the Bantu should hold in the community there was much heart searching. There was on the part of the whites agreement on one point only—the dependence of agriculture and industry on the manual labour of the native. The situation was complicated by the fact that the whites had not only the native to deal with but a very large number of coloured persons with a greater or less proportion of white blood—the well-known "Cape Boys." These people not only competed with the whites in skilled labour, but a good many of them had entered the professions as lawyers, doctors, journalists, land surveyors, etc. The pure African was following their example, and both the coloured and native peoples were learning the power of coöperation. They had their own newspapers, their own political and trade organizations, and were quick to learn from the methods of the whites. Especially powerful was the influence of education and Christian missions. Many natives made great sacrifices to obtain education. For educational facilities they had to rely chiefly upon the missionary societies. The provincial councils were not generous in their expenditure in this respect though the total expended on native education rose from £81,000 in 1913 to £137,000 in 1918. More than half the total sum was spent by the Cape province. In regard to higher education the Union Government took a somewhat more liberal attitude and gave its support to the South African Native College at Fort Hare.

The desire of the natives, or the more vocal section of the natives, to escape from European tutelage was seen in a growing inclination, particularly in the Transkeian territories, to secularize education and to obtain a larger share in its management. This desire for "self-determination" was also seen in the setting up of many churches independent of European control, a movement fostered by intercourse with the negro churches of the United States. Of these native separatist churches perhaps the most influential was the "Ethiopian Church of South Africa." Their leaders joined in the demands of the "Native National Congress," an organization claiming to represent the Bantu peoples of S.A., in demanding redress of grievances and in especial the removal of the colour bar which existed in all the provinces except the Cape. A deputation from this body came to England in 1919 "not to demand independence, but admission into British citizenship."

Such were the aspirations of educated men among the coloured and native races; the more extreme, among whom communist doctrines had gained a hold, raised the cry of "Africa for the Africans." The loyalty of the natives and the valuable services they rendered during the World War went to show that the extremists were not an immediate danger. But the natives also during the war got a new idea of their power. Bantus in Rhodesia, the "Cape Boys" from the Union served as combatants in the E.A. campaign—and they saw that the heaviest fighting there fell to black troops. A new situation had arisen, one of the most noteworthy being the development of a race, as distinct from tribal, consciousness.

The problem as it presented itself to the Union Government was how best to secure the future for the white race in S.A., surrounded as it was by a black population five or six times its numbers. The Government would have had to face the bitterest hostility of the Dutch community, and of a considerable section of the British in Natal and the Transvaal had they attempted to remove the colour-bar in those provinces or in the Free State; had the Boers had their way the colour-bar would have been set up in the Cape province. Gen. Botha did not subscribe to the principle of Cecil Rhodes—"equal rights for all civilized men." Yet he and his colleagues acknowledged that it was the duty of the State to help forward the native on the path of efficiency and civilization, in opposition to the standpoint of the extreme Dutch Nationalists that there was no room for the advancement of the native save at the expense of the white man. The point of view of the Government was that the natives should be aided in such a manner that they should not come into competition with the whites. The proposal which attracted most support was to keep blacks and whites in separate areas, while still employing natives for labour on white enterprises. The plan was feasible; it was for example being worked in Basutoland under the Colonial Office. In that territory white settlement was forbidden, but thousands of Basutos went on contract to the gold-mines or to farms in the Free State. And there were already native areas in the Cape, such as the Transkei, where, under white officials, the natives possessed some share in the administration. It was in this direction Gen. Botha looked for a solution of the problem. In a speech in Parliament (May 9 1912) he stated that "the time was coming when the native question would have to be considered most seriously in the direction of keeping whites and natives apart and preventing their intermingling. They would have to fix attention closely on the question of segregation, while treating everyone with absolute

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justice." The segregation plan received the support, among many others, of Sir Matthew Nathan, an ex-governor of Natal, and Gen. Hertzog. But it was opposed by those who, like Mr. P. W. Schreiner and Mr. Patrick Duncan (a leading member of the Unionist party), regarded it as both wrong and impolitic to put hindrances in the way of the advancement of the natives in civilization and industrial efficiency. Mr. Duncan in a striking pamphlet published in Oct. 1912 ("Suggestions for a Native Policy") admitted the dangers foreseen by the segregationists, but believed the remedy to be in European immigration on a large scale. "Nothing else," he declared, "will save S.A. for the European race." But to immigration on a large scale the Dutch community was definitely opposed, and it was not till 1920 that the Government made any strenuous effort to attract white settlers to the country.

A motion brought forward at the Unionist Congress in Johannesburg (Nov. 21 1912) to commit the party to the policy of segregation was defeated, the previous question being carried by 91 votes to 7. Opinion being so divided the Union Government found great difficulty in shaping its native policy. As a temporary measure a Native Land Act was passed in 1913 which prohibited the further acquisition of land by natives or from natives —an Act which led to vehement protests from native associations and leaders of native thought, while a legal decision was obtained that the provision of the Act did not apply to the Cape province. The Act had set up a commission, under the chairmanship of Sir William Beaumont, which had for its object the ascertainment of what land areas should be allocated to natives and those from which they should be excluded. The commission reported in 1916 and a Native Affairs Administration bill was introduced in 1917, chiefly as a means of ascertaining public opinion, native as well as white. It embodied the principle of separate areas in rural districts. After exhaustive consideration Parliament in 1920 passed a Native Affairs Act which was in effect a half-way segregation measure. The Act, for which Gen. Smuts was largely responsible, was based on the principle that the white man is the permanent and predominant factor in the civilization and government of S. Africa. But it was not repressive to the black man. It set aside areas for the exclusive occupation of the natives in which they would have greater opportunities than before for obtaining local self-government, it opened the way to a system of representative native congresses which would express authoritatively native opinion on intended legislation, and it held out the prospect of the development of native institutions parallel to but separate from those of the whites. In short Gen. Smuts, the great advocate for the union of the two European races in S.A., was equally earnest in his efforts to keep the streams of white and (nascent) black civilization apart. A feature of the Act of 1920 was the establishment of a permanent Native Affairs Commission to deal with the position of natives in urban areas, education and the Pass Law system, in all of which matters it was admitted that the natives had not received fair treatment. The Act was regarded by the white community—Dutch extremists apart—as a piece of constructive statesmanship, and its policy received the approval of the most responsible leaders of the natives. But danger lay in the inflammable language and actions of less responsible, and less educated agitators, working on the mass of their fellows, scarcely emerged from barbarism, and in the equally pernicious utterances of the white extremists. Events in 1920–1 showed the peril attendant on any mishandling of the native question.

Trade and Tariffs.

The promotion of trade and agriculture occupied much of the energies of the people and Government. A prolonged drought—lasting from Oct. 1911 to Nov. 1912—the most severe experienced in S.A. since 1862, affected chiefly Natal, the Transvaal and the Transkei. The severe losses sustained forced attention to the need of more scientific farming and to irrigation works, upon which the Government expended £500,000 in 1912. In 1919 there was another very serious drought involving the country in an expenditure of £16,000,000. This led to the appointment of a commission in 1920 to enquire into drought, soil erosion and other allied problems. One result was to emphasize the need of water storage in connexion with irrigation. In Oct. 1912 a State Land and Agricultural Bank began operations in the Union, and a similar institution was established in Rhodesia.

Much diversity of view existed as to the tariff policy of the Union. Early in 1912 a commission, of which Sir T. M. Cullinan was chairman, appointed to enquire into the conditions of trade and industries reported in favour of increased duties on wheat, flour, sugar, tea, clothing and furniture, declaring that it was "not only necessary that a policy of protection should be adopted, but that there should be continuity of policy." Two influential members presented minority reports in favour of the "open-door." Rhodesian feeling was in favour of a lower tariff, and it was suggested that Rhodesia might withdraw from the Customs Union rather than bear greater fiscal burdens. At Johannesburg on Nov. 19 1912 Sir Thomas Smartt declared that a plank in the Unionist party's platform was a tariff primarily for revenue purposes, combined with a policy for the encouragement of industries for the general benefit and the extension of the existing imperial preference. This was, in the main, the solution adopted. Tariffs and rebates were fixed by various Acts of Parliament passed between 1914 and 1919, designed to afford relief to home manufactures, the majority newly established. An Industries Advisory Board was set up in Oct. 1916, consisting for the most part of business men, and early in 1917 a Scientific and Technical Committee was instituted. There followed in 1921 the creation of a Board of Trade and Industries, and a definite policy of industrial development was undertaken by the Government. But Mr. F. S. Malan, Minister of Mines (and then acting Prime Minister) addressing the convention of the Federated Chamber of Industries at Port Elizabeth (July 25 1921) declared that the Government had no intention of "going in for an out-and-out protective policy." And Col. Reitz (Minister of Lands) told the sugar planters of Zululand that "the consumer must be protected. Higher tariffs would mean dearer prices."

One great department of state, the Railways and Harbour Board, was required by the Act of Union to be run with due regard to agricultural and industrial development and not as a producer of revenue for extraneous purposes. The Board built needed railway lines and undertook harbour works, though nothing material was done to enlarge the docks at Table Bay, a matter which provoked strong protests from the citizens of Cape Town. Mr. Sauer, the minister in charge of the department—whose budget was separate from that of the general budget of the Union—took an independent view of his duties and as early as July 1911 differences arose between him and his colleagues, especially with Mr. Hull, the Finance Minister. Mr. Hull had also to meet the attacks of Mr. Merriman, the most accomplished parliamentarian and ablest financier in the House of Assembly and a very candid friend of the Ministry. Mr. Merriman denounced the Government's financial proposals as predatory and extravagant, while Mr. Hull alleged that railway expenditure was incurred without Treasury sanction—that there had been a tendency to regard the railway and harbour administration as something for which the Government had no collective responsibility. General Botha admitted that the Cabinet had not been sufficiently consulted in railway matters and on May 18 1912 Mr. Hull resigned. A reconstruction of the Ministry was postponed until after the close of the parliamentary session (June 24), when the chief changes made were the appointment of Mr. Henry Burton (an ex-Cape minister), to the Ministry of Railway and Harbours, while Mr. Sauer became Minister of Agriculture, an office which Gen. Botha had combined with the premiership.

The Two Streams Policy.

The differences between Mr. Hull and Mr. Sauer were shortly afterwards forgotten in consequence of the attitude taken up by Gen. Hertzog, who now began publicly to assail the principles upon which the Union had been established. To what extent Hertzog was supported or restrained by ex-President Steyn is uncertain; but Steyn, whose opinion would have been decisive with a large section of the Dutch community, did nothing publicly to counter-

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act the rekindling of the fires of racial bitterness. The by-election campaign at Albany, caused by the resignation of Sir Starr Jameson, brought about a crisis. General Botha, and with him Gen. Smuts and the majority of the Dutch members of the Cabinet, had definitely accepted the British connexion, and the position of S.A. as a self-governing member of an Imperial Commonwealth, with corresponding responsibilities, and, knowing that peace between the two white races was essential to the prosperity of the country, he was an ardent advocate of the closest coöperation between them. On both these points Hertzog was violently opposed to his colleagues. His motto "South Africa first" meant in fact Dutch supremacy. In a speech at Nylstroom (Oct. 1912) he characterized Sir Thomas Smartt (who had succeeded Jameson as leader of the Unionist party) and other prominent members of the Opposition as "undesirable political foreign adventurers," and at Rustenburg, on Dec. 8, he declared that imperialism appealed to him only when it was useful to S. Africa. He had a short time previously pronounced in favour of the Dutch and British in S.A. remaining "two nationalities flowing each in a separate channel." General Botha though he publicly dissented from Gen. Hertzog's views was desirous if possible to avoid an open breach, but after the Rustenburg speech action was unavoidable. On Dec. 12 Col. Leuchers, Minister of Public Works and a Natal member of Parliament, resigned as a protest against Hertzog's "anti-British and anti-imperial sentiments." Botha then intimated to Hertzog that his resignation would be acceptable, but Hertzog refused to move. Botha met this difficulty by tendering his own resignation, Dec. 15, and was at once asked by the governor-general (Lord Gladstone) to form a new Ministry. This he had accomplished by Dec. 20, the new Cabinet being composed of the same members as the old except for the omission of Gen. Hertzog and Col. Leuchers (the latter replaced by Sir Thos. Watt, another Natal member). The death of two ministers—Mr. Sauer and Mr. Fischer—during 1913 necessitated a further remodelling of the Cabinet. Mr. N. J. de Wet became Minister of Justice and Mr. H. C. Van Heerden Minister of Agriculture.[1]

The cleavage in the ranks of the ministerialists (the S.A. party) became complete in 1913. It was soon apparent that the appeal to Dutch racialism had considerable support, notably in the O.F.S., and some 10 or 12 members of the House of Assembly elected as supporters of Gen. Botha turned to Hertzog as their leader. At the party conference opened at Cape Town on Nov. 30 Gen. de Wet nominated ex-President Steyn as "leader of the party outside Parliament, with power to nominate the Prime Minister." On this proposal being defeated the malcontents left the conference in a body and in Jan. 1914 a new party under Hertzog's leadership was formed. It took the title of the Nationalist party.

The year 1913 and the opening months of 1914 were, however, as notable for labour unrest as for political differences. The disturbances in Natal due to the opposition of the Indians to the Asiatic legislation of the Union have already been recorded. They caused no such trouble as attended disturbances on the Rand, which began with a strike of the white miners at the New Kleinfontein mine in May 1913. The strike was nominally on the question of hours, but it was symptomatic of a determination of Labour to gain greater control over industrial conditions. There was, too, a revolutionary wing to the movement, and the extremists seemed likely to carry with them the mass of the men.[2] The two antagonistic views were afterwards sharply put by Gen. Smuts and Mr. Creswell, the latter the leader of the parliamentary Labour party. Smuts declared the movement to have been "a conspiracy against constituted order." Mr. Creswell declared that there was "a conspiracy (of the Govt.) with capitalists to run the country in their own interests." Neither view gave a satisfactory explanation of the facts. The strike extended, negotiations for a settlement failed, feeling ran high and by the end of June the Government had drafted 2,000 troops into the Benoni district, the centre of unrest, and some 20 m. E. of Johannesburg. The leaders of the strike had chosen a time when the Union was without a regular armed force of its own. The citizen army provided by the Act of 1912 was not yet formed, while the militia and volunteers had been disbanded as from July 1, and the permanent force—the S.A. Mounted Riflemen—provided for in the Act of 1912, had only begun training in April (1913). British regulars were therefore drafted into Johannesburg, where serious rioting followed a demonstration by the men in Market Sq. (July 4). The strikers seized the electric power station, and during a night of terror burned down the Park railway station and the offices of the *Star* newspaper. Several persons were killed and many injured in conflicts with the police and military. The next morning Gens. Botha and Smuts intervened and opened negotiations with the strikers. While these were going on dynamite explosions occurred and the mob attacked the Rand club. The negotiators succeeded in reaching agreement and at night the strike was declared "off", one condition being the reinstatement of the men at the New Kleinfontein mine. But it was difficult to appease the mob and there was further rioting on July 6. In all some 20 persons were killed and 250 injured. A grave element of danger was the excited condition of the native labourers on the Rand mines and it was in part consideration of what they might do if the riots continued that drew the authorities and the strike leaders together. The situation continued anxious, as extremists were calling for a new and general strike. But on July 31 the executive of the Federation of Trades decided by 65 votes against 18 not to call a general strike. An official inquiry into labour conditions was then instituted, but in Jan. 1914 new trouble arose. A policy of retrenchment on the railways was resented by the men and a general strike proclaimed for Jan. 14. It was, according to the official view, an attempt by the Trades' Federation to control the railway administration. The Government acted promptly (Gen. Smuts was at the time both Minister of Defence and Minister of the Interior). Martial law was proclaimed and 20,000 troops mobilized and concentrated on the Rand. Ten prominent Labour leaders—not including Mr. Creswell—were arrested and secretly deported, illegal action for which the Government subsequently obtained an Act of indemnity. In Parliament Gen. Smuts justified his action on the ground stated, namely that the leaders of the men were engaged in a revolutionary conspiracy. The action of the Government had, in any case, prevented a renewal of the rioting of 1913 though a large number of outrages occurred. Ameliorative measures were then tried and during 1914 an Industrial Disputes Act was passed. It set up machinery intended to render easier the settlement of disputes and this Act was followed in subsequent years by other measures—such as the Factory Act of 1918—designed to improve labour conditions.

Rand Labor Riots.

In 1914 Lord Gladstone's term of office as Governor-General and High Commissioner expired and he returned to England shortly before the outbreak of the World War. His successor was Mr. Sydney Buxton, who on his appointment was created a viscount. Lord Buxton assumed office in Sept. 1914.

The outbreak of the World War tested S.A. in a manner in which no other British Dominion was tested. Twelve years only had passed since the Boers had been in arms against Great Britain, they had long and bitter memories and all the ties of kinship, affection, a common tongue and a common heritage which powerfully influenced the British in S.A. were in them lacking. The spirit of racialism had revived, and a large number of the Dutch were led to believe that the war was no concern of theirs and that S.A. should remain neutral. A smaller section actively sympathized with Germany and a few prominent Boers had entered into rela-

Effect of World War.

[1] The year 1913 witnessed the death of other prominent S. Africans:—Sir Gordon Sprigg, four times Prime Minister of Cape Colony, Sir Richard Solomon, High Commissioner in London of the Union, and Dinizulu, the son of Cetywayo. Sir Walter Hely-Hutchinson, formerly Governor of Natal and of Cape Colony, also died in 1913. Sir R. Solomon was succeeded as High Commissioner by Mr. W. P. Schreiner, who died in 1919. Sir Edgar Walton was appointed High Commissioner in 1921.

[2] The white employees in the mines were almost equally divided between those born in S.A. and those born in the United Kingdom. The foreign born were scarcely 5%.

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tions with the Germans in S.W. Africa. The German Government counted with some confidence that S.A. would stand aloof from the contest. It was misled. The attitude of Gen. Botha and of his colleagues was never in doubt. Botha, Smuts and the other Dutch members of the Government represented all those Boers who were not only faithful to the new allegiance they had solemnly recognized in 1902, but who were sincerely convinced that by the subsequent grant of responsible government to the ex-Dutch republics and the establishment of the Union, S. Africa's interest, as a self-governing dominion, was to stand side by side with the other members of the British Commonwealth.

The test as to the part S.A. would play in the World War soon came. On Aug. 7 1914, the Imperial Government telegraphed to the Union Government that "if they desired and felt themselves able" to do so, the seizure of such parts of German S.W. Africa as would give them the command of Lüderitzbucht, Swakopmund and the wireless stations there, would be "a great and urgent imperial service." And two days later the British Cabinet suggested that another expedition might be sent later to Windhuk, where there was a long-distance wireless station. On Aug. 10 Gen. Botha replied that he and his colleagues cordially agreed to coöperate with the Imperial Government and that the military operations indicated would be undertaken by the Union Government. General Botha had already intimated—on the day that war was declared—that the country would undertake its own defence, thus setting free for duty elsewhere the imperial garrison in S. Africa. It was not however until Sept. that Gen. Botha publicly announced the intention of the Government to send an expedition against German S.W. Africa, though this intention was communicated to Gen. Beyers on Aug. 13 and discussed at a meeting of the principal officers of the defence force held on Aug. 21. On that occasion Beyers expressed approval of the measures proposed. While their intentions in regard to S.W. Africa were meanwhile regarded as confidential, the fact that the Government had ranged itself on the side of Britain had been known from the first day of the war and had greatly excited the Dutch Nationalists. Some of them saw in it the opportunity they had eagerly awaited of regaining the independence of the Boer republics; some were already aiding the Germans in S.W. Africa. The decision of the Government to take the offensive against the Germans precipitated, but was not the originating cause of, the rebellion. German secret agents, too, had been busy, but their intrigues at most only served to fan smouldering fires of revolt. Botha submitted the resolution authorizing an expedition to German S.W. Africa at a session of Parliament on Sept. 9. It was bitterly denounced by Hertzog and his followers, who declared that the Union should remain neutral, but it passed the House of Assembly by a large majority on Sept. 10 and by the 14th had received the approval of the Senate. On Sept. 15 Gen. Beyers made clear his true attitude. He resigned his post of commandant-general of the Union Forces, affirming that "by far the great majority of the Dutch-speaking people of the Union" disapproved the expedition against German S.W. Africa. Botha's reply was that he himself would take command of the Union forces and personally command the operations against the Germans. On Oct. 9 Lt.-Col. Solomon G. Maritz, the commander of the Union forces—about 1,600 men—on the German frontier, was in open rebellion; on Oct. 23 de Wet was in rebellion in the Free State, the next day Beyers and Maj. J. Kemp were in rebellion in the Transvaal. The movement was concerted, though the plans for concerted action failed. Of the four rebel leaders named, Maritz was the least important and the only one proved to have been in treasonable relations with the Germans before the World War began. The evidence against Beyers of collusion with the Germans through Maritz after the war had started was conclusive, but there is no evidence that he rose in revolt out of sympathy with them. As one of their ablest leaders in the Anglo-Boer War he enjoyed a great reputation with the Transvaal Boers. Kemp also was known to them as an efficient soldier who had been one of De La Rey's chief lieutenants in the Anglo-Boer War. Kemp was now an officer of the Defence Force. De Wet was the most famous fighting general of the Free State Boers. All the men named desired to translate into action the policy which Hertzog advocated, and which they believed Steyn approved. In the opinion of a judicial commission[1] which later enquired into the rebellion (whose report was issued in Dec. 1916) Gen. De La Rey plotted a rising as soon as the war broke out. The chief aim was to restore the Dutch republics—if not to establish a completely independent S.A. Republic. At the time it looked as if De La Rey was being dragged into rebellion by Beyers and Kemp. It is certain that they depended upon De La Rey to give the word to the Transvaal burghers to rise. Whether or not through infirmity of purpose when De La Rey was brought to Treurfontein (Aug. 15) to address a meeting of burghers which had been called, in his name, with the intention of immediately starting a revolt instead of the expected words he advised his hearers to remain calm and wait events. De La Rey two days previously had been called to Pretoria by Botha and there had had a prolonged interview with Botha and Smuts who had exhorted him to use his unrivalled influence in the western Transvaal in the interest of peace.[2] And without question the burghers, though mystified, obeyed. De La Rey and dispersed quietly to their homes. Then came the public announcement of the expedition against German S.W. Africa and De La Rey went to Cape Town to attend the session of Parliament, of which he was a senator. Meanwhile the Citizen Force of the western Transvaal was gathered at Potchefstroom and Beyers and Kemp arranged with De La Rey that he should return N. and address the burghers in camp on Sept. 15. On the evening of that day, at Pretoria, Beyers announced his resignation. In the morning of the same day he had received a messenger from Maritz who brought word that "all was ready" on the border. De La Rey had reached Johannesburg from the Cape; Maritz's messenger was sent by Beyers to bring him to Pretoria and late in the evening the three set out to go by motor to Potchefstroom. The revolt was to be started the next morning. The way led through Johannesburg and the car was ordered to stop by armed police, who were looking out for a gang of criminals who had escaped in a motor. Beyer's driver disregarded the summons to stop and drove on. The police patrol fired and De La Rey was shot dead. The dramatic death of De La Rey disorganized the conspirators' plans. It deprived them of the one man who could have raised the whole of the western Transvaal against Botha and the one man whose military talents might have matched those of Botha and Smuts. It accounted for the delay in the rebellion, for the interim protestations of loyalty made by Beyers and de Wet's declaration that he wanted to act constitutionally. In de Wet's case there was no evidence that he had been mixed up with Maritz's intrigues with the Germans until after the World War had begun; his was pure discontent with the existing regime.

Rebellion of 1914.

An illuminating light on the mentality of the rebels was the profound belief that many of them entertained for the "visions" of a certain Nicholas Van Rensburg, a farmer of Lichtenburg, who had served in the Anglo-Boer War under De La Rey, at which time his reputation as a seer was established. Van Rensburg's sincerity was doubted by few—and he seldom professed to understand his own visions, which were of a true Delphic character. One of them was held to foretell the struggle in Europe and to indicate the victory of Germany "the grey bull" which defeated a red bull (England) in bloody combat. Another concerned Gen. De La Rey and with this vision was associated the number 15, which Van Rensburg beheld on a dark cloud from which issued blood. This man's visions and the faith they

[1] Composed of three judges of the Supreme Court, namely J. H. Lange (chairman), M. W. Searle, and F. A. Hutton.

[2] From Gen. Botha's account of the conversation De La Rey appears to have been in a distracted frame of mind. That he wished S. A. to break away from the British Empire and proclaim its independence is beyond question, and he saw in the World War an opportunity to achieve this object. He was very much under the influence of the "prophet" Van Rensburg (see later). By several observers of his conduct at this time De La Rey was believed to be mentally deranged.

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inspired among the burghers—and in none more strongly than in De La Rey himself—were cleverly worked upon by the conspirators—it was because of the visions that the Aug. and Sept. meetings were called for the 15th of the month. But the rebellion rested on more solid foundations than visions. As has been stated the moving cause was the desire of the Boers to regain independence, while support for the rebellion was largely gained by the assertions of Beyers and others that there would be no fighting and that Botha was secretly on their side.

The Appeal to Mr. Steyn.

News of Maritz's open revolt reached Beyers and Kemp on Oct. 12; two days later de Wet was in conference with Beyers at Pretoria and final plans prepared. But Maritz was crushed before the others could take effective action. General Smuts, as Minister of Defence, had taken over the full direction of affairs from headquarters. Colonel Coen Brits was sent to deal with the traitor and did so effectively; in an engagement at Kakamas on Oct. 24 Maritz's force was broken into small and fugitive bands and he himself compelled to take refuge over the German border. Meanwhile both Botha and Smuts were urgent in their efforts to prevent bloodshed in the Free State and the Transvaal. They turned to ex-President Steyn as the one man whose word could deter the rebels from executing their purpose. On Oct. 11 Botha telegraphed to Steyn—who, in poor health, was living at his farm Onze Rust, near Bloemfontein—informing him of the treason of Maritz, and saying "A word from you will go far." Steyn refused to speak the word. Not that he approved the action of Maritz, but because "I shall have to tell the people that I most strongly disapprove of the policy of the Government respecting an attack upon German W. Africa . . . that as far back as three years ago I warned you against such a policy and that on the outbreak of the European war I had again repeated that warning to Gen. Smuts. . . . As a result of that policy a number of officers and men, who as far as I know were loyal, have become rebels." To this Botha replied that the Government's policy was "not only supported but demanded by the vast majority of the population of the Union," and that, moreover, he possessed proofs that Maritz's plot was formed long before the Government's decision was made. He ended with a moving appeal to Steyn to speak a word "to warn our people against treason, against the everlasting stain that anything of the kind would be upon our national honour, and against the incalculably fatal consequences." No sign in reply came from Onze Rust. On Oct. 22 Botha again wrote to Steyn, informing him of the imminent revolt of de Wet, Beyers and Kemp. In this letter Botha referred feelingly to the outcome of an insurrection "headed by men who in the past have been our honoured leaders" and once more appealed to Steyn to turn those men "from the path of destruction where they now stand." Botha suggested that Steyn should summon de Wet, Beyers and Kemp to a conference at Onze Rust, and now at length Steyn acted. From Oct. 23 onward, and after hostilities had begun he used his efforts to bring the rebel leaders to reason. But only after he had been beaten did Beyers go to Onze Rust, nor was it until he, too, had been defeated that de Wet showed any desire to visit Steyn. The ex-President himself publicly uttered no word. It may here be added that two years later Steyn died and the restraining hand which he had laid upon the extreme manifestations of Dutch racialism was removed. Hertzog, who had not joined the rebels, and had indeed given Steyn some help in trying to induce de Wet and Beyers not to proceed to hostilities, was then free to develop his demand for separation from the Empire.

De Wet captured.

General Botha delayed operations against Beyers and de Wet as long as there was any possibility of avoiding bloodshed, indeed the Government was sharply criticized for allowing de Wet undisturbed to overrun the northern part of the Free State on pretext of carrying on private negotiations. Rebel activity in the Transvaal at length compelled action and Gen. Botha himself took the field against his old colleagues. If that action finally destroyed his influence with part of the Boers, it won the support of many others and it was one of the disappointments of the rebels that so many men of their own blood sided with the Government. On Oct. 27 Botha dispersed a rebel commando led by Beyers at Commissie Drift, S. of Rustenburg. Even after this encounter—in which the casualties were two or three men wounded—efforts were made to avoid further fighting, but unavailingly. Beyers crossed into the Free State and on Nov. 7 a fight took place at Gruis Drift, on the Vet river, in which some 400 rebels were taken prisoners. It was after this defeat that Beyers, under a safe conduct, sought a belated conference with Steyn, a conference which led to no result. Meanwhile de Wet had been active in the Free State, his burghers freely pillaging all whom they pleased. At Vrede on Oct. 29 he denounced "the ungodly policy of General Botha," the "miserable pestilent English" and described the S.W. expedition as "a dastardly act of robbery." On Nov. 9 he seized Winburg; he had refused to go to Onze Rust to see Steyn. Smuts rightly gauged the mentality of de Wet in stating that unless he were "convinced by force" he would not listen to reason. On Nov. 12 Botha defeated de Wet's main commando, some 2,000 strong, at Mushroom Valley, 18 m. S.E. of Winburg. After this de Wet was willing to go and see Steyn, but the Government was convinced that the time had gone by for the rebels to "extort peace terms" and on Nov. 17 Smuts informed Steyn that now unconditional surrender was required, on the basis of very lenient terms already announced. Pressed by the Government troops de Wet doubled and redoubled and finally, with some 50 followers, turned due W. hoping to make German territory. But he was overtaken about 100 m. W. of Mafeking—his tired horses being no match for the fleet armoured cars chasing him—and surrendered, Dec. 1 (1914) to Col. Brits. A few days later the end came for Beyers. After his visit to Steyn he had rejoined his commando, and after an engagement at Bultfontein on Nov. 16 made N. intending to re-enter the Transvaal. On Dec. 8, in the Hoopstad district, he was once again defeated. With some 25 burghers Beyers reached the Vaal river near Zand Spruit closely pressed by a party under Field-Cornet P. H. de Necker. While the rebels put up a delaying fight, Beyers and one companion tried to cross the river on horseback. When fired upon they dismounted. Their horses managed to gain the further bank, but Beyers and his comrade, though they escaped the bullets, were carried away by the current and drowned. A week later (Dec. 16) the last of the rebel commanders, Fourie, was defeated and he surrendered. The rebellion was over.[1]

Altogether about 10,000 men had been in armed rebellion, while the number of their sympathizers was very considerable. In their ranks were three members of Parliament. The casualties on the Government side were 132 killed and 277 wounded. Of the rebels over 5,700 were either captured or surrendered—their casualties are not known, and many returned home during hostilities under assurances that by so doing they would not be prosecuted. Only one man, Fourie, an officer of the Citizen Force who appears to have deserted while on active service, suffered the last penalty. He was tried by court-martial and shot on Dec. 20. The rest of the rebels were leniently treated. De Wet, in June 1915, was sentenced to six years' imprisonment and a fine of £2,000; Kemp was sentenced to seven years' imprisonment and a fine of £1,000. Others received lesser sentences and few, if any, served their full term; de Wet, for instance, and 118 others were released in Dec. 1915 in time to spend their Christmas at home.

During the insurrection Hertzog's name had been freely coupled with that of the rebels, and in the parliamentary session of 1915 he made himself their advocate. He was no rebel, neither,

[1] Major Kemp had been sent, on Nov. 2, by Beyers on a mission to get arms and ammunition from Maritz. Kemp, who had with him some 800 men, appeared at Kuruman on Nov. 8 where he obtained supplies from the townsfolk. Followed up by loyal forces he made his way to German territory and joined Maritz at the end of November. In Jan. 1915, in company with Maritz, he reappeared, attacked Upington and was defeated. At the same place on Feb. 3, with over 500 men he surrendered to Col. (later Maj.-Gen. Sir) J. L. Van Deventer, while 100 of Maritz's men surrendered at Kakamas. Maritz and his immediate following withdrew to German S.-West Africa. Not wanted there Maritz went to Angola and to Lisbon.

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he maintained, were de Wet, Beyers and their following. Their action was only "an armed protest" against the invasion of German S. West Africa.[1] Nor did Hertzog and his parliamentary supporters modify their attitude; they sought to gain at the polls what the rebels had tried to gain arms in hand. But Gen. Botha had no difficulty in enrolling thousands of Boer volunteers for the campaign in German S. West Africa; the force raised for that purpose was composed almost equally of Dutch and British S. Africans. The campaign ended in the surrender of the Germans on July 9 1915, and on his return home Botha received a triumphal welcome from Boer and Briton alike. Popular feeling against Germany had become intense with the sinking of the "Lusitania," which led to serious riots; in Johannesburg alone damage to German property estimated at £500,000 was done.

After the conquest of German S. W. Africa Nationalist hostility was aroused by the beginning of recruitment for service in Europe. The response to the appeal for volunteers, considering the hostility of the Nationalists, was excellent. First to last the Union (apart from forces used in suppressing the rebellion) raised 146,515 men for service in the World War, and of these over 30,000 served in Europe and 43,000 in E. Africa. These figures refer only to whites. Including the native labour contingents and the coloured combatant corps from the Cape provinces the total personnel of the S.A. forces on war service was 231,591. The casualties numbered 18,642, including 6,606 dead.

Forces raised for War Service.

None knew better than Gens. Botha and Smuts how deeply they were distrusted by a large section of the Dutch community. The general election held on Oct. 20 1915, fought on the issues raised by the rebellion, gave a very fair indication of the strength of the Dutch irreconcilables. Botha had appealed to the electors to sink their differences and "see the war through." Out of a total of 130 seats in the House of Assembly the S.A. (Botha's) party gained 54, the Nationalists (Hertzogites) 27 and the Unionist (mainly British) party 40. Labour, out of favour after the industrial upheaval, gained only three seats and there were six Independents (all anti-Hertzogites). Most of the Nationalist members were returned for constituencies situated in the districts where the rebellion had been. The luck of the ballot was with Botha and the Unionists for the figures of the poll showed the Nationalist strength to be greater than the number of seats secured. The figures were: South African party 93,374 votes, Nationalists 78,301, Unionists 48,484, Labour 25,305, Independents 12,029. Some 75% of the electors voted.

General Election, 1915.

As a result of the election Botha was dependent for continuance in office on the support of the Unionists, and this was ungrudgingly given. There was some talk of Sir Thomas Smartt and other leaders of the Unionists joining the Ministry, but this was not done. The cordial support given by the Unionists to Gen. Botha was the more valuable as the Nationalists continued their agitation and increased their demands. Hertzog's efforts were powerless to affect the policy of the Cabinet but they led to increased bitterness in S. Africa. The Government had, nevertheless, no difficulty in securing volunteers for service in German E. Africa. The appointment of Gen. Smuts as commander of the British forces there entailed his absence from the Cape, an absence prolonged by his selection early in 1917 as a member of the Imperial War Cabinet in London. This was a serious loss to Botha in the conduct of home policy.

After Steyn's death (in Nov. 1916) Hertzog became more openly hostile than ever to the imperial connexion. At Stellenbosch in May 1917 he declared that S. Africa's autonomy (*selfstandigheid*) entitled her to remain neutral in the war and that no real self-government could exist without independence of all other countries, including Great Britain. "The only bond that binds us together," he said, "is our common King but under him we each stand separately and independent of each other." But even "the common bond" was irksome, and the logical outcome of Hertzog's policy was seen in the adoption by the Nationalist party of republicanism as a plank in their programme, to be achieved "by steady constitutional pressure." The opposite policy was seen that year in operation in London. General Smuts was sitting in the Cabinet with equality of status with that of the ministers of the United Kingdom, and the Imperial War Conference of that year (1917) declared the Dominions to be "autonomous nations of an Imperial Commonwealth with an adequate voice in foreign policy." The adoption of republicanism in the Nationalist platform was strongly resented in the Union and on the motion of Mr. Merriman—who voiced very accurately the feelings of most of the Cape province Dutchmen—a motion condemning republican propaganda was carried (June 18 1917) by 72 votes to 21. The propaganda, however, grew in virulence. There was, said Gen. Botha in 1918, an agitation on foot to establish a republic by violent means.

Republican Propaganda.

It will be seen that throughout the World War S.A. had been divided by bitter racial strife. It was not, however, the traditional clash betweed Briton and Boer, but a combination of Boer and Briton against a section of the Boer community, and this marked an advance on old conditions. Nor were all those who gave Hertzog their votes really prepared to follow him to all lengths. But the defeat of Germany brought no respite in the Nationalist agitation—it rather increased, nor did it require much astuteness for Hertzog to fix upon President Wilson's declarations in favour of self-determination as a weapon. The last half of 1918 was, however, noteworthy in S.A. for other than political happenings. In the influenza epidemic which swept over the world S.A. suffered very severely. Influenza attacked both the white and coloured population and was most severe in the Cape peninsula. A total of 54,899 deaths were registered in Aug.–Dec. 1918. Of these, 11,510 were among whites and of these 6,094 occurred in the Cape province. (There was a recurrence of the epidemic in 1919, but in a milder form.)

As soon as the World War ended Gen. Botha was summoned to London[2] where he joined Gen. Smuts. They represented S.A. throughout the peace negotiations and both were signatories of the Treaty of Versailles, under which S. A. and the other British Dominions became original members of the League of Nations. The counter-measures of the Nationalists failed. No sooner had hostilities ceased than the central committee of their organization sent a note to President Wilson expressing their desire to lay before him their aspiration that the principle of self-determination should be applied as much to the S.A. people as to "other small nations." Mr. Wilson declined to interfere. General Hertzog was at heart most concerned to regain independence for the ex-Dutch republics. Thus in a debate initiated by Sir Thomas Smartt on the republican propaganda in the House of Assembly in Feb. 1919 he maintained the right of the Free State to break away from the Union. At the opening of the session in Jan. one of his henchmen, Mr. Tielman Roos, in the debate on the resolution congratulating King George on the victory of the Allies, had moved an amendment declaring that peace could only be maintained by the "complete application" of the principle of self-determination enunciated by the Allied and Associated Powers. This amendment had been defeated by 73 votes to 20.

Nationalists and Self-determination.

Hoping to get some advantage out of the struggle going on around the Peace Conference table in Paris Gen. Hertzog and certain of his colleagues determined to visit Europe. Hertzog held that the question of the Union as a whole becoming a republic was a matter in which Great Britain had no voice, but meanwhile Great Britain might "redress the wrong done to the ex-Dutch republics by restoring to them their freedom." He and his colleagues would lay their case before the Prime Minister, Mr. Lloyd George. When it was announced that a Nationalist deputation would leave for England, trouble arose. The crews of the mail steamers intimated that they would not put to sea if Gen. Hertzog and his colleagues were passengers. This difficulty was met by the offer to bring them over to England in a British

[1] In a proclamation issued by Beyers and de Wet on Oct. 29 1914, they signed themselves "generals of the protesting burghers."

[2] In Botha's absence Mr. F. S. Malan was acting Prime Minister.

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man-of-war. Hertzog, however, realized that that would render him ridiculous; eventually he and his friends sailed in a Dutch vessel to New York, whence they took passage to Europe. They saw Mr. Lloyd George, they visited Paris, and they returned to S.A. unsatisfied. Mr. Lloyd George pointed out to them, among other things, that the restoration of the Dutch republics was not a matter to bring before the Imperial Government; the Union of S.A. was a self-governing state and could speak only through its own constitutionally chosen Ministry.

The Treaty of Versailles having been signed (June 28 1919) Gens. Botha and Smuts returned to S. Africa. A few weeks later Gen. Botha, whose health had been indifferent for some time, died (Aug. 27) after a very brief illness. In him S.A. lost one of her greatest sons, and the Empire a man who, whether as friend or foe, had been large minded, sincere and whole-hearted. With regard to Botha's successor Lord Buxton, the governor-general, had no hesitation. Gen. Smuts was the inevitable choice. In Sept. at a special session of Parliament, the peace treaty with Germany was debated, and a resolution passed asking King George to ratify it on behalf of the Union. In this debate and on many other occasions Gen. Smuts dwelt on the enhanced position S.A. had acquired as a result of the World War; she had not only become an equal member of the British Commonwealth, with a voice in the direction of its foreign affairs, but a separate entity in the comity of nations. Greater freedom it could not possess; it was mistress of its own destinies, but, so he argued, it was not open to the Union to break away from the British connexion.

Botha's Death: Smuts Prime Minister.

The war had ended, economically S.A. had suffered from it less than might have been anticipated, and a period of trade expansion had set in. Smuts, both in generalship and in diplomacy, had been the greatest figure which the British Dominions had thrown up during the conflict. He was presently called upon to get the verdict of his own people on his policy and actions, for by the constitution, another general election was due. It was held in March 1920 in circumstances somewhat unfavourable for the Ministry. Though on imperial questions the Unionist party and the S.A. party held the same views, there were many points on purely domestic issues on which they did not agree and they opposed one another at the polls, often too when a Nationalist was contesting the same seat. There were several triangular and even some quadrilateral contests—caused by Labour candidatures. And the election showed that the Nationalists, determinedly narrow in their outlook—for many back-veld Boers the world outside S.A. counted as nothing—had gained strength. There were 134 seats to be filled as against 130 in 1915. The Nationalists came out the strongest single party with 45 seats; the S.A. party held 40, the Unionists 25, while Labour gained the remarkable number of 21 seats. Three Independents completed the list. The Nationalists were jubilant and with the help of the Labour members hoped for great things. Gen. Smuts was in a difficult position but he resolved to meet Parliament and carry on the Government. This could only be done with the help of the Unionists—and that help was given to Smuts as freely as it had been given to Botha. Even so, the margin of votes was exceedingly small and would have disappeared had not several of the Labour members on the main issues also supported the Ministry. As it was Smuts went through the session with remarkable skill and succeeded in passing more than one important measure—among others the Native Administration Act (*see* above).

The evidence that the election had afforded of the strength of the Nationalists could not however be ignored, nor was it possible that in the existing state of parties Parliament could continue to do its work efficiently or the country be at peace. Some way out must be found. Considering his race, it is not a matter for wonder that Smuts tried first to see if an accommodation could be reached with the Nationalists. A reunited party which would have the support of the whole Dutch community was a tempting prospect. Negotiations went on for some time; finally in Sept. 1920 a *hereeniging* (reunion) conference was held at Bloemfontein. It failed, and its failure might have been foreseen. On various points the Nationalists or the S.A. party were prepared for compromise, but when the test came it was seen that there was no bridging the gulf which separated them on essentials. Gen. Smuts and his party held firm to the principles of the unity of the Union and the preservation of the ties which linked the Union to the Empire. The Nationalists, on their side, refused to abandon the republican plank in their platform.

Hereeniging Efforts.

Gen. Smuts consequently turned for support elsewhere. In a manifesto issued on Sept. 29 and addressed to "all right minded S. Africans, irrespective of race or party" he asked them "to join a new party which shall be strong enough to safeguard the permanent interests of the Union against the disruptive and destructive policy of the Nationalists." This was an open bid to the Unionists, nor were they indisposed to respond. Their fundamental principles were those of Gen. Smuts and his followers. But when at the conference of the S.A. party, held on Oct. 27, a resolution was adopted directing the head committee of the organization to take the necessary steps not for the creation of a new party, but for "an expansion of the S.A. party," some difficulty was created. The Unionists, who represented the bulk of the British section of the community, had, though with natural regret, been prepared to make a new combination, but they disliked the idea of simple absorption into a predominantly Dutch organization. These feelings were expressed at the Unionist party conference at Bloemfontein early in November. Counsels of patriotism prevailed and at a meeting between the Unionist executive and Gen. Smuts at Johannesburg on Nov. 27, a complete agreement was reached. The Unionists joined the S.A. party, which retained its name. Nor was it an unfitting title, though it would become meaningless if the fusion of the two races came about, and the old distinction between Boer and Briton obliterated. This possibility was precisely what the Nationalists (and also a few British extremists) most dreaded while it was the goal to which Smuts looked forward. Speaking in London on May 22 1917, he had declared "we want to create a blend out of various nationalities. We want to create a new nation and that is the South African nation. . . . I am hopeful that . . . we shall in the end succeed and create under our South African sun a new type in the world."

The 1921 Election.

Having drawn together the supporters of "national unity of the European races and the economic development of S.A. along peaceful lines" Gen. Smuts made a new appeal to the country, backed by the whole strength of what had been the Unionist party. Smuts fought the election on the republican issue. With the alternative thus nakedly put the Nationalists took alarm. They knew that success for them on such an issue was impossible and therefore they tried to confuse the people, and snatch a victory on other grounds. Severance from the British Empire, the turning of the Union into a republic, was not, they declared, their immediate object, rather was it an ideal which they hoped to attain in a remote future. This manœuvre deceived no one. Even if the Nationalists did not ardently desire a complete rupture with Great Britain they did want to secure at once complete ascendency in the ex-Boer Republics. During the election campaign Hertzog was induced to put the case baldly. Heckled at a meeting at Roodebank in the Standerton district he said that "even today (1921) he would accept a republic in the Transvaal and Free State and those Englishmen who objected might retain their British citizenship. If they had any grievances they would be represented by a British diplomatic agent." He admitted that if his wish were granted and difficulties arose the country would be in exactly the same position as before the Boer War.

The election was held in Feb. 1921 and resulted in a notable triumph for Gen. Smuts and the enlarged S.A. party. But it was significant that the Nationalist vote increased and that on balance of losses and gains they held two more seats in the new than they had held in the old Parliament. The distribution of parties was as follows:—South African, 76, Nationalist, 47, Labour, 10, In-

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dependent 1.[1] The 76 seats held by the S.A. party compared with 40 in the old S.A. party and 25 in the old Unionist party. The gains of the enlarged party had been at the expense of the Labour candidates. But an analysis of the poll showed that Smuts had rallied to his side many doubtful voters besides those transferred from Labour. Nor could the Nationalists claim that those who voted for Labour candidates favoured their propaganda; there were in the Transvaal bitter contests between Nationalist and Labour candidates. In considering the figures of the votes cast it should be remembered that nine S.A. party candidates were returned unopposed, whereas only one Nationalist (Gen. Hertzog himself) was not opposed. It is also noteworthy that the Nationalists' successes were almost entirely in rural and remote constituencies, decisive evidence that their strength lay in the back-veld Boers. The figures were: S.A. party 138,942 (an increase of 19,455 compared with 1920), Nationalists 104,692 (an increase of over 8,000), Labour 28,983 (a decrease of over 12,000).

Following upon the election there was a reorganization of the Cabinet in which Sir Thos. Smartt became Minister for Agriculture, Mr. Patrick Duncan Minister for the Interior, and Mr. J. W. Jagger Minister for Railways and Harbours. Another leader of the late Unionist party, Sir Edgar Walton, was appointed High Commissioner in London. In June 1921 Gen. Smuts, Sir T. Smartt and Col. H. Mentz (Minister of Defence) came to London to attend the Imperial Conference. In regard to matters affecting the internal affairs of S.A. the most delicate question discussed by the conference was the status of British Indians (see above). While the ministers were still in London the question of the future of Rhodesia advanced a stage. A deputation had been invited to discuss with the Colonial Office a plan for ascertaining whether Rhodesia was prepared to take a referendum upon a definite scheme of self-government (*see* RHODESIA). Largely however as the result of the general election in the Union in Feb. 1921 the party in Rhodesia which preferred to join the Union had again grown in strength. The Rhodesian deputation saw Gen. Smuts early in Sept., immediately after his return to Cape Town, when it was made clear that though the admission of Rhodesia as a province of the Union would be welcomed, it was a matter for the Rhodesians to decide.

Native Unrest.

In the 1921 election campaign the Nationalists sought to evade the main issue partly by assailing the policy of the Government on native affairs. That policy has already been outlined; by Nationalist orators addressing the back-veld Boer the conciliatory measures adopted were denounced as "coöperating with niggers"; by Nationalist orators addressing audiences in the Cape province—where the native had the vote—the segregation clauses of the Act of 1920 were denounced as evidence of the bias of the Government against the Kaffirs. This method of electioneering had elements of danger, for discontent among considerable sections of the natives was pronounced. The chief ground of complaint was in regard to their economic position. The natives had been quick to learn the lesson of the strikes of white labour on the Rand and in 1917 and subsequent years there had been strikes and native disturbances at Johannesburg and other cities. There were also many evidences of political and religious ferment. Serious disturbances at the Lovedale missionary institute in April 1920,[2] were followed on Oct. 23 of the same year by a disastrous collision at Port Elizabeth. In the last-named case the native labourers had struck for higher wages and their leader, Masabalala, president of the Native Workers Union, had been arrested and refused bail. An angry crowd gathered before the court house and fire was opened upon it by the Europeans who feared an attack. Rioting and incendiarism ensued and for a time it looked as if Port Elizabeth would be at the mercy of the natives. In all over 20 persons (including one European) were killed and 40 injured. The action of the natives was condemned by many of their leaders, such as Dr. Rubusana, an ex-member of the Cape provincial council and by Mr. Jabavu,[3] a graduate of London University, who, while calling for the remedy of grievances, denounced the "Bolshevist propaganda" permeating the native mind. An investigation made by a commission appointed by the Government tended to show that the authorities at Port Elizabeth had mishandled the affair, and that bloodshed might have been avoided had Masabalala been granted bail. It was a cause for angry recriminations later when Nationalist candidates for Parliament appeared on the same platform as Masabalala.

A greater tragedy followed at Bulhoek, near Queenstown on May 24 1921. For months several hundreds of natives known as Israelites, proselytes of one Enoch Ngijima, who gave himself out as the prophet Enoch, had been allowed to remain at Bulhoek and they had become a menace to the community. Whether or not earlier action might have averted the calamity is not certain; in this case the Government acted with great forbearance. But at length it became imperative that the Israelites should be compelled to return to their homes, and forces were moved to Bulhoek to be in readiness for eventualities. Enoch proved intractable and his followers proved themselves possessed of all the fanaticism of dervishes. On May 24, when preparations were being made for their removal, large numbers of them, though destitute of firearms, charged the troops, and some 400 were killed or wounded before their ranks wavered and broke. On this occasion the soldiers had no option but to fire; the Israelites, though their reckless charge exhibited only fanaticism, had also shown military skill and had dug trenches and prepared ambushes for the troops. Their dispersal was a necessity. Neither did responsible native leaders approve Enoch's teachings.

The Bulhoek tragedy was, however, regarded by the leaders of the natives as the outcome of unjust economic laws. The case against the Government was put by Mr. Selby Maimang, the president of the Industrial Commercial Workers Union—a union which embraced nearly all the native and coloured trade organizations in South Africa—at its meeting at Cape Town in July 1921. Mr. Maimang said that the land laws of the country were to blame for the catastrophe. Enoch's following had fallen victims to bad influences brought about by bad administration. Coloured workers were smarting under irritating disabilities in every walk of life. Mr. Maimang, a representative of moderate opinion among the natives, reprobated the useless stirring up of passions, declaring it to be the duty of the Union to educate all non-European workers to guard their own interests. Organization was essential; they could only ward themselves against exploitation by a distinct band of comradeship. As to that many European employers were already convinced that combination among the natives engaged in industries was a factor which they could not ignore.

The decline in trade which became noticeable in the middle of 1920, and was acute in the first half of 1921, added to the difficulties of the industrial problem. It affected both white and coloured labour severely and caused renewed agitation on the Rand, while diamond mining came almost to a standstill.

Lord Buxton's tenure of the office of governor-general and high commissioner came to an end in 1920. In very difficult circumstances he had carried out his duties with firmness and in a manner which won the esteem of all classes, including the Nationalists. He identified himself with the interests of S. Africa. On giving up office he was granted an earldom (Oct. 21 1920), and on his return home served as chairman of the committee appointed to inquire into the future government of Rhodesia. Prince Arthur of Connaught was chosen as the new governor-general and high commissioner. He reached the Cape on Nov. 17—ten years after his father, the Duke of Connaught, had opened the first session of the Union Parliament.

[1] These figures include the results of recounts and of two by-elections in the Transvaal, necessitated by ties in the voting at the general election. At two by-elections for Cape Town constituencies in Sept. 1921 Labour candidates won, bringing the Labour members of Parliament to 12 and reducing the S.A. Party to 74.

[2] The students attempted to burn down the college buildings and murder the professors. The rioting began with complaints as to the quality of the bread served, which was the same for whites and blacks.

[3] Son of Tengo Jabavu (d. 1921), editor of *Imvo (zi Bantu)*, an influential native newspaper, which he had founded in 1884.

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AUTHORITIES: (*a*) *Official. The Official Year Book of the Union*, prepared by the Union census and statistics department is a valuable record and contains sections relating to state archives and official publications and a classified bibliography. The Colonial Office, London, publishes annual reports on the native protectorates, and the *Colonial Office List* (yearly) gives lists of all parliamentary papers. The Government of India issues reports concerning Indians in S.A. (see especially *Statement made by Sir B. Robertson before the Asiatic Enquiry Commission* (1921), a survey of the whole question).

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See also *The South and East African Year Book and Guide*, edited annually by A. S. and G. G. Brown, an increasingly useful work; *The South African Journal of Science;* the *Trans. Geological Soc. South Africa;* and the *Jnl. African Society of London.* For economics see the lists given in the *Official Year Book.* (F. R. C.)

DEFENCE AND MILITARY INSTITUTIONS

The establishment of union in S. Africa in the year 1910 involved a fusion of the different military systems then obtaining in the four colonies which became original Constituent Provinces in the new amalgamation. These systems were as follows. The Cape Colony maintained a permanent force (the Cape Mounted Riflemen) together with a volunteer force and a cadet organization. The forces of Natal consisted of a military force, of much the same strength (3,000–4,000 men) and character as the volunteer force of the Cape and a reserve organized in rifle clubs, and included cadets again on much the same lines as those of the kindred organization in the Cape Colony. The two forces contained regiments of long standing and high reputation gained in many local campaigns and embraced all arms. These regiments retained their identity in the new forces. A volunteer force on modern lines, confined to the towns, except for two mounted regiments recruited from country districts, was the form of military organization which had been adopted by the Transvaal. This force, however, had only been in existence for seven or eight years at the date of union. In the same period an efficient cadet system had been instituted. In each of these three colonies a small permanent staff was maintained. The Orange Free State relied upon the burgher system based on universal male liability for service in time of war, a principle accepted indeed by all the four colonies, and reaffirmed in the present S. Africa Defence Act.

It was not until June 14 1912 that it was found possible to pass a law embodying the recommendations which had been made and the conclusions which had been arrived at after investigation, but upon this date the S. Africa Defence Act, 1912, was placed on the statute book. Field-Marshal Lord Methuen, then commander-in-chief of the British forces in S. Africa, evinced great interest in the matter of South African defence and assisted the local military authorities in the conferences and deliberations which preceded the passing of the Act. By this Act every citizen between 17 and 60 (both included) is liable to render personal service in time of war in defence of the Union "in any part of South Africa." A permanent force is provided for, but in May 1921 an amending bill was before the House of Assembly, which if accepted would materially alter the composition and functions of this force.

Every citizen is liable to undergo, beginning in his twenty-first year, four years "peace training" in the Active Citizen Force, which constitutes the first line of defence. It is however permissible for any citizen to enter voluntarily for his "peace training" in any year between his 17th and 21st years (both included). The number of citizens to be trained in the Active Citizen Force is placed in the Act at 50% of the total number liable, but Parliament has power to increase this number. If the number required for training in any district is greater than that of its voluntary entries, a ballot may be taken to make good the shortage. After four years' "peace training" in the Active Citizen Force the citizen goes to Class A of the Citizen Force Reserve where he remains until his 45th year. A Coast Garrison Force is established, and service may be undertaken in that force as equivalent to Active Citizen Force "peace training." A similar concession is allowed to citizens who may elect to serve in the Royal Naval Volunteer Reserve which is part of the Royal Naval Reserve constituted under the Naval Forces Act 1903 (Great Britain and Ireland) and may be placed at the disposal of the Royal Naval authorities. Any citizen who at 21 has not been entered for service in the Active Citizen Force (or one of its equivalents) is compelled to serve for four years in a Rifle Association where he is taught to be "familiar with the use of military weapons of precision," after which he is included in Class B. of the Citizen Force Reserve until his 45th year. Cadet service is compulsory, but a request from a parent or guardian that a boy "be exempt from cadet training" secures a certificate of exemption. Several special reserves are provided for in the Act, and one of these, the Veteran Reserve, was largely used in establishments within the Union during the period 1914–8. The National Reserve consists of all citizens who, liable to render personal service in time of war, do not belong to any other portion of the forces. The full establishments of the Active Citizen Force in 1914 represented a force of approximately 30,000 men. The periods of "peace training" are not more than 30 days in the first year and 21 days in each subsequent year with a maximum of continuous training (in camp) of 22 and 15 days respectively.

The response to the first year's (1913) call for entries was striking, and 44,193 citizens entered voluntarily for training, producing a strength of 14,000 in excess of requirements. The following year saw the outbreak of the World War, and the annual registration in Jan. of all citizens who reach the age of 17 in the year has been in abeyance since Jan. 1914.

Immediately after the passage of the Defence Act in 1912 steps were taken to establish the military system for which it provided. The permanent force at its inception consisted of two portions. The staff was employed partly at defence headquarters and partly distributed in the 15 military districts of the Union. The South African Mounted Riflemen (five regiments and three batteries of field artillery) was, with the exception of the artillery, employed solely on police work, and divided into very small detachments on posts. The whole of the police force had in May 1921 been placed under the command of the commissioner of police, and the new military arrangements proposed in 1921 contemplated a reduced permanent force employed on military duties alone.[1]

The complications introduced by the rebellion made it impossible to call out the whole of the citizen forces in the formations in which they strictly belonged; and, though a considerable number of units of the Active Citizen Force were called out by proclamation in the regular way, most of the Dutch members of the forces—many of whom were beyond the age of those in the Active Citizen Force—were specially embodied under the old commando system to which they had been formerly accustomed. Thus the whole of the Dutch-speaking units serving under Gen. Botha in the rebellion and German S. W. Africa were organized on a commando basis, the English-speaking units being those of the Active Citizen Force. In the rebellion 30,000 troops (of whom 20,000 were of Dutch descent) were employed at a cost of £5,100,000 to the Union Government, and casualties to the extent of 132 killed and 242 wounded were sustained by the loyal troops. In German S.W. Africa 67,237 Union troops were engaged at an approximate cost of £15,000,000 and 127 lives were lost, the wounded amounting to 272.

[1] The S. African Mounted Riflemen, as a brigade, served in the rebellion of 1914, and at the close of the campaign in German S.W. Africa, but thereafter were retained in the Union, though many individual members of the force served with credit and distinction on many battle fronts.

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At the conclusion of the campaign in German S.W. Africa the Union Government turned its attention to other fields in which assistance was needed. These were oversea, and the liability of S. African citizens to military service did not extend to such distant spheres of activity. It was thus necessary to devise special measures to furnish troops composed of S. Africans who were prepared of their free will to serve beyond the limits of S. Africa.

In July 1915 the Imperial Government accepted the offer of the Union Government to furnish personnel for units for service beyond S. Africa. A director of war recruiting was appointed and recruiting was maintained until the Armistice in 1918. The following are the numbers of all the forces which were raised in the Union for the different campaigns in which South African troops took part:—

The rebellion	30,000
German S.W. Africa	67,237
Overseas (France)	30,880
German E. & Central Africa	47,521
For service in the Union	5,180

The achievements of the S. Africans in France and their fortitude under hardship in the East African campaign are matters of history.

The coloured community in the Cape province had early expressed a strong desire to furnish a representative body of troops, and an infantry battalion of the Cape Corps was formed, and later a second battalion was recruited. The regiment after gaining valuable experience in E. and Central Africa was sent as one battalion to Egypt and Palestine, where it served with credit. The natives of the Union, who throughout the war maintained an attitude of complete self-control and loyalty, furnished for non-combatant duties 35,000 men for German S.W. Africa, 10,600 for France and 18,000 for E. and Central Africa. Some hundreds of natives lost their lives in the transport "Mendi" which was sunk in the English Channel.

While, as a consequence of the large number of men who, especially at the outset of the war, joined the British forces as individuals, a full statement of the casualties sustained by S. Africa in the World War is not available, the following figures give some idea of the incidence of losses. In the S. African Infantry Brigade in France nearly 15,000 casualties were sustained, of which some 5,000 were killed. In the Cape Corps which served in E. Africa, Egypt and Palestine, the casualties in dead and wounded totalled 701. Disease and privation took heavy toll in East Africa and hundreds of men returned to the Union from the campaign in that country shattered in health. The Royal Naval Volunteer Reserve supplied and maintained a strong detachment for service in the Grand Fleet and naval establishments. Hospitals, camps, supply and ordnance depots, and veterinary hospitals were formed in S. Africa under Union control, and heavy purchases were made and vast amounts of supplies were forwarded to E. Africa under Union military supervision on behalf of the Imperial Government.

As regards the future military arrangements of the Union the main provisions of the Act of 1912 have been accepted as sound, though methods will doubtless be reformed to a considerable extent. An amending defence bill in May 1921, in addition to important changes in the constitution and functions of the permanent force, provided for a resumption of registration, with retrospective effect as regards citizens who should have been registered in and since 1918; also for the working of the normal training system in 1922, and for a substantial increase in the period of continuous "peace training," as well as for increasing cadet efficiency, by additional expenditure of public funds and by extending the age for cadet service. The bill was, however, dropped in June 1921. (J. J. C.)

SOUTH CAROLINA (*see* 25.499*).—The pop. of the state in 1920 was 1,683,724, an increase of 11·1% over the previous decade, as compared with 13·1% and 16·4% during the two preceding decades. During the decade 1910–20 negroes increased from 679,161 to 818,538, or from 44·8% of the total pop. to 48·6%. The density was 55·2 per sq. mile. The urban pop. was 17·5% of the whole, as compared with 14·8% in 1910. The pop. of Charleston was 67,957 and the decennial increase 15·5%, the white increase being 28·3% and the negro 4%. The white pop., increased by war industries, was 52·4% of the whole, constituting a majority for the first time in about 200 years. The pop. and decennial increase for the other leading cities were as follows:—

	1920	1910	Increase per cent
Columbia	37,524	26,319	42·6
Greenville	23,127	15,741	46·9
Spartanburg	22,638	17,517	29·2
Florence	10,968	7,057	55·7
Anderson	10,579	9,654	9·5
Sumter	9,508	8,109	17·3

Manufactures.—Textile mills paid very large dividends during 1917–20, and in addition doubled or trebled their capital. Wages rose greatly, but were cut 30 to 50% in the depression of 1920–1. The number of spindles in 1918 was 4,914,524; of operatives in 1919, 50,898, a decrease of about 4,000 since 1916; the bales of cotton consumed diminished from 972,000 in 1916 to 779,000 in 1918–9; capitalization that year was $201,237,320. Almost half the motive power in 1920 was hydro-electric. Unionization has not proceeded far among textile workers, though skilled trades in larger places are generally organized. The State Board of Conciliation, created in 1916, arbitrates labour disputes on invitation or investigates them on its own motion or the order of the governor. Women are forbidden to work in stores after 10 P.M. or over 12 hours in one day.

Agriculture.—The coincidence of the World War and a large cotton crop in 1914 demoralized farming. A law was passed forbidding the planting of more than a third of a farm's acreage in cotton, but was repealed before the next planting season. An enormous inflation of values soon followed and in turn was succeeded by a decline of prices from about $0.40 to $0.10 or $0.11 in six months (1920–1), entailing great hardship. Legislation (1912) sought to stabilize agricultural prices by a system of state warehouses for holding products for a favourable market. Private capital has been extensively invested to the same end. The boll weevil became a serious menace in 1920 in the south-western counties. A packing plant with a daily capacity of 400 hogs was established in Orangeburg. Butter-making in coöperative creameries has made some progress. Under the law of 1920 extensive drainage projects were undertaken. Agricultural methods have improved; farm-houses are better; banks, which have increased in number and capital, finance the farmer directly at greatly lower cost than formerly charged by "lien merchants." South Carolina led all the states in 1917 in crop value per acre with an average of $63. The value in 1918 was $75. According to state Government estimate cotton covered in 1920 45% of the cultivated acreage and represented 50% of the value of the 13 leading crops. One million five hundred and thirty thousand bales were raised, the state's acreage being fourth and its production second in the Union. Corn, second in value, amounted to 42,370,000 bushels. Other crops were: tobacco 66,950,000 lb.; rice 120,000 bus.; sorghum 1,500,000 gal.; peanuts 1,620,000 bushels. The average value of ploughed lands was $61 per acre as against $91 for the United States. Average monthly wages for adult male farm labour without board were $41.80, next to the lowest for any state. During 1910–20 the number of farms increased from 176,434 to 192,693; improved land from 6,097,999 ac. to 6,184,159 ac.; average value per farm from $2,223 to $4,946; average value per acre from $29.02 to $76.70.

Education.—School legislation since 1910 included an Act for compulsory school attendance in 1919 throughout the state, increased state additions to local funds, calculated to ensure after 1920 a seven-months' term in the poorest districts; night schools for adults; consolidation and grading of rural schools, with transportation for children; an increased number of high schools; special teachers and inspectors in rural and textile districts; greatly improved school buildings; enlarged facilities for agricultural, vocational and home economics training; state standard certification of teachers and enforcement of payment for tuition at state colleges by those able to pay. The most significant principle underlying the forward movement in education has been the recognition of the necessity of greater assistance from state funds and greater power in the state authorities as distinguished from the local divisions. Difficulties have been the lack of competent teachers to carry out the enlarged programme and maintain the higher standards, the shortness of the rural school term, and excessive local authority to do or neglect to do what it pleases. The expenditure on common schools in 1918–9 exceeded $8,000,000. Attendance in common schools in 1919–20 for whites was 226,065; for negroes, 251,980; total 478,045. There were in that year enrolled in the 36 colleges in the state 12,000 students, of whom a third were negroes.

The three most numerous religious denominations, the Baptist, Methodist and Presbyterian, have added materially during 1910–20 to their extensive work in higher education. All but 11 of the 36 institutions for higher education in the state were in 1920 under church control, and these institutions contained a thousand more students than all state and other non-sectarian institutions combined.

Social Legislation.—Every attempt of forces of reaction to abandon a step in the large number of forward moves in social legislation since 1910 has been defeated, usually overwhelmingly,

**These figures indicate the volume and page number of the previous article.*

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In 1912 race gambling was forbidden. In 1913 the penitentiary hosiery mill was abolished as harmful to the health of the prisoners. The State Board of Charities and Corrections, created in 1915, was reorganized in 1920 as the State Board of Public Welfare. The state hospital for the insane was entirely remade, materially and administratively, during 1915–9. A school for the feeble-minded was established in 1918. The placing of orphans and homeless children was taken over by the state in 1920. In 1918 the Industrial School for Girls, a reformatory institution for white girls, was established and the reformatory for negro boys was reorganized. The probate judge in each county is constituted a juvenile court, and several cities have undertaken remedial work for juvenile delinquents and dependents. Penal and charitable institutions (including church and private charitable institutions) have been since 1915 under state inspection. Since 1918 diseased women prisoners of all classes are held until cured. The age of consent was raised in 1921 to 16 years. No city has acted upon the permission in 1915 to segregate whites and negroes by city blocks. Marriage licences were required by law in 1911 and registration of births and deaths in 1914. Medical inspection of school children was made state-wide in 1920.

Finance.—The budget system, concentrating responsibility on the governor and the chairmen of the two legislative finance committees, adopted in 1919, has tended to economy and system, though the Legislature may disregard without any limitation the recommendations. The State Tax Commission, created in 1915, has improved the administration of the tax laws. The assessed taxable value of all property in 1920 was $448,222,786, being from a fourth to a third of the market value. For the state government there was raised a revenue of approximately $6,000,000; for county governments $12,000,000; for common schools (local tax) $8,000,000; and for municipal government between $5,000,000 and $6,000,000.

Political History.—The class feeling that has always been strong in South Carolina politics found violent manifestation during the governorship of Coleman L. Blease, who served two terms from 1911 to 1915. Blease's political tactics were calculated to appeal to the lower and less literate elements of the state; he quarrelled with the state Supreme Court, with the General Assembly, with other state officers and with the U.S. authorities. The Legislature was at all times controlled by his opponents, and probably more measures were passed over his veto than had been so passed in the case of all former governors combined. He startled a congress of governors at Richmond, Va., in 1912 by an open advocacy of lynching, and while governor he pardoned or paroled more than 1,500 criminals. At the time of his resignation (a few days before his term expired in 1915) he had freed all but 150 convicts, the number then said to be remaining in the institutions of the state. Almost his last official act was an order disbanding the state militia; this was promptly countermanded by his successor. Resigning without giving any explanation, he was succeeded for five days by Lt.-Gov. C. A. Smith. In 1918 Mr. Blease made a campaign for election to the U.S. Senate, taking extreme ground against the country's entering the war. He was overwhelmingly defeated. A progressive period began with the election of Gov. Richard I. Manning in 1914. A significant feature of the campaign was the support given to Prof. John G. Clinkscales in his advocacy of compulsory education. Gov. Manning's two administrations were marked by constructive legislation and effective coöperation with the national Government. Gov. Robert A. Cooper was elected in 1918 on a platform that made education its chief plank and frankly announced that as the result of progressive legislation taxes would be higher. He was reëlected without opposition in 1920. His chief measures were the strengthening of the public schools, the creation of a budget system and the consolidation of management of charitable and correctional institutions. The Australian ballot was put in force (1921) in primaries, though not in the general election, the latter being merely a formal ratification of the former as the Democratic nomination is equivalent to election.

The World War.—Of the total of 78 Congressional Medals of Honour awarded, South Carolina received six. The total number of men sent by South Carolina into the war was 54,254, not including those who had enlisted before the Unites States declared war. The amount of Liberty and Victory loans and other Government securities bought was $94,211,244, and $3,027,740 was contributed to Red Cross and similar appeals.

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SOUTH DAKOTA (*see* 25.506).—The pop. of the state in 1920 was 636,547, as compared with 583,888 in 1910, an increase of 52,659, or a little more than 9%. The average density in 1920 was 8·3 per sq. mile. The rural pop. was 84% of the whole in 1920, against 86·8% in 1910, an increase of 27,460, or 5·4%. The urban pop. (cities with 2,500 inhabitants and over) was 101,872 in 1920 against 76,673 in 1910, an increase of 25,199, or nearly 33%. The pop. of Sioux Falls increased 79·7% to 25,176 in 1920. Its rapid growth is due largely to the opening of extensive packing plants, stock yards and factories. Aberdeen in 1920 had 14,537 inhabitants; Watertown, 9,400; Mitchell, 8,478; Huron, 8,302; Rapid City, 5,777; Yankton, 5,024; Lead, 5,013; and Pierre, the state capital, 3,209. The foreign-born white pop. in 1920 was 82,372, of which 16,807 were Norwegians, 8,569 Swedes, 5,983 Danes, 15,670 Germans, 11,191 Russians, 4,453 Canadians, 2,943 British.

Communications.—A panoramic picture of the surface of the state in 1921 would present many changes from one in 1910, but both pictures would have the appearance of a chess-board, of which the country roads, running a mile apart from E. to W. and from S. to N., would mark the squares. In the hills, near river beds, in the bad lands, and in uncultivated and thinly populated portions, the roads are not uniformly maintained. The law provides that they be 66 ft. in width. Each square mile of land is called a section and contains, including one-half of the roads on the four sides, 640 ac. of land. The roads are still for the most part dirt roads. During the decade 1910–20 they were considerably improved by grading and elevating the centre. All of the 64 counties either have been actually engaged in the building of hard-surfaced roads or have started preparations for doing so. Advantage is taken of the Federal appropriations for highway purpose of which South Dakota's share was $4,458,545. State and county have made heavy assessments. Over $6,000,000 has been spent in building hard-surfaced roads. The state Legislature appropriated $2,000,000 for the construction, in 1921, at Rapid City, of a cement plant with a daily capacity of 2,000 barrels. A system of state trunk highways is supposed to connect all county seats and all towns having a pop. of 750 and more. A law provides that every county must employ a county engineer whose occupation is the planning of better highways. The automobile, the truck and the tractor have become more common than horsed vehicles, and have awakened the farmers to the advantage of good roads; 117,320 automobiles, enough to carry comfortably all the inhabitants of the state at one time were licensed in 1920. In connexion with the improvement of the roads, mention should be made of the bridge which was being built in 1921, at a cost of $1,500,000 across the Missouri river at Yankton, and which supplies the last connecting link of the Meridian Highway which crosses the state and extends from Winnipeg, Canada, to the Gulf of Mexico. Only about 300 m. of railway were built during the 10 years, 1910–20.

Agriculture.—There were 74,637 farmers in 1920, of whom 47,815 were owners, 26,041 renters and 781 managers. Many owners of the rented farms either lived on their farms or in the neighbouring towns, having rented to their prospective heirs. Though there were 74,637 farmers to 76,868 sq. m. of land, it is not the case that the great majority of the farmers occupied on an average a sq. m. of land each. All of the land area was not under cultivation; and among those who occupy the 34,636,491 ac. of agricultural lands outside of the corporate limits, the great majority of the farmers have each much less than the average, which is 454 acres. A minority, mostly west of the Missouri river, operate the large farms.

The farmers prospered during the 10 years, 1910–20. Their prosperity was evident in many other respects than the improvement of the highways and the large number of automobiles, trucks and tractors. Farm life underwent a rapid change. Electricity, telephones, rural mail delivery and consolidated school-houses added to the comforts and education of the people. Farm machinery was improved and bodily labour decreased. Many of the counties employ county agents, who are supposed to be highly trained agricultural experts. Because of the introduction of scientific methods, farm crops have become more varied and rotation of crops has become possible. The corn acreage in 1920 surpassed the wheat acreage, and the production of other grains and grasses increased. The introduction of alfalfa was especially noteworthy. Alfalfa was harvested three and four times a year. As a result, and also because of the large use of the silo, much more stock has been raised and more dairy products and eggs sent to market. The breeds of cattle, horses, hogs and poultry have been improved and many farmers raise only pure-blooded stock. A much greater number of farmers, as well as of city people, were in 1921 raising their own vegetables and fruits. Orchards and groves have increased in number and area. Because of many clusters of trees the unbroken prairie-like appearance of the farms has been modified. Farm values have more than doubled and the use of improved farm equipment has become much more exten-

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sive. There were not only many more farmers in 1921 than in 1910, but the investment per acre was much greater. The homes, barns, stables and granaries more recently erected are usually well built, are much larger than those of the past and have modern conveniences. Practically all of the towns with a population of 2,500 have their own electric light plants. The Homestake Mining Co. has a power plant costing about $2,000,000. The 1919 Legislature provided for an hydro-electric commission and appropriated $50,000 for the purpose of surveying the Missouri river to find water power. The engineers found three sites—Mobridge, Mulehead, and Medicine Butte—to be advantageous, in the order named. The commission presented a report to the 1921 Legislature and recommended that the Mobridge site be developed. It estimated that the dam and plant would cost $9,400,000 and the transmission system $7,833,000. Under the economic conditions existing in 1921 the Legislature hesitated to act favourably and the question was to be submitted to the people in the election of Nov. 1922. The following table shows the increase of farm products:—

		Acreage	Production	Value
Corn	1919	2,756,234	69,060,782 bus.	$89,779,016
"	1909	2,037,658	55,558,737 "	26,395,985
Wheat	1919	3,891,468	31,086,995 "	69,323,996
"	1909	3,217,255	47,054,590 "	42,878,223
Oats	1919	1,839,089	51,091,904 "	38,318,937
"	1909	1,558,643	43,565,676 "	16,044,785
Barley	1919	754,929	12,815,768 "	15,378,922
"	1909	1,114,531	22,396,130 "	10,873,522
Rye	1919	463,132	4,111,543 "	5,961,741
"	1909	13,778	194,672 "	115,126
Flaxseed	1919	159,234	1,109,303 "	4,880,931
"	1909	518,566	4,759,794 "	7,001,717
Potatoes	1919	58,180	2,863,186 "	7,157,983
"	1909	50,052	3,441,692 "	1,967,550
Hay and forage	1919	5,071,747	4,996,846 tons	71,988,845
" " "	1909	3,435,907	3,651,706 "	15,247,570

In 1919 receipts for the sale of dairy products were $12,222,562; of chickens, $1,477,500. The total value of domestic animals on farms was $232,364,625.

Minerals.—The value of the minerals produced in the state in 1919 was $5,500,000. Prof. Freeman Ward, state geologist, has computed the mineral products in yearly averages for the five-year periods, 1905–9 and 1915–9, as follows:—

	1905–9	1915–9
Bentonite	...	$5,480
Coal	$4,000	23,500
Copper	2,200	3,000
Gold	6,000,000	6,600,000
Gypsum	10,000	45,000
Lythia	1,000	38,680
Mica	50,000	10,400
Natural gas	18,120	19,000
Silver	97,900	126,000
Stone		
Crushed	23,480	80,000
Limestone	15,000	31,140
Sandstone	140,000	100,000
Structural materials	371,800	310,400

Manufactures.—The following table indicates the growth of manufactures:—

	1919	1909
Number of establishments	1,414	1,020
Proprietors and firm members	1,410	942
Salaried employees	1,242	682
Wage earners (average)	6,382	3,602
Capital	$30,933,030	$13,017,932
Salaries	2,076,199	615,621
Wages	7,905,426	2,297,512
Cost of materials	42,985,870	11,476,350
Value of products	62,170,782	17,870,135
Value added by manufacture	19,184,912	6,393,785

The principal industries in 1919 were flour-mill and grist-mill products, bread and other bakery products, printing and publishing, automobile repairing, cars and general shop construction and repairs by steam railway companies, lumber and timber products.

Doane Robinson, secretary of the state History Department, estimates the value of the total production of all commodities as $581,119,000 in 1918; $481,624,000 in 1919; and $316,305,000 in 1920. He gives the produce sold outside of the state as $270,536,000 in 1918; $376,720,000 in 1919; and $324,667,000 in 1920.

Finances.—The bank deposits were $206,496,073 in 1918; $235,617,276 in 1919; and $251,804,649 in 1920. They were protected by a depositors' guarantee fund amounting to $1,247,397 in 1920. The total assessed valuation of all taxable property was $1,598,544,562 in 1918, $2,095,154,178 in 1919, and $2,257,853,656 in 1920. The assessed valuation was usually not above half the real value, but even so amounted to $3,547 *per capita* in 1920. The tax levied was $17,781,439 in 1918, $21,470,598 in 1919, and $27,550,312 in 1920. The expenditure for the state Government, education, charitable and penal institutions was $1,255,593 in 1910, $9,711,964 in 1920. The state's debt in 1910 was $1,073,575 which was reduced until in 1919 the funds in excess of the debt amounted to $35,785. In addition there were in 1920 outstanding bonds, covering rural credit, highway and land settlements, amounting to $33,800,000.

Since 1917 South Dakota has had a noteworthy state rural credit system. Up to 1921, 13,575 applications had been made for loans amounting to $61,243,000. The rural credit board conservatively allowed only 7,915 loans, amounting to $31,083,450. This is more than four times the business done in the state by the Federal Farm Loan Board. The state can borrow money several per cent below the rate paid by individuals, and gives the farmers this advantage. The rural credit system having proved a success, the voters at the election of 1920 empowered the Government to make similar provisions for people in the towns. A law was consequently passed by the Legislature to create a municipal credit board and to make state loans to individuals for the purchase of homes. The state insures crops against hail at a low rate per acre. The Government administrative departments have been enlarged and a number of new commissions or departments have been created, including the following: insurance, railways, free circulating library, marketing, highway, rural credit, industrial, immigration, pure food and drug, state engineer, budget, tax, agriculture, charities and corrections, bank, depositors' guarantee fund, securities, health, pharmacy, live stock (sanitary), game and fish, coal mines, land settlement.

History.—South Dakota remained strongly Republican throughout the decade 1910–20. Of the political questions before the people the primary election law received the greatest attention. Successive Legislatures failing to deal with the matter by statute, an appeal to the initiative was successfully made at the election of Nov. 1912. Several months later, the Legislature of 1913 passed an Act of its own, and submitted it to the people at the 1914 election. It failed and the 1912 law remained in force. Thereupon the 1915 Legislature repealed the 1912 law and enacted one of its own, only to have the 1912 law in a somewhat revised form carried in the 1918 election. There has been much progressive legislation. The Non-Partisan League is a strong and active organization, but since a number of its policies have been adopted and carried out in legislation by the older parties it has not gained control of the Government. The code was revised and published in 1919. The number of men supplied by the state in the World War was 35,000, 10,000 being volunteers. There was purchased, in the state, of the Liberty and Victory bond issues $109,627,200. A bonus was voted for those who served in the World War and the sum of $6,000,000 appropriated for this purpose. Ex-service men engaged in farming are also given a state loan for "purchase of land, improvements and live stock to be placed on the land." The loan may be as high as 70 and even 90% of the value, and is payable on the instalment plan over a period of 30 years.

The governors since 1910, all Republicans, were Robert S. Vessey, 1909–13; Frank M. Byrne, 1913–7; Peter Norbeck, 1917–21; William M. McMaster, 1921– . (C. C.*)

SPA (*see* 25.525).—Pop. (1909) 8,293. The Germans occupied the town, which was undefended, on Aug. 4 1914, and it became first a hospital base and, later, a place of convalescence for their sick and wounded. The German Great G.H.Q. was transferred here from Kreuznach in March 1918 and the Kaiser fled from the Château du Neubois, 2½ m. E. of the town, into Holland on Nov. 8 1918. His concrete dugout at the château is preserved intact and shown to visitors. A conference of the Supreme Council of the Allies was held at Spa in July 1920.

SPAIN (*see* 25.527).—At the census of 1910, the total pop. (including the Balearic and Canary Is., as well as the territories of Northern Africa, but not those of the Guinea Colony) was 20,364,392, giving a density of 34·49 per sq. kilometre. The maximum density corresponds to the province of Biscay (161·59 per sq. km.) the minimum to that of Lerida (23·45). Figures above 100 per sq. km. are given by the province of Barcelona (148·46); Guipuzcoa (120·28); Pontevedra (112·80), and Madrid (109·80). There are only eight towns of more than 100,000 inhabitants, namely, Madrid (599,807), Barcelona (587,411), Valencia (233,384), Seville (158,287), Malaga (136,365), Murcia (125,057),

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Saragossa (111,704), Cartagena (102,542). The birth-rate varied between 2·83 and 3·08 per 100 inhabitants for the period 1914–9, 0·16 per 100 inhabitants being illegitimate. The marriage-rate fluctuated between 0·65 and 0·67 per 100 inhabitants during the war years, and made a sharp rise to 0·81 in 1919. In the same period the death-rate varied between 2·13 and 2·31 per 100 inhabitants, with an exceptional rise to 3·31 in 1918. Infant mortality is very high, being 20·20% of the total of deaths for infants of less than one year, and 16·73 between one and four.

Education.—There were in 1910 59·35% people who could not read (figure including and referring to all ages). In 1919, 51,815 youths (of which 3,730 were females) were studying in secondary schools. In the same year 23,660 students were inscribed in the 11 universities of the country. This figure does not include numerous special and technical colleges, catering for certain professions such as architecture, engineering, veterinary science, etc., or the numerous agricultural, and arts and crafts, schools financed by the Government, municipalities and provincial councils.

Agriculture.—Some progress is shown in area and production. Wheat crops oscillate near an average of 3,265,000 tons and reached their maximum at 4,145,751 in 1916. The wheat area averages 3,809,464 hectares. Barley shows greater fluctuations with an average of 1·5 million tons. Maize keeps close to its average of 0·6 million tons, while oats remain at 0·4 million tons. Vineyards suffer from parasitic trouble, and the area planted diminished gradually from 1905 (1·4 million hectares) to 1914 (1·2) then began to grow again, but without reaching its previous value. Yet the maximum crop corresponds to 1917 with over 4 million tons, of which 3·8 million were transformed into wine and produced 23·7 million hectolitres. The olive area grows steadily, and reached 1·6 million hectares in 1918. The maximum crop corresponds to 1911 with 2·2 million tons of olives, of which 2·1 were transformed into oil (0·4 million tons). The average figures are about half. Sugar, both cane and beetroot, is cultivated, but while cane decreases, beetroot shows an irregular increase in area (36,741 hect. in 1911, 66,000 in 1918). This increase does not, however, correspond to a similar increase in production. The best year was 1913, with 1·3 million tons, and the worst 1918, with 0·672 million tons. While the average value of the annual agricultural production of the country in 1903–7 was estimated at 3,824,394,425 pesetas (£152,975,777), it was valued at 7,975,623,025 pesetas (£319,024,921) in 1916. A growing tendency is manifest towards the use of mechanical implements, of which there are several manufacturers in the country. More important machinery is imported, mostly from America.

Mining.—Mining was much stimulated by the war, the high price of coal having allowed the working of deposits which would not have been economically workable in normal conditions. Some Spanish products played an important role in the war; thus, pyrites were in high demand. The total value of the production of Spanish mines passed from 453 million pesetas in 1910 to 1,323 millions in 1917.

Railways.—There are 14,902 km. of railway lines, of which 11,378 are normal and 3,524 narrow gauge. In 1918, the number of persons conveyed rose to 75,480,648, or an average of 206,796 daily. In the same period the transport of goods rose to 35,244,659 tons. Gross receipts amounted to 557,931,445 pesetas, or 37,060 per kilometre.

Pre-war and after-war traffic figures are as follows:—

	Persons	Goods (tons)
Pre-war average	50,350,000	29,090,223
1920	84,300,000	35,351,929
Increase	33,950,000	6,261,697

When war broke out, the Spanish railways were going through a crisis of growth, the traffic of the country having developed in excess of the railway plant, while the companies found themselves too near the date when they had by statute to revert their lines to the State, to be able to borrow money on good terms. The war aggravated this situation by all but stopping coast-shipping. Since then, a great increase in salaries and wages, as well as the rise in the price of coal and materials, has completely upset railway finance. An increase of 15% in rates was allowed after much opposition, and another is proposed which public opinion refuses to countenance. Several schemes are afoot to cope with the difficulty, all of them including a greater or lesser measure of State interference.

An electric railway line is proposed to link Dax with Madrid and Algeciras, by means of a French-gauge line, to be linked up in the future with Moroccan lines. This scheme is subordinate to a general scheme for the harnessing of water-power in the whole peninsula, through the construction of hydro-electric stations and a polygonal distribution line. A further advantage of the scheme would be that the numerous deposits of second-rate fuel existing in the peninsula would then be economically exploited in the production of electricity.

Merchant Marine.—Despite heavy war losses, the merchant fleet was in 1920 slightly larger than in 1914. The figures for 1920 were:—

		Ships	Tons
Sail	more than 500 tons	38	53,906
	less than 500 tons	516	60,639
Steam	more than 500 tons	379	840,007
	less than 500 tons	259	52,640
Total		1192	1,007,192

This represents an excess of 318 sailing vessels with 81,575 tons and 10 steam vessels with 48,325 tons over 1914.

Industry and Commerce.—The war gave great stimulus to Spanish industries. Though many enterprises born out of the artificial conditions created by an exceptional Allied demand died out with the peace, progress is to be observed, particularly in Catalonia, Biscay and Asturias. Thus, while in 1905 there were in Spain 775 business corporations with an aggregate capital of 5,633 million pesetas, there were in 1916 no less than 2,435 of such corporations with a capital of 9,456 million pesetas. The average value of foreign trade for the pre-war period was about 2,250 million pesetas, or 112.90 pesetas per head. The war radically altered the *régime*. The commercial balance was against Spain in 1911. An excess of imports over exports, which had reached 150·5 million pesetas in 1900, fell to 3·6 in 1904, exceeded 100 millions in 1905 and 1906, fell to 2 millions in 1907, and varied between 16 and 75 millions in the following years, while in 1912 there was a 10·6 million excess of exports. 1913 and 1914 saw high excess of imports again (229 and 170 millions), but after the war *régime* began in 1915 Spain registered in 1918 her maximum favourable balance, amounting to 338 million pesetas. Considerable imports of gold and silver tended to neutralize this figure in the total commercial statistics. The value of the peseta rose accordingly (see EXCHANGE, FOREIGN).

Banking.—The Bank of Spain increased its gold reserves considerably. From 576 million pesetas in 1914, they grew to 2,415 million pesetas in 1919. Banks developed in all parts of the country, and, with the end of the war, a general invasion of foreign banks was also to be observed. English banking, which till then had not seemed to be interested in the peninsula, appeared in Spain, and now forms an important feature in Spanish business, not only in Madrid, but in Barcelona, Valencia, Seville, etc.

Finance.—The Budget shows an increasing deficit due mostly to two causes: on the expense side, an increase in numbers and salaries of the bureaucracy; on the receipt side, a failure to reorganize taxation on a sound basis of direct taxes. If 1909 be taken as a unit (100), expenditure grew steadily up to 168 in 1918, while receipts grew to 134, including Treasury bills. The actual figures in pesetas for 1920–21 were:—Expenditure, 2,403,730,313.69; receipts, 1,842,720,570.32; the deficit being 561,009,743.37. The Public Debt, which had diminished by 2,000 million pesetas in 1910, had reached its previous amount again in 1918, and in 1920 was 11,926,295,232 pesetas.

HISTORY.—The closing months of 1910 were occupied by important legislation carried on by the Canalejas Government. The "padlock" bill, forbidding the settlement of further religious communities in Spain until the negotiations with the Vatican were completed was carried in the Senate (Nov. 4) and a compulsory service bill introduced while the Chamber discussed a Municipal Taxation Reform Bill with a view to the suppression of the unpopular *octroi*. Meanwhile, Señor García Prieto, after laborious negotiations, brought to a head the Spanish-Moroccan Agreement, which was signed in Nov. (*see* MOROCCO). The Agreement was well received by all political parties except the extreme Left. A bill was introduced and passed, regulating work in the mines; a moderate measure but a step in the right direction. An important political event, the breaking up of the Republican-Socialist block which had been created under the Maura-Cierva reactionary administration, was brought about unexpectedly by a debate on the Barcelona water supply. Señores Azcárate, for the Republicans, and Iglesias, for the Socialists, having expressed their disapproval of the action taken in the matter by Señor Lerroux and his radical followers, who controlled the municipality of Barcelona, a rupture ensued. Thus began the gradual weakening of the anti-dynastic Left, which continued in later years. The "padlock" bill was passed by the Chamber of Deputies on Dec. 22.

Canalejas Ministry.

Señor Canalejas' Cabinet ended the year greatly strengthened by its vigorous legislative policy. Yet, on the last day of the year, the prime minister being desirous of reconstituting his ministry handed in his resignation, and the King having renewed

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him his confidence, the new Cabinet was sworn in slightly reconstituted. The crisis thus settled, the King visited Melilla (Jan. 7–13) amidst scenes of great enthusiasm, France being represented by Gen. Toutée and by the warship "Du Chayla." Rumours of a Spanish intervention in Portugal began to circulate then but were promptly met by a strong denial from Señor Canalejas himself. This second Ministry lasted till April 3. Its main efforts were spent in securing unanimity for the negotiations with the Vatican, the most important point of which was the drafting of a new Associations Bill to apply to religious as well as to ordinary communities or societies, the Vatican refusing to renew negotiations unless the Spanish Government agreed to submit its bill to the approval of the Holy See. Señor Canalejas naturally resisted such a condition.

Associations Bill.

The Government was somewhat weakened by the attacks of Señor Urzáiz and Señor Azcárate on its financial policy particularly on their bills for the reform of the Public Debt and for certain alterations in the working of the Bank of Spain. But the end came from another quarter. A debate on the Ferrer case (*see* 25.568) gave rise to an extremely grave crisis. An outspoken speech by Don Melquíades Alvarez was answered by Señor Canalejas in a half-hearted way, which did not sufficiently conceal the fact that the prime minister was not far from agreeing with the opponents of the military court which had sentenced Ferrer. A deep discontent was soon manifest in the ranks of the officers of Madrid, and the War Secretary, Gen. Aznar, intimated that in his opinion the debate should be closed at once. Señor Canalejas submitted the resignation of the Cabinet to the King, who renewed his confidence to his prime minister. The new Cabinet appeared before the Cortes, and the debate on Ferrer's case was proceeded with in a somewhat cooler atmosphere. The incident was, however, typical as a forerunner of much that was to come in future years.

The Ferrer Case.

The attention of Parliament was soon diverted towards Moroccan affairs. The French were preparing their advance on Fez, a fact which forced Spain to an active policy in order to maintain her much diminished rights in Morocco. The first signs of this policy were received with ill humour by the French press, and a press duel began then between the two nations which was to last to the very eve of the World War. Meanwhile the Government had introduced its long expected Associations Bill (May 8), which provoked a protest from all the archbishops and bishops headed by the primate. The Government were successful in passing the bill for the suppression of the *octroi* (May 22). This success initiated a campaign of active opposition from the Conservatives, the aim of which was to defeat the bill in the Senate, but the plan failed, for the bill was passed by the Senate by 178 to 63 (June 3). The fact was significant of the amount of determination exercised by the Crown, for if it had not used its influence over the non-elective part of the Senate the Government would have been defeated by the Conservative vote.

Morocco Crisis.

The Government, meanwhile, in the teeth of popular opposition, rendered more dangerous by several strikes, was sending troops to Morocco and preparing for events. On June 9, Spanish troops landed at Laraish, thus putting France before a *fait accompli* which was not much to the taste of the Quai d'Orsay. France, however, was prevented from taking any strong action by the sudden arrival of the "Panther" at Agadir, but a certain tension prevailed between France and Spain all through the summer. At the same time, popular opposition to the war, not only to that which was going on in Morocco but to that which it was feared was going to break out in Europe as well, was spreading, and tended to encourage the extreme parties. Meetings took place in Barcelona and Madrid, this last one being stimulated by the presence of two French "comrades"; and a Republican rising plotted by the lower deck of the cruiser "Numancia," though unsuccessful, startled public opinion. The movement seems to have been connected with political efforts to overturn the monarchy, which were being prepared on land.

The greatest danger, however, was to come from a campaign of strikes which began early in the year. In Sept., nearly all these strikes still dragged on, and their effect was further aggravated by the feeling that the Government was attempting a big operation in Morocco behind the backs of the people. Grave disorders occurred in the Bilbao district, where 20,000 steel smelters went on strike, and the situation developed soon into a general strike, which spread to the coalfields of Asturias. The Government, which at first seemed inclined to favour the workers for the sake of national conciliation in view of the international situation, gradually veered round. They began by suspending the constitutional guarantees in Biscay (Sept. 12); then, on receipt of grave news from Asturias, in the whole of Spain (Sept. 19). By this time, the movement had spread to nearly the whole peninsula, and grave disorders had occurred in Catalonia and Valencia, notably in Cullera, where a magistrate was mobbed to death. The Government met the situation with coolness and resolution, and by Sept. 22 the strike fever had abated upon the settlement of the Bilbao strike.

Labour Troubles.

General Luque himself, though then a War Secretary, was sent to Morocco to preside over the operation, which began successfully on Dec. 6, but collapsed a few days later after a gallant attempt to force the passage of the River Kert. The Spanish press voiced a belief, then current in the Spanish army, that the Moorish tribes were provided with French arms and ammunition, and the imprisonment by the French Gen. Toutée of several French officials in Ujda gave some colour to this view, much resented though it was by the French press. General Luque, though in a veiled manner, suggested in an interview to the press that his failure had been due to lack of French coöperation. Under such unfavourable conditions began the negotiations for a Franco-Spanish agreement following upon the Franco-German Treaty on Morocco. The Spanish troops were soon attacked on the River Kert, and rumour attributed the move to French initiative. The matter had to be smoothed over by the Foreign Secretary, Señor García Prieto (Dec. 28).

Morocco: Tension with France.

During the first days of the new year the case of the Cullera riots came before the military supreme court. The court pronounced seven death sentences, and a press campaign started at once for the reprieve of the seven condemned men. Señor Canalejas seized the opportunity to make the King benefit by the popularity which always follows acts of clemency. He brought his Cabinet unanimously to agree that six out of the seven men should be reprieved, but that the seventh, the head of the riot, known as *El Chato de Cuqueta*, could on no account be recommended for mercy. He then allowed King Alphonso to be besieged by petitioners, including the old mother of the doomed man, who was granted a special audience, so that the King might be provided with an excuse for reopening the affair. Thereupon, Señor Canalejas agreed to reprieve *El Chato*, but resigned. Though the resignation was purely formal, the King took for himself all the merit of the act of clemency, and a wave of popular gratitude was his reward. Thus by a mixture of mercy and ability, Señor Canalejas reversed in 1912 the position which Señor Maura had created by his uncompromising policy of 1909, and this incident did much to harden Señor Maura in his attitude of "*implacable hostilidad*" to the Liberal party.

Cullera Rioters Reprieved.

Much of the parliamentary session was spent in the usual recriminations wherewith the Conservative party endeavoured to weaken Señor Canalejas' position, and on March 11 Señor Canalejas had to sacrifice several of his colleagues, notably his Minister of Public Works, Señor Gasset. The King renewed his confidence to Señor Canalejas, and the new Cabinet was reshuffled. The inclusion (as Minister of Education) of Señor Alba, known to be a personal follower of Señor Moret, was considered as a token of reconciliation between Señor Canalejas and his former chief. Señor Canalejas seized the opportunity afforded him by this crisis to adjourn Parliament until May 1.

Canalejas Cabinet Reconstructed.

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The salient feature of this interval was the launching of the Reformist party by Don Melquiades Alvarez, a moderate Republican working in close touch with Señor Azcárate and Señor Perez Galdós. In a first speech delivered on April 7, Señor Alvarez announced the formation of a Reformist party which would reconcile the moderate elements of the middle classes with Republican ideas. This was but the beginning of an evolution which was destined to bring a certain important portion of Republican opinion into the fold of the monarchy. On May 1 the Cortes was reopened and an agitated parliamentary session began, in which the main question in debate was the bill called "De Mancomunidades." This bill was a sop given by Señor Canalejas to Catalan opinion, for it allowed *Diputaciones* (elected provincial councils) to unite into groups for purposes of common administration, a measure which, though in appearance of a general character, was meant to enable the four Catalonian provincial councils to unite into a kind of local parliament. The bill caused a deep cleavage in the ranks of the Liberal party. General Weyler, Señor Montero Rios (president of the Senate), Señor Moret, and Count Romanones (president of the Chamber) were all emphatically against it. Senor Canalejas' difficulties were increased by the fact that, though the measure formed a part of a more ambitious Local Government Bill devised by Señor Maura during his last term of office, Señor Maura opposed it on the ground of its having been as it were taken from its context. Yet Señor Canalejas piloted his bill successfully through a hostile Chamber, and when, on July 5, he had the Cortes adjourned, the bill had been virtually passed. He, however, avoided a final vote, knowing that, on the bill appearing before the Senate, Señor Montero Rios would resign. His triumph was therefore more apparent than real.

Reformist Party.

Local Government Bill.

With the summer a period of strikes set in. Saragossa, Málaga and the mining and steel-smelting district of La Felguera (Asturias), became restive with social strife (August). Reus, Madrid and Murcia also suffered from partial strikes. But all these conflicts were soon overshadowed by a grave railway strike which affected nearly the whole country. Señor Canalejas met it by applying Art. 221 of the Recruiting Law, which in cases of danger or abnormal circumstances allows the drafting into military service of all men of military age working in industries of public importance; and this measure, combined with a really conciliatory policy, caused the collapse of the strike on Oct. 5. On Oct. 14 the autumn session of the Cortes began, and three days later the bill "De Mancomunidades" was passed in the Chamber, but the work of the session was suddenly brought to a close by the murder of Señor Canalejas on Nov. 12. The prime minister was shot dead in the Puerta del Sol (Madrid) in broad daylight, while he was inspecting the books at a book-shop window. The emotion aroused by the crime was enormous. The King, with his usual impulsiveness, hurried to the Home Office, where the body had been laid, in the first carriage which he found at his disposal; then, on the day of the funeral, he walked in person at the head of the mourners, through the streets of Madrid. This brought him great popularity. Meanwhile, Count Romanones had replaced Señor Canalejas at the head of the Government, with the definite task of passing the budget and of completing the treaty with France. On Dec. 27 this treaty was signed, after laborious negotiations which had begun on Dec. 6 1911. The discussion of the treaty occupied the remainder of the session, which Count Romanones closed at Christmas.

Period of Great Strikes.

Murder of Canalejas.

Treaty with France.

Having thus fulfilled the programme for which he had been entrusted with the seals of office, Count Romanones gave the King an opportunity to alter his policy by tendering the resignation of the Cabinet. The King, without consulting any of his statesmen, gave Count Romanones a new lease of power. This decision finally settled the question of Señor Canalejas' successorship to the direction of the Liberal party in favour of Count Romanones. Yet, his rival, Señor García Prieto, though bowing for the moment to the royal pleasure, signified his intention to stand for the leadership in the future by abstaining from a seat in the Cabinet, though coöperating with Count Romanones from outside. The Liberal solution of the crisis contributed further to increase the popularity of the King. The sensational withdrawal from public life which Señor Maura announced on Jan. 1 1913 worked in the same direction. In a lengthy note addressed to his followers he animadverted on the action of the King in having lent himself to a policy of coöperation between the Liberal opposition and the antidynastic Left. Señor Maura resigned his seat in the Chamber, followed by Señor La Cierva, and as these two names had symbolized reaction to the Spanish people since 1909, their withdrawal, in direct conflict with the King, enhanced the prestige of the Crown. Señor Maura's retirement was of short duration. On the 4th he saw the King; on the 10th he answered a message from his followers by accepting once more the leadership of the party.

Romanones Government.

Señor Alvarez, who meditated a *rapprochement* with the monarchy, made on this occasion a sensational speech, in which he had the courage to bestow great praise on the King at a public Republican meeting. Encouraged by the success of this first attempt, he spoke in the same strain in Murcia (Jan. 12) and obtained from his Republican audience an enthusiastic ovation for the King's policy. Nor did King Alphonso sleep on his laurels. On Jan. 14 he summoned to the palace for consultation the three most eminent men of Republican Spain, Señor Azcárate, head of the Republican-Socialist Coalition, and a respected specialist in labour questions, Prof. Cossio, a well-known pedagogist and art critic, and Señor Ramón y Cajal, the famous biologist. The significance of these interviews escaped no one, and least of all the Conservative Reactionaries. On Feb. 11, these interviews were the main subject of speeches delivered by Señor Azcárate and Señor Alvarez at a Reformist banquet in Madrid, the net result of which was the public recognition by these gentlemen of the fact that, whatever obstacles there were to the democratization of Spain, they did not come from the Crown. The meeting, a further step towards the monarchy taken by the middle-class and intellectual section of the Republican party, served to outline a scheme of conditions and constitutional guarantees which the Reformist party would require in order to coöperate with the Crown.

Count Romanones took a good share of whatever merit there was in this policy. The death of Señor Moret (Jan. 28) removed his most serious rival in the Liberal party. Count Romanones then endeavoured to persuade Señor Azcárate to accept the presidency of the Chamber, a clever move likely to reflect favourably on the prime minister, while avoiding the elevation of any would-be rival to the post considered in Spanish politics as the stepping stone to the premiership. Señor Azcárate refused, and Señor Villanueva was at last selected. The King's official visit to Paris, on completion of the Franco-Spanish treaty, had proved a success (May 6–9), and Count Romanones, having replaced Señor Villanueva by Señor Gasset as Minister of Public Works, felt strong enough to face the Cortes. But no sooner had he appeared before Parliament (May 26) than a speech by Señor Maura (28th) forced him to hand in his resignation. Señor Maura had merely re-stated his position of "*implacable hostilidad*" to a policy of coöperation with the parties of the antidynastic Left, and Count Romanones thought that no Liberal party could govern without a properly constituted Opposition, willing to take office on the fall of the Government. The crisis was again solved by the Crown in favour of the Liberal party. The King ratified the policy which Señor Maura had refused to countenance, and Count Romanones came back at the head of the same Government. But the discussion of the bill "De Mancomunidades," which at last had to come before the Senate, produced a still graver crisis, for it precipitated the division of the Liberal party, latent since the death of Canalejas. The group headed by Señor Montero Rios (president of the Senate), and his son-in-law, Señor García Prieto, dissented from that of Count Romanones on the prin-

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ciple of this bill, Count Romanones having accepted it as part of Canalejas' political testament. This difference of opinion brought about the resignation of the Cabinet (June 11). Despite insistent efforts from the King, no solution could be found to bridge over the difficulty; and on June 13, Count Romanones having failed to conciliate the non-conformists of his party, formed a Cabinet of personal followers, which aggravated the division. Parliament was indefinitely adjourned. The division in the party materialized in the formation of a García Prieto faction, and it was generally realized that the solution given to the crisis was a mere stop-gap, necessitated by the coming visit of M. Poincaré to Madrid.

The Government weathered several strike difficulties and had to face a troubled period of unrest in Morocco, where Gen. Marina succeeded Gen. Alfau as High Commissioner. A Franco-Spanish *rapprochement* was then initiated, with a visit of Gen. Lyautey to Madrid and of M. Barthou, the French prime minister, to San Sebastian, where he saw the King. All these movements prepared the ground for the official visit of M. Poincaré, then President of the French Republic, who arrived in Madrid Oct. 7. The President left Spain by way of Cartagena, where he embarked on the battleship "Diderot," Spain being represented by the battleship "España" and England by H.M.S. "Inflexible." Both the King and the President emphasized the fact that it was in Cartagena that six years earlier Spain, France and England had agreed on a common policy in the Mediterranean.

Franco-Spanish Rapprochement.

As soon as the summer holidays were over and M. Poincaré had left Spanish soil, the latent crisis which divided the Liberal party broke out again. The prime minister had to provoke it himself in the Senate. He was beaten (Oct. 25) and he resigned. The King then considered that the Liberal policy which he had consistently followed since Señor Maura's fall in 1909 was at an end. But he was not ready to follow Señor Maura in his uncompromising attitude, and he selected Señor Dato as a solution more acceptable to the democratic wing of the country. Señor Dato was unable to consult his chief on the King's offer, for Señor Maura had left Madrid for an unknown destination. He therefore accepted office (Oct. 27), being averse to leaving the Crown without the services of one of the two great historical parties. From this date, the Conservative party began to show open signs of division, and thus the second of the two great rotating parties, which Cánovas and Sagasta had created, began also to disintegrate. The first act of the new Government was to grant a decree giving validity of law to the bill "De Mancomunidades," a move directed to enlisting the sympathies of Conservative opinion of Catalonia. On the last day of the year, Señor Dato obtained from the King a decree dissolving the Cortes.

Señor Dato Prime Minister.

The first half of 1914 saw the consolidation of the Dato faction of the Conservative party. The general election, which took place in the spring, yielded a sufficient majority, both in the Senate and in the Chamber. Moroccan affairs were the main subject of discussion in Parliament and press, and the King lost a good deal of the popularity which he had won under the Liberals on account of several incidents which, rightly or wrongly, were interpreted as acts of personal power and interference with the discretion of the Government in military matters. This opinion was strengthened by an uncalled-for decree, countersigned by Gen. Echagüe as War Minister, establishing the King's right to correspond directly with his army officers of all ranks. Yet the Reformist movement, which had gathered great momentum at a demonstration on Oct. 23 1913, when Don Melquiades Alvarez had defined its aims and limits, gained ground, ably helped by an intellectual group headed by Prof. Ortega y Gasset.

Opposition to the King's Personal Power.

The international situation of Spain at the outbreak of war was defined by two sets of circumstances: official, and national or popular. The official situation was ruled by the Cartagena Agreement of 1907, confirmed by the conversations held in the same place in 1913 between M. Poincaré and Count Romanones. These agreements and conversations stipulated that "should new circumstances arise tending to alter the territorial *status quo*" in the Mediterranean or in the European and African coasts of the Atlantic, the three powers concerned (Spain, France and England) would "enter into communication" in order to take any measures that might be necessary. The war was obviously a "circumstance" falling within the limits of the above definition. Yet Spain did not "enter into communication" with France and England. But, contrary to what was generally believed at the time, her abstention was due to the fact that the two powers most interested in the matter, France and England, made no sign to set in motion the Cartagena Agreements. Faced with this situation, Señor Dato promptly declared for an absolute neutrality. This decision was based on a sound reading of the situation from its national and popular point of view. The violation of Belgium had given to the war an almost sacred character which the Allies emphasized to the full. Yet the fact did not escape Spanish public opinion that, though the defence of Belgium and the interest of the Allies were two coincident aims, they were not essentially one and the same "cause." Thus, while the generosity of England in rushing to the rescue of Belgium (and for that matter of France) was not denied, it was also realized that England had a strong national interest at stake which powerfully helped her to make up her mind. Now, such a strong national interest was entirely lacking in the case of Spain. Spain was in fact the only European nation which had no stake in the war. Add to this that the nation was divided as to its feelings. The working classes, the more numerous part of the intellectuals and most of the trading communities, were pro-Ally. The clergy, most of the army and of the bureaucracy and the "idle rich," were pro-German. The Moroccan negotiations had by no means improved the feelings of the Spanish people towards France. For the well-informed politician and publicist, France was the nation which treated with Germany and with England as if Spain did not exist, and turned round afterwards to make Spain pay what she had had to pay in Berlin or in London. For the clergy, France was the atheistic republic, the scarlet woman of the West. For the army, France was the ever-watchful rival in Morocco. For all of them, England was a nation whose dominating principle in foreign affairs was the increase of British power. Thus, the country was split into a reactionary and conservative pro-German wing and a democratic or "advanced" pro-Ally wing, and, as this division was real, and not fictitious as were the party groups, it cut across the parties. So-called Conservatives such as Señor Sánchez de Toca, so-called Liberals such as Count Romanones, sided with Reformists and Republicans on the pro-Ally side, while Liberals such as Señor Villanueva and Conservatives like Señor Besada led the pro-Germans.

On one definite point everybody agreed. Spain was to keep out of the war. There were only two exceptions, more apparent than real. Señor Lerroux, the leader of the Catalan Radicals, advocated participation in the war on the side of the Allies. But he spoke without responsibility, as a man who knows that he can make capital out of an opinion which he is perfectly sure he will never be in a position to carry into practice from office. The other case was more serious. On Aug. 10 *El Diario Universal*, a paper known to reflect the opinions of Count Romanones, published an article under the title of "Deadly Neutralities," which in a veiled manner advocated participation in the war on the side of the Allies. It created a great sensation, for it was attributed to Count Romanones himself, and it is certain that, if not written by him, the article was concocted under his direct inspiration. As events were to show, it was only meant as a *ballon d'essai*, and, after a short period of press agitation, was forgotten.

Policy of Neutrality.

The Government concentrated their activity on the organization of the country for the new situation created by the war. A "Committee of Initiative" was created for the study and coördination of national and private efforts to deal with war problems, and this Committee was put under the chairmanship of Señor La Cierva—a move to attract this important political figure to the Datist side of the

War Legislation.

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Conservative party. Parliament resumed its sittings on Oct. 30 and unanimously endorsed the foreign policy of the Government. The country was meanwhile recovering from the first shock of the war, getting used to abnormal conditions, and even beginning to realize that there might be some material profit to be made out of it. The pro-German press raised frequent protests against the enormous increase in exports to France which the Customs reported. Metals, raw and manufactured, clothes and boots, all kinds of foodstuffs, horses and mules, poured into France, under the "neutral" eye of the Government. Before adjourning the Cortes, however, the Government introduced and passed a bill which gave them special powers to deal with such matters as customs tariffs, railway rates, State purchases of food, shipping and expropriation of foodstuffs. A navy bill was also passed, authorizing the building or purchase of 4 fast cruisers, 6 destroyers, 28 submarines, 3 gun-boats, 18 mine-laying and auxiliary ships, mines and submarine defences, aircraft, and several important naval land works in Ferrol, Cadiz and Cartagena. The Foodstuffs Act did not prevent a period of serious unrest in the spring, due to the scarcity artificially created, partly by excessive exports, partly by speculative holding up of stocks. Special Juntas, composed of the civil governor, the financial delegate and the mayor of the provincial capital, were set up in each province to administer all available stocks of food, and a policy of prohibition of exports was even initiated in March (1915). Yet the great increase in exports had contributed perhaps more than any other cause to the rise in the value of the peseta, a rise which gave the Government an opportunity to repatriate the Public Debt, *i.e.* enacting that all Spanish Government stock held by foreigners which was payable in francs or sterling should become payable in pesetas in the Spanish market.

German Propaganda.

Though the Cortes was closed, great political activity was displayed, by all parties, with a view to a consolidation of the loose political forces of the day into that symmetric form of two rotating parties the need of which seemed to be felt as a habit by all concerned. This activity, which the Government had driven towards the press and public meetings by closing Parliament, was stimulated by an active German propaganda, soon to be imitated by similar endeavours on the part of the Allies. The mouthpiece of extreme pro-German views was Señor Vazquez de Mella, an eloquent and versatile Carlist professor and M.P., who on May 31 pronounced a strong pro-German speech in the Zarzuela theatre (Madrid), before a house full of Germans, Carlists and Maurists, and adorned by the presence of a cluster of aristocratic ladies, many of whom belonged to the Queen's household. But though the excitement produced by this and similar outbursts of partisan feeling did not go very deep, and though the mass of the people were not swayed out of the attitude which they had spontaneously assumed, the Government thought there might be some danger in liberty, and they decided to deny all permits for meetings on neutrality and the war. Despite many complaints, for the measure was obviously illegal, the Government held fast to their decision.

Financial Crisis.

It is worth noting that while this protest from all political groups, including the two sections of the Liberal party headed by Count Romanones and Señor García Prieto, failed to shake the power of the Government, a crisis was precipitated on the refusal of the business community to coöperate with the Government in the launching of a loan. The Finance Minister, Señor Bugallal, prepared an issue which was expected to yield 750 million pesetas (£30,000,000), 283 of which were already covered by exchange for an equivalent sum in short-term bonds. The new money to be found did not therefore exceed 467 million pesetas, or a little over 19 millions sterling. Now, of this sum, no more than 52 million pesetas (just above 2 millions sterling) was subscribed, and it was noticed that small subscriptions far exceeded the sums subscribed by big owners of capital. Several explanations were put forward, but the main cause of the failure seems to have been a reluctance of business circles to subscribe under conditions which were not considered generous enough for the subscriber. The resignation of the Government (June 22) as a result of this failure was quickly followed by a reinstatement of the same Cabinet, despite the insistent desire for retirement manifested by the Minister responsible, Count Bugallal. The situation of the Treasury was by no means flourishing. The estimates for 1915 had been set at 1,465 million pesetas against 1,281 million pesetas revenue. But as months went by, both sides of the account showed signs of moving in the wrong sense. The liquidation at the end of the year was to show that revenue would remain at 1,202 million while expenses, not including Government purchases of foodstuffs, were to rise up to 1,556 million. The Government had to fall back on Treasury Bonds negotiated through the Bank of Spain.

Industrial Prosperity.

The difficulties were of course of a purely administrative order, for the work of the country was in full swing under the stimulus of war orders. As one sign of this growing industrial coöperation between Spain and the Allies, the shipowners announced to the Government (Aug. 1915) that the premiums granted them by the Shipping Acts as a measure of protection were no longer necessary and would not be cashed. This was, of course, but a euphemistic way of hinting that such premiums were no longer worth the sacrifice which they entailed of the shipowner's liberty to trade as he pleased between foreign ports. Great shipping profits ensued, and torpedoings followed. On Aug. 17 the s.s. "Isidoro" of Bilbao was sunk by a German submarine. On Aug. 20 the s.s. "Peña Castillo" of Santander sank in obscure circumstances. Public opinion was divided as to the right attitude to take in these circumstances, and while it was generally recognized that some sort of protest should be made, the free hand claimed and obtained by shipowners for the carrying on of their highly profitable industry was a serious handicap to their case.

Fall of the Dato Government.

Though the war absorbed most of the political interest of the day, several efforts were made to reunite the Liberal groups into one party again, and these efforts having failed, owing mainly to the unwillingness of either leader to surrender his claims to the leadership of the whole, Count Romanones, the more active of the two, prepared a plan of campaign against Señor Dato's Government on the Military Reform Bills then being prepared by the War Secretary, Gen. Echagüe. General Echagüe introduced his bills, and Señor Dato declared that the Chamber would have to pass them before discussing the budget. Count Romanones was adamant against this condition imposed by a Government which had kept Parliament closed for the best part of the year, and the Government fell on Dec. 6.

Romanones Cabinet of Reunited Liberals.

This crisis is worth recalling for it marked a further step in the approximation of Don Melquiades Alvarez to the monarchy. King Alphonso having expressed a wish to hear Señor Alvarez' opinion along with that of the leaders, the chief of the Reformist party called at the royal palace for the first time. The crisis ended in the formation of a united Liberal ministry (the two groups having melted into one as they came nearer the warmth of office). Count Romanones took the premiership, and, in order to counterbalance the effect of his well-known pro-Ally views, assigned the Foreign Office to Señor Villanueva, a notorious pro-German. Señor Barroso (Justice) and Señor Burell (Education) represented the García Prieto faction. Señor Urzáiz, an independent and outspoken Liberal, went to the Exchequer, probably at the suggestion of the King, who also caused Admiral Miranda, though a Conservative, to remain at the Navy Office. General Luque came back to the War Office, and Senator Salvador was appointed Minister of Public Works.

The programme of the Government was very much the same as that of its predecessor: neutrality, military bills, financial and economic reforms, and the budget. In a sense, the inclusion of Señor Urzáiz, who, though a Liberal, was a party unto himself, and of Adml. Miranda, a Conservative, initiated the period of mixed ministries, which was about to open as a logical consequence of the gradual weakening of the old parties, and in its

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turn would accelerate the process of their disintegration. The experiment, so far as Señor Urzáiz was concerned, proved a failure. A man with a strong will and little adaptability, he came into conflict with his chief and was dismissed before he had time to resign (Feb. 25). The union of the two branches of the party which this Cabinet consecrated was apparent. Apart from the underlying cleavage between the García Prieto and the Romanones groups, the party showed further signs of division owing to the rising ambitions of Señor Alba, who by a clever use of the opportunities of his new office, made for himself an enviable reputation of a bold democratic tax-legislator. His bill on war profits aroused the opposition of all the minorities except the socialist. Yet Count Romanones, with a fine political *flair*, backed his Finance Minister. The matter, however, was purely political, for the bill had not been passed when the Cortes was closed, a general railway strike having suddenly upset all Government plans on July 13. Count Romanones faced the conflict with an unusual luxury of precautions, constitutional guarantees were suspended in the whole peninsula, and martial law declared in Madrid. But the strike was over one week later, and the autumn session was too deeply occupied in the discussion of Señor Alba's ambitious budget schemes to think of the War Profits Bill. The discussion of these schemes dragged on till Dec. 19, when it was resolved to validate the old budget for the coming year, while the new one was further discussed. The Government reappeared before the House on Jan. 19, but in the meantime Count Romanones had resigned and accepted office again with the same ministry. This curious crisis (Jan. 9) was probably devised by the prime minister as a means to recover from the King the moral authority which some thought he had lost at the hands of the pro-German press, which accused him of drawing great profits as a business man from his foreign policy as a prime minister.

Count Romanones wore his neutrality with a difference, and, though the inheritor of Señor Dato's policy, he did little to conceal his pro-Ally views. The natural development of the war made every day more urgent the need of defining a policy which would be something more than a mere passive attitude. By Sept. 1916, Spain had lost more than 30,000 tons of shipping by torpedoing, and more than 50,000 in circumstances which were, to say the least, obscure. The shipping interests asked for Government help. A period of Government activity set in, during which Count Romanones was loyally seconded by Señor Gimeno, a pro-Ally Foreign Secretary, but the pro-German press countered by a fierce personal campaign against the weakest flank of the Government, the prime minister's industrial interests. On Jan. 31 Germany sent in a note establishing an "absolute blockade" of the Allied coasts. Count Romanones was committed to a policy which implied a firm answer to such a note. He gave it, for, though somewhat watered down by his pro-German colleagues, the Spanish note of Feb. 6 signed by Señor Gimeno was a well-worded protest against German methods with neutral rights. But the prime minister was too shrewd a politician not to realize that this firmness meant nothing unless backed with the will to fight if necessary, and that public opinion would not follow him so far. He therefore resolved to leave the Government there and then, at the top of the wave of his own policy.

Resignation of Romanones.

Other considerations of home policy were perhaps not altogether without effect on his decision. A dangerous social-political upheaval was taking place under his eyes. In March and April, a serious strike situation developed in Madrid and Valladolid, which necessitated this second town being declared in a state of siege. In Barcelona, a military conflict, which was fundamentally to alter Spanish politics for years to come, was beginning to make itself felt. When on April 20 Count Romanones resigned, he took the easiest path. His fall, however, cost him the leadership of his party, the majority of which, somewhat frightened at his bold foreign policy, turned towards Señor García Prieto, while Señor Alba consolidated a separate group. The new Ministry, under the premiership of Señor García Prieto, was

Social-Political Upheaval.

frankly neutralist, and Germany rightly interpreting the position felt freer to intensify its submarine campaign. But the Government had to concentrate on a far graver problem, the situation created by the so-called Committees of Defence. The artillery and engineer officers had been organized for years past into a Committee of Defence, the main object of which had been the maintenance of certain standards of professional honour and of certain rules of comradeship as to promotions, etc. The infantry officers had no such organization, their *esprit de corps* being less developed. But towards the middle of 1916, a system of infantry Committees of Defence had appeared, which soon evinced a tendency to claim authority over the army, and to interfere with the Government in such a manner that towards the end of the year, Count Romanones, then in office, insisted on their dissolution. Despite the reassuring reports of Gen. Alfau, Capt.-General of Barcelona, the headquarters of the organization, the system continued, a situation which was not altogether unconnected with Count Romanones' eagerness to resign in April 1917. General Aguilera, the War Secretary in Señor García Prieto's administration which then took office, was frankly averse to the Committees, and ordered the leaders to be arrested. A reserve Junta had been prepared, which stepped into the shoes of the arrested officers, and the conflict was only aggravated. General Alfau was dismissed and General Marina sent in his stead. But meanwhile, probably owing to royal hints, a less disciplinarian line of action was taken, and the arrested men were released. It was known later that an ultimatum had been placed in the hands of Gen. Marina, with a time-limit of 12 hours (June 1). Not unnaturally, the Government resigned. Count Romanones having refused to support any Liberal situation which would recognize the Committees, Señor Dato was called to office, and on June 9 the Liberal party ended a short spell of office during which its disintegration had rapidly advanced. Señor Dato's Government capitulated before the Juntas and accepted their regulations in full.

Dato Again Prime Minister.

This victory of a movement which, in its essence, was revolutionary, had an immense effect on immediate events as well as on the political evolution of the country. The revolutionary ferment was stimulated. A state of excitement and hope—due to the plausible, high-spirited language of the Juntas—spread over the revolutionary Left. The more responsible elements of advanced politics thought it necessary to give a lead to this popular spirit. Political manifestos asking for a renovation in Government and Constitution followed each other (Socialists June 12, Catalanists June 16, Left-Coalition June 16). All but three of the deputies and senators for Catalonia met on July 5 at Barcelona, and passed a resolution asking for an immediate meeting of the Cortes, and declaring that, should the Government refuse to comply with this request, a meeting of all the deputies and senators composing the Cortes would be called at Barcelona on July 19. The Government refused to recognize the right of the Catalan representatives to dictate its policy, and made it known that should the Assembly meet on the 19th it would be considered as rebellious and treated as such. The Assembly met, 13 senators and 55 deputies attending, including all the Socialist Republican and Reformist members of the Cortes, and, before the Civil Governor dissolved it by (formally) arresting one by one all its members, it voted conclusions asking for a reform of the Constitution, and set up three commissions to prepare reports on reforms to be submitted to a second meeting to take place later. At one moment, it looked as if these 68 men would take the lead of the revolutionary spirit which the bold action of the army officers had stirred in the country. But the mass of the Assembly was too dull, and no real leader manifested himself in it. Thus two attempts, one military, one middle-class, both directed against the evils of the old *régime*, failed through lack of coördination and mutual understanding. A third attempt, and a third failure, was still to come. On Aug. 2 the railwaymen of the Northern railway announced a strike. Though at first the men appeared desirous of a settlement, neither the Government nor the company succeeded in

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avoiding the strike, which began on the 10th. On the 12th, a general strike was suddenly launched in the whole country. It was clearly revolutionary, and aimed at the overthrow of the monarchical system and its replacement by a more or less socialistic republic. The country was declared in a state of war. Riots of a grave character took place in nearly every important town and industrial district of the country, and the military, which had been entrusted with the situation, crushed the rebellion with a ruthless hand. This revolutionary onslaught was somewhat aimless and impulsive, yet the period of street fighting lasted a whole week. By Aug. 9 the situation was well in hand. The net result was to prove that the only real force in the country was the Army Committee system.

The General Strike.

On Aug. 10, the Council of Ministers passed a special credit for military expenses, implying an extension and renovation of several important services. The Juntas, conscious of their strength, encroached further and further upon the administration of the War Office, and even asserted themselves in the field of civil politics. Their first victim was Marshal Primo de Rivera, whom they practically forced to leave the War Office. Then the scandal became public, on the Government having lifted the censorship. The Committees attempted to deliver a message into the hands of the King, and a period of intense political excitement ended in the fall of Señor Dato, who had to resign on a "perfectly constitutional" hint by the King. In point of fact Señor Dato was expelled by the Army Committees. The crisis was long and laborious, and in the midst of it, the Parliamentary Assembly met in Madrid (Oct. 30) in order to hear the reports prepared by the three commissions appointed in its first sitting. Speeches were pronounced by Señor Cambó and Señor Alvarez, which were addressed rather to the King, then in consultation with political leaders, than to the Assembly. Both leaders declared that they would not accept office in a Government which would not be ready to adopt the conclusions of the Assembly, involving some democratic changes in the Constitution. But while Señor Alvarez held fast by this declaration, Señor Cambó allowed two of his followers to enter the Cabinet which was at last formed by Señor García Prieto. This Cabinet was a Coalition ministry in which, in order to give satisfaction to the new demand for an impartial general election, a non-political judge was given the post of Home Secretary. It was composed of Maurists, Liberals and Catalanists. Señor La Cierva, who took the War Office, was the real head of the Cabinet. His policy consisted in ingratiating himself with the Committees of Defence, so as to become their leader and representative.

Power of the Committees.

García Prieto Coalition Government.

An incident which occurred early in the year (Jan. 3) showed the extent to which the revolutionary action of the Juntas had affected the army. The N.C.O.'s, it was suddenly found out, had formed a Committee of Defence and were threatening to take action unless their claims were satisfied. Señor La Cierva had no difficulty in applying to them, with the blessing of the Officers' Committees, those drastic measures which the Officers' Committees had themselves deserved. Nor was the system of Committees of Defence limited to the army. Juntas were soon formed by the civil servants of nearly all Government departments, and on Jan. 12 1918, on the occasion of a difference between the Postmaster-General and his subordinates, an agitation began which was ultimately to cause the downfall of the Government. On Feb. 21 the telegraph officers went on strike—by meticulously carrying out official regulations.

On Feb. 24 the general election took place in these abnormal conditions. For the first time a Coalition Government presided over an election, and great hopes were entertained as to the result. The new Chamber, however, was but an average of the preceding ones, different only in that no party in it had a clear majority. Señor La Cierva began then to act as the self-appointed leader of the Committees. He first provoked a crisis (Feb. 27) so as to get rid of his Catalanist colleagues, Señores Ventosa and Rodés, who would have been obstacles to his plans, and having accepted their replacement by two second-rank men he faced the Government with a demand that a programme of extensive military reform be enacted by Royal Decree, without submitting it to Parliament. This provoked a second crisis, Señor Gimeno, Count Romanones' representative in the Cabinet, having stood firm against such an insult to Parliament. The crisis, however, was settled on the secret understanding that the decree would be granted while Señor La Cierva would negotiate the self-dissolution of the Juntas. Then the conflict was suddenly aggravated on its civil side, the Government having decided to be as firm with the civil Juntas as it had been weak with the military ones. At the instigation of Señor La Cierva, the telegraphs were put under War Office authority and all civil Juntas were declared officially dissolved (March 14), while Señor La Cierva obtained from the military officers an apparent submission under the form of a reduction of their own Juntas to the status of "Committees of Technical Studies." On Feb. 17 the postal services declared a strike. Señor La Cierva's efforts to cope with this by means of military improvisations ended in utter failure, and at the very first sitting of the Cortes (March 18) the Government fell. All possible combinations were tried and failed, until on March 21 at midnight, at a meeting of ex-prime ministers called by the King in his study, after, it is said, having threatened his abdication, King Alphonso succeeded in forming a "ministry of all the talents," composed as follows: Maura (Premier), Dato (Foreign Office), Besada (Finances), Cambó (Public Works), Alba (Education), Marina (War), Pidal (Navy). The solution given to the crisis produced an outburst of popular enthusiasm due mostly to the downfall of Señor La Cierva. This Government had agreed on a concrete programme: reform of the standing rules of the Cortes, amnesty, military reforms, budget. The Government carried them all but the fourth, Señor Alba having left the Cabinet on their refusal to pass his education plans (Oct. 8), which ultimately brought the Cabinet to its end on Nov. 6.

Señor La Cierva and the Committees.

Ministry of "All the Talents."

The new Government had to be formed amid the sensation caused by the arrival in Madrid of the news of the Kaiser's flight, and great changes were expected as the result of this. The Reformists having refused to coöperate on the conditions offered them, the changes were limited to the appointment of a Liberal Ministry, on Nov. 9, with Señor García Prieto as prime minister. The world being full of the idea that the triumph of the Allies meant that of democracy, the Government published an "advanced" manifesto. Other signs of the *Zeitgeist* were a bold Land Bill, introduced by Señor Alba, a series of telegrams of congratulations sent by King Alphonso to all the Allied chiefs of state, a meeting of the Conservative party, where a reform of the Constitution was seriously mooted, the waiving by the Government of their right to appoint the Mayor of Madrid, and a revival of the Catalanist question as manifested in a message to the Government addressed by the *Mancomunidad*. This last message produced a split in the Cabinet, Count Romanones, its Foreign Secretary, being in favour of Home Rule. The ministry thus fell on Dec. 3 1918, and it was decided that Count Romanones would form a stop-gap cabinet so as to pass the budget and leave the King free for a change of policy. The first important act of Count Romanones was his visit to President Wilson, then in Paris.

Liberal Government of García Prieto.

Romanones Ministry.

It is clear that from the middle of 1917 on, home problems occupied the Spanish mind more than the war. The incidents of the submarine campaign had to be handled by Governments which knew the country to be resolved not to fight, divided as to its sympathies, and rent by revolutionary and constitutional crises. It is to the credit of the successive Governments which ruled Spain during this period that they succeeded in steering clear of all obstacles, home and foreign, overburdened as they were with home problems and foreign advice not always disinterested. On June 29 1917 a German submarine, "UC52," arrived in Cadiz for repairs. Señor Dato allowed its arrival and

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departure within 24 hours, and thereupon had a Royal Decree signed forbidding submarine navigation in Spanish waters. The next incident of the kind was the escape of "U 53," which had been interned in Cadiz under the above Royal Decree. The escape appears to have been due to an excessive amount of trust in the German commander on the part of the Spanish naval authorities, whom the Government promptly deprived of their commands. On the initiative of the Romanones administration a treaty had been negotiated in London between the Marqués de Cortina and the English Government. This agreement was signed on Dec. 6. Its importance consisted in that it legalized, in the eyes of the pro-Germans, all trade with England, which received food and ore in exchange for coal. Torpedoings continued all the same, and the Spanish Government sent strongly worded notes on the sinking of the s.s. "Giralda" and the s.s. "Duque de Génova" (1918). The s.s. "Larrinaga" was torpedoed while conveying petrol from New York to Santander, on a Government charter (July 25 1918), and thereupon the Spanish Government, alarmed at the heavy losses sustained by the merchant marine, decided to apply to Germany the claim of ton for ton. This was the high-water mark of anti-submarine methods adopted by the Spanish Government. Germany had agreed to the ton-for-ton indemnity when the end of the war came. The Spanish merchant marine had lost 65 ships representing 140,000 tons.

From the material point of view, the neutral attitude adopted by Spain contributed to accelerate the progress which was observable in her economics in the pre-war years. This period of exceptional activity comprises two coincident movements. One is a somewhat artificial "inflation" of Spanish industries, due to the demand of the Allies. The other one is the mere continuation of a development already noticeable before the war. Thus certain industries, really national, such as that of olive oil, succeeded at last in establishing themselves in foreign markets. The effect of the war on the country was therefore neither altogether bad nor altogether good. While it served to stimulate a progress which had already set in, it also created artificial conditions which contributed much to social unrest by flooding the country with money too easily earned.

Industrial Effects of the War.

Count Romanones did not precisely find in Paris in 1919 the diplomatic triumph which he had expected, but neither did he return wholly disappointed. He brought back a seat in the Council of the League of Nations for Spain. He found the country astir with a mixture of two political currents, one a democratic, constitutional agitation, born of the Allied victory, another one a revolutionary agitation which could be traced to the unwholesome effect of the Juntas' *pronunciamientos*. The main effect of these two movements was felt in Barcelona, and was represented by Catalanist propaganda, a military undercurrent of opposition to it, and lastly a syndicalist agitation which made the two former forget their mutual enmity and unite against it. Two sets of events suddenly revealed the power of the syndicalist agitation: a general strike which paralysed the whole life of the town, and a series of murders of employers. The Government played with two policies. It militarized the strikers, then tried to conciliate them by sending to Barcelona three liberal-minded civil authorities—Señor Morote, Señor Montañes (Civil Governor) and Señor Doval (Chief of Police). A violent conflict arose between the military and the civil authorities, and when the strike had been settled by the latter, the Government suddenly resigned. It was known afterwards that this resignation was due to the military having expelled the civil authorities from the town. Señor Maura took office on April 15, asked for a decree dissolving the Cortes, and to the consternation of all parties, obtained it. This amounted almost to a *coup d'état* on the part of the King. After a general election held under a strict censorship, under the protest of all the Left parties (including the Monarchical Liberals), and with the use of electioneering methods which had fortunately been long forgotten in Spain, Señor Maura failed to bring to the new Cortes more than about one-eighth of its total membership under his banner. His Government fell scandalously under a discussion of his electioneering methods (July 15), and Señor Sánchez de Toca (Señor Dato being ill), formed a Conservative Cabinet, which had to deal with a grave situation in Barcelona, where syndicalist trouble was again brewing. But a new outburst of the Juntas forced the Government to resign, and Señor Allendesalazar (a follower of Señor Maura) took office with a Coalition Cabinet. The change of policy which the change of Cabinet implied determined an aggravation of the conflict. Murders continued. A mutiny organized by syndicalist soldiers took place in a barracks in Saragossa. Disorders broke out in Valencia and Santander. Another militaristic outburst, the publication of secret letters by Gen. Milans del Bosch (Capt.-General of Catalonia) and the subsequent dismissal of that officer by the Government, which in its turn caused the resignation of Señor Gimeno, imposed by the military, ended the life of the Cabinet, which, having passed the Budget, left office on March 4 1920. Two schools of thought manifested themselves then: one favourable to occasional coalitions, taking office in order to carry out definite programmes, another one favouring the reconstruction of the old system of two rotating parties. The King favoured this second school, represented by Señor Dato and Señor García Prieto, and the former was called to power. But the general election which he called forth at the end of 1920 showed that the mainspring of that old system—*i.e.* the docility of the electorate to any kind of government—could no longer be counted upon. Señor Dato failed to obtain a working majority, his supporters numbering 177 members out of 405. All his efforts were accordingly bent towards the reconciliation of the several factions within the Conservative party. While engaged in this task he was assassinated by anarchists on March 8 1921.

Troubles in Barcelona.

Fall of Romanones Government.

Conservative Cabinet under Sanchez de Toca.

Dato Prime Minister.

Spanish Literature

The dominant feature of Spanish contemporary literature in 1910–21 may be found in an effort to achieve the fusion of the critical with the creative element in the race (see S. de Madariaga, "Introduction to Spanish Contemporary Literature," *London Mercury*, Sept. 1920). With the death of Galdós, the sceptre of Spanish literature falls on Miguel de Unamuno (b. Bilboa, 1864), a professor of Greek in the university of Salamanca, a voracious reader, familiar with all European, American and classical literature, and an indefatigable writer. Unamuno represents the modern version of the Spanish mystic writer. His main concern is the relation of man to creation. It is the subject of his masterpiece *El Sentimiento Trágico de la Vida*, a book of passionate meditation, and, at any rate as an attitude of mind, it dominates his criticism (*En torno al Casticismo*, *Ensayos*), his novels (*Abel Sánchez*, *Tres Novelas y un Prólogo*) and his plays (*Fedra*). In these works Unamuno appears as the apostle of an ideal of life more closely connected with spiritual Easternism than with the intellectual and social tenets of the West. He thus fulfils in Spain much the same function which Dostoievsky held in Russia, for Spain, like Russia, stands as a transition between East and West. His ideal is in intensity rather than in extension, in individual achievement, the saving of one's soul, rather than in social work and collective material progress. His style corresponds to his beliefs. It reminds one of Carlyle's in that it is written with the whole man's being, body and soul, but it is never eloquent and rhetorical; rather does it tend to conversational familiarity and evinces now and then a proclivity towards being led to new thoughts by the mere shuffling of words.

Should we care to complete the parallel with Russia by finding a Spanish westerner to oppose to Unamuno, as Turgueniev stands to Dostoievsky, a younger man than the Basque master, José Ortega y Gasset (b. 1883), would have to be mentioned. A professor of Philosophy at the university of Madrid, Señor Ortega y Gasset is a refined humanist, strongly influenced by German contemporary neo-Kantian schools of thought. His style is naturally polished and his mind penetrating and acute,

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His main work is in the field of criticism and psychology (*Meditaciones del Quijote*, *El Espectador*). To this same school may be ascribed José Martinez Ruiz (b. 1876), better known under his literary name as "Azorin." His art has all the finish and exquisiteness, all the smallness also, of miniature-painting. He has had the rare merit of applying it to the interpretation of national scenes and places (*Castilla*, *Los Pueblos*), and has thus contributed in no small measure to the movement for national self-knowledge which is noticeable in contemporary Spain.

In fiction, though belonging to an older generation, Vicente Blasco Ibáñez (b. 1866) must be mentioned, since he continued to wield a never-idle pen. His creative vigour was unabated. His war novel, *Los Cuatro Jinetes del Apocalipsis*, made him famous with the English-speaking public. Older novels have been translated, such as *Sangre y Arena* (as *The Matador*) and *La Barraca* (as *The Cabin*). Blasco Ibáñez represents a kind of art which is Spanish only in its subject, but not in its spirit, manner or style. He is more closely related to the French *naturaliste* school than to any Spanish literary tradition. Of a younger generation, Pio Baroja (b. 1872) is perhaps the most widely read. A Basque, with all the acuity of mind of his race and not a little of its rustic independence and antagonism to civilization, Baroja writes abundantly and carelessly, with more spirit than art. He is more capable of rendering with remarkable accuracy separate aspects of truth than of weaving them into an organic unity endowed with life. His best work is perhaps *Idilios Vascos*, where he has rendered the quaint charm of his own country. Ramón Pérez de Ayala (b. 1881), a critic of great talent, has written several novels, the best of which are *Novelas Poemáticas* and *Belarmino y Apolonio*.

Jacinto Benavente (b. 1866) is still the dominating figure of the Spanish theatre. His most famous play, *Los Intereses Creados* (1907), is not representative, for it illustrates but one phase of the talent of this many-sided author. A more powerful tragedy, *La Noche del Sábado*, is of the same period. In more recent times he has given an intense drama of love in *La Malquerida*. There is, however, a type of play in which Benavente must yield the prize to the brothers Alvarez Quintero (Serafin, b. 1871; Joaquín, b. 1873). As authors of *Comedias de Costumbres* these two writers, who always work together, are unsurpassed. The list of their comedies is long (*Las de Cain*, *Puebla de las Mujeres*). Other playwrights of note are Linares Rivas (b. 1866), remarkable for his skill in the handling of dialogue; Martinez Sierra (b. 1881), a delicate psychologist; and Pinillos ("Parmeno," b. 1875), a vigorous painter of social conflicts. But drama and comedy are but one, and not the more important, aspect of the Spanish theatre. Still more typical of the nation is what is modestly known in Spain as *género chico* (small genre), a full growth of theatrical production, generally short and accompanied with music, and ranging from variety pieces akin to operettas to little masterpieces of musical drama. Its best-known exponents are the brothers Quintero and Carlos Arniches (b. Alicante, 1866).

The two main currents which influenced Spanish poetry towards the close of the 19th century, *i.e.* the national tradition and the symbolist school of France, more or less interpreted by South American poets, such as Ruben Dario (b. 1867), remained still observable up to 1920, though the first was more vigorous and conscious, the second widened so as to include all influences, from those of d'Annunzio to those of Maeterlinck and even Rabindranath Tagore. As more typically national, we shall mention Miguel de Unamuno (*Rosario de Sonetos Líricos*, *El Cristo de Velázquez*), strong and somewhat unharmonious, but true and austere; Antonio Machado (b. 1875) (*Soledades*, *Campos de Castilla*), whose pessimistic serenity is in keeping with the landscape of central Spain which inspires his poems; and Salvador de Madariaga (b. 1886), whose *Romances de Ciego* restate, in a new spirit, the old Spanish theme of Jorge Manrique. Other poets appear under more complex influences. Thus Manuel Machado (b. 1874), whose main inspiration is popular and southern, has, however, written excellent verse in which the influence of French elegant sensibility is discernible. Juan Ramón Jiménez (b. 1881), more remarkable for his exquisite sensibility than for his power (*Arias Tristes*, *Elegías*), is led by his melancholy moods towards fluid rhythms which, though more subtle, remind one of Maeterlinck and, through him, of Rossetti. Ramón del Valle Inclán (b. 1870), perhaps the most skilful musician amongst modern Spanish poets, has given in *La Marquesa Rosalinda* an admirable example of the adaptability of the Spanish language to the most refined rhythms. Ramón Pérez de Ayala (b. 1881), in *El Sendero Innumerable*, succeeds in effecting a happy wedding of thought with harmonious poetry, in a work not wholly uninfluenced by Francis Jammes, d'Annunzio and Walt Whitman.

Among historians of literature the work of Marcelino Menéndez y Pelayo is continued by D. Ramón Menéndez Pidal (b. 1869), whose works on the Poem of Myo Çid and on the Spanish chronicles have thrown great light on the origins of Spanish epic poetry. Francisco Rodríguez Marín (b. 1855), the editor of *Don Quixote*, a specialist in Spanish folklore, has succeeded the master as head of the National Library. In the younger generation, Federico de Onis (b. 1885) has edited Fr. Luis de Leon, and Américo Castro (b. 1885) has worked on Lope de Vega.

Journalism, always a great art in Spain, where the paper is infinitely more read than the book, is cultivated by all writers, and every one of the names quoted above might be quoted here again as a journalist. Mention must be made, however, of two eminent contemporary writers whose work is almost exclusively journalistic—Ramiro de Maeztu (b. 1874), a versatile mind whose educating influence on the Spanish reading public has been incalculable; and Luis Araquistain, a powerful dialectician and a master of the polemic style. (S. DE M.)

SPECTROSCOPY (*see* 25.619).—As developed in more recent years (1910–21) the science of spectroscopy has for one of its chief purposes the analysis of spectra, and the deduction therefrom of the nature of the atoms and molecules which generate the spectra. The progress which has been made in this connexion has depended upon improved determinations of the wave-lengths of spectral lines, the further investigation of the varying spectrum of the same substance when excited to luminosity in different ways, the more complete analysis of certain spectra into regular series systems, and, finally, on theoretical investigations. In another direction, important advances have been made in the interpretation of the spectra of the various classes of celestial bodies, which may be regarded physically as experiments on large masses of matter at various high temperatures.

Standards of Wave-Length.—Extensive interferometer determinations of wave-lengths in the arc spectrum of iron, based upon 6438·4696 "international" angstroms for the red cadmium line, have been made by K. Burns[1] and others, which provide valuable standards for the general determination of wave-lengths by interpolation. It has been found, however, that the wave-lengths of many lines differ considerably in different parts of the arc, so that special precautions are necessary in order to obtain comparison spectra in agreement with the tabulated standards. Probably the most accurate set of standards are those given by St. John and Babcock,[2] who used a small central zone of a "Pfund" iron arc operated between 110 and 250 volts, with five amperes or less, at a length of 12 mm. This list contains 1026 lines, from λ3370 to λ6750, and for most of them the wave-lengths are believed to be accurate to 0·001 angstrom.

Flame, Arc and Spark Spectra.—The range of spectroscopic research has been almost indefinitely extended by the discovery that in nearly all cases the same substance yields different spectra when stimulated in different ways. Such differences are of little importance from the point of view of *chemical* analysis, but they have become of great significance to the physicist, and have also greatly aided in the interpretation of the spectra of celestial bodies.

The three typical methods of producing luminosity for the observation of the spectra of metallic elements or their salts are the flame, the electric arc and the electric spark. As a general rule, the three sources exhibit important differences. In the flame the lines are comparatively few in number; in the arc the flame lines remain prominent, but many more lines, including some which are as strong as the flame lines, make their appearance. In the spark, there is a tendency for many of the typical arc lines to disappear, whilst other lines may be much intensified, and entirely new lines may also be present. The important class of lines which are intensified, or which only appear, under the violent action of the condensed spark were

[1] *Lick Obs. Bull.*, No. 247 (1913); *Zeit. f. Wiss. Phot.* xii., 269.
[2] *Astrophys. Jour.* liii., 260 (1920).

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designated *enhanced lines* by Sir Norman Lockyer, and this name has been generally adopted. The different classes of lines are thus commonly known as flame, arc, and spark (or enhanced) lines, according to their relative prominence in these three sources. This classification, however, is in some respects imperfect, and more definite designations will doubtless eventually be based upon the theoretical considerations to which reference will be made later.

There are many possible variations of these experimental methods of producing spectra, but it would seem that the equivalent of one or other of the three typical sources, or of some intermediate stage, is almost invariably obtained. A more detailed temperature classification of the lines has been based upon experiments with the electric furnace by King,[1] but the terms flame, arc and spark lines suffice for most purposes of description.

Similar variations have also been observed in the spectra of gases when submitted to the action of discharges of varying intensity, and the different classes of lines are sometimes distinguished by analogy as arc and spark lines, although with few exceptions the arc is not actually employed. Independent justification for these names, however, is found in the fact that the arc spectra of some gases can be directly observed. The primary and secondary spectra of hydrogen, for example, have both been observed in the arc,[2] and some of the principal series lines of oxygen have also been observed in the spectra of metallic arcs in ordinary air.[3] The actual spectrum given by a gas depends upon its pressure as well as upon the intensity of the discharge by which it is made luminous. Generally speaking, the greater the pressure of the gas, the greater will be the strength of the discharge required to produce the " spark " lines.

One important aim of modern spectroscopic research has been to search for an explanation of these phenomena, for it cannot be doubted that the causes of the variations in the spectra are intimately connected with atomic structure. In this connexion it will be instructive to refer first to the spectra of known compounds. There are many compounds which can be excited to luminosity without total decomposition,[4] and it has been found that each compound gives a characteristic spectrum by which it can be identified as such. These spectra invariably consist of bands, and different sets of bands characterize, for example, the oxides, chlorides and fluorides of the alkaline earth elements.

It is sufficiently obvious that if a compound be stimulated so strongly that it becomes dissociated, the spectrum will change from one consisting of bands representative of the compound to one containing the lines of the constituent elements. It is not only compounds, however, that show changes of this character. Experiments on nitrogen, for instance, show a range of spectra from one consisting wholly of bands to one in which lines occur alone. Even hydrogen has two spectra: (1) the highly complex, so-called secondary spectrum, which doubtless represents a banded spectrum of rather coarse structure[5]; and (2) the familiar line spectrum, constituting the Balmer series. Similar results have been obtained for many other elements, and from analogy with the spectra of compounds the natural conclusion is that the band spectra of the elements arise from molecules, while the line spectra are produced by the atoms which are set free when the molecules are dissociated.

If this be a true view, the change in the structure of the atom, or in its mode of vibration, which accompanies the successive modifications of the line spectrum becomes a question of paramount interest. Lockyer[6] did not hesitate to believe that while the arc lines of an element were to be attributed to ordinary atoms, the enhanced lines could only be produced by the splitting-up of the atoms themselves, and he called these simpler forms of matter the proto-elements. Proto-calcium, for instance, denoted calcium which had been broken up into sub-atoms by the application of a sufficient stimulus. A somewhat similar, but more probable, explanation has been based upon an application of the quantum theory by Bohr to Rutherford's nucleus theory of the atom. This theory is founded largely on the analysis of spectra into regular series.

Range of Observations.—For the complete determination of the laws of spectra it is necessary to extend the observations far beyond the limits of the visible spectrum. Conspicuous success in the direct photography of the near infra-red spectrum has been achieved by Meggers and others, by the use of ordinary plates stained with dicyanin.[7] By this method excellent photographs of the arc spectra of a large number of elements, extending to λ10,000, have been obtained with a concave grating, and the positions of the lines have been measured with a high degree of accuracy. For the present, the extreme infra-red can only be investigated by thermal effects, involving the use of the thermopile, bolometer, or radio-micrometer, as in the researches of Paschen, Lehmann, and Randall.

Spectroscopic observations in the direction of the ultra-violet, beyond the limit about λ1850 set by the absorption of quartz, and beyond about λ1700 set by the absorption of air, which were first made by Victor Schumann, have been greatly extended by the use of concave gratings, and wave-lengths of considerable accuracy have been determined. Lyman has recorded lines as far as λ500 angstroms, and in similar work at Toronto, McLennan has observed a line attributed to carbon at λ584. A still greater extension has been made at Chicago by Millikan[8] and his colleagues, who have observed lines of nickel as far as λ202. Several improvements in technique were necessary to this success. It was achieved, in the first place, by using gratings specially adapted for the purpose; secondly, by working in an essentially perfect vacuum, through the use of powerful pumps; and finally, since no ordinary spark could pass in a vacuum, by the use of a specially strong sparking apparatus which was capable of forcing a discharge across a very small space between the electrodes. Such a spark was found to produce the extremely short X-rays in the case of carbon, so that the gap which had previously existed between ordinary light waves and X-rays was for the first time bridged.

Spectroscopic data thus cover a very wide range, and offer many interesting problems to the investigator. Their solution depends on his ability to make a true analysis of spectra, and to deduce therefrom the corresponding atomic or molecular conditions.

Analysis of Spectra.—Considerable progress has been made in the analysis of spectra into series. One of the most important advances in this direction is the increased knowledge of the primary spectrum of hydrogen, which is now known to contain, not only the Balmer series, but also two similar series, one in the infra-red and the other in the far ultra-violet. The former was discovered by Paschen, and the latter, previously predicted by theory, was found by Lyman with his vacuum spectrograph. Each of these series is well represented by a mathematical formula, which is simplified if the lines are expressed by their " wave-numbers " (ν) instead of their wave-lengths. The wave-number is the number of waves per centimetre *in vacuo*, and is proportional to the frequency of the vibration. In practice, it is obtained by dividing the wave-length (in angstrom units), connected to a vacuum, into 10^8. In these terms, the formulæ for the hydrogen series are as follows:—

Lyman series: $\nu = \frac{N}{1^2} - \frac{N}{m^2}$ $(m = 2, 3, \ldots)$.

Balmer series: $\nu = \frac{N}{2^2} - \frac{N}{m^2}$ $(m = 3, 4, \ldots)$.

Paschen series: $\nu = \frac{N}{3^2} - \frac{N}{m^2}$ $(m = 4, 5, \ldots)$.

Thus, a general formula for the primary hydrogen spectrum, which might include other undiscovered series, would be $\nu = \frac{N}{m_1^2} - \frac{N}{m_2^2}$. N is a constant, whose value[9] is 109678·3. m is a constant integer for any one series; and m_2 has a different integral value for each line of a series. R. W. Wood[10] has recently extended the Balmer series to $m = 22$, *i.e.* to 20 lines, by experiments with long vacuum tubes. In the spectrum of the sun's chromosphere, 34 lines of the series have been recorded.

There is only one other known spectrum which has the same simplicity as that of hydrogen—namely, the enhanced spectrum of helium. This includes the series first found by Pickering in the star ζ Puppis, and the line λ4686 and others calculated by Rydberg, by whom both series were attributed to hydrogen. These lines were produced in the laboratory by Fowler,[11] and additional lines of the Pickering series, first indicated by Bohr's theory, were afterwards observed by Evans[12] and by Paschen.[13] It was, in fact, the theoretical work of Bohr which first suggested that the lines in question originated in helium and not in hydrogen.

The enhanced series of helium can be represented by a formula similar to that for hydrogen, with the difference that the series constant has rather more than four times the value for hydrogen. Thus, the series which includes λ4686 is given by $\nu = 4N'\left(\frac{1}{3^2} - \frac{1}{m^2}\right)$ when N′ is 109723. The complete Pickering series is given by substituting $1/4^2$ for $1/3^2$ in this formula, and a further series calculated by the use of $1/2^2$ has been partially observed by Lyman. It should be noted that alternate lines of the Pickering series are nearly coincident with the Balmer series of hydrogen.

[1] Several papers in the *Astrophys. Jour.*

[2] Fowler and Shaw, *Proc. Roy. Soc.* A lxxxvi., 128 (1912).

[3] Meggers and Kiess, *Sc. Pub. Washington Bur. of Standards*, No. 324, p. 644 (1918).

[4] Stimulation by " active nitrogen," according to the methods of R. J. Strutt (now Lord Rayleigh), is particularly effective for the spectra of many compounds.—*Proc. Roy. Soc.* lxxxvi., 105 (1912).

[5] An excellent photographic map of this spectrum has been given by T. R. Merton, *Proc. Roy. Soc.* A xcvi., 382 (1920).

[6] Lockyer, *Inorganic Evolution* (1900).

[7] *Scientific Papers, Bureau of Standards*, No. 312 (1918), and subsequent papers.

[8] *Astrophys. Jour.* liii., 1 (1920).

[9] W. E. Curtis, *Proc. Roy. Soc.* A xcvi., 147 (1919).

[10] *Proc. Roy. Soc.* A xcvii., 455 (1920).

[11] *Monthly Notices R. A. S.* lxxiii., 62 (1912); *Phil. Trans.* A ccxiv., 254 (1914).

[12] *Phil. Mag.* xxix., 284 (1915).

[13] *Ann. d. Phys.* l., (1916).

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Other spectra exhibit several series superposed. The three types of series early recognized as occurring in the same spectrum were denoted by Schuster as the "Trunk," "Main Branch," and "Side Branch" series, but these names are now entirely superseded by the titles: "Principal," "Sharp," and "Diffuse," originally assigned by Rydberg. A fourth type of series, called the "Fundamental" or "Bergmann" series, has since been recognized. The four chief types are closely interrelated, but apparently have a certain measure of independence. Each series may consist of singlets, doublets, or triplets.

In each series the lines converge to a definite limit, and their wave-numbers are obtained by subtracting a sequence of "terms" from the wave-number of the limit. The formulæ for series in general, however, are not known with the same accuracy as for hydrogen and enhanced helium. In some spectra, notably the arc spectra of the alkali metals, a close approximation to a series is given by such a formula as that of Hicks,[1] namely, $\nu = A - N/(m+\mu+\alpha/m)^2$ where N has nearly the same value as for hydrogen, while μ and α are constants and A is the limit of the series; as before m takes successive integral values. In some series, however, such a formula by no means gives an accurate representation of the observed lines. All that the theoretical investigator can accept with confidence at present is that the general term formula is $N/[f(m)]^2$, where $f(m)$ is a function of m whose form is known only for hydrogen and enhanced helium.

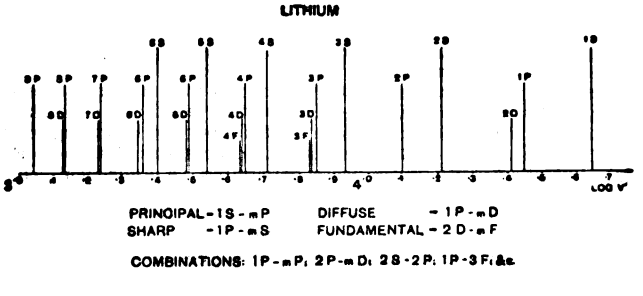
The four main sequences of terms are denoted, for brevity, by the symbols mP, mS, mD, mF, where different integral values of m correspond to the different terms in each sequence. The limit of each of the four series is the first term of one of the others, so that in the abbreviated notation, we have:—

Principal series	$= 1S - mP$
Sharp series	$= 1P - mS$
Diffuse series	$= 1P - mD$
Fundamental series	$= 2D - mF$

The term 1P has one, two, or three values, according as the series consists of singlets, doublets, or triplets; and, similarly, the term 2D has two or three values, in doublet and triplet series respectively, when satellites are present in the diffuse series.

It was first shown by Ritz, and expressed in his "combination principle," that lines often occur in positions corresponding to other differences of terms besides those giving the four main series. Thus, there may be a series $2S - mP$, $1P - mP$, and so on. Many lines not previously included have in this way been proved to form part of general series systems.

The recognition of the importance of "terms" is a definite step towards the simplification of spectra, since the number of terms is less than the number of lines included in the series and combinations. Moreover, theoretical investigations indicate that the terms have a more immediate physical significance than the lines themselves. On this account, it is of great interest to construct a "term-spectrum," in which the terms, instead of the lines, are plotted along a horizontal scale. Such a term-spectrum—for the element lithium—is shown in the appended diagram. For economy of space, the terms are represented horizontally by their logarithms instead of their actual values.



In the term-spectrum diagram, the four main sequences are distinguished by the varying heights of the strokes by which their terms are represented. The highest principal term (1P) minus the sets of sharp and diffuse terms, gives the sharp and diffuse series of lines respectively, while the highest sharp term (1S) minus the set of principal terms, and the highest diffuse term (2D) minus the set of fundamental terms, give the principal and fundamental series. These four series are generally well developed, but, as already remarked, other combinations often arise. It appears, however, that all the combinations which are mathematically possible do not occur with the same frequency.

Origin of Spectra.—The theory of Bohr,[2] which has already been mentioned, offers a remarkably accurate explanation of the spectra of hydrogen and enhanced helium, and gives a physical meaning to the terms which has proved very fruitful in suggesting new directions of research. According to this theory, the atom of an element consists of a positively charged nucleus surrounded by an appropriate system of electrons, such that the total negative charge of the electrons is equal to the positive charge of the nucleus. Nearly the whole of the mass of the atom is concentrated in the nucleus, which is very small in comparison with the distances separating it from the electrons. When an electron is removed from its normal position by the application of an external stimulus, it may traverse temporarily one or another of certain orbits determined by quantum considerations. In each of these orbits it has a certain amount of energy, which is assumed to remain constant while the electron revolves in the orbit. The terms of the spectrum are then taken to be proportional to the respective amounts of energy. When the electron returns to its normal position, it comes to an orbit in which, for equilibrium, it must possess less energy than it had in the temporary orbit. The difference of energy, which is proportional to the difference of the corresponding terms, is emitted as a homogeneous radiation, and gives rise to a definite spectral line, while, if the electron occupies successively different orbits on its return, several lines will be produced in succession. The actual spectrum at any moment is the summation of the different lines yielded by atoms in different states. The term spectrum can thus be regarded as a diagram of the atom, in which the nucleus is at the zero of the scale (to the right in the diagram), and the strokes are parts of the possible orbits. A spectrum line appears when an electron passes from one orbit to another on its return towards its normal position in the innermost orbit.

The differences between the arc and enhanced spectra receive a simple explanation on the Bohr theory. The lines of an arc spectrum are supposed to be generated by the disturbance of a single electron and its subsequent interaction with the nucleus and remaining electrons. When two electrons are removed from their normal positions, and one remains at a great distance, the return of the second electron generates an entirely different spectrum consisting of the enhanced lines. An atom which has lost one or more electrons is said to be "ionized."

Assuming the hydrogen atom to consist of a nucleus and a single electron, the energies of the possible orbits can be calculated, and are found to be proportional to the observed terms N/m^2. Helium, the next lightest element to hydrogen, is believed to have two electrons, and the mathematical problem of determining their motion has not yet been solved. If one of the electrons is removed, however, the atom is similar to that of hydrogen, except that the nucleus has a double positive charge and a greater mass. The resulting enhanced terms are therefore calculable. They again have the form N/m^2, but N has now a much larger value than it has for hydrogen. It is represented in both cases by the expression $\frac{2\pi^2 E^2}{ch^3} \cdot \frac{mM}{m+M'}$ where e, m, and E, M, are respectively the charge and mass of the electron and nucleus, h Planck's constant and c is the velocity of light. In the case of hydrogen $E = e$, and when the experimental values of the various quantities are substituted in the formula, the series constant is reproduced with remarkable accuracy. The second factor increases with M, so that it will be slightly greater for helium than for hydrogen. Also, the double nuclear charge makes the first factor in the expression for N four times as great for enhanced helium as it is for hydrogen. These theoretical requirements have been completely verified by experiment. Fowler, calculating N for hydrogen and helium from the observed lines, used the theoretical expressions to calculate the value of M/m,—*i.e.* the ratio of the masses of the hydrogen atom and the electron—and obtained a result in very close agreement with that arrived at by direct measurement. Moreover, he has shown[3] that in the more complicated spectra of the alkaline earths, the enhanced line terms are also represented by formulæ in which N has four times its value for arc spectra.

It has not yet been possible to calculate the theoretical terms of other spectra, on account of the mathematical difficulties connected with the interaction of more than two bodies. The same principles, however, are believed to apply to atoms containing many electrons, and the physical conceptions of the theory have led to valuable information regarding the order of excitation of the lines under gradually increasing stimulus.

Further developments of the theory, taking into account the variation of the mass of the electron with velocity required by the theory of relativity, have indicated that the lines of the hydrogen and enhanced helium series are complex, and under high resolution should appear to consist of several components. This has been verified by Paschen,[4] who found results for helium in remarkable agreement with the predictions of Sommerfeld. The intensities of the several components also are in the ratio calculated by Sommerfeld by a special hypothesis.

Resonance and Ionizing Potentials.—Strong support for the Bohr theory is given by experiments in which atoms are bombarded by electrons, with a view to temporary disintegration. If an electron, of charge e falls through a potential difference, V, it acquires a

[1] *Phil. Trans.* A vols. ccx., ccxii., ccxiii., ccxvii., ccxx.

[2] *Phil. Mag.*, vol. xxvi., pp. 1–25; 476–502; 857–875 (1913); vol. xxvii., pp. 506–524 (1913); vol. xxix., pp. 332–335 (1915).

[3] *Phil. Trans.* A ccxiv., 254 (1914).

[4] *Ann. d. Phys.*, vol. l., pp. 901–940 (1916).

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Spectrum	GROUP							
	VIII. or O	I.	II.	III.	IV.	V.	VI.	VII.
Arc	Not completely analyzed	Doublets	Triplets and singlets	Doublets	Triplets?	Doublets?	Triplets	(?)
Enhanced . . .	(?)	Not completely analyzed	Doublets	Triplets and singlets	Doublets?	Triplets?	Doublets?	Triplets?

quantity of energy, eV, expressed in appropriate units. If such an electron bombards a neutral atom, it is found that no change takes place until V reaches a certain value, when there is a sudden radiation of energy corresponding to a particular line—usually a strong flame line—in the spectrum of the bombarded atom. According to Bohr's theory, the energy in this particular radiation is equal to $h\nu$, where ν is the wave-number of the line, and h is Planck's constant. Experiments with several elements show that this critical value of V is determined by the relation $eV = h\nu$. This means that the energy of bombardment has been just sufficient to remove the electron in the atom from its normal position to the next orbit, and, on its return, the electron restores the energy in the form of monochromatic radiation of the appropriate frequency. If V is expressed in volts, the wave-number of the emitted line is numerically equal to $V \times 8102$. The value of V when emission first takes place is known as the "resonance" or "radiation" potential. Further, by increasing V, it is possible to remove an electron from the atom altogether. If the energy, eV, in this case is equated to $h\nu$, the resulting value of ν is found to be equal to the largest term in the spectrum—usually the term 1S, the limit of the principal series. This term would correspond to the innermost orbit of the electron, and the result suggests that the energy which must be applied to remove an electron from the atom is just equal to the energy possessed by the electron when revolving in its normal position. The potential required to remove an electron from the atom is known as the "ionizing potential." It has been determined experimentally for a number of elements and has been found to be in complete agreement with the orbital energy as calculated from the largest term in the spectrum. The Bohr theory thus presents a simple picture of the processes taking place in experiments of this type.

The Stark Effect.—The resolution of spectral lines under the influence of intense magnetic fields—usually known as the Zeeman effect—has been extensively studied for a large number of elements. Somewhat similar effects, but much greater in magnitude, produced by an electric field, have been brought to light by Stark,[1] and examined in considerable detail by a number of workers. Nicholson and Merton [2] have shown that the Stark effect may operate to an appreciable extent in an ordinary vacuum-tube discharge, causing a broadening of the lines. Both the Zeeman and Stark effects have been treated on the basis of the Bohr theory,[3] with some success.

Spectra and the Periodic Table.—Attention is being drawn more and more to the relation of the spectrum to the periodic table of the elements. While it cannot be said that the relation is known with any approach to completeness, a number of important facts have been noted which may ultimately prove of great service in the interpretation of the table. It has long been known that, when doublets or triplets occur in the spectra, the wave-number separations of their components (which are constant in the sharp and diffuse series) are approximately proportional to the squares of the atomic weights of the elements producing the spectra—so long as those elements belong to the same family group. The Zeeman effect also is generally the same for lines of corresponding series in the spectra of elements belonging to the same group. But perhaps the most comprehensive connexion of spectra with the periodic table is established by the "displacement law" of Kossel and Sommerfeld.[4] It has been observed that the "complexity" of the lines of a series—*i.e.* their character as singlets, doublets or triplets—is constant throughout a group, but varies from one group to another. The displacement law states that, when an element is ionized, the enhanced series take on the same type of complexity as the arc series produced by the element to the left (*i.e.* in the preceding group) in the periodic table. It is assumed that electrons arrange themselves round the nucleus in rings, and that spectrum phenomena are produced by electrons in the outer ring. If the outer ring contains an odd number of electrons, the spectrum will consist of doublets, while, if the number is even, the spectrum will show triplets and singlets. In the periodic table each element contains one outer electron more than its neighbour in the preceding group, while a group consists of elements having the same number of electrons in the outer ring. It follows that the removal of an electron from an element will make the outer ring similar to that of the immediate forerunner of the element in the table, and so make the enhanced lines of the first element of the same type of complexity as the arc lines of the second. Removal of a second electron would restore the arc type of complexity, for the number of outer electrons would again become odd or even, as the case might be. A second ionization is difficult to bring about in most cases, but with silicon it is probable that one, two, and even three electrons have been removed, step by step, thus making possible four distinct spectra. These appear to show the alternation of complexity required by the displacement law. The table above gives the types of series produced by the neutral and ionized elements of the various groups, so far as they are known at present.

The spectra of the higher groups are much more complex than those of the lower ones. Their series, if they possess any, are possibly of a different type from those with which we are familiar. The displacement law, however, suggests that, by repeated ionizations, series—and therefore terms—might be detected in such spectra, of the same kind as those of the groups of elements on the left. But since, with each successive ionization, the term constant, N, is multiplied in the ratio 1:4:9:16—etc., the chief series lines might tend rapidly to approach the far ultra-violet and become difficult to observe.

Band Spectra.—Several band spectra have been studied in further detail, but it does not appear that any very fundamental advance in our knowledge of the structure of these spectra has been made. The discovery of a band spectrum of helium,[5] however, is probably of considerable importance. It has been shown by Fowler [6] that, while the individual bands follow the ordinary laws of band spectra, the heads of some of them are arranged in accordance with the laws of line series. In this respect the helium bands appear to be quite unique. Unlike the *lines* of helium, the bands have not yet been traced in any celestial source.

The Solar Spectrum.—A striking feature of continued work on the solar spectrum is the identification of a large number of faint lines with lines composing the bands of certain compounds, in addition to the band lines of carbon and cyanogen previously recognized by Rowland and Lockyer. The peculiarities of the region about the G group of Fraunhofer have been shown by Newall [7] to be due to the absorption of the well-known hydro-carbon band $\lambda 4315$, and the group P has been found by Fowler and Gregory [8] to include the strong ultra-violet band of ammonia having its maximum near $\lambda 3360$. In addition, the band of luminous water vapour beginning at $\lambda 3064$ has been found by Fowler [9] to be present in the solar spectrum. A large number of previously unknown solar lines have thus been accounted for, and it is not improbable that the thousands of faint lines which remain unidentified may eventually be traced to other band spectra.

An interesting application of modern theories of spectra to solar problems has been made by M. N. Saha.[10] On the reasonable assumption that the composition of the sun is essentially the same as that of the earth, it remains to account for the absence of spectral indications of many of the elements. Dr. Saha urges that the varying representation of different elements arises from the varying response of these elements to the solar stimulus, depending upon the structure of their atoms, and the consequent difference in their ionizing potentials. Cæsium, for example, has a low ionizing potential and is considered to be completely ionized in the sun, so that the familiar lines do not appear, while the chief lines of the ionized element are out of range. In contrast, sodium has a higher ionizing potential and is only partially ionized in the sun, so that the lines of the neutral atoms appear strongly. Other elements, such as neon and argon, have very high ionization potentials, and are not excited at all. Dr. Saha finds support for his views in calculations of the percentage ionizations of various elements at different temperatures and pressures, and it is possible that the peculiarities of the solar spectrum may be satisfactorily explained by these considerations.

Stellar Spectroscopy.—Our detailed knowledge of the spectra of the stars has been greatly advanced by the use of the large telescopes which have been erected, and considerable progress has also

[1] *Ann. d. Phys.*, vol. xliii., p. 965 (1914), etc.
[2] *Phil. Trans.* A. vol. ccxvi., p. 459 (1916).
[3] Bohr, *Danish Acad. Sc.* iv., 1, part ii., pp. 1–100 (1918); H. A. Kramers, *Mémoires Acad. Sc., Copenhagen*, 8th ser., iii., No. 3, pp. 287–384 (1919); Epstein, *Ann. d. Phys.*, vol. 1, pp., 489–520, 815–840 (1916).
[4] *Verh. Deut. Phys. Gesell.* (1919).
[5] W. E. Curtis, *Proc. Roy. Soc.*, lxxxix., 146 (1913); E. Goldstein, *Verh. Deut. Phys. Ges.*, xv., 10 (1913).
[6] *Proc. Roy. Soc.*, xci., 209 (1915).
[7] *Monthly Notices R. A. S.*, lxxvi., 640 (1916).
[8] *Phil. Trans.* A ccxviii., 351 (1918).
[9] *Proc. Roy. Soc.* A. xciv., 472 (1918).
[10] *Phil. Mag.* xl., 809 (1920).

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been made in the interpretation of the stellar lines through experiments in the laboratory. In particular, the use of stronger discharges than had previously been employed has led to the discovery of new lines of several elements, which have been identified with the lines occurring in the hotter stars. Certain lines of the Wolf-Rayet stars, for example, have thus been traced to carbon by Merton,[1] and others to oxygen by Fowler and Brooksbank.[2] The general outcome of the experimental reproduction of stellar lines is to support the view that the order in which the different classes of stars had been arranged is a true temperature sequence. This order, previously indicated by Secchi and Vogel, is now generally expressed by the classification introduced at Harvard by E. C. Pickering, in which the most important classes, passing from the white to the redder stars, are designated by the letters B, A, F, G, K, M.[3] On passing from the relatively cool M stars to the hot B stars, it is necessary, in accordance with the work of Lockyer, to employ a gradually increasing stimulus in order to excite the spectra which appear at successive stages of the stellar sequence.

There are certain peculiarities of the successive stellar spectra which call for explanation, if it be assumed that all stars are of essentially the same composition. Thus, at every stage of the stellar sequence there are many elements which are not represented at all, and different selections of the elements appear at the various stages. The earlier attempts to deal with such questions are incompatible with modern views as to the origin of spectra. The new theory of spectra, however, supplemented by a theory of the temperature radiation of gases, has been shown by Dr. M. N. Saha[4] to provide a very probable explanation of most of the phenomena. According to this theory, a gas or vapour may emit radiations, or become ionized, by subjecting it to appropriate thermal stimulus, depending in part upon the density, and the emissions produced mechanically by the spark may thus also be generated by the action of a sufficiently high temperature. Dr. Saha concludes that, under the temperature stimulus prevailing in the atmosphere of any particular star, certain elements are excited to radiation of their characteristic lines, in accordance with their resonance and ionization potentials, while other elements are either ionized, or the stimulus is too weak to excite the lines by which their presence could be recognized. When an element is completely ionized in this way, it will often happen that the most characteristic lines of the modified atoms will lie far in the ultra-violet, outside the range of possible observation, so that the element will escape detection. Again, under the action of the highest temperatures, a second step in ionization may set in, producing still more refrangible chief lines as a rule, so that even the elements which yield enhanced lines in the ordinary range of spectrum at some stages will eventually cease to be represented. The simplification of the spectra of the hotter stars thus receives an acceptable explanation; the surviving elements represented in the spectra are those for which the maximum amount of energy is required to produce the successive ionizations, or those for which these conditions yield lines of sufficient intensity within the range of spectrum which is open to observation. Preliminary calculations of the probable temperatures at which such changes of spectrum would occur are in substantial agreement with the temperatures of the various classes of stars deduced from spectro-photometric observations by Wilsing and Scheiner. It therefore seems probable that temperature is the controlling factor in determining the character of the spectrum given by a star, and, as Dr. Saha remarks: "The stellar spectra may be regarded as unfolding to us, in an unbroken sequence, the physical processes succeeding each other as the temperature is continually varied from 3000° to 40,000°."

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SPEE, COUNT MAXIMILIAN VON (1861–1914), German admiral, was born June 23 1861 at Copenhagen. He was first officer of the battleship "Brandenburg" when it was sent to East Asia in 1899 during the Chinese boxer disturbances. In 1908 he was chief of the staff of the North Sea command, and in 1913 he was appointed chief in command of the Cruiser Squadron. When the World War broke out he was on a voyage with this squadron from Tsing-tau to the South Sea Islands. He was hard pressed by British and Japanese naval forces, but was at an advantage when he was engaged on Nov. 1 1914 off Coronel on the Chilean coast by Adml. Cradock with a British squadron which was inferior to his own in numbers and speed, as well as in range and weight of fire. Adml. Cradock went down with his ship, the "Cape of Good Hope," and the "Monmouth" was also sunk. On the following Dec. 8 Count Spee's squadron was drawn into action off the Falkland Is. by the powerful cruiser squadron of Adml. Sturdee which had been sent out to look for him. Count Spee's own ship, the "Scharnhorst," was sunk, he himself and his two sons going down with all hands. The "Gneisenau" was also sunk, as were the "Leipzig" and the "Nürnberg." The light cruiser "Dresden" escaped, but was afterwards sunk off Juan Fernandez in the Pacific.

SPIELHAGEN, FRIEDRICH VON (1829–1911), German novelist (*see* 25.667), published during his later years *Freigeboren* (1900); *Die schönen Amerikanerinnen* (1902); *Ultimo* (1903); and *Am Wege* (1903). He died at Charlottenburg, Berlin, Feb. 25 1911.

SPIERS, RICHARD PHENÉ (1838–1916), English architect and author. Phené Spiers occupied a unique position amongst the English architects of the latter half of the 19th century, his long mastership of the architectural school at the Royal Academy having given him the opportunity of moulding and shaping the minds of more than a generation of students. He was educated in the engineering department of King's College, London, and proceeded thence to the atelier Questel of the École des Beaux-Arts, Paris, for upwards of three years, a method of study rare for an architectural student in those days. On his return he won the gold medal and travelling scholarship of the Royal Academy, and in 1865 the Soane medal of the R.I.B.A. In 1871, after he had worked in the offices of Sir Digby Wyatt and William Burges, he gained second premium with a spirited design (showing a good deal of the Neo-Grec feeling consequent on his French training) for the new Criterion building, London. His work of about this period included Lord Monkswell's house, Chelsea. Phené Spiers travelled in France, Spain, Egypt, Syria and the East, and besides his record of more purely architectural data, he made many water-colour sketches showing much talent and facility. He was a frequent exhibitor at various galleries, and a good specimen of his art—the loggia at Hampton Court—is in the Victoria and Albert museum. His works and publications were many, and covered a wide ground. Amongst them are his new edition of James Fergusson's *History of Architecture* and the further volumes on Indian and Eastern art; *Architectural Drawing; The Architecture of Greece and Rome* (conjointly with the late W. J. Anderson); *The Mosque at Damascus;* and the articles on Persian and Roman Architecture in Dr. Russell Sturgis's *Dictionary of Architecture*, besides an edition of Pugin's *Normandy*. For the *E.B.* Spiers wrote most of the articles dealing with architecture. The position to which his erudition and ability entitled him was fully recognized in other countries as well as his own, as is shown by his election to membership of many foreign societies in France, Spain and America. He died in London Oct. 3 1916.

SPIRITUALISM: *see* PSYCHICAL RESEARCH.

SPITSBERGEN (*see* 25.708).—The highest peaks in Spitsbergen are believed to be Mount Newton, 5,676 ft., and Mount Poincaré, 5,446 ft., both in the eastern part known as New Friesland. Mount Eidsvoll in King James Land is 4,770 ft. and Mount Monaco on Prince Charles Foreland is 3,543 ft.

Geology.—Considerable exploration has not greatly modified the main conception of the geological structure. The old rocks of the W., generally described as the Hekla Hook series, seem to be of Silurian age to which may also be ascribed the so-called Archaean rocks of the N.W. There are no Permo-Carboniferous rocks in King James Land and the strips of rocks on the N.E. side of Prince Charles Foreland and the opposite shores of the mainland, formerly attrib-

[1] *Proc. Roy. Soc.*, A, xci., 498 (1915).
[2] *Monthly Notices, R.A.S.*, lxxvii., 511 (1917).
[3] The work of H. N. Russell, in general agreement with that of Lockyer, renders it probable that the true sequence is from M to B with increasing temperature, and thence from B to M with decreasing temperature, the density increasing throughout. Stars of rising temperature, on account of their great volume, have been called "giants," those of falling temperature "dwarfs." Differences between the spectra of giants and dwarfs of the same spectral class have been found by Adams (see *Monthly Notices, R.A.S.*, lxxxi., 334).
[4] *Proc. Roy. Soc.*, A, xcix., 135 (1921).

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uted to that age, are now known to be Tertiary. Certain of the coal measures in Advent Bay prove to be of Cretaceous and not Tertiary age and these Cretaceous beds probably appear also below the Tertiary beds in Lowe Sound.

An extinct volcano and several hot springs with a temperature of 75° to 82° F. were discovered in Bock Bay, off Wood Bay, in 1910. The volcano seems to date from a later period than any other volcanic manifestation found in Spitsbergen. Research has proved that dislocation has played a great part in determining the main features of the fjord system, especially in Ice Fjord where the course of the fjord has been decided by great faults.

Climate.—From the meteorological data now available, including eight years' records from Green Harbour, the following means may be given: Cape Thordsen, Jan. 0·3° F., July 39·9° F.; Green Harbour, Jan. 6·7°, July 39·7°; Axel I. (Lowe Sound), Jan. 1·6°, July 40·3°; S.E. of Edge I., Jan. 1·5°, Aug. 37·4°; Bear I., Feb. 10·4°, Aug. 40·1°. The mean annual precipitation at Green Harbour is 11·6 in.; Prince Charles Foreland has more and the interior of Spitsbergen less.

Exploration.—There is little doubt that the land called Svalbard ("cool coast") in the Icelandic annals, discovered by Norsemen in 1194, was really Spitsbergen. If Spitsbergen was forgotten by the Norsemen it was possibly rediscovered by Russian hunters from the White Sea in the 15th or 16th centuries or at least previous to Barents' rediscovery in 1596.

Recent exploration in Spitsbergen has been devoted mainly to geological work, largely with economic ends in view, and detailed cartographical survey. A German expedition under Lt. Schroeder-Stranz in 1912 came to grief on the N. coast, after the loss of the leader. Half the staff were lost and the survivors were rescued by Norwegians under A. Staxrud.

The principal survey work has been done by Norwegians working in small parties every summer since 1906, assisted by grants from the Norwegian State. These parties have been successively commanded by G. Isachsen, A. Staxrud and A. Hoel, and have mapped in detail the western side of the mainland from the N. coast to the South Cape. The work is expedited by the use of photogrammetric methods to assist triangulation. The detailed survey of Prince Charles Foreland has been completed by Dr. W. S. Bruce and assistants who have also mapped the area between Klaas Billen and Sassen bays. Swedish surveyors have mapped the land round Lowe Sound and Braganza Bay. The Prince of Monaco has shown continued interest in Spitsbergen exploration by giving assistance to several explorers, including the Swiss H. Stoll who in 1913 crossed the unknown country between Lowe Sound and Agardh Bay on Stor Fjord. Lt. W. Filchner in 1910 surveyed the glaciated region between Temple Bay and Mohn Bay. In 1920 J. M. Wordie scaled several of the highest peaks on the W. coast, including Mounts Monaco, Rudmose and Barents. Hydrographic surveys have been carried out by G. Isachsen and others on the W. coast and in Green Harbour, by W. S. Bruce in Foreland Sound, Klaas Billen and Sassen bays and Stor Fjord. Swedish Government surveyors have been at work in Lowe Sound. Oceanographical work has been done in Spitsbergen waters by Dr. F. Nansen. The Norwegian Government has maintained a wireless telegraph station and meteorological observatory in Green Harbour since 1911. A German meteorological station was founded in Eleltoft Haven, Cross Bay, in 1910 as the outcome of a visit by Prince Henry of Prussia and Count Zeppelin when experiments with dirigible balloons were conducted. This station was abandoned in Sept. 1914. In 1920 Norway opened a new meteorological and geophysical station for aerological and geomagnetic research. Besides the Norwegian state wireless station at Green Harbour, there were in 1921 seven others (4 Norwegian, 2 English and one Swedish). In Aug. 1921 a Norwegian Church was consecrated at Longyear City.

Mining.—The development of the coal-fields has proceeded rapidly, greatly stimulated during the war by the scarcity and high price of coal in Scandinavia. The coal-mine in Longyear Valley, Advent Bay, which had been under American ownership since 1905, was sold in 1916 to Norwegians who have been assiduous in their export. Several other Norwegian mines have started, notably in Kings Bay, Green Harbour and Hjorth Haven in Advent Bay. Swedish mines were opened in Lowe Sound (Braganza Bay) in 1917. There are Russian mines in Green Harbour and Dutch mines at Cape Boheman. British enterprise, hampered by war conditions, revived in 1919 in the coal-bearing areas in Klaas Billen Bay and Lowe Sound. By 1920 practically all the coal-bearing areas were annexed by one or other company and at least five mines had reached the export stage. The total amount of coal exported in 1919 was 90,000 tons, all of which went to Norwegian ports, including some to Narvik for the Swedish railways. The coal exported so far is of Tertiary and Cretaceous age and proves to be good steam coal. Bituminous coal of Carboniferous age will soon be available for export. Jurassic coal occurs but is of poor quality and no longer worked. Mining continues throughout the year but the export season at present is from June to Sept. The largest mining camp is Longyear City in Advent Bay, housing some 400 men in summer and 300 in winter. No other minerals besides coal are as yet exploited commercially, but large deposits of iron ore (36% iron) and gypsum are known, as well as smaller deposits of zinc and asbestos. Signs of oil have been reported. A Norwegian company is exporting coal from Bear Island. The approximate area (in sq. m.) of estates owned by various nationals in Spitsbergen is as follows: British 6,500, Norwegian 900, Swedish 400, Russian 60 and Dutch 10. Whaling was revived in Spitsbergen waters in 1905, abandoned in 1912 and restarted during the World War. The only station is now in Green Harbour. Winter fur-hunting is pursued by a few Norwegians.

Political History.—The question of political control had been discussed since about 1870, mainly by Norway, Sweden and Russia, without any solution being found. Spitsbergen therefore occupied the curious position of being *terra nullius*. In 1907, however, Norway again opened negotiations for an international conference to decide the question of sovereignty, and one was held at Christiania in July-Aug. 1910, followed by another in 1912, without definite result. In July 1914 a conference which included also representatives of Britain, France, Belgium, the United States, Holland and Germany tried to devise a form of administration consistent with the country remaining a *terra nullius*, but the outbreak of the World War put an end to the discussions. In 1919 the Supreme Council conferred the sovereignty of Spitsbergen, including Bear I., on Norway. The signatories of the treaty were Great Britain and the British Dominions, France, Italy, the United States, Japan, Holland, Denmark, Norway and Sweden. The rights and territories of nationals other than those of Norway are safeguarded, and Norway is not allowed to show preferential treatment to Norwegian mining companies or to levy taxes except for expenditure on the administration. Disputed claims to estates were to be decided by a neutral commission presided over by a Dane.

BIBLIOGRAPHY.—The literature is in the main scattered in periodical publications: specially useful are *Ymer* (Stockholm), *Videnskapsselskapets skrifter* (Christiania), *Naturen* (Bergen), *Scottish Geographical Magazine* and *Résultats des Campagnes Scientifiques*, par Albert I., Prince de Monaco, vol. xl., xli., and xlv. Two modern works giving recent history and economic developments are *Spitsbergen: its exploration, hunting and mineral riches*, by R. N. Rudmose Brown (1920), and *Spitsbergens Natur og Historie*, by G. Holmsen (1911). "Fra Ishavet" by G. Isachsen in *Det Norske Geografiske Seiskabs Aarbok* (1916–19) gives much information about Norwegian hunters. *The Dutch Discovery and Mapping of Spitsbergen 1596–1829*, by F. C. Wieder (Amsterdam, 1919), has many reproductions of early maps. The meteorological observations at Green Harbour are published annually in *Jahrbuch des Norwegischen Meteorologischen Instituts* (Christiania). *Mit Zeppelin nach Spitzbergen*, by A. Miethe and H. Hergesell (Berlin 1911), is noteworthy for the excellence of its illustrations, including colour plates. Some of the results of the Norwegian surveys are collected in *Expédition Isachsen au Spitsberg 1909–10. Résultats scientifiques* (Christiania 1916). The geomorphology of Spitsbergen is explained by G. de Geer, "On the physiographical evolution of Spitsbergen" in *Geog. Annaler*, I. (Stockholm 1919).

(R. N. R. B.)

SPORTS AND GAMES.—The tendency towards "internationalism" in competitive sports and games had been rapidly growing in intensity, partly as a result of the establishment of the Olympic Games, from 1896 onwards; but it was rudely interrupted by the World War, and conditions were still unfavourable up to 1921 for more than a limited renewal. The decade from 1911 to 1921 offers no proper material, therefore, for a consistent history in this field, by way of supplement to the separate articles in the earlier volumes of this Encyclopædia; nor, indeed, in the case of most sports and games, as carried on in 1910–21, had there been more than minor changes, either in equipment, methods or rules. So far as British and American interests, however, are concerned, the chief statistics, as regards the main events in the more important sports and games, are recorded in the following sections.

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Athletics, Track and Field.—The Olympic Games were held at Stockholm in July 1912, the highest number of points being scored by the United States, and again at Antwerp in 1920, the 7th Olympiad being projected for Paris in 1924.

While the United States won the track and field events of the 1920 Olympic games in Antwerp by a considerable margin in the point score, and set new records in the pole vault, the high jump, and the 400-metre hurdles, the Americans totalled only 9 first places, the same as the team of 24 men from Finland. The "stars" of the American team were C. W. Paddock in the 100 metres, Allan Woodring in the 200 metres, Frank Loomis in the 400-metre hurdles, Richard Landon in the high jump, Frank Foss in the pole vault, Pat Ryan in the hammer, Pat McDonald in the 56-lb. weight, and H. H. Brown, the individual winner in the 3000-metre team race, the only American to win a distance event. In swimming the Americans were supreme, with Duke Kahanamoku and Kealoha, both of Hawaii, Norman Ross, Ethelda Bleibtrey, Aileen Riggin and Charlotte Boyle. The winners at the American eastern college meetings were: 1911, Cornell; 1912, Pennsylvania; 1913, Pennsylvania; 1914, Cornell; 1915, Cornell; 1916, Cornell; 1918, Cornell; 1919, Cornell; 1920, Pennsylvania; 1921, California. Princeton won against Oxford (July 8 1920) at Queen's Club, London, by 6 events to 4. At the Pennsylvania Relay Games (April 30–May 1 1920) the Oxford-Cambridge 2-m. team, Tatham, Stallard, Milligan and Rudd, set a new world's record of 7 min. 50 ⅘ sec.

Cricket.—Before the war English cricket was in a flourishing condition. The visit of a South African team to Australia in 1910–1, in which the South Africans did hardly as well as had been expected, served as a prelude to the so-called Triangular Tournament of 1912; and in the meantime an English team under the management of the Marylebone Cricket Club carried through a successful tour in 1911–2. Of 18 eleven-a-side matches the M.C.C. team lost only the first test match; four were drawn, and 18, including four test matches, were won by the Englishmen. At the end of 1910 a team sent to South Africa by the M.C.C. won two and lost three test matches. In 1912 the interest in county cricket was largely eclipsed by the Triangular Tournament between England, Australia and South Africa, in which nine test matches were played. England proved victorious, winning four matches (three against South Africa and one against Australia) and drawing twice with Australia, owing to bad weather. The Australians beat the South Africans twice. Of the 102 matches played up to 1920 between England and Australia, England won 46 and Australia 35. Of those played in England the home team won 17 and Australia 8, and 17 were drawn. In those played in Australia England won 30 and Australia 27, three being drawn. In 1921, however, in their visit to England, the Australians won an easy victory.

A new method of deciding the English county championship was inaugurated in 1911. With the idea of discouraging the players from aiming at drawn matches, five points were given for a win, and three points (with one point to the losing side) for a first-innings victory. The championship was won by Warwickshire in 1911, by Yorkshire in 1912 and by Kent in 1913. In 1914 the championship was not decided owing to the outbreak of war, but the M.C.C. Committee adjudged Surrey the winners. It was resumed in 1919, when a new system was adopted, by which only wins counted, the winners being the county with the highest proportion of wins to matches played. Yorkshire was at the head of the list in 1919, and Middlesex in 1920 and 1921.

The Oxford and Cambridge match was not played between 1915 and 1918. In 1911, 1914 and 1919 Oxford won, and in 1912, 1913 and 1921 Cambridge were the winners, the match in 1920 being drawn. From 1911 to 1921, with the exception of the years 1915 to 1918, when the match was not played, Eton won against Harrow.

English Football.—(1) Rugby.—In 1911 a French team for the first time was victorious in an international match, beating Scotland in Paris. In the same season Wales beat England, Ireland, Scotland and France; Ireland beat England, Scotland and France; England at Twickenham beat Scotland and France. In 1912 all the international matches that took place in the United Kingdom were won by the fifteen playing in its own country. England defeated Wales and Ireland, but narrowly lost to Scotland. Ireland beat Scotland and Wales, and Wales beat Scotland. In no match was France victorious. A strong South African team began a tour in Great Britain in the autumn of 1912. After gaining several decisive victories over counties, the South Africans lost to Newport, were with great difficulty victorious over Llanelly, the United Services and London, beat Oxford and Cambridge Universities, were narrowly beaten at Twickenham by another London fifteen, and easily beat Scotland at Edinburgh. They next gained their most decisive victory at Dublin, securing 36 points against Ireland, and beat Wales by a try at Cardiff, but lost to Swansea by the same margin. In the international matches in 1913 England defeated Scotland, Wales, Ireland and France; Wales beat Scotland, Ireland and France; Scotland beat Ireland and France; and Ireland beat France. In 1914 England beat Scotland, Wales, Ireland and France; Wales beat Scotland, Ireland and France; and Ireland beat Scotland and France. From 1915 to 1919 the matches were not played. In 1920 England beat Scotland, Ireland and France; Wales beat England, Ireland and France; Scotland beat Wales, Ireland and France; and France beat Ireland. The University match went in favour of Oxford in 1910, 1911, and 1913. Cambridge won in 1912, 1914, 1915 and 1920. (2) *Association.*—In 1910 a tour was undertaken in Brazil by the Corinthian Football Club, and another in North America in 1911–2. From 1907 to 1914 amateur international football was affected by a dissension among English clubs. In consequence of the Football Association insisting upon the admission of professional clubs (so-called) to the district associations, a large number of amateur clubs, including the University, College and Public Schools Club, seceded to form the Amateur Football Association. The officers of the army, while sympathizing with the seceders, considered it advisable for the sake of regimental football to retain their connexion with the Football Association. But in 1911–2 they used their influence to promote a reconciliation. A conference was held at which the delegates of the two associations only failed to arrive at an agreement because the older body would not accept an arrangement by which the younger could receive the adherence of newly formed amateur clubs. In 1914, however, the Football Association and the Amateur Football Association sank their differences. The Amateur elevens of the Football Association won matches with Wales, Belgium, France and Holland in 1910–1, but lost to Ireland. In 1911–2, besides victories at the Olympic Games, they defeated Ireland, Wales, Denmark, Holland and Belgium. The Amateur Football Association teams beat Wales and France in both seasons. The full representative eleven of the Football Association defeated Ireland and Wales in 1911 and drew with Scotland. Ireland lost to Wales and Scotland, and Scotland drew with Wales. In 1912 England and Scotland again played an indecisive match, but both beat Wales and Ireland; Wales lost three matches. In 1913 England beat Scotland and Wales; Wales beat Ireland and drew with Scotland; Scotland beat Ireland; and Ireland beat England. In 1914 England beat Wales; Scotland beat England; Ireland beat England and Wales and drew with Scotland; and Wales drew with Scotland. In 1920 England beat Scotland and Ireland; Wales beat England and drew with Ireland and Scotland; and Scotland beat Ireland. The Football Association Cup was won in 1911 by Bradford City, in 1912 by Barnsley, in 1913 by Aston Villa, in 1914 by Burnley; in 1915 by Sheffield United, and in 1920 by Aston Villa. The championship of the Football League was carried off by Manchester United in 1911, by Blackburn Rovers in 1912, by Sunderland in 1913, by Blackburn Rovers in 1914, by Everton in 1915, and by West Bromwich Albion in 1920. The principal trophy of the Amateur Football Association was won in 1911 by the Old Malvernians, in 1912 by Oxford City, in 1913 by the New Crusaders, in 1914 by Ealing, and in 1920 by Dulwich Hamlet. The Arthur Dunn cup for public school clubs fell to the Old Reptonians in 1911, to the Old Malvernians in 1912, to the Old Brightonians in 1913, to the Old Reptonians in 1914, to the Old Wykehamists in 1920, and to the Old Carthusians in 1921. Oxford won the University match in 1911 and Cambridge won in 1912, 1913, 1915; in 1914 and 1920 the match was drawn.

American Football.—Of all amateur sports in America, college football (the American Rugby game) drew the largest crowds and aroused the greatest enthusiasm. Occasional professional teams drew big gate receipts, especially in Ohio and Michigan, where the professional game was popular, but in general it was not encouraged. After 1908 a number of colleges abandoned football because of the deaths and injuries that resulted from the old-style mass playing. In the following years, especially in 1910 and 1912, radical revisions of the old rules were made; the new rules were designed to foster a more open style of play and to make the game more interesting to spectators. The periods of play, formerly two halves of 35 min. each, were altered to four periods of 15 min. each, with an intermission of one minute between the first and second, and third and fourth periods, and 15 min. between the second and third periods. The playing field, from goal line to goal line, was shortened from 110 to 100 yd. and each side was given four trials in which to make the required 10 yd. The removal of the restrictions on the forward pass was one of the most conspicuous changes; this with other new rules, had the effect of encouraging an open, running game, in which the advantage lay rather in quick thinking and skillful playing than in mere weight or strength. The full possibilities of the new rules were not realized for some time, but, as familiarity with them increased, the play became more spectacular, and there was no question that the game had been improved from the standpoint of both spectator and player. Ordinarily the schedule of football games was not designed to determine the champion team among eastern colleges; therefore in reviewing the football games of the decade 1910–20 the choice of the strongest teams is to some extent a matter of opinion. From 1910 to 1915, inclusive, Harvard University had a succession of strong teams, which in nearly every year gained what appeared to be a clear title to the championship. The succession was interrupted in 1911, however, when Princeton defeated both Harvard and Yale. In the next year the honours went to the smaller colleges—especially the university of Pittsburgh and Colgate University—and this was interpreted as due in part to the fact that the new rules had removed certain handicaps from the less powerful teams. Football probably had never been so popular as in 1916; it was estimated that in that year 35,000 games were played throughout the United States, with an attendance of 6,500,000. Owing to the entrance of the United States into the war, the

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major teams practically cancelled their schedules during the two following years, but in the army and navy every unit had its team. A full schedule was played by the A.E.F., the winners being the 89th Div. team, captained and coached by Captain Gerhardt of West Point. The resumption of college games in the east in 1919 showed that college football had lost none of its popularity. One of the strongest teams of 1919 was that of Pennsylvania State College, though Harvard went through the season without experiencing defeat. Despite a tie with Harvard, Princeton was generally conceded to have had the best team turned out in the east in 1920, the first really normal year of play after the war. The tendency among colleges was more and more towards open play, with much kicking and forward passing. The east, however, continued to play a far more conservative game than was popular in the west and south. Among the colleges of the middle west the strongest teams were Michigan (1910), Minnesota and Michigan (1911), Wisconsin (1912), Chicago (1913), Illinois (1914), Illinois and Minnesota (1915), Ohio State (1916–7), Illinois (1918–9), Ohio State (1920). Ohio State, champions of the middle-west group in 1920, played an intersectional match at Pasadena at the Festival of Roses in that year with the university of California, and was badly defeated. The large attendance at football matches led to the construction of immense stadiums of concrete and steel to accommodate the crowds. Two of these stadiums, those at Harvard and at Syracuse University, had been constructed before 1910; after that year there were built a number of others, among which the most noteworthy were, perhaps, those at the university of Chicago, Yale (the "Yale Bowl"), the university of Michigan, Princeton (the Palmer Memorial stadium), the university of Pennsylvania and the college of the City of New York. The greatest of these structures, the Yale Bowl, has exterior dimensions of 940 by 744 ft. and a permanent seating capacity of 61,000. This huge amphitheatre cost more than $500,000 and is considerably larger than the Roman Colosseum, which had a seating capacity of about 45,000. The Palmer stadium at Princeton provides seats for 41,000 and cost $350,000.

The *Association* game made remarkable gains in popularity not only among American colleges and the country clubs, but among the big industries as well. Each year the United States Football Assn. conducted a national cup competition, the final round of which was won in 1920 by the Ben Miller Athletic Club of St. Louis from the Fall River Club of Quincy, Mass. Previous winners include the Bethlehem Steel Co., the Fall River Rovers, and the Brooklyn Field Club.

Baseball, the universal American sport, occupied the attention of the public in the United States chiefly as a professional game in which the leading cities were represented by baseball teams comprising two major leagues—the American and the National. At the end of each year the winning teams of the two leagues played what was known as the world series for the championship. During 1910–20 these contests were by far the most popular of all annual sporting events. This is indicated by the attendance and gate receipts, which in 1920 were 174,414 and $564,800, respectively, and in 1919, 236,928 and $722,414, as against an attendance of 125,222 and receipts of $173,980 in 1910. In the following list of world-series contests since 1910, the name of the winning team is given first, that of the losing team second, and the score in games third: 1910, Philadelphia (American League) *vs.* Chicago (National League), 4—1; 1911, Philadelphia (A.L.) *vs.* New York (N.L.), 4—2; 1912, Boston (A.L.) *vs.* New York (N.L.), 4—3, one game tied; 1913, Philadelphia (A.L.) *vs.* New York (N.L.), 4—1; 1914, Boston (N.L.) *vs.* Philadelphia (A.L.), 4—0; 1915, Boston (A.L.) *vs.* Philadelphia (N.L.), 4—1; 1916, Boston (A.L.) *vs.* Brooklyn (N.L.), 4—1; 1917, Chicago (A.L.) *vs.* New York (N.L.), 4—2; 1918, Boston (A.L.) *vs.* Chicago (N.L.), 4—2; 1919 Cincinnati (N.L.) *vs.* Chicago (A.L.), 5—3; 1920, Cleveland (A.L.) *vs.* Brooklyn (N.L.), 5—2. In 1914 an attempt was made to organize a third major league, known as the Federal, but this was unsuccessful, and at the end of the following season it was amalgamated with the two older leagues. After 1919 baseball was for a time under a cloud, owing to charges that certain members of the Chicago American League team had been bribed by outside persons to lose the 1919 world series. The accused players were expelled from organized baseball, and there was a general overhauling, with the result that final authority over the game was given to Kenesaw Mountain Landis, a Federal judge known for his proficiency in the law and his knowledge of baseball. During the World War American soldiers carried the game to England and France, where it was a favorite diversion in the camps of Canadian and U.S. soldiers. The professional game enjoyed an extraordinary revival after the war, the crowds breaking all records, especially since Sunday playing was more generally permitted by law than before. Colleges generally resumed the game, though interest in college baseball was slight in comparison with interest in college football.

Lawn Tennis.—American players, during 1910–21, were in the forefront, but an increasingly high standard of play was being shown among other nationalities besides the British and American, notably the French and Japanese. The International Davis Cup was won by Australia in 1911 and 1914, by the British Isles in 1912, and by the United States in 1913 and 1920. In 1911 the United States team (Larned, McLoughlin, Little and Bundy), were beaten by Australia (Brookes, Dunlop and Heath) after beating Great Britain (Dixon, Lowe and Beamish). In 1912 Great Britain (Dixon, Parke and Beamish) defeated Australia (Brookes, Heath and Dunlop). In 1913 the United States (Hackett, McLoughlin, Little and Williams) beat Great Britain (Parker, Dixon, and Roper-Barrett). In 1914 Australia (Brookes, Wilding, Dunlop and Doust) beat the United States (McLoughlin, Williams, Behr and Bundy); McLoughlin defeated Brookes in a memorable match (14–16, 6–3, 6–3), and Wilding by 6–2, 6–3, 2–6 and 6–2, but McLoughlin and Bundy lost the doubles to Brookes and Wilding. In 1920 the United States (Hardy, Johnston, Tilden, Williams and Garland) defeated Great Britain, France and Australia.

In the English singles (world's) championships A. F. Wilding won in 1911, 1912 and 1913; N. E. Brookes in 1914; G. L. Patterson in 1919; and W. T. Tilden in 1920 and 1921. Mrs. Lambert Chambers won the English ladies' singles in 1911, 1913 and 1914; Mrs. Larcombe in 1912; and Mlle. S. Lenglen in 1919, 1920 and 1921. In the English covered court championship A. H. Gobert won the singles in 1911, 1912, 1920 and 1921; Gobert and M. J. G. Ritchie won the doubles in 1911, Wilding and S. N. Doust won the doubles in 1912 and 1913. P. M. Davson won the English singles in 1913 and 1919. In 1914 Ritchie won the English singles and in 1914 and 1921 T. M. Mavrogordato and Davson won the doubles. In 1919 the English doubles were won by R. Lycett and R. W. Heath, and in 1920 by Gobert and Lycett.

In the United States, William A. Larned won the championship for the seventh time in 1911, his experience proving too much for the challenger, Maurice F. McLoughlin; the doubles went to Raymond D. Little and Gustave Touchard, while Miss Hazel Hotchkiss won the women's title for the third time. In 1912 McLoughlin won the American championship, Larned not being in the tournament; McLoughlin and Thomas Bundy won the doubles from Little and Touchard, and Mary Browne won the women's championship. The outbreak of war in 1914 robbed the Newport tournament of interest. The German team was interned in England on the way home. Meantime Williams won the national title, and McLoughlin and Bundy the doubles. In 1915 much attention was paid to building up the junior tournaments. There was no international competition. William M. Johnston, of California won the championship. With Clarence J. Griffin, another Californian, he also won the doubles. Miss Molla Bjurstedt (later Mrs. Mallory), won the women's championship. In 1916 the United States was the world's lawn-tennis centre. The season was marked by the appearance of two Japanese players, Kumagae and Mikami, in the principal tournaments. Williams won the national singles title, Johnston and Griffin the doubles. Miss Bjurstedt took every title she contested. In 1917, with the United States in the war, tennis was transferred to the army and navy, all the ranking 10 players being in the services. The "patriotic" singles, in lieu of a national championship, was won by R. L. Murray, a Californian settled in the east. In 1918 R. L. Murray won the title in straight sets from William T. Tilden. Tilden and Vincent Richards won the doubles title. In 1919 Johnston won the singles title from Tilden, while Brookes and Gerald Patterson, from Australia, took the doubles. Brookes, Patterson, Lycett and Thomas, of Australia, invaded the United States, but were beaten at Forest Hills, 4 matches to 0, by Johnston and Williams, and in the doubles by Tilden and Johnston. In 1920 Tilden won back the singles titles from Johnston, while Johnston and Griffin won the doubles.

Polo.—The United States retained the cup against England at Meadowbrook in 1911, winning by 2 to 0, the American team consisting of the famous "big four," Lawrence Waterbury and J. M. Waterbury (forwards), Harry Payne Whitney (No. 3), and Devereux Milburn (back); in 1913 the same team won again by 2 matches to 0. In 1914 Lord Wimborne's team took the trophy to Great Britain winning 2 straight matches from an American team consisting of Milburn, who played both 3 and back, the two Waterburys, and Rene La Montagne. In 1921 an American invasion of Hurlingham was led by Devereux Milburn, whose team, consisting of himself at back, J. Watson Webb at No. 3, Thomas Hitchcock, Jr., at No. 2, and Louis E. Stoddard at No. 1, brought the cup back to the United States winning 2 straight matches by 11 to 4 and 10 to 6.

Yachting.—Just before the outbreak of the war Sir Thomas Lipton renewed his challenge for the America's Cup, there having been no races since 1903. "Shamrock IV.," a much-criticized boat, was sent to a drydock in Brooklyn, while "Resolute" and "Vanitie" reappeared and contested the right to sail as defender. The thirteenth series of races for this trophy was not sailed until July 15–27 1920, off Sandy Hook. The challenger was designed by C. E. Nicholson and was sailed by Capt. William P. Burton, an amateur skipper. Capt. Andrew Jackson Applegate, an American familiar with conditions on this course, acted as professional pilot. The defender was "Resolute," winner of 7 out of 13 races against "Vanitie," 4 being won by the latter and 2 called off. "Resolute" was built by a syndicate of New York yachtsmen, composed of J. P. Morgan, Cornelius Vanderbilt, Arthur Curtiss James, George F. Baker and others. The skipper was the well-known amateur, Charles Francis Adams of Boston. The sailing-master was Capt. Chris Christensen, he and the mates being of Scandinavian birth but American citizens. The defender was designed by Nat. Herres-

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hoff, of the Herreshoff family of Bristol, R.I. The first 2 races were won by "Shamrock," the last 3 and the cup by "Resolute." Twice the yachts failed to finish within the 6-hour time limit. Once the wind was deemed too strong to permit a start. It was feared that with lee decks awash there was risk of losing a man overboard. In all but one race "Resolute" was allowed 6 min. 40 sec. handicap, due largely to the challenger's great sail area with Marconi mast and extreme hoist. In the same year was held the first race for the championship of the North Atlantic fishing fleet off Halifax. "Esperanto," United States, defeated "Delawanna," Canadian, in two straight races over a 40-m. course, for $4,000 and a cup.

Golf.—In Great Britain, H. Vardon was the champion in 1911 and 1914, E. Ray in 1912, J. H. Taylor in 1913, G. Duncan in 1920, and Jock Hutchison in 1921. In the amateur championships H. H. Hilton won in 1911 and 1913, John Ball in 1912, J. L. C. Jenkins in 1914, C. J. H. Tolley in 1920 and W. I. Hunter in 1921. The ladies' open championship fell to Miss D. Campbell in 1911, to Miss G. Ravenscroft in 1912, to Miss Muriel Dodd in 1913, and in 1914, 1919, 1920 and 1921 to Miss C. Leitch.

In the United States the amateur championship was won by H. Hilton in 1911 and by Jerome Travers in 1912. J. J. McDermott won the open tournament both in 1911 and 1912. Travers defeated Anderson for the amateur title in 1913, and Francis Ouimet won the open title, after a tie with Harry Vardon and Ted Ray of England. No amateur before had won this title, and Ouimet was only 20 years old. Miss Gladys Ravenscroft, of England, won the American ladies' championship in 1913. In 1914 Ouimet defeated W. C. Fownes for the amateur title, and Walter Hagen won the open from a field of English, French and Scotch professionals; the women's title went to Miss Georgiana Bishop. The amateur title for 1915 went to Robert M. Gardner; and Jerome Travers won the open, the second triumph of an amateur. In 1916 "Chick" Evans took the amateur title from Gardner, and the open from the professional Jock Hutchison. With the United States at war in the following year golf was abandoned save as exhibitions were given in aid of the Red Cross. The first revival came in 1918 with a match in Canada between American and Canadian amateurs, which was won by the Canadians, 23 to 19. A complete revival followed in 1919; S. Davisson Herron won the amateur title, though four former champions, Travers, Gardner, Ouimet and Evans, were entered. "Bobby" Jones was the runner-up. The open was won by Walter Hagen, while Miss Alexa Stirling easily took the women's title. Gardner went to England in 1920 for the amateur championship, and was only beaten in the final, after an extra hole, by Cyril J. Tolley, the Oxonian. Ray and Vardon made this year a remarkable invasion of the United States, Ted Ray winning the open championship. The amateur title went to Evans. The U.S. team easily won the Devonshire Cup from Canada. In 1921 an American invasion of England by the strongest of professional and amateur teams resulted in the winning of a team match by the Americans, and of the open championship by Jock Hutchison, of St. Andrews, a naturalized American.

Horse Racing.—The following is a list of the winners of the Derby in England from 1911 to 1921:—

	Winner	Owner	Trainer	Jockey
1911	Sunstar	Mr. J. B. Joel	C. Morton	G. Stern
1912	Tagalie	Mr. Raphael	D. Waugh	J. Reiff
1913	[1]Aboyeur	Mr. Cunliffe	Lewis	Piper
1914	Durbar II.	Mr. H. B. Duryea	(trained in France)	MacGee
1915	[2]Pommern	Mr. S. B. Joel	C. Peck	S. Donoghue
1916	[2]Fifinella	Mr. E. Hulton	R. C. Dawson	J. Childs
1917	[2]Gay Crusader	Mr. Fairie	A. Taylor	S. Donoghue
1918	[2]Gainsborough	Lady James Douglas	A. Taylor	J. Childs
1919	Grand Parade	Lord Glanely	Barling	F. Templeman
1920	Spion Kop	Major G. Loder	Gilpin	F. O'Neill
1921	Humorist	Mr. J. B. Joel	Morton	Donoghue

[1] Craganour, who came in first, was disqualified.
[2] "New Derby" run at Newmarket.

Other "classic" races resulted as follows:—

	Oaks	Doncaster St. Leger	2,000-guineas Newmarket	1,000-guineas Newmarket
1911	Cherimoya	Prince Palatine	Sunstar	Atmah
1912	Mirska	Tracery	Sweeper II.	Tagalie
1913	Jest	Night Hawk	Louvois	Jest
1914	Princess Dorrie	Black Jester	Kennymore	Princess Dorrie
1915	[1]Snow Marten	Not run	Pommern	Silver Tag
1916	[1]Fifinella	Not run	Clarissimus	Canyon
1917	[1]Sunny Jane	" "	Gay Crusader	Diadem
1918	[1]My Dear	" "	Gainsborough	Ferry
1919	Bayuda	Keysoe	The Panther	Roseway
1920	Charlebelle	Caligula	Tetratema	Cinna
1921	Love in Idleness		Craig an Enan	Bettina

[1] Run at Newmarket.

In 1914, before the season was half over, came the war. During most of August racing was suspended, partly because of difficulties of transit and also because some courses were occupied by the military. Owing largely to the King's desire that the interests of the many people employed in racing establishments should not be endangered, the remaining fixtures were carried out, so far as regarded the more important ones. For the first time since 1865 the Derby was won by a horse bred and trained in France, Durbar II. On May 16 1915 the Jockey Club issued a notice suspending all racing under their jurisdiction, except the Newmarket fixtures, until further notice. Substitute races for the Derby, Oaks and St. Leger were arranged at Newmarket.

In the United States, too, horse-racing was interrupted by the war, but there was a prompt revival afterwards. In 1920 Man-O'-War, a chestnut colt by Fair Play-Mahubah, from the Glen Riddle Farm, and trained by Louis Feustel, started in 21 races, winning 20 and taking one second. Its total winnings amounted to $244,465. Man-O'-War held the American running records for 1 m. (1 min. 35 ⅘ sec.), 1¼ m., 1½ m. and 1¾ m. The climax of the 1920 season was a match race between Man-O'-War, owned by Samuel Riddle, and Sir Barton, owned by Commodore Ross of Canada, at a mile and a quarter, at the Kenilworth track, Windsor, Ont. The race was for a purse of $75,000 and a $5,000 cup offered by A. M. Orpen. Man-O'-War won by seven lengths in 2 min., 3 sec., three seconds slower than the record made by Whisk Broom II. in 1913.

Rowing.—For the professional championship of the world, the following contests took place:—

1910—R. Arnst beat E. Barry on Zambesi.
1911—R. Arnst beat H. Pearce on Parramatta.
1912—E. Barry beat R. Arnst on Thames.
1912—E. Barry beat E. Durnan on Thames.
1913—E. Barry beat H. Pearce on Thames.
1914—E. Barry beat J. Paddon on Thames.
1919—A. D. Felton beat E. Barry on Thames.
1920—E. Barry beat A. D. Felton on Parramatta.

In England the winners in the Oxford and Cambridge boat races for 1911–21 were:—

1911.....Oxford	1915–9.....Not rowed
1912.....Oxford	1920.....Cambridge
1913.....Oxford	1921.....Cambridge
1914.....Cambridge	

In the 1912 races, as originally rowed, both boats became waterlogged and Cambridge sank. But the race was rowed again the following Monday, Oxford winning.

American rowing, interrupted by the war, was promptly revived, and assumed an international character when in 1920 the veteran crew of the U.S. Naval Academy at Annapolis defeated a picked English eight over the canal course at Brussels for the Olympic championship. In 1921 the Annapolis crew, with two new men in the boat, was defeated by Princeton University in a race on Carnegie Lake, over a course of a mile and three-quarters. The same Annapolis crew in the same year won the revival of the Poughkeepsie Regatta over three miles, easily defeating California, Cornell, Pennsylvania, Syracuse and Columbia, the last named up to that time an unbeaten combination. Yale defeated Harvard in 1921, on the Thames river at New London, Conn., at four miles, using English rigging and boat, and being coached in the last two weeks by James Corderry, an English sculler, who had succeeded Guy Nickalls at the eleventh hour as coach at New Haven. In 1920 Harvard beat Yale, but the previous year Yale won under the coaching of Prof. Mather Abbott, an Englishman who had taught rowing for many years at St. Paul's School, Concord. Syracuse in 1916 won the Poughkeepsie Regatta under the coaching of James A. Ten Eyck. In 1920 Charles E. Courtney, Cornell's rowing coach, the foremost of American coaches, died. The winners of the American Intercollegiate regatta after 1909 were Cornell (1910, 1911 and 1912), Syracuse (1913), Columbia (1914), Cornell (1915), Syracuse (1916 and 1920), Annapolis (1921). The Yale-Harvard races were won as follows: Harvard (1910, 1911, 1912, 1913), Yale (1914 and 1915), Harvard (1916), Yale (1919), Harvard (1920), Yale (1921).

Boxing.—The official maximum boxing weights (Great Britain and the United States) are as follows:—Flyweight, 8 st. (112 lb.); Bantamweight, 8 st. 6 lb. (118 lb.); Featherweight, 9 st. (126 lb.); Lightweight, 9 st. 6 lb. (132 lb.); Welterweight, 10 st. 7 lb. (147 lb.); Middleweight, 11 st. 6 lb. (160 lb.); Light-Heavyweight, 12 st. 7 lb. (175 lb.); Heavyweight, no maximum.

In 1920 the official list of the world's champions was:—*Flyweight*, Jimmy Wilde (Gt. Britain); *Bantamweight*, Peter Hermann (U.S.A.); *Featherweight*, Johnny Kilbane (U.S.A.); *Lightweight*, Benny Leonard (U.S.A.); *Welterweight*, Jack Britton (U.S.A.); *Middle*, Mike O'Dowd (U.S.A.); *Heavy*, Jack Dempsey (U.S.A.).

The results of the Amateur Boxing Association Championships in England were as follows in 1911–4:—

	Bantamweight	Featherweight	Lightweight
1911	W. W. Allen	H. Bavers	A. Spenceley
1912	W. W. Allen	G. R. Baker	R. Marriott
1913	A. Wye	G. R. Baker	F. Grace
1914	W. W. Allen	G. R. Baker	R. Marriott

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	Middleweight	Heavyweight
1911	W. Child	W. Hazell
1912	E. V. Chandler	R. Smith
1913	W. Bradley	R. Smith (walked over)
1914	H. Brown	E. V. Chandler

In professional contests the bantamweight championship of England was won by Digger Stanley against Alec Lafferty in 1912, by B. Beynon in 1913 (*vs.* Digger Stanley) and by Curly Walker in 1914 (*vs.* C. Ledoux). Fred Welsh was the lightweight champion of England in 1912 (*vs.* Matt Wells), 1913 (*vs.* H. Mehegan) and 1914 (*vs.* W. Ritchie). Johnny Summers was the welterweight champion of England in 1912 (*vs.* Arthur Evernden) and 1913 (*vs.* S. Burns). Jack Harrison was the middleweight champion of England in 1912 (*vs.* Private McEnroy). In 1913 (*vs.* Packy Mahoney) and 1914 (*vs.* Colin Bell) Bombardier Wells was the heavyweight champion of England, and in 1913 (*vs.* Alec Lambert) Kid Lewis was the featherweight champion of England. In 1912 Jim Driscoll (Cardiff) won the featherweight championship of the world against Jean Poesy (France); Jack Johnson (America) (heavyweight champion of the world) beat Jim Flynn (America); Georges Carpentier (France) beat Jim Sullivan (England); Frank Klaus (America) beat Carpentier; Billy Papke (America) beat Carpentier.

In 1913, in the middleweight championship of the world, F. Klaus beat Billy Papke; in lightweight championship of the world F. Welsh beat H. Mehegan; in featherweight championship of the world, J. Driscoll and Owen Moran drew; and in heavyweight championship of Europe, Carpentier beat Bombardier Wells.

In 1914, in lightweight championship of the world, F. Welsh beat W. Ritchie; and in heavyweight championship of Europe, Carpentier beat Gunboat Smith.

In 1915, at Havana, Jess Willard defeated Jack Johnson in the 25th round for the world's championship.

In 1919, at Toledo, U.S.A., Jack Dempsey beat Jess Willard (holder) for the world's championship in the 3rd round.

On Dec. 4 1919, at the Holborn Stadium, London, Carpentier beat Joe Beckett in a fight for the heavyweight championship of Europe. Beckett was knocked out in the first round after the fight had lasted one minute fourteen seconds. In 1921 Carpentier was beaten at Jersey City, U.S.A., by Dempsey, in the 4th round, in a contest for the heavyweight championship of the world, the greatest interest having been excited by this fight.

Swimming.—American swimmers in 1920 held a majority of the world's records. A large number of these records were held by three men—Duke Kahanamoku of Hawaii, Perry McGilvray of Chicago and Norman Ross of San Francisco. Kahanamoku won the 100-metre race at the Olympic games of 1920, establishing a new world's record of 1 min. $\frac{2}{5}$ sec. Ross was winner in two events (400 metres and 1,500 metres); Warren Kealoha of Honolulu was victorious in the 100-metre backstroke race, and the American team carried off the honours in the 800-metre relay. Two races were lost to Swedish swimmers. American women also proved themselves good swimmers, one of their triumphs was the defeat in 1919 of two Australians, Miss Fanny Durack and Miss Wylie, who visited the United States in that year. The victorious Americans were Miss Ethelda Bleibtrey and Miss Charlotte Boyle, both of Brooklyn. Miss Bleibtrey won a number of races at the Olympic games in 1920, where she established a record of 4 min. 34 sec. for 300 metres open water.

English Billiards.—Since the prohibition of consecutive spot hazards and the push stroke, English professionals have relied chiefly upon the top-of-the-table game. An innovation, however, was introduced in 1911 by the Australian, George Gray, who repeatedly made huge breaks by means of a series of losing hazards from the red ball. In all, he scored 24 breaks of four figures, of which the highest was 2,196. Gray invariably declined to play matches with ivory balls, and these breaks were not made under Billiard Association rules. H. W. Stevenson, though not at his best in 1911, beat M. Inman twice for the championship of the Billiards Control Club. In Jan. 1912 George Gray met Stevenson and defeated him in two games out of three of 18,000 up. M. Inman beat T. Reece for the Billiard Control championship in 1912, 1913 and 1914. In 1919 Inman beat Stevenson in the Billiard Association championship by 6,532 points in 16,000. In 1920 W. Smith beat C. Falkiner in the Billiard Association championship by 1,500 points in 16,000. In 1921 Newman beat Reece in the professional championship by 5,256 points in 16,000.

In 1911 H. A. O. Lonsdale did not defend his title of amateur champion, and the cup reverted to H. C. Virr. An alteration was made in the arrangements, the champions of England, Ireland, Scotland and Wales meeting in competition in the finals. Virr beat Major Fleming by only seven points in 3,000 for the amateur championship in 1912. The influence of Gray's example was plainly perceptible in this competition in the use made of the losing hazard. In 1913 Virr beat J. Nugent by 1,044 points in 3,000 and in 1914 by 1,962 in 3,000. In 1914 the Scottish championship was won by A. Croneen, and the Welsh championship by A. Paton. In 1915 the Welsh champion was A. Cable. In 1915 the United Kingdom Amateur Championship was won by A. W. T. Good (England) by 3,000 points to 2,716. In 1918 it was won by Graham Symes by 2,000 points to 1,721. In 1919 S. H. Fry won the Amateur championship by 2,000 points to 1,729, but in the Billiard Control Club's Amateur Championship Tournament was beaten by Major Fleming by 2,000 points to 1,903. In 1920 Fry again won the Amateur Championship, by 3,000 points to 2,488.

A break of 1,016 was made by Stevenson in 1912 against W. Cook, without a series of spot strokes, anchor cannons or long successions of losing hazards. Stevenson made a break of 919 in 1913, and in the same year M. Inman made one of 894. In 1903 the amateur S. H. Fry made a break of 236.

Archery.—The opportunity may be taken here to correct the earlier article on ARCHERY in some particulars. The bow now used by men is from 6 ft. 1 in. to 6 ft. 4 in. in length; a lady's bow ranges from 5 ft. 6 in. to 5 ft. 8 in., measured between the nocks; these lengths according in the one case with an arrow of 27 in. to 28 in. and in the other with an arrow of 25 in. to 26 in. Exceptionally long arms may render necessary an arrow an inch longer and a corresponding addition of one or two inches to the bow. The "weight" of a bow is the number of pounds required, when appended to the string, to draw to the head an arrow of 28 in. for a man's bow or 25 in. for a lady's. The weight of men's bows varies from 36 lb. to 58 lb., of ladies' from 18 lb. to 30 lb., the lighter weights being sufficient for beginners. Bows are styled "self" or "backed" according as they are made of one wood or of two or more glued together. "Self bows," if of yew, are usually made of two pieces joined by a double fish splice at the handle: as it is difficult to find a piece of this wood (incomparably the best) of sufficient length while free from knots. If made of lance they are invariably of a single piece. "Backed bows" may be of yew, backed either with the same wood or with hickory; or alternatively of washaba or of ruby, lance, or other woods backed with hickory; the back being the flat side of the bow, and the "belly" the rounded side. Three woods are sometimes employed, a thin strip of fustic being interposed between a belly of yew and a back of hickory. There should be an inflexible centre of about 21 inches, whence the bow should taper gradually towards each end. It should be straight, the back true, and, when strung, the string should appear to cut the belly into two equal parts. Self yew bows are the best. They are light in the hand, the sweetest to pull, and have the best cast; but they require careful handling. They are also expensive, costing from £5 to £15, and they are liable to "crysals," or tiny cracks, which gradually spread until the bow breaks. A yew backed yew, which is next in merit, can be bought for £5 and is somewhat less liable to crysals. Between the others there is little to choose, provided that they are properly made, and not "reflexed," as they are said to be when the ends bend outward; for these jar the hand. Their price varies from 25s. to 3 guineas. The string for a man's bow should be from 6 in. to $6\frac{3}{4}$ in. from the back of the bow when strung; for a lady's from $5\frac{1}{4}$ in. to 6 in., according to the length of the bow. The nock of arrows—it is never called the "notch"—should not be "cut square" but rounded. The feathers must be wing and not body feathers, which are quite useless. They should be from the same wing, *i.e.* right or left, about $1\frac{1}{2}$ in. long and tapering to the front from a depth of $\frac{1}{2}$ in. at the nock. If balloon-shaped, their greatest depth should be at one-third of their length from the nock-end.

With regard to target scoring and handicapping it should be noted that a St. George's Round has never been shot at a public meeting, or, indeed, at any meeting held within the last 60 years. Handicapping by the loss of rings has been obsolete for more than 35 years, nor is there any system which can rightly be called handicapping by points. Handicapping is now carried out either by dividing the archers into classes according to their powers, or by deducting percentages from their scores for previous successes.

As regards the history of archery, some corrections may also be made. The bow was used in war at a later date than 1860, viz. by the Japanese against the English at Surni Nosake, September 5 1864. Nor did the Armada year see the last appearance of the English archer. A company of archers was raised for the expedition to the island of Rhè in 1627. There were archers among the Russian troops in the Crimea. Again, the relation of Finsbury Archers, the Hon. Artillery Company and the Royal Toxophilite Society requires restatement. In July 1676, William Wood, Marshal of the Finsbury Archers, was sent round with a paper, signed by Sir E. Hungerford and others, setting forth that the "officers and others of the Society of Archers, within the cities of London and Westminster" have determined "that the bearer shall have a silver badge and bear the same as Marshall to the Queen's Majesty's Regiment of Archers." The names of the subscribers were appended (Guildhall MSS. 193). Consequently this badge or shield had no connexion with Oxford. The Finsbury Archers became extinct about 1761, but the Royal Toxophilite Society was not founded until 1781, when Mr. P. Constable, the last captain of the Finsbury Archers, joined it and handed to it the shield and other valuables. There was, therefore, no combination of the two clubs in 1841. It is incorrect to assert that the Finsbury Archers were not connected with the Hon. Artillery Company. They were connected, and under their powers shot over the Finsbury Fields up to 1657. The Archers' Division of the Hon. Artillery Company was formed by members of the Royal Toxophilite Society in 1784. (X.)

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SPRING-RICE, SIR CECIL ARTHUR (1859–1918), English diplomatist, was born in London Feb. 27 1859, the second son of the Hon. Charles Spring-Rice (1819–1870), sometime assistant under-secretary for foreign affairs, and grandson of the 1st Baron Monteagle. He was educated at Eton and Balliol College, Oxford, and entered the Foreign Office in 1882, becoming private secretary to Lord Granville in 1884 and précis writer to Lord Rosebery in 1885. He went to Washington as third secretary in 1886, and after various brief appointments went in 1895 to Berlin. In 1898 he became secretary at Teheran, and from there went in 1901 to Cairo as British commissioner on the Caisse de la Dette. In 1903 he went to St. Petersburg, first as secretary and later as councillor of embassy, remaining in Russia during the war with Japan of 1904–5 and the revolution of 1905. In 1906 he was sent to Persia as minister, having lately been created K.C.M.G., and his stay there coincided with the period of the delicate negotiations which preceded the signing of the Anglo-Russian agreement of 1907. In 1908 he was created G.C.V.O. and went to Sweden as minister, and in 1912 was appointed ambassador to the United States. Ill-health, however, prevented his undoubtedly brilliant capacity from making his work at all prominent during his tenure of this position. He died at Ottawa on his way home to England Feb. 14 1918. He married in 1904 Florence, daughter of Sir Frank Lascelles, and left two children.

SQUIRES, RICHARD ANDERSON (1880–), Newfoundland politician, was born at Harbour Grace, Newfoundland, Jan. 18 1880. He was educated at the Methodist College, St. John's, and Dalhousie University, Halifax. In 1902 he was admitted a solicitor, and in 1911 was called to the bar (K.C. 1914). In 1909 he entered the Legislature as Liberal member for the Trinity district, for which he sat until 1913. In 1914 he became Minister of Justice and Attorney-General, from 1914 to 1917 was a member of the Legislative Council, and from 1917 to 1918 Colonial Secretary. He was nominated leader of the Liberal party in Aug. 1919, and the same year became Prime Minister.

STAFF, MILITARY (*see* 25.752).—One result of the unqualified success which Prussian arms achieved in the wars of 1866 and 1870–1 was that the general staff principle, which had so largely contributed to give victory to the hosts controlled by von Moltke in those contests, was adopted by almost every military power during the last quarter of the 19th century. The exact nature of the arrangements necessarily varied in different countries, but the ideals sought after were the same. Thus in the different staff organizations as they were constituted in peace-time, work in connexion with devising plans for offensive operations and for ensuring territorial defence, duties dealing with the collection of military information, the superintendence of the education of officers, the conduct of manœuvres and the training of troops, were kept as far as possible distinct from administration—"*adjutantur*," as the Germans call it. Before the year 1900 most armies possessed a general staff which was more or less in close touch with its Government on the one hand and, thanks to its ramifications, with the troops on the other.

Only two of the more important nations—the United Kingdom and the United States—adhered for all practical purposes to previously existing systems, under which preparation for war was relegated to the background in staff duties. It is true that in either state certain improvements were effected by the military authorities, tending towards ensuring that at least some of the functions properly performed by a general staff should be allocated to special branches of the staff; but, such as they were, they did not go very far. Then came the S. African War of 1899–1902. The difficulties and disappointments encountered by British military forces in that protracted struggle, coupled with the unsatisfactory working of the staff in the field (especially in its higher grades) during the progress of the operations, made plain the need of reform, and the War Office was considering the question of far-reaching modifications of the system in force when, in 1904, the Government suddenly set up a "War Office Reconstitution Committee" charged with the duty of reorganizing the central administration of the army. The committee recommended a number of drastic alterations, but by far the most important of its proposals was that a General Staff Department, which was to constitute the foremost branch of the professional side of the War Office, should be created forthwith out of certain existing sections, with entirely new sections superposed. The committee further urged that a general staff organization, acting under the aegis of, and in close touch with, the general staff in Whitehall, should be introduced into military districts and commands. The recommendations of the committee were accepted by the Government, and so it came about that a British general staff was established ten years before the outbreak of the World War. During those ten years remarkable progress was made, and when the nation was confronted by the tremendous emergency of Aug. 1914 it had at its disposition a body of well-trained general staff officers, sufficient for the comparatively small army that was available to take the field at the opening of hostilities, although totally insufficient to meet the requirements of the vast forces which had to be improvised after war had broken out. The Government of the United States was still later than that of the United Kingdom in establishing a general staff of the kind that Scharnhorst had thought of a century before. This was only set on foot in 1911, six years before the entry of the Republic into the great conflict which was to upset so many preconceived ideas on the subject of conducting war, but which was to prove—even more conclusively than had the Franco-German War and the Japanese triumphs of 1904–5—how imperative it is under modern conditions for a state which embarks upon a serious struggle with a foreign foe to have an efficient and suitably organized military staff at its command. Owing to the very small number of trained general staff officers that were available when the country became committed to hostilities on a vast scale, the U.S. forces were even worse equipped in this respect when they took the field in Europe than were those of the United Kingdom in their greatly expanded form.

The remarkable progress that has taken place in science of recent years has tended to impose some entirely new duties upon military staffs, brought about their expansion in certain directions, and even necessitated the creation of some entirely new branches as part of their organization. There is, for instance, in the first place that development in railway communications which has occurred in most civilized countries and in many possible and actual theatres of war, as also the contriving of numberless devices by which the construction of new lines of rail is facilitated during operations in the field. Then again there is the question of electric communications, which to-day play so conspicuous a part in war. Improvements in small arms and in ordnance have brought it about that the volume of ammunition needed for the weapons in the hands of troops has come to be out of all proportion to the amount which experience had proved to be ample in campaigns of the past. Developments in mechanical traction are giving this an ever-increasing military importance, not merely from the point of view of the supplying of armies but also from that of their tactical employment. The appearance of the tank on the battlefield is another feature of very recent date which tends to increase staff work. Finally, there is the establishment of air power which has introduced a factor of incalculable importance as affecting the control of belligerent armies; whether the combatant aeronautical service of a nation form part of its military organization or be independent, its operations in time of war impose duties upon military staffs such as had not to be performed by them in any contest previous to the World War. In some cases it is mainly the general staff that finds its labours increased by these modern developments, in other cases the new work falls rather upon the administrative staff. But in all cases both subdivisions of the staff are, at least to some extent, affected.

One most important duty which devolves upon the general staff in a State compelled by its geographical position and by political and international problems to maintain fighting forces both by sea and by land is the establishing and the maintenance of intimate relations with the naval authorities. Such conditions prevail in the case of most maritime nations, and, where this is so, it is imperative that the two services shall be capable of

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effective coöperation in the event of war. Effective coöperation when an emergency arises can only be ensured if the military staff has been in close touch with the corresponding naval staff in time of peace. Much attention had fortunately been paid to this question in the United Kingdom during the period that intervened between the creation of the British general staff and the outbreak of the World War. Permanent contact existed between the thinking branches of the Admiralty and of the War Office. Problems which might possibly arise in the future had been examined by them in conference, principles of action had been laid down, details had been worked out, and to this is to be attributed the secrecy and the smoothness with which the British Expeditionary Force was transported across the Channel to France during the fortnight succeeding the declaration of war in 1914. Moreover, thanks to their being brought into contact at staff rides with naval officers and to the happy relations which existed between these two services, British general staff officers as a body had studied and were acquainted with naval doctrine and naval procedure, a great advantage when, as was the case at the Dardanelles, operations partook of an amphibious character. General staffs on the Continent did not, on the other hand, prove to be equally well-informed as to maritime conditions; this was made apparent during discussions such as often took place between military authorities representing the different Allies, concerning the policy which ought to be pursued in the Near East and other problems in which sea-power was necessarily involved. It is only natural, however, that a military staff which is representative of a sea-faring people should devote more attention to such subjects than will that of a non-maritime nation or of a nation possessing small maritime interests and limited maritime resources.

When a country elects to make of its air service a department of State distinct from the army, as has happened in the United Kingdom, it necessarily falls to the lot of the military general staff to maintain those intimate relations with the aerial general staff by which alone mutual coöperation can be secured in time of war. Under such circumstances the military general staff stands towards the air service as it does to the navy.

"War," said Clausewitz, "is only a continuation of State policy by other means," and elsewhere that "none of the principal plans which are required for a war can be made without an insight into the political relations." It was a recognition of this truth on the part of her Government that led to the triumphs of Prussia, first over Austria and then over France, in the days of von Moltke, the foremost professional interpreter of Clausewitz' doctrines. The executive in Berlin had during the middle decades of the 19th century been working hand in hand with the general staff. Sadowa and Sedan were the outcome. The history of the short-lived German Empire indicates that in later years a tendency made itself felt for the general staff to attempt to direct, and even partially to succeed in directing, the policy of the Government. A system of genuine militarism in its worst form began to creep in, which in due course brought untold disasters on the German people; but the passages quoted above from the great Prussian military writer do not inculcate anything of that kind. What they do inculcate is that there should be at all times an intimate understanding between what has been called the "brain of the army" and the civilian executive at the head of the State. The truth is that any Government which understands its business will always, when any question of a delicate nature arises between it and the rulers of some foreign Power, keep itself fully acquainted with the resources at command for enforcing its wishes should a quarrel supervene. If, moreover, the most is to be made of such fighting force as a country will dispose of in the event of finding itself in a state of belligerency with some neighbour, it is indispensable that the military—as also naval—authorities shall have made beforehand a study of the strategical situation that will, as far as can be foreseen, arise when hostilities break out. It is also indispensable that those authorities shall have been made aware in advance of the likelihood of the struggle's taking place. It is on the central directing branch of the general staff, *i.e.* on the General Staff Department at the War Office in the case of the United Kingdom, as it was on the "Great General Staff" of the days of von Moltke and the German Empire, that devolves the duty of maintaining relations with the Government and of advising it regarding the military aspect of problems created by the international situation. That central directing branch of the general staff is entitled to expect that the Government shall keep it fully *au courant* with the political conditions of the day.

The merits of the doctrine preached by Clausewitz seem to be self-evident, but leaders of opinion in the United Kingdom were slow to realize its importance. There existed an almost unaccountable inability to perceive the dangers to which a State unprepared for emergencies is exposed. When a Royal Commission presided over by Lord Hartington virtually recommended the setting up of a general staff in 1889, one of its members, a prominent politician who at a later date came to be Prime Minister, actually—in one of the most fatuous documents ever written by a public man—objected to the proposal on the grounds that, owing to its peculiar position, Great Britain had no need to study possibilities of conflict in advance. With such ineptitude in influential quarters, the bitter experiences of the S. African War were required to awaken British statesmen to a realization of their responsibilities. The lessons of that contest were to some extent learnt. By the setting up of the Committee of Imperial Defence, in which professional opinion was given a powerful voice, some preliminary steps had been taken in the right direction even before the creation of the general staff in 1904, and, subsequent to that date, the general staff at the War Office has been constantly consulted by the British Government and has been kept well-informed on all points of importance connected with the international situation.

How, as a matter of administration, the relations between the general staff and the executive are to be governed, and by what process communications between them are to be carried out, necessarily depends upon the political system in vogue in the state concerned. In any country possessing representative institutions the general staff can only be acting in a consultative capacity, at all events in peace-time. In the United Kingdom in the years preceding the World War the Chief of the Imperial General Staff and the Director of Military Operations were *ex-officio* members of the Committee of Imperial Defence. When strategical or administrative questions in which military force was or might be concerned were to be discussed by the committee, documents setting out the general staff view on the subject were laid before it by the general staff representatives. The decision of the committee on the points under discussion was taken and recorded, and executive action sometimes followed if it was involved by the decision. But although the more prominent members of the Government were included in it, the committee itself was merely a consultative body, and no executive action involving expenditure could follow on one of its decisions without the obtaining of at least nominal Cabinet sanction. Such recommendations were liable to be vetoed on account of the expense by the committee without reference to the Cabinet. Moreover, it did not necessarily follow that the view of the general staff would be accepted by the committee even on academical questions.

An interesting example of the working of the system is provided by the story of the Dardanelles. The expediency of an attack upon the Straits in the event of a war with Turkey was gone into by the committee as an academical question in 1906. The general staff were opposed to such a venture and the Admiralty representatives in the main agreed with them, the committee decided that the undertaking would in the event of a contest be inadvisable, and the result was that study of the subject on the part of the general staff virtually ceased. When early in the World War the project was brought up afresh by the First Lord of the Admiralty, the decision which the Committee of Imperial Defence had arrived at eight years before was ignored, and when the operations were undertaken their progress was hampered by lack of information, owing to the general staff's having acted on that decision and having to some extent abandoned research with regard to the topography, the resources and so forth of this

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potential theatre of war. But experience proved that the general staff had been right.

When hostilities arise some instrument a good deal more effective than a consultative committee is needed to control conduct of the war, and, from Aug. 1914 to the date of the Armistice, the operations were, in the case of the United Kingdom, for the first two and a half years of the struggle under supreme charge of various forms of war council directly representative of the Cabinet and given a free hand by that body. They were later under supreme charge of the specially established War Cabinet. The general staff was practically always represented at the meetings of the war councils and of the War Cabinet, but purely in an advisory position without voting power. They were responsible to the council or the Cabinet for the advice they gave, but the council or the Cabinet was responsible to the country for accepting or rejecting that advice. It is true that as a result of somewhat peculiar conditions that held good in the early days of the struggle, attributable partly to the unique personality of Lord Kitchener and partly to the weakening of the general staff at the War Office when its cream was skimmed off and dispatched to the Continent, the influence of the brain of the army was not for a time exerted very effectually in the councils of the Government. But that was only a passing phase. At a later stage the general staff was always at least allowed to express its views, even if its opinion was not necessarily accepted.

As a matter of fact its opinion was occasionally ignored in questions of considerable importance. This was no doubt partly due to some want of confidence in its judgment felt in Government circles owing to the slow progress made towards victory, and partly due to the personality and the temperament of certain members of the Government itself. The general staff also must have been sometimes at fault on occasions when its advice was rejected, although, should the full facts ever be made known impartially, posterity will probably pronounce it usually to have been right. Still, a general staff, however well-organized it may be and however gifted and informed its personnel, is not infallible. That this is so was demonstrated in the protraction for years of the World War, whereas the British general staff had at the outset confidently reckoned on its only lasting some months. The German general staff, again, looked with contempt upon the huge forces that Lord Kitchener was known to be improvising, until the value of the British "New Armies" was proved up to the hilt in the field; and at a later stage of the struggle it totally miscalculated and underestimated the military potentialities of the United States. Moreover, all the European general staffs alike, in their forecasts made in time of peace, underrated the wastage in personnel and the expenditure in ammunition in a modern campaign on a great scale.

It has been said that a general staff must "think politically." If this maxim is merely to be taken as meaning that a general staff should appreciate political habits of thought, watch political tendencies, and keep itself acquainted with the political aspects of every question influencing military action alike in peace and in war, its truth is indisputable. But one of the most important duties falling to the lot of a general staff, especially in times of emergency, will often be to strive to prevent mere policy from adversely influencing the conduct of operations of war or affecting Government decisions in connexion with military subjects. History provides some striking examples of political considerations gravely prejudicing the prospects of armies in the field. MacMahon's fatal march to Sedan was a case in point. The retention of Gen. Penn Symons' advanced force at Glencoe in the opening days of the Natal campaign of 1899 furnishes another instance. Had the question at issue been regarded solely from the soldier's point of view, it is more than doubtful whether Gen. Townshend would ever have been launched on his ill-omened effort to reach Bagdad in Nov. 1915. When problems of this kind present themselves, a general staff will often have a difficult and delicate rôle to play. But the golden rule to govern its conduct on such occasions would seem to be that it ought to regard and present the problem from the fighting point of view alone. The politicians can look after the political side.

It cannot be too clearly understood that neither in the United Kingdom nor in any other military state does the staff of an army in reality consist of a general staff alone. There must always be what, for lack of a more distinctive nomenclature, is called in the British service its "administrative" side—although in point of fact many of the duties of a general staff are necessarily of an administrative character. It is indeed the case that, at least in peace-time, the administrative staff of an army is in a sense the more important of the two. The army has to be recruited and fed and clothed and equipped, and its discipline has to be maintained, otherwise there will be no troops for the general staff to dispose of and there will be no *raison d'être* for the general staff. Whereas the general staff will often in peace-time be engaged on work which in the event may prove of little profit, the administrative staff is constantly busy disposing of questions which if not dealt with will cause a collapse. Calling the administrative staff "*adjutantur*" may alter its status and may lower its dignity, but does not alter the fact that it is a staff and that it performs staff duties. The organization as affecting the administrative staff that was introduced into the War Office in the United Kingdom in 1904, and in due course extended throughout the army (the details of which have been touched upon in earlier paragraphs), worked extremely well both at headquarters and with the troops during the pre-war period, and it also gave good results when subjected to trial at manœuvres between 1909 and 1914. The same staff organization was extended to India shortly after it came into force in the United Kingdom. Nor, when it came to be put to the test in warfare on a gigantic scale in many parts of the world, was it found wanting. Although the problems engaging the attention of the quartermaster-general's staffs and the inspector-general of communications' staffs were in many respects fundamentally the same in the Gallipoli Peninsula, in Mesopotamia, and in France and Flanders, the wide differences in the geographical and topographical conditions as between the three theatres of war obliged the problems to be solved on separate lines in each case. In France and Flanders several railways connected the troops at the front with the secure and well-equipped ports that acted as bases. In the Gallipoli Peninsula open beaches under fire served for bases, and the communications were to all intents and purposes maritime. For most of the time in Mesopotamia it was a case of an army dependent on one single line of river communication, hundreds of miles long, although the river was gradually to some extent supplemented by specially constructed sections of railway. And yet the organization of the administrative staff as it had been designed in peace-time met requirements under these diverse sets of circumstances. Where failures occurred, they were due to errors in execution or else to lack of essential resources. Such alterations as have recently been carried out as a result of the teachings of the World War have been in detail and not in principle.

The British plan subordinates the administrative staff to the general staff less than is the common practice. This is perhaps due to the nature of British campaigns of the 1874–1902 era, campaigns fought in regions often destitute of communications and always poor in resources. Almost everything hinged on supply and transport in these contests, and the transport generally had to be improvised on entirely new methods for each particular case. Losses in action were as a rule trifling as compared to losses from disease. For one thought that the commander or his chief advisers gave to the enemy, ten thoughts were given to communications. Instead of looking to the front they were generally looking to the rear. Duties such as are now apportioned to the administrative staff greatly outweighed in importance duties such as are now apportioned to the general staff. There was little difficulty in beating the enemy if only supplies could be got up to permit a fight. But, to whatever cause it may be attributable, the fact remains that the chief of the general staff of a British army nowadays is merely in the position of *primus inter pares* relatively to the adjutant-general and the quartermaster-general—and it is the same at the War Office. In almost all other armies, on the other hand, including that of the United States, the chief of the general staff is definitely chief

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of the staff. And he also is usually called chief of the staff, the heads of different branches of the administrative staff being absolutely subjected to him. The "chief of the staff" plan was moreover adopted in the case of several British campaigns of modern date, *e.g.* that of 1882 in Egypt and Lord Wolseley's and Lord Kitchener's expeditions up the Nile in 1884–5 and 1898. A chief of the staff was appointed to Sir R. Buller at the outset of the S. African War (although owing to unforeseen events he never took up the post), and at a later date Lord Kitchener went out as chief of the staff to Lord Roberts.

If the existing British staff organization comes to be compared with those where the chief of the general staff is also chief of the staff, it will be found that there is something to be said on both sides. That part of the British system under which a command or a district is in peace-time supplied with a superior officer in charge of administration, to whom wide responsibilities are allowed and who is generally in practice senior to the principal general staff officer, permits the general in command to devote nearly the whole of his attention to preparing his troops for war. But that arrangement would be unworkable in the field. There the progress of operations is so dependent on the work of the administrative staff that the commander cannot transfer his authority in connexion with the latter to somebody else—as is recognized in the British staff organization in time of war by the heads of the adjutant-general and the quartermaster-general staffs, as well as the inspector of communications, then dealing direct with the commander. Still, the fact that a peace arrangement does not fit in with the requirements of war is not a conclusive argument against that arrangement's holding good in peace-time, which after all represents the normal condition of things; and the British plan of a chief of administration is only a special feature in a larger question. Objections do undoubtedly exist in peace-time to the supremacy of the chief of the general staff. That automatically makes him responsible for the work of the administrative staff, and as all manner of administrative problems—unimportant problems, perhaps, but problems which have to be solved—are constantly arising in peace-time, most of the chief of the general staff's time may come to be occupied with matters that are not general staff matters at all, and military policy, manœuvres, training of troops, higher instruction, defence schemes, and so forth, may suffer. But, if peace represents the normal state of affairs, armies none the less exist for purposes of war, and in time of war the case for the British system is not so strong.

In face of the enemy, operations—planning them, deciding whether the plan is feasible, and taking the necessary steps for their execution—are of paramount importance, but cannot be said actually to govern administration, for unless the army's establishments are maintained and unless it has its food, its ammunition, etc., it cannot carry out the operations. The success of the plan may in the main depend on strategical and tactical factors; but in framing the plan the duties which the administrative staff will have to perform in connexion with its execution must have been considered with meticulous care. It is for the administrative staff to say whether the plan is feasible from the point of view of supply, transport, depots, hospital service, and so forth. There may be great administrative difficulties in the way, which will as a matter of course be represented. It is, however, for the general staff to weigh the administrative as against the strategical aspects of the case and then lay the whole subject before the commander for a final decision. The British *Field Service Regulations* clearly admit by implication that the chief of the general staff is the superior of the adjutant-general, the quartermaster-general and the chief of communications, without their being actually under him. That, under conditions such as develop on active service, is apt to prove a somewhat clumsy arrangement and to give rise to friction. It is neither one thing nor the other. Granted that the "chief of the staff" system means centralization, granted that it demands from the chief of the general staff a somewhat closer acquaintance with purely administrative questions than would be necessary if the heads of the chief branches of the administrative staff were virtually his equals, even granted that under it less of his time will be available for the consideration of the strategical and tactical situation than would otherwise be the case, the system does seem a more satisfactory arrangement for purposes of operations in the field than that which found favour in the British army after the setting up of the Army Council. Nor would it seem to follow as a matter of course that the "chief of the staff" system must not be adopted in war-time, simply because it does not obtain during peace. (C. E. C.)

STAMBOLIISKI, ALEXANDER (1879–), Bulgarian statesman, was born at Slavovitsa in Bulgaria Sept. 1 1879. He was of peasant origin, but obtained a good education at Sofia and then at Halle in Germany. In 1902 he became editor of the newspaper of the Agrarian League and later entered the Sobranje. He soon acquired great influence among the peasants, and from the first took up an attitude of fearless opposition to King Ferdinand's policy. In 1908 Stamboliiski headed the Agrarian protest against the Declaration of Independence, as being in the interest of the dynasty rather than of the people. In 1911 he made a violent speech in the Grand Sobranje, opposing the amendment to the constitution by which the King was given the right to make secret treaties, and in 1913 he openly accused the King of having brought about the calamitous war with Serbia. On Sept. 17 1915 Stamboliiski accompanied the other leaders of the Opposition to the palace, and, in a forcible speech and later in personal conversation, he warned the King with characteristic *brusquerie* that if he again plunged the country into war it would end in disaster and that he would lose his throne, if not his head. Stamboliiski was then condemned to imprisonment for life, and was kept in strict and painful confinement from Sept. 30 1915 for three years; he was, however, allowed access to books and spent much of his time in study and writing. On Sept. 25 1918, when imminent catastrophe compelled Bulgaria to seek an armistice, he was released, and, after a stormy interview with the King, went to the front, where a revolutionary movement among the troops was developing. He returned with the insurrectionary troops to Sofia, and order was restored only after much loss of life; Stamboliiski was obliged to go into hiding, even after the King's abdication. The Government, however, soon realized that his help was essential in the critical state of the country, and he became Minister of Public Works in Todorov's Cabinet. Although the Agrarians had not an actual majority after the election of Aug. 1919, Stamboliiski became President of the Council and Minister for Foreign Affairs; on Nov. 27 he had the courage to sign the Treaty of Neuilly on behalf of his country. In April 1920 the Cabinet was reconstructed, Stamboliiski remaining as Premier, Minister for War and of Foreign Affairs in a Cabinet composed entirely of his own followers.

STANFORD, SIR CHARLES VILLIERS (1852–), Irish musical composer (*see* 25.773), published in 1911 *Musical Compositions;* three years later appeared *Pages from an Unwritten Diary* and in 1916 *A History of Music,* written in conjunction with his former pupil, Cecil Forsyth. In later years his music included the operatic piece *The Critic* (op. 144), produced by Beecham in 1916, and *The Travelling Companion* (op. 146), which won a Carnegie award in 1917, but had not yet been produced in 1921. In 1919 his symphony *L'Allegro ed Il Pensieroso* also won a Carnegie award, and in 1921 his setting of a poem by Mr. Justice Darling entitled *At the Abbey Gate*—the point being the burial of the Unknown Warrior in the Abbey—was produced by the Royal Choral Society in the Albert Hall. Stanford's *Songs of the Fleet,* originally produced in 1910, gained great popularity, and he also composed much chamber music.

STANMORE, ARTHUR HAMILTON HAMILTON-GORDON, 1ST BARON (1829–1912), British administrator, was born Nov. 26 1829, the youngest son of the 4th Earl of Aberdeen. He was educated at Cambridge and afterwards entered politics, becoming private secretary to the Prime Minister, Lord Derby, from 1852 to 1855, and sitting as member for Beverley from 1854 to 1857. He was successively governor of Trinidad (1866–70), Mauritius (1871–4), Fiji (1875–80), New Zealand (1880–2) and Ceylon (1883–90). He was raised to the peerage in 1895, and

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died in London Jan. 30 1912. He was succeeded by his son, George Arthur Maurice Hamilton-Gordon, born Jan. 3 1871, who in 1916 was appointed lord-in-waiting to King George V.

STEAD, WILLIAM THOMAS (1849–1912), English journalist (*see* 25.817), was drowned on the "Titanic" April 15 1912.

STEED, HENRY WICKHAM (1871–), English journalist, was born at Long Melford, Suffolk, Oct. 10 1871, the son of a local solicitor, and was educated at Sudbury grammar school and the universities of Jena, Berlin and Paris. From 1896 to 1913 he acted continuously as foreign correspondent to *The Times*, beginning in Berlin, passing on to Rome, where he remained five years (1897–1902), and thence to Vienna (1902–13). His *Hapsburg Monarchy* (1913; 4th ed. 1918) is recognized as the most illuminating work that has been written on Austria-Hungary. In 1914 he became foreign editor (in London) of *The Times*, and in Feb. 1919 was appointed to succeed Mr. Geoffrey Dawson as editor. During the World War he was a prominent supporter of the Yugoslav movement. In 1918 under Lord Northcliffe he was engaged on propagandist work in the enemy countries, and he headed a special mission to Italy in March and April of that year. His other publications include *The Socialist and Labour Movement in England, Germany & France* (1894); *L'Angleterre et la Guerre* (1915); *L'Effort Anglais* (1916); *La Democratie Britannique* (1918).

STEER, P. WILSON (1860–), English painter (*see* 25.868), exhibited after 1886 practically the whole of his work at the New English Art Club, in whose formation he took a leading part and of which he was at one time president. His earlier work, such as the "Boulogne Sands" showed the influence of impressionism in its feeling for light and its handling of colour; but after 1895 he adopted a more sober palette, at times using strong black shadows with silvery lights, and gave increased attention to design. After 1900 he returned to the use of a full range of pigment, and produced some of his finest work, such as "Richmond after Storm" (1903) and "The Isle of Purbeck" (1909). In later years he only used the impressionist colour analysis to a very limited extent, and generally worked within a chosen and limited colour scheme. His feeling for colour harmony and power of rendering subtle variations in tone relate him to Gainsborough (a likeness well exemplified in "The Beaver Hat"), and give his work its characteristic quality. Most typical perhaps are his landscapes, mainly wide stretches of country with broken skies, full of light, atmosphere and a sense of space; but he also produced many portraits and figure compositions, his paintings of the nude being marked by great appreciation of the character and quality of flesh. His later work includes "A Summer Evening" (1914), "Painswick Beacon" (1916), "The Vale of Gloucester" (1917), "Chirk Castle" (1917), and a considerable group of water-colours, very delicately and directly handled. A self portrait is in the Uffizi Gallery, Florence, and he is represented in the Tate Gallery, the Municipal Gallery, Dublin, and the Johannesburg Gallery.

STEFÁNSSON, VILHJÁLMUR (1879–), Canadian explorer, was born at Arnes, Manitoba, Nov. 3 1879, of Icelandic parentage. He was educated at the universities of North Dakota and Iowa, and afterwards at Harvard. He became a newspaper reporter, but later was appointed to an instructorship of anthropology at Harvard, and became deeply interested in the problems of the Arctic regions. He made a private expedition to Iceland in 1904, and the following year returned with a Harvard archaeological expedition. He visited the Eskimo of northern Alaska (1906–7), and in 1908 started on a four years' expedition to the Arctic shores of Canada under the auspices of the Geological Survey of Canada and the American Museum of Natural History, with interesting results. In 1913 Stefánsson was appointed commander of the Canadian Arctic expedition which sailed from Victoria, B.C., in June of that year to explore the northern shores of Canada and Alaska. In 1914, with two companions, he crossed Beaufort Sea on the moving ice from Martin Point, Alaska, to the north-western corner of Banks I.; in 1915 he visited the sea west of Prince Patrick I. and discovered more land to the north; and in 1916 discovered land west of Axel Heiberg Island. The following year he travelled, again over moving ice, as far as lat. 80° 30′ N. and long. 112° W. The expedition returned to Canada in 1918 (*see* ARCTIC REGIONS). Stefánsson published *My Life with the Eskimo* (1913), *The Friendly Arctic* (1921) and an anthropological report on the expedition of 1908–12, besides many articles in scientific journals. He received many honours from learned societies.

STEIN, SIR (MARK) AUREL (1862–), British archaeologist, was born at Budapest Nov. 26 1862. Educated in the public schools of Budapest and Dresden and afterwards at the universities of Vienna and Tübingen, where he studied Oriental languages and antiquities, he went to England for further study and then to India, where he became principal of the Oriental College, Lahore, and registrar of the Punjab University in 1888. Eleven years later he was appointed to the Indian Education Service, and for the next two years carried out archaeological explorations for the Indian Government in Chinese Turkestan. In 1906–8 he made further explorations (*see* 27.425) in central Asia and western China, receiving the gold medal of the Royal Geographical Society. From 1909 he was superintendent of the Indian Archaeological Survey, and in 1913–6 carried out explorations in Persia and central Asia, described by him in the *Geographical Journal* (1916). He was created K.C.I.E. in 1912. His other publications include *Chronicle of Kings of Kashmir* (1900); *Ancient Khotan* (1907) and *Ruins of Desert Cathay* (1912).

STEVENSON, ADLAI EWING (1835–1914), American political leader (*see* 25.907), died at Chicago June 13 1914.

STEWART, JULIUS L. (1855–1919), American painter (*see* 25.914), died in Paris Jan. 4 1919.

STEYN, MARTINUS THEUNIS (1857–1916), Dutch S. African politician (*see* 25.915). After the prominent share which he took in the work of the S. African National Convention in 1909–10 ex-President Steyn retired into private life at his farm, Onze Rust (Our Rest), near Bloemfontein. From this retirement he never emerged till his death Nov. 28 1916, except to address occasional meetings of the Dutch people of S. Africa on topics of national interest. Yet this almost complete retirement from public activities did nothing to lessen his influence with his own people. It cannot be said that this influence was exercised to promote racial peace in S. Africa. When the dissension between Gen. Botha, the first Prime Minister of the Union of S. Africa, and Gen. Hertzog began to shake the frame of the Ministry, ex-President Steyn might have had a decisive influence in composing that difference, which was ultimately to break Gen. Botha's Cabinet and to lead to long dissension among the Dutch-speaking people of S. Africa. His weight, however, was thrown without reserve on the Hertzog side. The ideas of ex-President Steyn were the ideas of Kruger. He held with tenacity the creed of the Boer who regarded himself as the holder of S. Africa by a species of divine right, who resented the intrusion of the British element, and was determined to treat that element as intruders and "foreign adventurers." Beyond doubt they were sincere, if narrow. He held, as Kruger had held, and as Gen. Hertzog held, that the intrusion of the British element involved a descent into the muddy waters of commercialism, the strife of contending ideas and embroilment in the tangles of world-politics.

STINNES, HUGO (1870–), German industrialist and financier, was born at Mülheim on Feb. 12 1870. He was the son of Hugo Stinnes, and grandson of Matthias Stinnes, who was the founder of a firm in no great way of business at Mülheim in the Ruhr district. After passing his leaving examination from a *Realschule*, young Stinnes was placed in an office at Coblentz where he speedily picked up the elements of a business training. In order to get a practical knowledge of mining he worked for a few months as a miner at the Wiethe colliery. He then, in 1889, attended a course of instruction at the Academy of Mining in Berlin. In the following year he entered the firm which his grandfather had founded. He remained there only two years and then established a firm of his own, Hugo Stinnes, Ltd. The whole original share capital was 50,000 marks (pre-war = £2,500). Gradually, from dealing in coal, he became

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himself the owner of several mines and extended his business to the manufacture of different kinds of fuel such as briquettes. He also began to purchase sea-going vessels as well as river steamers and barges, the latter, especially on the Rhine, on a constantly increasing scale. He next organized an extensive international business in coal, and had 13 steamers trading to and from North Sea, Baltic, Mediterranean and Black Sea ports. They carried coal, wood and grain, also iron-ore, Stinnes having begun to manufacture iron and steel. He also imported great quantities of English coal and had an agency at Newcastle as well as an interest in some English mines. This led to his establishing branches of his business at Hamburg and at Rotterdam. Before the World War he was the possessor of a fortune which was vaguely estimated at several millions of pounds. He was a director of many of the greatest industrial and mining companies of Westphalia, the Rhineland and Luxemburg. Business interests of this magnitude were constantly expanding, and he became interested in numerous subsidiary enterprises, such as tramways and the supply of electric power and light. He was always engaged in founding new concerns or amalgamating existing ones. Stinnes managed to maintain an extensive and even a detailed knowledge of the working of all the concerns in which he was engaged, and in all of them to exact zealous and conscientious work from his business subordinates. The secret of his success was essential unity of direction and coordination of aims in all branches of his enterprises.

When the World War broke out he secured an enormous share in the war profits which flowed into the coffers of the great industrialists. In enemy countries, it is true, his enterprises were sequestrated, and his firm at Rotterdam placed on the Allies' "black list." But he was richly compensated, apart from the regular indemnification paid by the German Government, when he was called in by Ludendorff as the most competent expert to give advice, to organize the coal and the industrial production of occupied Belgium and to help to set in motion the gigantic production of war material which the German G.H.Q. demanded from the homeland. His connexion with Ludendorff led to his becoming an influence behind the scenes in German politics, and, after the revolution, to his entering the Reichstag, as well as to his début as a newspaper proprietor on a grand scale. During the war he had extended his activities in Hamburg and had bought up in 1916 the Woermann and the E. African lines. In these fresh undertakings he became associated with the two greatest German shipping concerns, the Hamburg-American line and the North German Lloyd. His Hamburg interests continued from that date onwards to multiply in something like geometrical progression. Half a dozen landed estates were purchased in Saxony to supply timber for pit props. At Flensburg in Schleswig he secured control of the largest Baltic shipping concern, and proceeded to build a new fleet of ships, christening one of them the "Hindenburg." In the elections of June 1920 he secured a seat in the Reichstag as a member of the Deutsche Volkspartei, the new electioneering name of the former National Liberal party. He had about the same time begun to buy up leading German newspapers, one of his main objects being to organize a solid and powerful *bloc* of opinion in Germany in support of law and order and the promotion of the highest industrial and commercial efficiency. His newspaper purchases included the *Deutsche Allgemeine Zeitung* in Berlin, formerly the organ of Bismarck and then of all succeeding German Governments, the *Münchener Neueste Nachrichten* and the *München-Augsburger Zeitung*, the last-named being one of the oldest newspapers in Germany. Both of the South German journals were previously exponents of a very much more democratic trend of opinion than that which came to characterize them under the new proprietorship. Ancillary to these acquisitions large interests were secured by Stinnes in paper-works in order to make his newspapers independent of the paper market.

In the autumn of 1921 he was reported to be contemplating some still vaster venture in the nature of a super trust to control every industry in Germany, so that the whole might ultimately be coördinated like one gigantic concern regulating production, transport and the supply of the German markets and those of the whole world. It might thus be possible to avoid waste, sudden crises, ruinous competition and foreign commercial dictation. He was reported to have already expended the equivalent of about £250,000,000 on these aims and to be continuing to sink further millions in them. The Social Democrats were believed not to be averse from Stinnes' vaster scheme, as it corresponded in certain aspects with their own plans, when they were in power, for coördinating all German industries, pending the possibility of socializing them. An instrument for superintending this coördination in the social and economic aspects was ready to hand in the Economic Council of the German Reich, set up by the new Republican constitution of 1919.

The only public check which Stinnes was known to have received in the course of his career was at the Spa Conference in 1920, when he attempted to address that assembly in peremptory language concerning the impossibility of the coal deliveries demanded by the Allies and was summarily silenced by the president.

STOCK EXCHANGE (*see* 25.930).—Before the outbreak of the World War in Aug. 1914 the London Stock Exchange had for several years experienced two remarkable periods of activity, both being the outcome of industrial development which caused a rapid intensifying of the demand for two commodities—namely, oil and rubber. This was the sequel to the discovery of the internal-combustion engine. and its increasing adoption in mechanical road transport.

Pre-war Rubber and Oil Booms.—The rubber boom came first. It began in 1909, and lasted until about 1912. The demand for rubber applied a great stimulus to the rubber plantation industry in the Malay States, the Dutch East Indies, Ceylon and India. The price of rubber rose at one time to over 12s. per lb., and an enormous number of new companies were formed, mostly with capitals of moderate size. In order to popularize rubber as an investment the resourceful company promoter introduced shares of the denomination of 2s. each. The innovation was extraordinarily successful, and a very large number of companies were floated with capital divided into 2s. shares, while others formed prior to the boom sub-divided their shares into the smaller and more popular denomination. Prices of shares rose to extraordinary heights. Premiums of thousands per cent were common, the shares of the Patalung and Selangor companies, two of the earliest plantation companies, rising to premiums in excess of 3,000 per cent. In Stock Exchange parlance the public "got the bit between its teeth," and the boom persisted for a long time. Large fortunes were made by people who participated in the boom in the early period. A reaction in the price of rubber, which ultimately fell below 1s. per lb. in 1921, had already put an end to the boom before the war began. Although the extravagant prices paid during the boom were at no time justified, the companies paid very satisfactory dividends for years; and it was not until the post-war depression, which was unparalleled in its severity, swept over the commodity markets in the latter part of 1920 and the first part of 1921 that the industry was faced with real difficulties. The tremendous stimulus applied to planting in 1910, 1911 and 1912 led to the inevitable overproduction, and in 1919 and 1921 schemes for limiting output were put into force.

The oil boom began shortly after the activity in rubber had been well spread. It persisted for a longer period, for the reason that the price of oil rose steadily from the introduction of the motor-car. It eventually reached its maximum height in 1920, but a reaction began in 1921, and this produced a corresponding movement in the share market. There was an enormous demand for petroleum spirit in the war period, and the price rose steeply. After the cessation of hostilities the price rose further, a circumstance which was partly due to the conversion of locomotives and ships' engines from coal to oil, partly to the great extension of mechanical transport on the road and in the air, and partly to the fact that the refinement and distribution of oil was in the hands chiefly of two vast organizations. The boom was accom-

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panied by the flotation of a number of companies, particularly in Russia, where the Maikop field for a time attracted much attention. But in comparison with rubber, oil did not provide the same opportunities for the company promoter, and the flotation of companies for the exploitation of oil-fields, known and unknown, was comparatively limited. The oil boom lasted approximately 10 years, when a reaction set in. But meanwhile huge fortunes were made. Bonus shares were issued in great numbers by the principal oil companies, and this, together with high dividends, kept public interest at a high level.

With the exception of the oil market, stock markets were in a depressed condition for some time before the outbreak of war.

The War Period.—Early in July 1914, rumours of war began to affect the Continental *bourses*. On July 13 the Vienna market was demoralized by fear of hostilities, but it was not until July 24, when the terms of the Austrian ultimatum to Serbia were made known, that the London market became seriously perturbed. From that date until Friday July 31, when the London Stock Exchange Committee for General Purposes decided to close the House for an indefinite period, markets were inundated with a vast flood of selling orders from home and abroad, and excitement was intense. The European *bourses* virtually ceased to function, and this diverted an enormous stream of foreign selling orders to London. Inter-*bourse* securities naturally suffered a very heavy decline. On Monday July 27 many London jobbers ceased to "make prices." This was "general carry over" day, and the difficulties to be met by speculators were formidable. The settlement, however, was completed on Wednesday July 29, without any very serious disaster, though 9 failures, involving 20 members, were announced. Dealing, however, had become a matter of negotiation entirely, and on Thursday July 30 1914 the House opened for the last time that year. During the first two hours no attempt was made to do business, and the next morning the committee decided not to reopen the House until further notice. On Monday July 27 four consecutive transactions in consols were officially recorded at prices showing a movement of £1 between each bargain, a circumstance without precedent in modern London Stock Exchange history. During the closed period, business, despite official discouragement, was not entirely suspended. A certain amount of dealing, on a strictly cash basis, was found to be possible. On Sept. 14 the committee fixed minimum prices for trustee stocks, based on the quotations ruling on July 30, the object being to prevent disastrous depreciation. The New York Stock Exchange similarly made minimum prices for American shares, and these values were adopted by the London committee. The maintenance of these prices was insisted upon by the banks, which had undertaken to continue their loans against securities without asking for any additional margin.

Meanwhile the question of dealing with the uncompleted mid-August account was taken in hand on the London Stock Exchange and completed on Nov. 19, a special set of rules governing its arrangement. The gist of these rules was that bulls of stock carried over on July 27 should put up a 5% margin on high-class securities, and 10% on others, and pay interest fortnightly, or alternatively pay a higher rate of interest in lieu of margin. The "taker in" was put under the obligation of continuing to "take in" stock at July 27 prices until 12 months after the war, or the expiring of the Courts (Emergency Powers) Act, 1914, whichever event was the sooner. The declaration of a moratorium, which was continued until Nov. 4 1914, made it impossible to reopen the Stock Exchange for some months. About £90,000,000 had been borrowed against securities before the war began, and it was not until the moratorium came to an end that the mid-August settlement was carried through. The affairs of a small number of members were in this operation wound up under the liquidation rule, but the amount of stock carried over under the temporary regulations was smaller than had been feared. As stocks rose to the mean price of July 27 they had to be taken up or sold. On Dec. 23 1914 the conditions governing the reopening of the London Stock Exchange were promulgated. The minimum price list was then extended to include inter-*bourse* securities. Minimum prices were gradually abolished as liquidation ceased and prices settled down to the new level of investment values. On July 3 1916 the last of the minimum prices were removed.

The London Stock Exchange was reopened for the first time after the outbreak of war on Jan. 4 1915. Severe restrictions were placed upon the transaction of business, in accordance with arrangements made in Dec. 1914, between the Committee for General Purposes and the Treasury. These arrangements were embodied in Temporary Regulations which were substituted for the old regulations governing Stock Exchange practice. All bargains had to be done on a cash basis. The suspension of virtually all speculative business was the most important innovation introduced by the Temporary Regulations. Normally, speculation forms the great bulk of business effected on the Stock Exchange, and its temporary abolition deprived many members of their occupation. The volume of business which it was possible to do was further restricted by two other features of the Regulations—namely, the "physical possession" rule, which prohibited dealings in stock that had not been in physical possession in the United Kingdom since Sept. 1914, and the fixing of minimum prices for trustee and other securities, which were in nearly every case the mean prices on July 27. Both of these rules were relaxed to some extent during 1915; the former to facilitate sales of American securities held in Allied and neutral states, and to allow sales of colonially held stock. When they were established, minimum prices undoubtedly served a very valuable purpose, but when the issue of high-yielding war loans completely altered the standard of investment, as regards the yield in interest, no useful purpose was served by them. The retention of minimum prices fixed on a pre-war basis of credit made it impossible to deal in the securities affected, and that was the reason for their removal. But the absence of speculation naturally caused a considerable reduction in membership. On the day of reopening the number of transactions was less than 1,000. On subsequent occasions the number rose to well over 3,000 per day, but in 1915 the daily average was nearer 2,000 than 3,000. A heavy loss of revenue was sustained by the company owning the Stock Exchange, and in 1915 it failed to distribute an interim dividend.

The arrangement by which all stocks carried over at the outbreak of war were continued until after the end of the war, unless the "end of July 1914" prices were reached, worked well in practice, thanks largely to the American demand for securities; and the "open" position on the London Stock Exchange, which in Aug. 1914 was about 90 millions sterling, had been reduced by the end of 1915 to about 20 millions.

With the reopening of the London Stock Exchange an important reform was introduced which was continued after the cessation of hostilities. The Temporary Regulations provided that every bargain should be recorded. This practice was much preferred by the public to the pre-war custom of marking only occasional bargains. The absence of buying and selling prices, dealers being prohibited from offering stock in the market, was one of the reasons for the compulsory marking of all bargains. This reform led to the issue of a supplementary list of bargains in securities not quoted in the daily "official" list. Thus, from Jan. 4 1915 onwards, a complete record of business done was furnished by the two lists, on the authority of the committee. Another innovation was the retention in the lists of prices of previous bargains, which added to their value to the public.

The course of prices in 1915 and subsequent war years was generally downward. In June-July 1915 the flotation of the unlimited 4½% British Government War Loan made a lowering of investment values inevitable. This for a time checked business in the stocks protected by minima, and caused a heavy fall in other fixed interest-bearing securities. In March 1915 minimum prices were reduced to a small extent. The minimum for Consols was reduced from 68½ to 66½ prior to the issue of the 4½% War Loan, and it was removed later when the great bulk of the stock had been converted into the 4½% stock. The market for American securities was very active and strong throughout 1915, and

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prices showed a substantial advance on the year. The war-time prosperity in the United States caused a great demand for American securities held in the United Kingdom and France. European holders were encouraged to sell by the appreciation of the dollar in terms of sterling, which enabled a profit on exchange to be made. In the second half of the year the British Government bought large quantities of American securities held in the United Kingdom and sold them in the United States in order to provide itself with means of making payment for munitions, etc. (*see* DOLLAR SECURITIES MOBILIZATION). It is estimated that in this year about 150 millions sterling of American securities were transferred to the United States. Towards the end of 1915 the Government ceased operations in the market, and invited holders either to sell or loan approved securities to it. Thus came into force what was subsequently known as the Dollar Securities Mobilization Scheme. The terms of purchase were approximately the parity of the New York price, and for loan a bonus of ½% per annum in addition to the interest or dividend on the loaned security, plus a premium of 2½% in the event of the Government exercising its right to sell the stock loaned to it. The Temporary Regulations were made more stringent as the war continued, but 1917 witnessed a check to the depreciation of fixed interest-bearing securities for the first time since the S. African War of 1899–1902, and also a sustained upward movement in industrial securities.

The following table, compiled from figures published by the *Bankers' Magazine*, shows the course at different important dates of investment values since the calculations were first made. The values relate to 387 representative securities:—

Jan. 1907	£3,843,000,000
*July 20 1914	£3,371,000,000
†Nov. 1918	£2,822,000,000
Dec. 1919	£2,634,784,000
Dec. 1920	£2,319,777,000

*Pre-war. †Month of Armistice.

The general depreciation was due not only to the exceptionally heavy demand for money to carry on the war, but also to the growing burden of direct taxation in the United Kingdom. For a time the British investor showed a marked preference for industrial securities, on which high dividends were paid together with, in many cases, bonuses either in the form of cash or scrip. Bonus shares were created and issued by a large number of concerns. The scarcity of capital caused a steady rise in the rate of interest, and first-class companies found it necessary to pay 8% and even more on new debentures and preference capital. The Treasury scheme for buying and borrowing dollar securities in 1916 was followed in 1917 by a scheme for requisitioning those which had been neither lent nor sold. This put the finishing touch to the process which had begun in 1915, of extinguishing the American market in London.

Throughout the war period the London Stock Exchange Co. had a very lean revenue. Receipts, which in 1914–5 amounted to £296,757, dwindled to £130,304 in 1917–8; and the dividend dropped to £1 per share.

A feature of the year 1918 was the advance in foreign Government securities, especially those of neutral nations. Bonds of the neutral countries were bought for exchange purposes, and they changed hands up to extraordinarily high figures in the first half of the year. Spanish 4's touched 135 at one time, owing to the rise in the sterling value of the peseta, and Swedish 3½% stock rose to 115, through appreciation in kroner.

Calculations made by the *Bankers' Magazine* show that the values of 387 representative securities fell during 1919 from £2,801,089,000 to £2,634,784,000, a decrease of £166,605,000, equal to 5·9 per cent. (As on July 20 1914, the total was £3,371,000,000, the decline in the five and a half years to Dec. 1919 was no less than £736,216,000, or nearly 22 per cent.) At one time during the war the values touched £2,572,000,000. This was on April 20 1918—at the height of the Germans' last great offensive effort. It is interesting to note that in Jan. 1907, when the valuations began, the total was £3,843,000,000. The valuation at the end of 1919 showed a net shrinkage of £1,208,000,000, or 31½%, of which £736,216,000 was due to conditions brought about by the war. The war-time depreciation in fixed interest-bearing securities was greater than this. Taking the values of 108 fixed interest-bearing securities we find that the total on July 20 1914 was £1,989,000,000, at the close of 1918 £1,575,000,000, and at the end of 1919 £1,378,906,000. On the other hand, the value of 279 speculative investments, *i.e.* the dividends on which fluctuate according to profits, was £1,382,000,000 on July 20 1914, at the close of 1918 £1,226,000,000, and at the end of 1919 £1,255,578,000. Thus there was a net depreciation in fixed interest-bearing securities of £610,094,000, or 30%, in the whole war period, of which £196,094,000 occurred in 1919; while speculative investments showed an increase of £29,578,000 in value during 1919, or 2.4%, but a net depreciation of £126,422,000 on the whole period, or 9 per cent.

After the War.—In spite of marked activity in speculative investments, the year 1919 witnessed a generally downward tendency in prices of securities, with the result that a large part of the appreciation which took place in the closing months of 1918, following the collapse of Germany's war effort, was lost. The reaction was due in a large measure to heavy Government expenditure, bringing with it the pressure of high taxation, and an adverse American exchange, the former involving a continuance of heavy borrowing, and the latter a rise in the Bank of England rate from 5 to 6% at the beginning of Nov. 1919. The failure of the British Government's Funding Loan operation in the summer had an adverse effect on the market for gilt-edged investments, and the City of London received something like a shock on learning that national expenditure in the second half of the year was scarcely distinguishable in amount from that of a large part of the war period. Markets, however, presented a generally animated appearance. This was in part due to the return of warrior members. Attention was mainly concentrated on speculative securities, notably oil, brewery, insurance, shipping, S. African gold, and commercial and industrial securities. Fixed interest-bearing securities were persistently neglected, owing to the higher value of money and the competition of numerous new issues offering yields as high as 9 per cent. In the summer of 1919, various war-time restrictions were removed from the London Stock Exchange with the approval of the Treasury. The removal of the embargo on exports of capital enabled foreign-held stocks to be realized in the London market; but arbitrage transactions continued to be prohibited. Some of the declarations which had to accompany each transaction were abolished, but the temporary regulation prohibiting any but cash transactions was retained.

Gold-mining shares made a substantial advance in the closing months of 1919 owing to the high premium received on gold under an arrangement come to in July for restoring free conditions to the market for gold newly produced. This enabled the companies to declare larger dividends in Dec., and rescued a large number of low-grade mines from imminent bankruptcy. Towards the close of 1919 Rand Mines shares were introduced on the New York market, this being the first time that S. African gold shares were listed in Wall Street. The diamond companies enjoyed a wonderful prosperity during the year, the De Beers Co.'s revenue amounting to as much as one whole day's war expenditure at the maximum level. Record dividends were paid, and share quotations reached unprecedented figures.

The year 1920 was the most remarkable of the early post-war period. At the beginning markets in London were extraordinarily active, owing to the boom in trade. The oil market was in a state of ceaseless activity, and other speculative markets felt some of the reflected glory of inflated oil profits. Nomination for membership of the London Stock Exchange rose in price to £650, but was almost unsaleable at the end of the year. There was a great congestion of work in brokers' offices in the early months, and they were kept open until late at night for several weeks. But the introduction of a British budget of 1,200 millions, with its unpleasant reminder of the burden of taxation, administered a check to the reckless buoyancy of markets. The collapse of the exchanges of all the countries except the United States

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Sweden, Switzerland and Holland, caused a steady stream of liquidation in London from the Continent, which grew in volume when, later in the year, a heavy fall occurred in wholesale commodity prices. The fall in commodities forced traders to realize securities. The pressure to obtain money to finance production and distribution and pay taxes caused persistent liquidation in the gilt-edged market, and British Government securities fell to a level giving a return of well over 6% per annum. In Dec. 1920 the leading stocks, in some cases, touched the lowest points on record. The 5% War Loan fell to 81 1/16, Victory Bonds to 70 1/2, Funding Loan to 65 1/16, and Consols to 43 1/4. The *Bankers' Magazine* calculations of the prices of 381 representative securities in Dec. 1920 showed a fall in values of no less than £315,000,000, the largest loss ever recorded in one year. British and Indian funds fell in value in 1920 by 11·9%, foreign Government stocks by 18·8%, home railway stocks by 17·3%, foreign Government stocks by 23·5 per cent. The decline in commercial and industrial securities was much greater, the percentage being 40·9. The severity of this reaction was, of course, due to the sudden collapse of the six-year-old boom in trade. Iron and steel shares suffered a depreciation of 33·7%, shipping securities of 21·7%, and S. African mining shares of 39·2 per cent. The losses of the investor were so severe that he lost all interest in speculative stocks and turned his attention to gilt-edged stocks. This brought about a steady recovery in the latter in the first half of 1921. The issue of foreign Government loans in London, which was suspended on the outbreak of war, was renewed in 1921, when a loan to the São Paulo Government was issued, followed by an issue of Norwegian Government bonds.

American and Foreign Stock Exchanges.—The shock of the World War caused stock markets all over the world to shiver and collapse more or less. By custom London was a market to which every *bourse* abroad turned for help when there was any pressure, and for a period of at least a fortnight after the middle of July 1914 the London market was called upon to absorb a flood of selling orders from every mart in Europe where securities were dealt in. While the European *bourses* had to all intents and purposes suspended business by the beginning of the week ended Aug. 1, there was a fairly free market for securities in London in the great majority of international securities down to the middle of the week. The news of the coming war affected the European *bourses* early in July. On the 13th of that month the Vienna market was described as having become quite demoralized by the fear of war. The Berlin *bourse* reflected this nervousness because Germany was Austro-Hungary's chief lender, Government and municipal loans of the Habsburg Empire being held in Germany to the extent, it was estimated, of over £200,000,000. On Monday July 27, the day before the declaration of war by Austria, the panic in Vienna was such that the *bourse* was ordered to be closed for three days. Subsequent events showed it was destined to be closed for an indefinite period. The Brussels market followed the lead of Vienna, ceasing business on July 27, and the Paris *coulisse*, or outside unofficial market, also suspended operations on that day. On Tuesday July 28, before the declaration of war by Austria had become known, dealings became very difficult. On July 29 all account dealings in Berlin were suspended, transactions being confined to cash bargains. The Amsterdam and St. Petersburg *bourses* were entirely closed that day, while on Thursday all markets suspended business except London, Berlin, Paris and New York, but the settlement in Paris fixed for July 31 was postponed. Business on the Berlin *bourse* was ordered to be suspended on the following day (July 31), though the *bourse* was kept open. The Paris market remained open throughout that day, July 31, but only six quotations were available out of some sixty stocks and shares usually quoted in reports from that centre. The Paris *bourse* was the only stock-market to keep open its doors after Thursday July 30. But this *bourse* is under the direct control of the Government, and the authority of the Goverment was no doubt responsible for the *bourse* being kept open. Down to Sept. 2 a few quotations were forthcoming from Paris, but on that day the *bourse* was shut until further notice owing to the approach of the Germans to the French capital. The New York Stock Exchange was open on Tuesday July 28, when the news of the declaration of war by Austria first became known, and it was called upon to withstand the first shock of that announcement. By the end of the day's session it was found that transactions for the first time that year (1914) had exceeded one million shares. On Tuesday July 28 the Toronto Stock Exchange was closed, after being open for 10 minutes, and business on the Montreal market ceased in the afternoon. On July 30 violent breaks in prices occurred on the New York Exchange, but there was at all times a market. The next day, however, the committee decided to follow the lead of London and to close the Exchange.

New York.—In the latter part of 1912 there was a serious decline in American securities, owing to selling from Europe brought about by the Balkan War, but as soon as this unloading ceased the market was much unsettled by the decision of the Supreme Court of the United States ordering the dissolution of the Union Pacific–Southern Pacific merger. Down to the beginning of the World War New York had shown a tendency to develop more and more as a market for international securities, though very little was actually done to encourage foreign securities to seek a market there. In the short and frantic period in the last few days of July 1914 bankers saw ordinary standards of value scattered to the winds and loans aggregating $2,000,000,000 imperilled almost in a night. When the House was closed special committees were set up to undertake the stupendous task of straightening out the apparently hopeless tangle of contracts outstanding when operations were suspended.

The New York Stock Exchange tentatively opened its doors again on Nov. 28 1914, for trading in bonds only. As the experience was encouraging, the committee decided to reopen the House for regular trading on Dec. 13. Minimum prices had been fixed by the committee on Oct. 13, and trading in unlisted securities was resumed on the following day. The minimum prices were revised from time to time and abolished on March 31 1915, owing to a rise in quotations having rendered minima no longer necessary. Then began the most remarkable era in the history of the Exchange. In point of feverish activity and wild fluctuations in prices, the year 1915 was then without precedent. Million-share days, sensational advances, and equally sensational declines, were common occurrences. Price movements were very erratic. The most conspicuous feature of the enormous volume of trading was the participation by the outside public seldom if ever before witnessed on the New York Exchange. Under clique and pool manipulation, prices were whirled upward with startling rapidity. Stocks which led the advances were those of companies which, it was supposed, would benefit most largely from war orders. Throughout the year there was heavy buying of both stocks and bonds by investors and financial interests of the first rank. Many securities reacted from their highest levels before the close of the year, but others, on good business prospects, retained the greater part of their phenomenal rise. Even more remarkable was 1916. Activity was intense, and prices rose to exceptionally high figures. Every dollar security offered from Europe was eagerly snapped up.

The following year witnessed a reaction. The depreciation in the market value of American railway securities was estimated at $3,000,000,000—about one billion in bonds and two billions in shares. The principal causes of this great shrinkage in the market value of railway securities, in which about one-twelfth of the wealth of the United States was invested, were reported to be as follows:—

(1) Enormous destruction of capital in the war, with unprecedented Government loans at rising rates of interest.

(2) The liquidation by Europe of about $1,700,000,000 of American railroad securities in payment for munitions of war.

(3) A rapid advance in the cost of railroad materials and labour, with no compensating advance in railroad rates, and fear on the part of investors that the Government would not promptly raise rates to maintain railroad property and credit.

When the U.S. Government declared war, the composure and strength of the Stock Exchange was an impressively favour-

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able omen. This composure did not continue throughout the year. Prices of outstanding bonds declined steadily; and in Sept. and Oct. an extremely violent movement of liquidation swept over the Stock Exchange, carrying prices of the best investment stocks down to a level lower than that of the panic of 1907. This extreme demoralization of the Stock Exchange did not result from money tension—lending rates were comparatively low throughout the year—nor was it primarily a consequence of decreased earnings or of a weakened economic position on the part of the investing public. It was due to war taxation legislation, and the drawing up of estimates as to how much would have to be raised by taxes and by loans. In 1918 there was a recovery, with prices generally higher on the whole.

In 1919 there was a boom in stock markets which will rank in American finance as one of its greatest historical episodes. The pegging of sterling exchange at $4.76½ was removed on March 20 1919, and the other Allied exchanges were released a few days later. But the depreciation of European currencies which followed did not stop European purchases. These increased in volume, and the demand acted as a powerful stimulant on the stock market. There began a speculation in stocks of an unprecedented description. Thousands of industrial corporations were endowed by the war with enormous reserves of cash which war taxation had barely skimmed. The atmosphere of Wall Street was charged with the wildest rumours of "melon splitting," increased dividends, and Liberty Bond distributions. Prices advanced by 10 and 12 points in a day, and on some days 20- and 30-point rises were not uncommon. Amidst this furious activity the million-share day ceased to be exceptional. In May the Stock Exchange was obliged to close on Saturdays in order to give the staffs an opportunity of overtaking arrears of work. When, in the latter part of June 1919, the first reaction occurred, there had been 46 consecutive million-share days. The rise in the value of money was said to be the chief factor which brought the boom to an end. By the middle of Oct. the Federal Reserve Bank of New York found its proportion of reserve to liabilities reduced below the minimum prescribed by law. Call money rose to 30% in Nov., the highest figure since 1907. A coal strike, the heavy fall in the exchanges, and the failure of the Senate to ratify the Peace Treaty, were depressing factors.

Stocks reached the peak of the rise in Nov. 1919. On that occasion the figure was only fractionally below the high-water mark of the war period, viz. 101·51, which marked the culmination of what was described in the picturesque language of Wall Street as the "war-brides" boom of 1916. Then followed the bursting of the distended balloon. In about three weeks the average price of 50 stocks dropped more than 15 points to 85. The collapse remained in the minds of members for a long time afterwards. Despite occasional rallies, prices dropped steadily, and it was manifest that the World War boom was definitely over. November 1920 was also a month of devastating declines, which produced conditions resembling a panic. The index figure of the 50 stocks fell to 68·85, against 94·07 in April.

In the first 11 months of 1920 transactions in stocks on the New York Stock Exchange showed a considerable reduction in volume from those of the corresponding period in 1919—210,220,428 shares, against 296,822,497. The par value of the shares dealt in was $17,983,885,575, or about nine billions of dollars less than the year before. Bond transactions, on the other hand, were much larger, increasing from $2,473,588,050 to $2,495,821,750 for Government bonds, from $258,442,500 to $319,567,400 for state and municipals, and from $522,315,000 to $693,527,000 for those of private corporations.

Arbitrage dealings were restored between New York and London at the beginning of Dec., but there was little business of this character. The depreciated paper pound killed the market for American securities in London. Throughout 1920 a growing interest in foreign securities was shown by American investors, and a comparatively large number of foreign Government and municipal obligations were sold in the American security markets. Competition of domestic issues, however, was fierce, and no little difficulty was experienced in inducing the American public to take up foreign bonds. This had a serious restricting influence on America's export trade, and owing to the inability of Europe to pay for her purchases by exports she had to depend largely on credit given by the United States. In 1921 the depression in trade became very marked, but later a recovery set in.

Paris.—Down to 1911 Paris had been a powerful and persistent supporter of the world's money markets, because of the saving habits of the French people, but in the three years prior to the outbreak of war a change had developed. This was particularly noticeable after the Balkan War of 1912 had disturbed the European *bourses*. France had begun early in 1914 to bring money home to meet her own needs. Excessive issues of short-term notes, the disturbances in Mexico, and the collapse of the St. Louis & San Francisco railway in 1913, caused a feeling of revulsion as regards American securities, and Paris, in the year prior to the outbreak of war, was steadily selling them. On the other hand, Germany was increasing her creditor position in the world's markets. The Paris *bourse* witnessed the end in 1911 of a bull campaign which had lasted for several years, and 1912 saw a persistent depression in gilt-edged stocks. The price of French 3% Rentes, which touched 105 in 1898, when Mr. Cochery dreamed of conversion, fell to 87½ in 1912, and with the outbreak of the Balkan War there was a panic.

The *bourse* was reopened after the events of Sept. 1914, on Dec. 7, and thereafter there was a steady rise in prices. After 15 months of war the first war loan was raised. As a necessary preliminary the settlement of the long-deferred end of July 1914 *bourse* account was begun on Sept. 30 1915, and was carried through with comparative ease. The open account had been very largely reduced by gradual sales, and the Bank of France came to the rescue of both Parquet and Coulisse, lending the former about 150 and the latter 35 million francs. The plan of settlement adopted differed considerably from the London Stock Exchange scheme—5% interest was charged from July 1914, to Sept. 1915; holders were asked to pay their differences in full, or were given the option of paying 10% of their differences at the first settlement, and 10% on each subsequent monthly settlement until the balance was wiped off; 6% was fixed as the rate on all unpaid differences; from the make-up prices of the end-Sept. account differences had to be settled at each settlement as before the war. After the first *post-bellum* settlement contangoes averaged about 4½ per cent. All new business was for cash, dealing on account being confined to clearing up accounts which existed before Aug. 1 1914.

Berlin.—Before the war the Berlin *bourse* was subject to frequent attacks of nerves. On Sept. 4 1911 the *bourse* had what was described as its worst day of the year. It was alarmed by the foreign political situation. Nevertheless business was very active in that year, and the stamp duty on *bourse* transactions produced £75,000 more than in 1910. In 1912 the *bourse* was again much disturbed by political fears, and rumours of war caused heavy selling from time to time. Excessive speculation in the earlier months of 1912 caused the Government Commissary of the *bourse* to issue a public warning. On Oct. 1 of that year came news of the Balkan mobilization, and a panic seized the market. Settlement stocks in one day lost, on an average, 20 points. The total loss in values in that year was estimated at about £150,000,000. On the outbreak of war, Germany imposed more stringent conditions upon the Stock Exchange business than any other country. The open market for stocks and shares was abolished, and the publication of prices was strictly forbidden. Towards the end of 1915, cautious efforts were made, with some success, to liquidate *bourse* transactions which had remained in suspense since the outbreak of war. In 1916 there was much speculation on the German *bourses*, and this was given as a sufficient reason for continuing the veto upon the publication of quotations. But at the end of that year, lists of prices were issued for the first time since July 1914, for the purpose of taxation assessments. The quotations showed many large gains in industrial securities, due, of course, to the enormous profits made by German companies. In 1916 the dividends of 10 explosives manufacturing concerns averaged 22¾%, a group of metal companies paid out 20%

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on a capital of £9,000,000, and a group of leather companies paid 19% on an average. All the German war loans were, however, listed by special instruction at the price of issue. In 1917 there was again considerable speculation on the *bourses*, with generally rising prices, but the intervention of the United States in the war caused a set-back. At the end of 1917 the listing of prices was resumed, but publication of prices was strictly prohibited. German 3% stock rose 7 to 8 points, and there was a strong demand for industrials. Between Sept. and Dec. 1918 the quotations of German securities on the German markets fell so heavily that German financial writers estimated the decrease in capital value at about 50 per cent. Meanwhile Germany witnessed her foreign credit—such as it was—go to pieces. This was proved not only by the price of the mark, but by an almost universal desire in neutral countries to withdraw outstanding credits to Germany. The index figures prepared by the *Frankfurter Zeitung* showed the following (*a.* representing values of 24 of the principal shipping, mining and dyeing concerns; *b.* of 10 important munitions, metal, petroleum and potash concerns. The table shows the effect of speculation before the German collapse, then a heavy fall, followed by a slight recovery at the end of 1918):—

	July 28 1914	Dec. 31 1917	Aug. 31 1918	Dec. 5 1918	Dec. 31 1918
a.	185	278	272	151	164
b.	232	445	442	177	197½

Amsterdam.—The Amsterdam Stock Exchange, which was closed on the outbreak of war in 1914, was reopened on Feb. 9 1915. Business at first was not very extensive, except in shipping and home industrial shares. Foreign stocks were very weak in 1915 owing to persistent selling from Germany. The year 1916 was a record of remarkable fluctuations, and at the close all kinds of shares showed enormous gains. The largest improvement took place in the securities of home industrial concerns, which made huge profits, as the result of the elimination of German competition. The Dutch Indian plantation companies made enormous profits, especially the sugar plantations, which sold a great part of their output to the British Government at high prices. Rubber and tobacco shares also improved in value. Royal Dutch shares were introduced for the first time on the American market in 1916. In 1917 the stock markets were rather quiet. Russian stocks fell enormously in the last months in consequence of the stoppage of interest payments, and the announcement that the Bolshevist Government would cancel the national debt. This latter step could only mean a serious financial disaster for Holland, where Russian stocks had found a ready market as being thoroughly sound investments. The total Dutch ownership of Russian stocks of State as well as private railways was estimated at 1,500,000,000 to 2,000,000,000 florins. New shipping shares amounting to 27,500,000 florins in face value were added to the market in 1917. In the following year the tendency was irregular, and sometimes weak, directly owing to the German collapse, but towards the end of the year prices rose again. Large new issues were made by shipping, plantation, and trading companies.

Vienna and Budapest.—In the early years of the war there was extravagant speculation on the Vienna and Budapest *bourses*, and prices rose to extraordinary heights on the enormous profits on paper made by all the industries of the country. But a heavy collapse succeeded the military breakdown in 1918, and the subsequent break-up of the old Empire.

Switzerland.—Following the example of the chief foreign *bourses*, the Basle and Zurich Stock Exchanges suspended operations towards the end of July 1914. The Geneva and Lausanne *bourses*, however, remained open even during August. On Jan. 7 1915 the Basle Stock Exchange resumed the publication of its daily price list. A further step forward was taken on Dec. 1 1915, and on April 25 1916 the bond market was reopened in its entirety. On June 26 transactions were extended to the full pre-war list. The Zurich *bourse* restarted official business on May 15 1916. (C. J. M.)

STOKER, BRAM (1847–1912), Irish author, was born in Dublin Nov. 8 1847 and was educated at a private school there and at Trinity College. He entered the Irish civil service, to which his father also belonged, and wrote critical articles for various newspapers. He was called to the English bar, but in 1878 he joined Sir Henry Irving at the Lyceum theatre and was for many years his secretary and finally his biographer. He wrote a number of novels, of which *Dracula* (1897) was the best known, as well as *Personal Reminiscences of Sir Henry Irving* (1906). He died in London April 20 1912.

STOLYPIN, PETER ARCADEVICH (1863–1911), Russian statesman, was born in 1863, the son of Admiral Stolypin by his wife, a princess of the house of Gorchakov. He was educated at the university of St. Petersburg, and in 1884 entered the Government service. In 1902 he was appointed governor of Grodno, and in 1905 was transferred to Saratov, where he became known as a firm administrator. In 1906 he was recalled to take up the position of Minister of Internal Affairs, and in July of the same year succeeded Goremykin as Minister President. His career as Premier is described in the article RUSSIA. His firm and repressive policy toward all kinds of sedition caused him to be regarded as a deadly enemy by the revolutionary party, and many attempts upon his life were made. In Aug. 1906 a bomb was exploded at his summer residence, which seriously injured one of his daughters, but all efforts to kill him proved vain until 1911, when he was shot in a theatre at Kiev on Sept. 14, before the eyes of the Imperial family, by a Jew named Mordka Bogrov. The minister died of his wounds Sept. 18 1911.

STONE, MARCUS (1840–1921), English painter (*see* 25.957), died in London March 24 1921.

STONE, MELVILLE ELIJAH (1848–), American journalist, was born at Hudson, Ill., Aug. 22 1848. His father was a Methodist minister, of New York birth, who had moved to Illinois in early life and combined his activities as a circuit-preacher with the running of various small businesses, including book-selling and printing. He had English, Scottish and Irish blood in his veins, the Stone family having settled in New England in the 17th century. In 1860, when Melville was 12, his father was made pastor of a Methodist church in Chicago, and it was there that he got his schooling. In 1864 he began work as a newspaper reporter, but after sundry journalistic experiences he was set up in business in 1868 as proprietor of an iron-foundry and machine-shop, which incidentally made a specialty of the supply of folding theatre-chairs, etc. In the great Chicago fire of 1871 this was destroyed, and Stone was then for some time occupied in the administrative work of municipal relief and reconstruction after the fire. But in 1872 he again took up journalism, as one of the editors of the Chicago *Republican* (subsequently *Inter-Ocean*), and later of the *Post and Mail*, becoming for several years a political correspondent at Washington. At the end of 1875, having returned to Chicago, he and a colleague started a new Chicago paper, the evening *Daily News* (*see* 19.571), and, after he had obtained the help of a new partner in Victor F. Lawson as its manager, their venture soon became increasingly prosperous. In 1878 he and Lawson bought out the *Post and Mail*, and in 1881 they established the *Morning News* (later *Record* and *Record-Herald*). In 1888 Stone's interest was bought out by Lawson, and he retired, taking a prolonged holiday in Europe. Returning to Chicago in 1891, he took to banking by the foundation of the Globe National Bank, of which he became president, and he kept up this connexion for about ten years; but meanwhile pressure was put on him to take part in the reorganization of the Associated Press, then already a well-known news-agency, and in 1893 he accepted the position of general manager. In this capacity Melville Stone became even more prominent and powerful in the journalistic world than he had been as a Chicago editor and newspaper proprietor. At that time the Associated Press was still struggling (*see* 19.547) with its competitor, the United Press, but its enterprise now received a new stimulus, and by 1897, under Stone's management, and as subsequently reorganized in 1901, its service knew no rival. Stone had intimate relations with all the leading men of his time and played an important part in the publicity given to events and movements. He held this position until

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the close of 1918, when he retired. During that period of 25 years the budget of the Associated Press had grown from $500,000 to $6,000,000 and it had come to furnish more than half the news printed in American newspapers.

See the Autobiography: *Fifty Years a Journalist* (1921).

STOREY, GEORGE ADOLPHUS (1834–1919), English painter, was born in London Jan. 7 1834. He was partly educated in Paris, but in 1850 returned to England and commenced studying in London at J. M. Leigh's school, subsequently entering the Royal Academy schools. His first picture was hung in 1852. He was in early life a follower of the Pre-Raphaelite school, but gradually changed his style, becoming well known both as a subject painter and for his excellent portraits. He was elected A.R.A. in 1876 and R.A. in 1914. He became teacher of perspective at the Royal Academy in 1900. Among his best-known pictures are "The Old Soldier" (1869); "Christmas Visitors" (1874); "Mischief" (1897) and "The Love-Letter" (1901). Storey published several books, the most important being *Meissonier* (1886) and *Theory and Practice of Perspective* (1910). He died at Hampstead July 29 1919.

STORY-MASKELYNE, MERVYN HERBERT NEVIL (1823–1911), English mineralogist, was born near Wroughton, Wilts, Sept. 3 1823; he was descended on the mother's side from Nevil Maskelyne, the Astronomer Royal. He was educated at Bruton grammar school and Wadham College, Oxford, and studied for the bar, but in 1850 was invited to deliver lectures at Oxford on minerals, where he stipulated for a chemical laboratory, then a complete novelty in the university. He was prominent in the struggle over the proposal to erect a museum of science and in 1856 became professor of mineralogy with a laboratory in the new museum; but from 1857 he combined the work with the keepership of the minerals at the British Museum and resided in London. In 1880 he resigned this post, but retained his Oxford professorship until 1895. He had inherited a Wiltshire estate from his father, and in 1880 he entered Parliament as Liberal member for Cricklade. In 1885 he was reëlected for N. Wilts as a Liberal Unionist and sat until 1892. He studied especially crystallography, meteorites and gem-stones, and was the author of many scientific papers, and of a book *On the Morphology of Crystals*. He also possessed a valuable collection of antique gems. He died at Bass Down, near Swindon, May 20 1911.

STOUT, SIR ROBERT (1844–) New Zealand judge and statesman, was born on Sept. 28 1844 at Lerwick, Shetland Isles, where he was educated at the parish school and became a pupil teacher. He arrived in New Zealand in 1863, and became second master in the Dunedin grammar school and afterwards in the Dunedin district high school. On July 4 1871 he was admitted as a barrister and solicitor of the Supreme Court of New Zealand, and he then matriculated at Otago University, which opened in that month. In 1873 he took first-class honors in mental and moral science and political economy, and from 1874 to 1876 he was Law lecturer at Otago University. Elected member of the Otago Provincial Council in 1872, he became provincial solicitor in 1873, and he held that position until the abolition of the provinces in 1876. In 1875 he was elected to Parliament as Liberal member for Caversham and in Feb. 1878 he became Attorney-General and Minister of Lands and Minister of Immigration in Sir George Grey's Ministry. But in the following year he resigned owing to the serious illness of his partner, and he did not return to public life till 1884 when he entered Parliament again as member (M.H.R.) for Dunedin East. On the defeat of Sir Harry Atkinson's Government he joined with Sir Jules Vogel in forming a Ministry, which lasted less than a fortnight (Aug. 18 1884), but after another Atkinson Government had held office for a few days (Aug. 28–Sept 3) a second Stout-Vogel Government was formed which lasted three years. In both the Stout-Vogel Governments Sir Robert Stout was Premier and Attorney-General. At the general election in 1887 the Government was defeated and he lost his seat by a narrow margin.

Refusing the offer of other seats, Sir Robert Stout remained out of politics till after the beginning of the long Liberal-Labour régime in 1891. Both by Ballance and by Seddon he was offered a portfolio but he declined both offers. In June 1893, however, he was elected at a by-election for Inangahua as an Independent Liberal, and at the general elections of 1893 and 1896 he was elected for Wellington City, to which he transferred his residence and his legal practice. In 1898 Sir Robert Stout resigned his seat, and in June 1899 he became Chief Justice.

In politics Sir Robert Stout was a strong Liberal of the individualistic school, devoting special attention to the land and labour questions and to educational and temperance reform. Among his principal measures were the Land Act of 1877, the first Land Tax Act, which he drafted in coöperation with Ballance and which became law in 1878, and the Civil Service Reform Act of 1886, which threw the doors of the service open to women and made examination and competition (the latter being added by the Legislative Council) the tests of all appointments except those of experts. As a member of a Royal Commission appointed in 1881 he helped the late Mr. Allen Holmes in forming the Code of Civil Procedure, which was enacted in the following year and made the Supreme Court Procedure of New Zealand one of the simplest in the world. A life-long abstainer, Sir Robert Stout was always a keen advocate of temperance reform. The local option bills which he introduced in 1876 and 1893 did not get further than their second reading, but the second of these measures forced the hand of the Seddon Government and led to the establishment of local option by a less liberal measure in the same session.

He became a member of the New Zealand University Senate in 1884, and also of the Victoria University College Council, Wellington. In 1903 he was elected chancellor of the university. He was made a K.C.M.G. in 1886. Besides writing many essays and lectures on social, literary and legal subjects, he was the author, jointly with his son, J. Logan Stout, of *New Zealand* in the Cambridge University Manuals of Literature and Science, and of the article on New Zealand in the Oxford University Survey of the British Empire. He married in 1876 Anna Penrhyn, daughter of Mr. J. Logan, official clerk to the Superintendent of the Province of Otago. He had four sons—of whom two served in the war as medical men and one obtained the D.S.O.—and two daughters.

STRACHAN-DAVIDSON, JAMES LEIGH (1843–1916), British classical scholar, was born at Byfleet, Surrey, Oct. 22 1843, and educated at Leamington College and Balliol College, Oxford. He graduated first class in *literae humaniores* in 1866, and was elected to a fellowship of his college the same year. This he held until 1907 when, on the resignation of Edward Caird, he was elected to the mastership of the college. His whole life was devoted to university teaching and administration, as classical tutor, examiner, delegate of non-collegiate students, pro-vice-chancellor, etc., and to the study of Roman history. Amongst his published works were *Cicero and the Fall of the Roman Republic* (1894), *Problems of the Roman Criminal Law* (1912), as well as articles on the Roman Constitution in *Smith's Dictionary of Antiquities*. He died at Oxford March 28 1916.

STRACHEY, JOHN ST. LOE (1860–), English journalist, was born at Sutton Court, Som., Feb. 9 1860, the second son of Sir Edward Strachey, 3rd Bart., and Mary Isabella, daughter of John Addington Symonds. He was educated at Balliol College, Oxford, graduating with a first-class in modern history, and was subsequently called to the bar, but he adopted journalism as his profession from the age of twenty-four. In 1886 he became assistant editor of the *Spectator*, and after the death of R. H. Hutton (1897) and the retirement of Meredith Townsend (1898) he became proprietor of the paper, which under his editorship not only maintained but increased the high reputation it had gained (*see* 19,562) for sober political criticism and well-informed appreciation of art and literature, so that he exercised great influence upon English opinion. St. Loe Strachey also edited (1896–7) the *Cornhill Magazine*. He was specially interested in problems of rural housing, pauperism and local government generally. Amongst his publications are: *The Manufacture of Paupers* (1907); *Problems and Perils of Socialism* (1908); *The Practical Wisdom of the Bible* (1908); *A New Way of Life* (1909).

STRAIGHT, SIR DOUGLAS (1844–1914), English lawyer and journalist, was born in London Oct. 22 1844 and was educated

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at Harrow. Up to 1865 he engaged in journalism, but was then called to the bar and soon worked up an extensive practice, especially at the Central Criminal Court, London. He sat in the House of Commons as Conservative member for Shrewsbury from 1870 to 1874, and from 1879 to 1892 he was a judge of the High Court of Judicature at Allahabad. He was knighted on retirement, and four years later he returned to journalism as editor of the *Pall Mall Gazette*. He retired in 1909, and died in London June 4 1914.

STRAITS (DARDANELLES AND BOSPORUS.)—The waterway formed by the Dardanelles, the Sea of Marmora and the Bosporus, which connects the Mediterranean and the Black Sea, has possessed marked political importance from the earliest times. This importance, however, grew with increasing rapidity during the 19th century. The increase of population, the growth of commerce, the construction of railways, and the rise of nations in the basin of the Black Sea, enormously added to the political and military significance of the Straits. And while these factors gained in weight yearly, the Ottoman Empire, which held the guardianship of the Straits, declined yearly in vigour and strength. Correspondingly, it became more and more the object of national intrigue and ambition on the part of foreign Powers, whose designs would benefit were they in a position to control the Straits themselves.

These matters received forcible illustration during the World War. Problems having their origin in the existence of the Straits became then of supreme importance, even to the extent of prolonging or shortening the period of war. At the Peace Conference, too, questions of the Straits became acute. The seaborne commerce of the 100 million inhabitants occupying the basin of the Black Sea must perforce pass through the Straits. By railway communication with central Asia this region, too, is concerned with control of the Straits. The traditional Russian ambition for a warm water port looked to Constantinople and the Straits for fulfilment; and in 1915 the Powers in alliance with Russia accepted the Russian claim to the great position. Apart from Russia and Turkey, three states—Georgia, Rumania and Bulgaria—had a coast-line confined to the Black Sea, and therefore depend upon the Straits as the one route for their maritime trade with the outer seas. To Germany, control of the Straits in war by her ally Turkey meant the isolation and strangling of her enemies, Russia and Rumania. In fact the closing of the Straits at this time had much to do with the collapse of Russia, the outbreak of the revolution, and the prolongation of the war. With such possibilities and interests hanging upon them, the Peace Conference dealt comprehensively with the Straits in the Treaty of Sèvres. Under this treaty they were thrown open to all navigation in peace and war, without distinction of flag, and blockade of these waters was prohibited. An International "Commission of the Straits" was established to control the waterway. And still further to ensure that military interruption should not take place, a demilitarized "Zone of the Straits" was created, embracing all adjoining coastal territory. Within this area all military works and fortifications were to be razed, and the construction of similar works was forbidden.

(W. J. C.*)

STRAITS SETTLEMENTS AND DEPENDENCIES (*see* 25.980*).—The resident pop. of the Straits Settlements proper, according to the census of 1911, was 705,405, divided as follows: Singapore, 303,321; Penang, 141,559; Province Wellesley, 128,978; Malacca, 124,081; the Dindings, 7,466. Males outnumbered females nearly as 2 to 1. Included also in the Government of the Straits Settlements are Labuan (pop. in 1911, 6,546), Christmas Island (1,369) and the Cocos Islands (749).

In Labuan and Cocos Islands males did not greatly outnumber females, but in Christmas Island, with an almost wholly labouring pop., males were 1,328 and females 41.

In 1919 the pop. of the whole colony was estimated at 827,719. That of Christmas I. was 514 on Jan. 1 and 617 on Dec. 31.

In the colony the birth-rate in 1919 was 30·3 per thousand. The death-rate, which was 46·45 per thousand in 1911, fell to 29·15 in 1915, rose, with an epidemic of influenza, to 43·85 in 1918, and was 33·04 in 1919. The principal causes of death in the last year were infant diseases (5,848) and malaria (4,623), and the other most serious maladies as returned were tuberculosis, beri-beri, pneumonia, and dysentery, but probably many deaths were due primarily to influenza. The epidemic of this disease resulted in the revival, after 30 years, of the native *wang-kang* ceremony at Malacca, in which a model boat is constructed in a temporary temple, and is subsequently burnt as a sacrifice to some supposedly neglected god.

Principal nationalities and religions were shown by the census as follows:—

Nationalities	Chinese	Malay	Indian	Europ. and Amer.
Straits Setts. proper	366,765	135,762	81,928	7,276
Labuan	1,799	4,434	—	34
Christmas I.	1,252	44	—	19
Cocos Is.	—	668	—	39

Religions	Chinese	Mahommedan	Hindu	Christian
Straits Setts. proper	359,760	261,154	52,579	24,474
Labuan	—	4,430	—	116
Christmas I.	—	46	—	32
Cocos Is.	—	669	—	50

[1] Other than Mahommedan and Christian.

Chinese immigrants in 1919 numbered 70,912—21·4% more than in 1918, and 73·6% less than in the "record" year, 1911. Adult males were 62·4% and females 19·5%. 101,433 immigrants arrived at Penang from southern India, and 46,767 Indians quitted the colony. There were 2,439 labourers from Netherlands India.

The Chinese community was on the whole prosperous during the World War; the increased cost of living and the high rate of exchange with China bore hardly upon the poorer classes, but the increase of wages in great measure counterbalanced these disadvantages. The Chinese freely supported patriotic and charitable funds, and after some demur, before its purpose was fully understood, recognized without further difficulty the war-tax ordinance of 1917. The war, however, produced its problems for the community. It was necessary to establish a censorship of Chinese newspapers, and in June 1919 an anti-Japanese boycott resulted in rioting in Singapore and Penang, while a Chinese patriotic league and an anarchical body, the so-called Truth Society, gave some trouble.

Finance.—Revenue in 1911 amounted to $11,409,220, in 1919 to $34,108,465; expenditure in 1911 to $9,085,389, in 1919 to $34,901,233 ($1 = 2s. 4d.). A noteworthy financial measure was the introduction of an income tax, which, in spite of controversy, raised £400,000 sterling in 1917 without friction.

The colony had at the end of 1919 a debt of £6,913,354 sterling in respect of the loan raised by the issue of 3½% Straits Settlements inscribed stock, 1907. About four-fifths of this loan was expended on account of the Singapore Harbour Board, and the rest on account of the Penang Harbour Board, the municipal commissioners of Singapore and Penang, and on Government harbour works, and interest charges are borne by these bodies.

Among Government monopolies that of opium is by far the most productive; the sales of chandu in the colony in 1919 yielded $17,511,229, in addition to which there were sales to the Federated and Non-Federated Malay States and Brunei. But prices were raised and other measures were taken in that year with a view to the gradual reduction of the amount of opium consumed.

Economic conditions: Agriculture, etc.—In many respects the colony actually benefited from the World War: there was, for instance, an increase in the gross value of trade from £63,600,000 in 1914 to £148,200,000 sterling in 1917. The more serious economic problems were not all results of the war. For example, it was about 1909–10 that a remarkable development of agricultural activity set in, especially in Malacca and Province Wellesley. This took the direction mainly of rubber planting, which led to the neglect of fruit cultivation and other forms of native agriculture; and this tendency has persisted. It has been asserted, indeed, that the rubber industry has been overexploited here: the people ceased in great measure to cultivate their own food crops and raise their own live stock, and became dependent on imported food stuffs. In 1917 rice was imported from Rangoon, Siam, and French Indo-China; wheat flour from Australia and India; cold storage foodstuffs from Australia, and other foodstuffs from China. Difficulties connected with shortage of supplies and shipping made it necessary to set up food control in 1917. An enquiry was instituted into measures for increasing home produce of rice and other foods, and "cultivation clauses" were inserted into leases of newly alienated lands. In 1918 the United States restricted imports of rubber, with a consequent reaction upon the Straits Settlements industry. This could not, however, immediately affect food cultivations, and in that year shortage in India, floods in Siam, and the demand for imported rice in Java and

** These figures indicate the volume and page number of the previous article.*

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Japan caused serious conditions in the Straits Settlements. Siam prohibited export of rice in July 1919; the Straits Settlements controller took entire charge of import and wholesale dealing, and a food production department was established which fostered home planting, and in spite of many difficulties it was found possible, early in 1920, to ensure supplies for several months. The Governments of the Straits Settlements, Netherlands India, and Ceylon agreed in 1919 to purchase through a single agent to avoid competition.

The cultivation and yield of coco-nuts declined in and after 1917, and the destruction of palms to make room for rubber had advanced so far in Singapore and Province Wellesley that an enactment was directed against it. Copra prices, however, rose in 1919. The clove, nutmeg, gambier, and areca nut industries of Penang shared in the general decline of cultivations which had become subsidiary to that of rubber. The pineapple cultivation was affected by the difficulty of obtaining tin plate for the canning industry. As for live stock (of which mention has been made above) a report for 1917 showed that whereas in 1910 Malacca exported 12,000 pigs, in the later year that number was imported, and that the former large export of poultry from Penang was more than balanced by import.

Forestry.—Measures have been taken to amalgamate the forest services of the Straits Settlements and the Federated Malay States, the first step being taken in 1918, when the forests of Malacca were placed under the deputy conservator of forests for Negri Sembilan. The area of reserved forests in 1920 was 107,270 ac., about 11% of lands in the colony. The mangrove industry has been fostered by imposing a control over cutting, and by replanting, over 2,000,000 seedlings having been planted in Penang and the Dindings in 1919.

Tin.—War conditions reacted favourably upon the tin trade. In July 1918 the price reached $160 per picul, and subsequently $185 when buying was prohibited except under licence. But after the Armistice the price, already declining, was further lowered when the Imperial Government ceased to buy direct, and the Federated Malay States had to guarantee purchase at $118 per picul.

Commerce.—Imports were valued at £43,856,000 sterling in 1914, and exports at £38,032,000. Both rose annually thereafter almost without exception, until in 1919 the figures were: imports, £96,664,000; exports, £99,318,000. The *entrepôt* trade in tin and Pará rubber is illustrated by the following figures for 1919:—

Imports (piculs)

From	Tin	Tin Ore	Rubber
Malay States	133,000	686,000	1,412,000
Netherlands India	38,000	113,000	456,000
Siam	6,000	207,000	—
Other countries	2,000	32,000	79,000

Exports

To	Tin, piculs	Value	Rubber, piculs	Value
United Kingdom	324,000	$41,347,000	406,000	$ 44,088,000
United States	454,000	$59,928,000	2,310,000	$230,511,000
Elsewhere	219,000	$27,445,000	254,000	$ 24,227,000

Shipping.—The total tonnage of shipping entered and cleared for the year 1919 is shown as follows: Singapore 14,088,775; Penang, 14,009,126; Malacca, 564,400; Christmas I. and Labuan, 222,882. The principal flags were British (nearly five-ninths of the whole), Japanese, and Dutch, and the total increase over the year 1918 was 5,820,913, nearly four-fifths of which was in British shipping. The total of 18,885,183 tons thus compares with 13,064,270 tons for 1918 when the shortage of shipping was most acute, and with 27,124,789 tons in 1913.

Work on the Lagoon wet dock and main wharf reconstruction, Tanjong Pagar, was completed and made over to the Singapore Harbour Board in May 1917. The revenue and expenditure of the Board, which reached $6,015,648 and $4,216,015 respectively in 1912, declined to $5,432,425 and $3,421,271 in 1915, and amounted to $9,617,718 and $5,444,410 in 1918. Penang wharf and dock receipts amounted in 1919 to $996,372 (approximately), and expenditure to $815,092. The wharf tonnage returns for Singapore and Penang show the following figures:—

		No. of Vessels	Net Tonnage	Inbound and Outbound	
				Coal, tons	Cargo, tons
Singapore	1913	2,708	5,794,536	1,338,495	1,462,788
	1918	2,114	3,330,791	732,231	1,213,730
Penang	1913	732	1,532,361	282,067	399,412
	1918	513	581,132	60,029	251,183

Land Communications.—The Singapore Railway Transfer Ordinance, 1918, enabled the Government of the Federated Malay States to construct a causeway across Johor Straits and to lay a railway to connect the Singapore line with the Johor and Federated Malay States systems. The sale of the Singapore Railway and railway stores involved a sum of $4,149,750. Metalled roads in the colony at the end of 1919 had a length of 584 m. (Singapore, 96 m.; Penang and the Dindings, 86 m.; Province Wellesley, 166 m.; Malacca, 231 m.; Labuan, 5 m.); and the Public Works Department had charge, in addition, of 50 m. of gravelled roads in Malacca, and 93 m. of "natural" roads in Penang, the Dindings, and Prov. Wellesley.

Education.—The centenary of the modern foundation of Singapore by Sir Stamford Raffles was the occasion of local celebrations in Feb. 1919, and by way of commemoration it was decided to found a Raffles College for higher education. Evidence of the general enthusiasm for this scheme was given by the prompt provision of subscriptions which ensured its success and enabled plans to be laid forthwith. The Straits Settlements Government promised a donation of $1,000,000 and an annual contribution of $50,000; the Governments of the Federated Malay States and Johor, and many private individuals, contributed. There have been other signs of a demand for a more active education policy; it being especially desirable as a counter measure against undesirable propaganda.

The Government maintained in 1919 eight English schools, and aided 45 English, Anglo-Tamil, Malay, Tamil, and Chinese schools; it also supported the Malacca Training College for Malay teachers. The Central Training College in Perak, the erection of which was started in that year, is intended for Malay teachers not only in the Federated Malay States but also in the Straits Settlements.

Labuan.—Revenue collected in Labuan in 1919 amounted to $38,308, and expenditure was $81,927. The total value of trade was $3,748,930 in that year, and $2,763,561 in 1918. Merchant shipping entered and cleared amounted to 141,686 tons in 1919. The Labuan Exploration Co. of London undertook a geological survey in 1920 with the view of prospecting for minerals.

Christmas Island.—Revenue (1919), $26,155; expenditure, $12,791. The export of phosphate of lime, which reached 89,889 tons in 1917, showing a large increase, fell to 53,370 tons in 1918 and amounted to 68,621 tons in 1919. The export was taken in 1919 by Japan (71%) and Australia. Shipping entered and cleared amounted to 81,197 tons (61% Japanese). There is a small export of rubber. The phosphate company maintained its output during the war, completed an inclined haulage way, and carried the railway to new quarries at South Point in 1918–9.

Cocos Islands.—A typhoon in 1909 left standing only 3% out of over 1,000,000 coco-nut palms, but replanting was completed in 1911, and export of copra was resumed two years later and reached 800 tons in 1918. An exchange cable station of the Eastern Extension Telegraph Co. and a high-power wireless station are established on Direction Island. The German raider "Emden" landed a party to destroy these on Nov. 9 1914, and was caught and herself destroyed by the "Sydney" of the Australian navy, running ashore on North Keeling Island, while her landing-party captured and escaped in the schooner belonging to the proprietor of the islands.

The governor of the Straits Settlements is high commissioner for the Malay States, Federated and Non-Federated (*see* MALAY STATES), and also for Brunei, and British agent for Sarawak and British North Borneo. These three divisions of northern Borneo are dealt with below.

Brunei (*see* 4.681).—Pop. (1911), 21,718. Revenue (1919), $162,020; expenditure, $138,844. Imports were valued in 1916 at $254,756, and $614,061 in 1919; exports at $734,254 in 1916 and $1,134,864 in 1919, including plantation rubber ($243,596), cutch ($304,249), and coal ($296,621). The demand for sago, wild rubber (jelutong) and other forest produce, and dried fish, was great, and purchase prices ceased to be controlled by a group of traders as previously, which enabled the peasantry to profit to the extent of balancing the high prices of rice and other foodstuffs. Attempts were made to increase home production. The rice crop of 1918–9 failed, but the effort was maintained and rewarded in the following season. Plantation rubber (429,823 lb.) came mainly from the Brunei district, which has become the chief centre of the industry, in place of the Temburong basin. The cutch industry was suffering from the former indiscriminate cutting of mangroves in accessible districts where no replanting had been done, and the production was only maintained at the expense of heavier labour and transport. The Brooketon collieries yielded 29,565 tons of coal in 1918 and 26,274 tons in 1919. Attempts to develop a petroleum field at Tutong at this period were unsuccessful, though it was still expected that later there would be good results. Plantations and mines were encountering a serious shortage of labour, owing to the prosperity of the native traffic in forest produce, etc., above referred to.

Sarawak (*see* 24.207).—Pop. (estimated 1919), 600,000. Revenue (1918), $1,921,964; expenditure, $1,455,692. Imports, $9,908,732; exports, $11,540,190. Gold was exported to the value of $1,256,500 in 1915 and $923,100 in 1918. An extensive oil-field has been developed in Baram district, and 74,400 tons of oil were exported in 1918. Other principal exports include sago, pepper, and jelutong. There are four wireless stations, affording communication with Singapore. Charles Vyner Brooke (b. 1874) succeeded his father, Sir Charles Johnson Brooke, as rajah on May 17 1917.

British North Borneo (*see* 4.262).—Pop. (1911), 208,183; (estimated 1919), 227,000. The revenue of the British North Borneo Chartered Company (exclusive of land sales) has shown unbroken increase since 1910, from £170,767 in that year to £234,804 in 1914

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and £373,936 in 1919; expenditure for 1919 amounted to £193,230. Imports were valued in 1919 at £925,235, and exports at £1,453,990, including rubber (£782,037), tobacco (mostly grown on estates; £230,122), coal (£78,706), copra (£39,629), cutch (£24,651), sago, and dried fish. The company's railway from Jesselton extends to Melalap in the interior, and has a branch from Beaufort to Weston, and a total length of 130 miles. There are four wireless stations. A Legislative Council was established in 1911 to aid the governor and civil staff in the local administration: the commercial, planting, Chinese, and native communities are represented on it. The company created an opium monopoly department in 1913, following the policy of the Straits Settlements Government. (O. J. R. H.)

STRANG, WILLIAM (1859–1921), British painter-etcher (*see* 25.982), was in 1918 elected president of the International Society of Sculptors, Painters and Gravers. In 1909 the degree of LL.D. was conferred upon him by Glasgow University. His later work includes the etchings "The Little Flower Girl" (1909); "Nymph and Shepherds" (1910); "On the Omnibus" (1911); "The Walls of the Alhambra" (1912) and "The Mirror" (1912); besides various portraits, including one of Thomas Hardy (1910). He had only recently been elected a full R.A. when he died suddenly at Bournemouth, on April 12 1921.

See *Catalogue of William Strang's Etched Work, 1882–1912* (1912).

STRATEGY: *see* TACTICS.

STRATHCONA AND MOUNT ROYAL, DONALD ALEXANDER SMITH, 1ST BARON (1820–1914), Canadian statesman (*see* 25.1000), died in London Jan. 21 1914. His barony passed by special remainder to his daughter Margaret Charlotte, wife of Robert Jared Bliss Howard, of Montreal (d. 1921).

STRAUSS, RICHARD (1864–), German composer (*see* 25.1003). His opera, *Ariadne auf Naxos* (1912), was produced at His Majesty's theatre by Thomas Beecham in May 1913 and the same year *Der Rosenkavalier*, first produced at Dresden in 1910, was performed at Covent Garden with great success, eight performances being given; in point of fact, this proved to be Strauss's most popular opera. His other recent works include *Festliches Praeludium*, for orchestra (1913), and *Josephs Legende* (1914). In addition to the works enumerated mention should be made of *Eine Alpensinfonie*, (1915, op. 64); and the three-act opera, *Die Frau ohne Schatten*, libretto by Hugo von Hofmannsthal (1916, op. 65). In the winter of 1920–1 Strauss visited S. America, where he officiated at Buenos Aires as opera conductor, subsequently returning to Vienna.

STRAVINSKY, IGOR (1882–), Russian musical composer, was born at Oranienbaum, near St. Petersburg, June 18 (O.S. June 5) 1882. His father was an opera singer, who early discovered his son's remarkable musical gifts. At the same time, however, he wished the boy not to devote himself entirely to music but to study law, and with this end in view Igor Stravinsky entered the University of St. Petersburg. At the age of 22, however, a meeting with Rimsky-Korsakov decided him in the direction of a musical career, and the former declared himself ready to take Stravinsky as a pupil. His first work for orchestra was a symphony (1907), followed by a suite, *Faune et Bergère*, and two short works, also for orchestra, *Feu d'artifice* and *Scherzo fantastique*. A meeting with Serge Diaghiliev turned his attention to the possibilities of the ballet, and in rapid succession appeared *L'Oiseau de feu* (1910), *Petrouchka* (1911), and *Le Sacre du Printemps* (1913). His next important work was an opera, *Le Rossignol* (1914), founded on Hans Andersen's fairy story of *The Nightingale*, of which the second and third acts were later worked up into a symphonic poem, *Le Chant du Rossignol* (1917). The opera was produced at Covent Garden in 1920, and the same year appeared a revision by Stravinsky of Pergolesi's *Pulcinella*.

STREUVELS, STIJN, the pen-name of FRANK LATEUR (1871–), Flemish author, who was born at Heule, West Flanders, Oct. 4 1871. He was a nephew of Guido Gezelle (1830–1899), a celebrated Flemish poet, and until 1905 worked as a baker at Avelghem, a village near Courtrai in West Flanders. Writing in the West Flemish dialect, he was accepted in Belgium and Holland as the most distinguished Low Dutch author of his day. He produced many short stories, including *Openlucht* (1905) and *De Vlaschaard* (1908), a collection of which, translated into English by A. Teixeira de Mattos, appeared in 1915 under the title of *The Path of Life*. In 1912 appeared *Het glorierijke Licht* ("The Glorious Light").

STRIKES AND LOCK-OUTS (*see* 25.1024).—In the following account of later developments between 1907 and 1921, strikes in the United Kingdom are first dealt with, sections following for other countries.

(A) UNITED KINGDOM

I. *Statistics.*—Table 1 shows the total number of strikes or lock-outs recorded in each year from 1907 to 1920, inclusive; the number of workpeople involved therein, and the aggregate loss of working days due to these disputes.

Table 1.

	No. of Disputes	No. of Workpeople Directly and Indirectly Involved	Aggregate Duration of Disputes in Working Days
1907	601	147,000	2,162,000
1908	399	296,000	10,834,000
1909	436	301,000	2,774,000
1910	531	515,000	9,895,000
1911	903	962,000	10,320,000
1912	857	1,463,000	40,915,000
1913	1,497	689,000	11,631,000
1914	999	449,000	10,111,000
1915	707	453,000	3,040,000
1916	578	281,000	2,581,000
1917	803	885,000	5,809,000
1918	1,300	1,142,000	6,332,000
1919	1,413	2,515,000	34,903,000
1920	1,715	1,932,000	27,011,000

It will be seen that the figures show a general advancing tendency, partially checked during the World War. The total for the year 1920 shows the highest figure ever recorded for number of disputes, the highest figure (with one exception) for the number of workpeople involved, and the highest figure (with three exceptions) for the aggregate duration of disputes. The exceptions in this latter case are 1893, with 30,468,000 working days; 1912, with 40,915,000 working days; and 1919, with 34,903,000 working days. In 1893, 1912 and 1920 the high figures were principally due to great coal strikes; the year 1919 was a year of great industrial unrest.

As showing the general advancing tendency of the figures, it may be instructive to compare the average of the four years 1907–10 with the average of the four years 1917–20:—

	Average of Years 1907–10	Average of Years 1917–20
No. of Disputes	492	1,308
No. of Workpeople Involved	315,000	1,633,500
Aggregate Duration (in Working Days)	6,416,000	18,511,000

It should be stated that the increase in the number of disputes may be partly accounted for by improved facilities for obtaining information with regard to minor disputes, which may have previously escaped notice; but this will not account for more than an insignificant part of the increase in the figures for number of workpeople involved and for aggregate duration, since the greater disputes, involving large numbers of workpeople, have always been well reported in the newspapers. Table 2 (p. 583) shows the distribution of strikes between the principal groups of trades, taking the averages for the 10 years 1911–20.

Table 2 shows that the average number of workpeople involved in each dispute was a little over 1,000, and that the average duration of disputes was about 14 days. The figures, however, vary widely as between one trade and another. Thus, the average number of workpeople varies from a little more than 200, in the building trades, to over 3,000 in the mining and quarrying group; while the average duration varies from 8 days, in the transport trades, to 27 days in the building trades.

The figure for average numbers involved, and still more that for the average duration, give an exaggerated idea of what may be called the "normal" magnitude and duration of a strike. It is the great strikes, involving many thousands of workpeople, that are commonly also the hardest fought and the most prolonged. Great

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masses of workers are not mobilized for industrial conflict except for some object which they regard as of first-class importance; and it is exceptional for a strike or lock-out of this magnitude to occur unless all means of reaching a pacific settlement have been exhausted, and unless both employers and workpeople are organized in strong combinations, with great financial resources. All these factors tend to prolong precisely those strikes—in reality a small minority—which involve large numbers of workpeople, and thus exaggerate enormously the figure for "aggregate duration." For example, nearly 40% of the aggregate duration of disputes in the building trades was due to the great dispute in the London building trade in 1914, which lasted for more than six months and accounted for about 2,500,000 working days. In the mining and quarrying industry, two-thirds of the total aggregate duration of all the disputes was due to the two great coal strikes of 1912 and of 1920; if these were eliminated, the average number involved in disputes in this group of trades would be reduced from over 3,000 to 1,800, and the average duration from 14 to 8 days. The case is much the same with the other great groups of trades; and, speaking broadly, it may be said that the vast majority of recorded disputes involve comparatively small numbers of workpeople, and last less than a fortnight—often indeed, only a few days.

To put the same thing in another way, The number of disputes which had an aggregate duration of 25,000 days and upwards varied, in the period 1904–13, from 11 (in 1904) to 72 (in 1913), with an average of 32, or 5% of the total number of disputes. Yet this 5% of disputes accounted for 65% of the number of workpeople involved, and for no less than 86% of the aggregate duration.

Or again, the number of disputes in which 2,500 workpeople or upwards were involved varied, in the years 1904–13, from a minimum of 4 (in 1905 and in 1907) to a maximum of 43 (in 1913), with an average of 18, or less than 3% of the total number of disputes; but this 3% of disputes accounted for 67% of the total number of workpeople involved, and for 74% of the aggregate duration.

Some trades are far more subject to industrial disturbance than others; in the building trades the proportion of men who strike or are locked out rarely reaches 1% of the total number employed in the industry, and in the clothing trades the proportion is not much higher; whereas in the coal-mining industry the proportion who strike or are locked out rarely falls below 5% and frequently rises above 20% in a year.

The mean percentages of workpeople involved in disputes for the years 1904–13 were as follows:—

Building trades	0·7
Coal mining	21·4
Other mining and quarrying	2·2
Metal engineering and shipbuilding	3·3
Textile trades	6·4
Clothing trades	1·3
Other trades	1·7
All Trades	4·4

The statistics of *causes* show, on the whole, remarkable regularity. Such fluctuations, as there are, are due principally to the prevalence or otherwise of wage disputes. In years of good or improving trade, strikes for advances in wages are numerous; in years of bad and declining trade such strikes become much fewer.

The statistics of *results* show somewhat less regularity. The principal features of this part of the table are the diminishing proportion of disputes settled in favour of the employers, and the increasing proportion settled by a compromise. In the first half of the period the proportion of disputes settled in favour of the workpeople was 24% on the average; settled in favour of the employers, 44%; and compromised, or partially successful, 32%. In the second half of the period the corresponding percentages were 26, 28, and 46. It should be noted that the second period includes three or four years of exceptional prosperity, a condition which tends to promote settlements in favour of the workpeople; and that this was followed by the period of the war, when prices were constantly rising and industrial conditions were altogether abnormal.

Table 2.

Group of Trades	No. of Disputes	No. of Workpeople involved (Thousands)	Aggregate Duration in Working Days (Thousands of Working Days)
Building	119	25	652
Mining and Quarrying	164	508	7,067
Metal Engineering and Shipbuilding	265	180	2,765
Textile	107	138	2,143
Clothing	58	19	258
Transport	88	150	1,230
Miscellaneous (including Employees of Public Authorities)	260	68	968
Average for all above Trades[1]	1,061	1,088	15,083

[1] Exclusive of the general strike at Dublin in 1913–4, which cannot be classified under any of the separate trade headings. This strike involved about 20,000 workpeople, and had an aggregate duration of about 1,900,000 working days.

Table 3 classifies the disputes of the years 1900 to 1920, (*a*) according to their causes, and (*b*) according to their results:—

Table 3.

Year in which Disputes began	Proportion of Disputes arising on questions of: Wages	Hours of Labour	Employment of particular Classes or Persons.	Other Questions	Total	Proportion of Disputes settled: In favour of Workpeople	In favour of Employers	Compromised	Indefinite or Unsettled	Total
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
1900	68	1	14	17	100	31	34	34	1	100
1901	63	4	13	20	100	26	44	30	..	100
1902	60	5	13	22	100	24	47	28	1	100
1903	60	4	14	22	100	23	48	29	..	100
1904	65	4	13	18	100	17	51	32	..	100
1905	66	4	13	17	100	20	47	33	..	100
1906	68	3	11	18	100	32	37	31	..	100
1907	64	3	14	19	100	32	41	27	..	100
1908	62	3	14	21	100	20	44	36	..	100
1909	59	6	14	21	100	18	46	36	..	100
1910	57	4	15	24	100	25	37	38	..	100
1911	64	3	16	17	100	25	32	43	..	100
1912	63	3	17	17	100	27	31	42	..	100
1913	66	3	16	15	100	29	25	46	..	100
1914	63	3	18	16	100	25	33	42	..	100
1915	73	2	12	13	100	23	37	40	..	100
1916	76	3	12	9	100	22	27	51	..	100
1917	73	1	15	11	100	31	20	48	1	100
1918	68	2	17	13	100	29	21	48	2	100
1919	64	11	15	10	100	24	22	54	..	100
1920	69	3	15	13	100	24	29	47	..	100
Averages	65	4	14	17	100	25	36	39	..	100

II. *Principal Disputes.*—The year 1908 (in contrast to 1907, which was entirely free from any disputes on a great scale) saw three great disputes: (1) a shipbuilding dispute involving 35,000 workpeople, and with an aggregate duration of 1,719,000 working days; (2) an engineering dispute on the N.E. coast, involving 11,000 workpeople, and with an aggregate duration of 1,706,000 working days; and (3) a dispute in the cotton trade, involving 120,000 workpeople, and with an aggregate duration of 4,830,000 working days.

In each of these three disputes the workpeople struck against (or were locked out to enforce) a proposal to reduce wages. This was at one time a common and important cause of disputes; the great coal strike of 1893, for example, was against a reduction in wages. During 1910-20 there were few or no disputes of any importance on this ground; in fact, these three disputes in 1908 were the last important disputes arising out of an attempt to reduce wages, until the ship-joiners' dispute, which, beginning in Dec. 1920, was the precursor of a series of strikes or lock-outs culminating in the coal strike of 1921.

In each of the three disputes referred to above, one or more of the trade unions concerned was prepared, before the strike or lock-out occurred, to accept the terms offered by the employers; but in each case one or more other trade unions resisted the reduction. Modified terms offered by the employers were accepted in all three cases.

There were no important disputes in 1909; but in 1910 several prolonged disputes, involving large numbers took place.

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Trouble arose in Northumberland and Durham in Jan. 1910, with regard to the working of the coal mines under the Eight Hours Act (the Coal Mines Regulation Act, 1908), which came into operation, in those two counties, on Jan. 1 1910. Agreements had been reached between the two coal owners' associations and the respective miners' union in Dec. 1909, as to the working of the mines under the new arrangements; but a large number of men at the various mines repudiated the agreements, and refused to go down the pits. About 85,000 workpeople were involved in Durham, and about 30,000 in Northumberland. At most of the pits the strike was over by the end of Jan.; but a minority of men stood out, and the strike was not finally settled until April. The aggregate duration of the dispute was about 1,280,000 working days in Durham and about 1,080,000 working days in Northumberland.

Certain members of the United Society of Boilermakers and Iron and Steel Shipbuilders stopped work in Aug. 1910, in breach of an agreement with the Shipbuilding Employers' Federation, at two shipyards, one on the Tyne and the other on the Clyde; and the Employers' Federation locked out the members of the Boilermakers' Society at all the federated shipyards on Sept. 3. About 25,000 workpeople were directly or indirectly affected.

A provisional agreement made between representatives of the parties on Oct. 11 1910, was twice rejected by the workpeople on a ballot vote, and it was not until Dec. that a final agreement supplementing that of March 1909 was reached, and accepted by the workers. Work was resumed on Dec. 15. The aggregate loss of time in this dispute was about 2,850,000 working days.

A strike of *coal miners and surface workers* in the Rhondda Valley began on Sept. 1 1910 and continued for nearly a year, being settled in Aug. 1911. It arose out of a dispute at one pit concerning the price list for a particular seam, and was followed by sympathetic strikes at other pits belonging to the same employers. An agreement was finally reached on the price list, and on a guarantee of an average wage. About 12,800 men and boys were involved at the beginning of the strike.

The years 1911-2-3 were years of violent, and almost continuous industrial unrest. Among the most important disputes of these years were those described below.

A series of *seamen's and transport workers'* strikes began in June 1911. The original occasion of the first dispute was a demand put forward by the National Sailors' and Firemen's Union for the formation of a conciliation board, consisting of representatives of the Union and of the Shipping Federation, to consider a programme of reforms desired by the Union. The Federation refused to discuss the demands, and the seamen and firemen came out on strike at various dates in June 1911, many of the principal ports being affected. (London was not affected till a little later.) Strikes of dock labourers, carters, tramwaymen, and other transport workers occurred at some of these ports, partly in sympathy with the seamen, and partly in support of demands of their own for improved working conditions. Serious disorder occurred at Hull, Manchester and Salford.

Settlements were reached at various dates in July and Aug. affecting seamen and dockers at Hull and Goole; seamen and carters at Manchester; dock labourers and tramwaymen at Liverpool; and seamen and transport and other workers at Cardiff. There were also a large number of sectional settlements in the London dock, shipping, and transport trades.

The *railway* dispute of 1911 began with a strike of 1,000 railwaymen (goods porters, etc.) at Liverpool on Aug. 5, the men alleging their inability to get their grievances dealt with by the conciliation boards set up under the scheme of 1907. They were joined by railwaymen at Manchester and at many other centres. On Aug. 15 the executives of four of the railwaymen's trade unions sent to the various railway companies a resolution, stating that they were being pressed by their members to declare a strike, and giving the companies 24 hours to decide whether they would immediately meet representatives of the workers to discuss their grievances. The Government got into touch with representatives of the companies and of the trade unions on Aug. 16; and on the following day the Prime Minister announced that the Government was prepared to appoint immediately a Royal Commission, to investigate the working of the Railway Conciliation Agreement, and to report what amendments, if any, were desirable in the scheme. This announcement did not prevent a strike; but a provisional settlement was reached on Aug. 19, and work was generally resumed on Aug. 21 (except on one railway, where it was resumed on Aug. 23). The Royal Commission began its sittings on Aug. 23, and reported on Oct. 18. The trade unions, however, refused to accept the Commission's recommendations without various modifications; the railway companies, on their side, took the line that both sides were bound by the findings of the Commission. On Nov. 22 the House of Commons debated the question, and passed a resolution to the effect that the parties should be invited to meet with the view of discussing the best mode of giving effect to the report of the Royal Commission. The Board of Trade signified to the parties their readiness to call a fresh conference " on the understanding that the findings of the Royal Commission were accepted in principle and in substance." The parties accepted these conditions, and a conference was held, at which an agreement was reached, the recommendations of the Royal Commission being accepted with certain alterations and additions. The effect of the new agreement was to expedite the settlement by the conciliation boards of matters in dispute, to secure greater uniformity in the decisions of the conciliation boards, and to give such decisions greater finality than they had previously possessed.

The Cotton Weavers' Association of N. and N.E. Lancashire engaged in an active campaign in this year (1911) against the employment of non-unionists. The employers replied by a general lock-out, which began on Dec. 28, about 160,000 workpeople being involved. This is exclusive of the workpeople in the spinning section of the trade, who were put on short time, or thrown out of work, owing to the stoppage of the principal outlet for their production. The chief industrial commissioner (Sir George Askwith) invited the parties to a conference, which was duly held; and an agreement was reached on Jan. 19 1912. Work was to be resumed on Jan. 22, under the old conditions of employment, on the understanding that no action should be taken for six months in the way of tendering notices or striking mills on the non-unionist question. It was also agreed that, at the end of that period, Sir George Askwith would, if requested, submit proposals for the settlement of the question.

The great *coal* strike of 1912 involved an aggregate loss of working time of over 30,000,000 working days in the coal mines alone. There was also, of course, much consequential unemployment and under-employment in other industries. The percentage unemployed among members of trade unions rose to 11.3% at the end of March 1912; while blast furnaces, steel sheet works, and the glass bottle industry, were brought almost to a standstill, and tinplate mills working were reduced to about 14% of the normal number.

The strike arose out of a demand by the Miners' Federation for the payment of a minimum wage for every man and boy working underground in the mines. A conference between representatives of the coal-owners and of the miners had discussed the question of the earnings of miners in " abnormal " places (*i.e.* in working places where, owing to the thinness of the seams, or other causes beyond their control, the hewers were unable to earn the recognized minimum or average rate for the district), and a considerable measure of agreement had been reached; but at the annual conference of the Miners' Federation at Southport on Oct. 6 1911, it was decided " to take immediate steps to secure an individual district minimum wage for all men and boys working in mines in the area of the Federation, *without any reference to the working places being abnormal.*"

A ballot of the members of the Federation was taken on the question of handing in notices to establish the principle of an individual minimum wage, as expressed in the resolution quoted above. There was a large majority (445,801 to 115,721) in favour

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of giving notice; and notices were accordingly handed in, to terminate at the end of Feb.

At a subsequent meeting the Miners' Federation fixed the minimum rates they were prepared to accept in each district for piece workers "at the face" (*i.e.* hewers, etc.); and also added the following general instructions to their representatives, for their guidance in any negotiations that might ensue with the mine owners:—

"No underground adult worker should receive a rate of wages less than 5s. per shift." (This did not apply to the Forest of Dean, or to Bristol and Somerset.) "Individual minimum wages for all piece workers other than colliers to be arranged by the districts themselves, and to be as near as possible present wages."

Day rates for underground workers, and boys' wages, were also to be left to local arrangement; the boys' wages not to be less than the then existing wages, and not in any case less than 2s. a day.

Unsuccessful negotiations took place between the coal owners and the men; and on Feb. 20 Mr. Asquith, who was at that time Prime Minister, intervened, and invited both parties to meet him and other members of the Government, separately, in conference on Feb. 22. From that date onward till March 15 the Prime Minister kept in constant touch with the parties, who finally met, in joint session, with representatives of the Government, on March 12, 13 and 14. On March 15, the Prime Minister announced that the Government had decided to ask from Parliament "a legislative declaration that a reasonable minimum wage, accompanied by adequate safeguards for the protection of the employer, should be a statutory term of the contract of employment of people who are engaged underground in coal mining."

In accordance with this announcement the Prime Minister introduced a bill in the House of Commons on March 19 1912, which received the Royal Assent on March 29, as the "Coal Mines (Minimum Wage) Act, 1912." The Act provided for the setting up of a joint district board in each of 22 districts specified in a schedule to the Act, to determine the minimum rates of wages for workmen employed underground in coal mines. On March 27 the coal owners met and adopted a resolution in favour of working the Act; and on the same day the men's Federation decided to take a ballot of the members on the question of resuming work, pending the settlement of minimum rates by the district boards. The ballot showed a majority (244,011 to 201,013) against resumption; but, at a national conference held on April 6, it was decided to terminate the strike.

A great strike of *dock and other transport workers* in the Port of London and on the Medway began on May 21 1912, and lasted over two months. The immediate occasion of the dispute was the refusal of a workman who belonged to the Amalgamated Society of Foremen Lightermen to join the Amalgamated Society of Watermen, Lightermen, and Bargemen; the latter society is affiliated to the National Transport Workers' Federation, but the former is not. The employers refused to interfere, and between 5,000 and 6,000 lightermen left work on May 21, followed later by a number of dock workers, who ceased work in sympathy.

The underlying cause of the dispute, however, was dissatisfaction with the carrying out of the various agreements that had been arrived at in settlement of the disputes in the previous year (*see* above). The Government ordered an enquiry to be held by Sir Edward Clarke, K.C.; and the alleged grievances of the workmen were found to come under seven heads, including:—

Employment of non-union men, in alleged breach of an agreement, by two of the employers' associations.

Refusal of an employers' association to meet the trade union to discuss rates of wages and conditions of labour.

Refusal of certain employers to pay rates of wages fixed by various awards or agreements. Alleged interference with union workmen.

The board of trade invited representatives of the employers and of the workers to a conference, to discuss Sir E. Clarke's report. The men accepted, but the employers declined to be present, and stated that they could not accept Sir E. Clarke's report as an award on the points dealt with by him. They were unable to adopt certain suggestions made by the Board of Trade for the formation of a federation of employers; and refused, "under any circumstances, to any recognition of the Union of Transport Workers' Federation ticket, or any discussion for such recognition." Following upon debates in the House of Commons, and upon further conferences with the parties, the Government put forward various proposals on June 7; these were accepted (in substance) by the men, but refused by the employers. The Transport Workers' Federation thereupon declared a national strike of transport workers. Certain of the unions affiliated to the Federation took a ballot of their members as to the advisability of ceasing work, the result being in each case a majority against a strike; and only about 20,000 men, at Manchester and some of the minor ports, came out on strike. These all returned unconditionally after a few days' stoppage.

The places of the men on strike in London had by this time begun to be filled up by non-unionists; and the employers took a very determined attitude, refusing to agree to any conditions precedent to the men returning to work. Further negotiations were fruitless, and on July 27 the men's strike committee recommended an immediate resumption of work. By July 31 the return to work was fairly general; and by Monday, Aug. 6, practically all the men who could find work were reinstated. About 100,000 workpeople were involved in the dispute, and the aggregate duration was about 2,700,000 working days.

A strike of *tube and other metal workers* in Birmingham, Wolverhampton, Wednesbury, and other towns in the "Black Country," began on April 25 1913, and continued until the middle of July. As many as 50,000 workpeople were involved at the height of the dispute, and the aggregate duration was about 1,400,000 working days. The majority of the strikers were labourers or semi-skilled workers; but a large number of skilled men were thrown idle owing to the absence of the labourers. The men demanded an all-round advance of 2s. a week on day-rates, and 10% on piece-rates, with a standard minimum of 23s. a week for unskilled men; and various rates, on a scale rising with each year of age, for youths and for girls. The parties were brought together through the intervention of the chief industrial commissioner; and an agreement was signed on July 7, fixing the standard rate for adult able-bodied unskilled labourers at 23s. in the Birmingham district, and at 22s. in the Black Country district, to be raised to 23s. after six months. The rates for youths and for girls were also fixed, on a scale rising by ages. Piece-work rates were to be fixed by agreement between the several employers and their workmen, the day-rate, however, being guaranteed irrespective of piece-work earnings.

The Dublin dispute of 1913–4 was unique in British industrial history, in that it was the only dispute of importance, at least since regular records have been compiled, in which all the trades of a whole city and district were involved, including even agriculture. It was, in fact, the nearest approach to a "general" strike that had ever been known. Ever since the year 1908 there had been much industrial unrest in Dublin, frequently taking the form of the sympathetic strike. The "sympathetic" strike, in this developed and organized form, is a species of boycott, aiming at the complete dislocation of the trade of the firm or firms attacked; the withdrawal of their own employees is supplemented and reinforced by the refusal of the employees of other firms to handle their goods. The immediate occasion of the strike was an announcement by the Dublin Tramway Co. of the temporary closing of their parcels department, and of their intention, when that department was reopened, not to allow their employees in that department to belong to the Irish Transport and General Workers' Union, which had been active in the policy of the sympathetic strike. A number of tramwaymen struck work on Aug. 26, demanding the reinstatement of the locked-out workpeople in the parcels department; they also put in claims for increased wages, shorter hours, and other concessions. Following this came strikes (or lock-outs) of employees of flour millers, coach builders, biscuit manufacturers, coal merchants, steamship companies, master carriers, master builders, timber importers, cement and brick merchants, and farmers in the County Dublin; besides a large number of independent firms, in a wide variety of trades. At a meeting on Sept. 3, 400 employers in Dublin passed a resolution to the effect that "the

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position created by the Irish Transport and General Workers' Union (a union in name only) was a menace to all trade organizations, and had become intolerable"; and pledging themselves not to employ members of that Union, or any persons refusing to carry out his employer's lawful and reasonable instructions. A large number of employers endeavoured to require their workpeople to sign an undertaking in the following terms:—

"I hereby undertake to carry out all instructions given to me by or on behalf of my employers, and, further, I agree to immediately resign my membership of the Irish Transport and General Workers' Union (if a member), and I further undertake that I will not join or in any way support this Union."

On Sept. 26 it was announced that a Court of Enquiry had been appointed, consisting of Sir George Askwith, Sir Thomas Ratcliffe Ellis, and Mr. J. R. Clynes, to inquire into the dispute, and to take such steps as might seem desirable with the view of arriving at a settlement. The Court of Enquiry heard evidence at Dublin on Sept. 29 and on Oct. 1–4, and issued their report on Oct. 6. The report (1) regretted that no steps had been taken to set up Conciliation Boards, as had been several times suggested; (2) reported that there were indications that substantial grievances existed in the various industries; (3) condemned the policy of the sympathetic strike; "no community," it declared, "could exist if resort to the sympathetic strike became the general policy of Trade Unionism"; and (4) condemned the undertaking which the employers had endeavoured to impose on the workpeople, as contrary to individual liberty, and such as no workman or body of workmen could reasonably be expected to accept. The report also made proposals for the settlement of the dispute, based on the establishment of a series of conciliation committees. These proposals were accepted by the workers but rejected by the employers, who declared that they could not recognize the Irish Transport and General Workers' Union, until it was reorganized on proper lines, with new officials approved by the British Joint Labour Board.

Various other efforts were made to settle the dispute, notably by the Joint Board (the "British Joint Labour Board," already referred to). This was a composite body representing the parliamentary committee of the Trades Union Congress, the Executive Committee of the General Federation of Trade Unions, and the Executive of the Labour party. These overtures came very near to success, the parties being brought together in joint conference; but the negotiations broke down, on Dec. 20 1913, on the question of reinstatement. All this time the employers had been gradually replacing the men on strike or locked out; and a few of the men who had struck (or been locked out) had returned to work. During Jan. and the early part of Feb., the majority of the remaining strikers whose places were still open returned to work, most of them agreeing to handle all goods and to obey orders. In some cases the men also undertook not to belong to the Transport Union.

The principal dispute of 1914 was in the London *building* trade. Numerous strikes had occurred against the employment of non-unionists, although most of the trade unions were bound by agreements which contained (*inter alia*) a stipulation that there should be no discrimination between union and non-union labour. At a conference with eight of these trade unions, held on Dec. 23 1913, the employers put forward certain proposals for enforcing these agreements by means of penalties; these proposals were rejected by the trade unions, and on Jan. 7 1914, the London Master Builders' association gave notice that they regarded the working-rule agreements as no longer in force. The employers next endeavoured to impose on the workpeople an individual undertaking to work peacefully with non-unionists, on pain of a penalty of twenty shillings. Most of the men refused to sign the undertaking, and the strike began on Jan. 26 1914. Various efforts were made to settle the dispute; but proposals which had been agreed to by the men's representatives were twice rejected by the trade unions on a ballot vote. One of the smaller unions, however, accepted the terms at the second vote, and came to a sectional agreement; and sectional agreements were afterwards made with two other trades. At this point the National Federation of Building Trade Employers resolved on a lock-out of all their employees throughout the country, if the dispute were not settled by Aug. 15. Before the threat could be carried out, however, the World War had begun; and a settlement was hastily reached, on the basis of the acceptance by the men of the terms last offered by the employers, with certain modifications. The chief points in the settlement were:—

Employers to be at liberty to employ any man, but unions to have right of appeal against any operative who has made himself specially objectionable to his fellows. Ticket inspection granted, but not during working hours. National executives of unions to guarantee observance of rules. Six months' notice to be given for termination or modification of rules.

There was a strike of coal miners in Yorkshire, lasting from the middle of Feb. to nearly the end of April 1914, in which about 150,000 workpeople were at one time involved. The employers at certain collieries had refused to add the usual percentages to the newly established district minimum rates; and it was finally decided that a lower minimum should be fixed for certain collieries, and the percentages above standard calculated on these reduced minima.

The outbreak of the World War brought all the important current disputes to an end; and, though there were a large number of disputes in the remaining months of 1914, and indeed during the whole period of the war, most of them were quite unimportant, and were brought to a very speedy conclusion. After the passing of the first Munitions Act in 1915 many of these strikes were illegal; and, even when they were not illegal, they were sometimes unauthorized by the central executives of the respective trade unions. The fact that the dispute was illegal or unauthorized; the swift intervention of the Government, armed with emergency powers; and—perhaps more important than all these—the severe reprobation of strikes by public opinion, tended to restrict their scope and above all to shorten their duration. Hence the aggregate duration even of some of the disputes that excited most public feeling, such as the Clyde Engineering dispute of Feb. and March 1915 (about 110,000 working days) was quite trivial by comparison with the great disputes before the war.

On Feb. 4 1915, the Government appointed Sir George Askwith, Sir Francis Hopwood, and Sir George Gibb, as a "Committee on Production in Engineering and Shipbuilding Establishments," to enquire and report as to the best means of insuring that the productive power of the employees in engineering and shipbuilding establishments for Government purposes should be made fully available. The Committee recommended (*inter alia*) that industrial disputes should never be allowed to result in a stoppage of work; and that disputes which could not be settled by the ordinary means should be referred to an impartial tribunal for immediate investigation and report with a view to a settlement. The Government accepted the recommendation, and appointed the Committee on Production as the tribunal indicated.

Hence in 1915, though there were over 700 disputes, there was only one with an aggregate duration of over a million days, a coal strike in South Wales, arising out of a deadlock over a wages agreement.

There was also only one large dispute in 1916, a strike of 30,000 jute workers at Dundee, which lasted from March 24 to June 8. The workpeople claimed an advance of 15% on piece-rates of wages, but ultimately returned to work on the old terms. This year was particularly free from disputes in the coal industry, which is generally the most affected by disputes.

Several unauthorized strikes, on a fairly large scale, occurred in the *engineering* trades in 1917. These excited a great deal of public attention, both because of the vital importance of maintenance of the fullest possible engineering output during the war, and also because the strikes were openly outbreaks of revolt, not only against the restrictions imposed on industrial freedom by various statutes and regulations, but also (what was felt to be even more serious) against the authority of the trade union executives. Measured, however, by the test of aggregate duration, only one of these disputes—the engineering strike of May 1917—was of very serious importance; and, as all the disputes had many features in common, it will suffice here to give an account of the dispute in May and of another in November.

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In Nov. 1916 the Government had introduced a system of "trade cards," under which certain trade unions, including the Amalgamated Society of Engineers, were permitted to issue cards to their own members, conferring (under specified conditions) protection from military service. The system was obviously open to abuse, and the Government decided to abolish it. Simultaneously they had before Parliament a new munitions bill, which, as originally drafted, proposed (*inter alia*) to make provision for "dilution" (*i.e.* the partial utilization of unskilled or semi-skilled labour on work hitherto confined exclusively to skilled men) on commercial engineering work. Previously "dilution" had been confined to Government work.

The immediate occasion of the strike was a trivial dispute at an engineering works at Rochdale, the owners of which had committed a technical offence against the Munitions Acts. They were prosecuted and fined; but the result of the prosecution was not known until after the strike had begun.

On April 29 1917 the honorary secretary of an unofficial body called "the Manchester Joint Engineering Shop Stewards' Committee" sent out a letter calling upon engineers to come out on strike at the close of work on the following day against (1) dilution on private and commercial engineering work; (2) the withdrawal of the trade cards, and (3) the new munitions bill. Most of the engineering employees in Lancashire (which is the chief centre of the textile engineering trade) came out; and also in Sheffield, Derby, Southampton, and finally London. On the other hand, Glasgow, Newcastle, Cardiff, Birmingham, and Leeds, which were mainly "munition" centres, and not likely to be affected by the new policy, remained at work.

The unofficial committee who had taken charge of the strike denounced the official executives of the trade unions in violent terms. The executives, on their side, denounced the strike, and came to an agreement with the Government for the abolition of the trade card system. The Government supported the executives, declared their determination not to recognize the rebellious shop stewards, and finally arrested eight of these. Ultimately, however, the Government was obliged to receive the shop stewards' leaders; but under the guise of "the unofficial strike committee," and accompanied by the Executive Council of the Amalgamated Society of Engineers (the principal trade union concerned). A settlement was immediately arrived at, the unofficial committee agreeing to go back to their districts and get the men back to work, and leaving the negotiations in the hands of the Executive Council of the Amalgamated Society of Engineers.

The trade card system was abolished; but later in the year the minister of Munitions announced the withdrawal of the clauses in the Munitions Bill which would have permitted dilution on private work.

The Coventry strike was also a "shop stewards" strike, Coventry being one of the centres of the Shop Stewards movement. Unrest in this town was increased by the housing conditions, which were very bad, owing to the influx of munition workers and the consequent excessive overcrowding. On Nov. 19, the toolmakers and toolsetters at one of the engineering works in Coventry adopted a "stay-in" strike, as a protest against their inadequate rates of pay (in comparison with the unskilled men whom they had to instruct), and also in support of their demand for the recognition of the shop stewards. Next day the shop stewards went in a body to interview the head of the firm; he was ready to meet them, "and not ask who they were," but this was not enough for them; they demanded to be received *as shop stewards*. The employer refused, and the shop stewards called out all the workpeople. The whole of the engineering firms at Coventry were stopped within a few days, when it was estimated that 50,000 workpeople (men and women) were out. The strike was settled on Dec. 2 1917, by four members of the Government, who interviewed representatives of the employers and of the workpeople, the latter including some shop stewards. The negotiations which followed led up to an agreement between the Engineering Employers' Federation and the trade unions which for the first time recognized shop stewards, if duly elected and officially endorsed and controlled by their trade unions.

Apart from the engineering and munition trades the most important dispute of 1917 was a strike of *colliery examiners* (overmen, firemen, and shot-firers) in South Wales for the recognition of their trade union; the other underground and surface workers, to the number of nearly 128,000, were thrown idle by the strike. After a stoppage of three days the Colliery Examiners' Trade Union was recognized, and the employers agreed to set up a joint board to decide questions relating to firemen and shot-firers.

Industrial disputes were very numerous in 1918, but the great majority involved small numbers and were of short duration. Nearly all the considerable disputes occurred in the second half of the year; the extreme seriousness of the military situation in the first half of the year exercised a restraining influence sufficient to prevent many large movements. The only strike of any magnitude in this period was one among coal miners in the employment of a "combine" in S. Wales, who sought for recognition of a committee of their own, confined to workers in the pits of the combine.

An *engineering and munition* strike occurred at Coventry and Birmingham in July 1918, against the introduction of what was known as the "embargo." This was a prohibition by the Government of the engagement of any additional skilled men by certain firms. The prohibition applied only to a very small number of firms, but this fact was not known to the workers; indeed the existence of the embargo at all was not generally known until a notice (in misleading terms) was issued by one of the firms affected. The strike was brought to an end, after a week's stoppage, by the Government announcing that men absent from work on July 29 would have their protection certificates withdrawn.

Two strikes in the *cotton* trade occurred in this year, one in Sept. and the other in December. The first arose from a demand of the cotton spinners and piecers for unemployment pay for time lost owing to the restrictions on the working of the mills imposed by the Cotton Control Board to meet the shortage of raw material. They returned to work after a week's stoppage on the promise of an enquiry by an independent tribunal, to be appointed by the Government. The second strike was in support of a demand by the cotton spinners and piecers, and the card-room workers, for an advance of 40% on the current rates of wages (*i.e.* on the list prices, *plus* all the percentage additions already made thereto). They returned after nine days' stoppage, having obtained an advance of 50% on the standard piece-price list of wages, equivalent to about 30% on the current rates.

In this year there was also a long dispute (lasting 47 working days) between a coöperative society and the Amalgamated Union of Coöperative Employees. This union seeks to organize all classes of employees of coöperative societies, whether distributive or productive, without regard to occupation, or "craft." The coöperative society, however, demanded that its employees in printing works should belong to one or other of the "craft" unions, and not to the Amalgamated Union of Coöperative Employees. The matter was ultimately referred to arbitration, and decided in favour of the society.

The years 1919 and 1920 were years of great industrial unrest in a variety of trades. The hours of labour in the *engineering and shipbuilding trades* were reduced, as from Jan. 1 1919, from 53 or 54 to 47 per week; but many of the workers were dissatisfied, some desiring a reduction to 44 or even 40 hours, while others were aggrieved because the rates paid to piece workers and to "lieu" workers were not increased to compensate for the reduction of hours. (Time workers received the same rate of pay for the reduced hours as for the hours previously worked.) Workpeople, to the number of 150,000 in all, came out on strike in Jan. at various centres, and remained out for periods ranging from one to eight weeks. Some returned to work unconditionally; others agreed to return on the promise of a national settlement.

There was much unrest in the *coal mining* industry. One hundred and fifty thousand miners were on strike in Yorkshire in Jan. 1919, in support of a demand for a simultaneous stoppage of 20 minutes per shift for meals for surface workers; most of these were out for one or two days only. The demand was granted, for the period of Government control. The same men were on strike

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again in July and Aug., for an advance of 14·3% in piece-rates to compensate for the reduction in hours from eight to seven per day; after a stoppage of from 25 to 29 days they accepted the national settlement, which gave an advance of 12·2%. In March 100,000 miners in South Wales, the Midlands, and Yorkshire were on strike, and another 75,000 miners in Nottinghamshire, Derbyshire, Lancashire, and other districts were on strike in July, over the question of the miners' demands for increased wages, a reduction of hours, and the nationalization of the mines.

There was a great strike in the cotton trade, for a reduction of hours and 30% advance in wages, in June and July 1919, both the spinning and the weaving sections being affected. The advance was granted, and the hours were reduced from 55½ to 48 hours per week (instead of 46½, as asked).

The greatest *railway* strike that had ever occurred in England began at midnight on Sept. 26 1919. An agreement had been made between the Government, the Railway Executive Committee (representing the companies), and the trade unions in March 1919, providing, *inter alia*, for the determination by negotiation of new standard rates of pay for the various grades. Standard rates were agreed upon, in Aug., for drivers and motormen, firemen and assistant motormen, and engine cleaners; and in Sept. the Board of Trade forwarded to the National Union of Railwaymen their proposals for the standard rates of other grades, showing an average advance of 100% on pre-war rates, with a minimum of £2 a week. The Union rejected these proposals, claiming that the new rate should be based on the highest standard rate already existing for each grade, *plus* 33s. war wage, with a minimum of £3 a week. Failing a favourable reply by Sept. 25, they announced an immediate strike. Negotiations continued, and fresh proposals were made by the Government; but the Union did not feel justified in postponing the strike, which accordingly began, as stated, at midnight on Sept. 26. The Associated Society of Locomotive Engineers and Firemen, although not directly concerned in the dispute, supported the National Union of Railwaymen, and its members also ceased work.

On Oct. 1 a conference, arranged by the National Transport Workers' Federation (to which the railwaymen are affiliated), was attended by representatives of the Trades Union Congress Parliamentary committee, of the Labour party, and of a number of other trades besides railways. A mediating committee was appointed, and negotiations were resumed between the Government, the mediating committee, and the National Union of Railwaymen. A settlement was reached on Oct. 5, and work was resumed on the following morning.

The settlement provided for the resumption of negotiations, with the understanding that they should be completed by Dec. 31 1919; and for the stabilization of wages at their then existing level up to Sept. 30 1920 (subject to review at any time after Aug. 1 1920). It was also provided that "no adult railwayman in Great Britain shall receive less than 51s. so long as the cost of living is not less than 110% above pre-war level."

A strike of *ironmoulders, coremakers, and iron and steel dressers* began on Sept. 22 1919, and lasted until Jan. 12 1920. About 65,000 men were involved in the immediate dispute; but the shortage of castings consequent on the dispute greatly hindered the working of the engineering industry for many months.

The demands of the men were for an advance in wages of 15s. a week for journeymen and 7s. 6d. a week for apprentices. At the settlement on Jan. 12 they accepted an advance of 5s. for men over 18 years of age, the same as had been granted to men in the engineering trades in the previous November. It was also agreed that negotiations should be resumed on the questions of: (1) the general working conditions in foundries; (2) questions arising out of the introduction of the 47-hour week; (3) minimum standard rates for the various districts; and (4) the jurisdiction of the unions over apprentices, and the wages of apprentices.

A strike of all classes of workpeople in the *furnishing* trades began in the Manchester district and N. E. Lancashire on June 27 1919, in support of a demand for an advance in wages, a working week of 44 hours, and other concessions. On July 26 a lock-out was declared at High Wycombe, Birmingham, Nottingham, Bristol and other centres, to enforce the termination of the dispute. At most of the centres involved in the lock-out settlements were reached by the end of Oct., advances in wages being granted; in some cases provision was made for the discussion of proposals to introduce sectional work, piece-work, or female labour, where not formerly in operation. The original dispute was also settled at the end of Oct., various advances being granted. At High Wycombe, where the largest number of workpeople was involved, the lock-out was not brought to a close until nearly the end of Nov.; here also advances in wages, varying according to sex and standing and the class of work done, were granted.

The year 1920 was remarkable for one dispute, the national *coal strike* of Oct. and Nov., the aggregate duration of which was second only to those of the two previous great coal strikes in 1893, and in 1912; and for an unprecedented number of smaller disputes, in a great variety of trades, many of which would have ranked as "great" disputes in a normal year. There were also many minor disputes in the building and in the textile trades. The coal strike began out of a demand put forward by the Miners' Federation of Great Britain (1) for a flat-rate advance in wages of 2s. a shift for all persons of the age of 18 years or over, with corresponding advances for those under that age; and (2) for a reduction of 14s. 2d. a ton in the price of domestic coal. These demands were presented to the Controller of Coal Mines on July 15, and refused by the Government on July 26. A ballot of the Federation showed a great majority (606,782 to 238,865) in favour of a strike in support of these demands; and strike notices were handed in, in every district, to expire on Sept. 25.

Negotiations between the Government and the miners continued, in the course of which the miners dropped their demand for a reduction in the price of domestic coal. The Government, after making various alternative proposals which were not acceptable to the miners, concentrated on the policy of making any advance that might be granted bear some relation to increased output. The miners, however, still pressed for an immediate unconditional advance of 2s. The strike notices were twice postponed, at first for a week and then for another fortnight, in order to allow the negotiations to continue. At this stage the mine-owners were called into conference; and meetings between representatives of the miners and of the mine-owners took place almost daily from Sept. 25 to Oct. 2, inclusive.

During the first fortnight of Oct. a second ballot of the miners took place on certain proposals which had been formulated by the mine-owners at these conferences. These were to the effect that if, during the first fortnight of Oct. there were indications that the output of coal was at the rate of 240,000,000 tons per annum, an advance of 1s. a shift should be conceded as from Oct. 1, with an additional 6d. for each 4,000,000 tons, up to 3s. at 265,000,000 tons. The wages for the remainder of the year would be similarly regulated, and the whole scheme would come up for review at the end of December. The owners also pledged themselves to coöperate with the men in measures for increasing output. These proposals were rejected by the men, on a ballot vote, by a still larger majority (635,098 to 181,428); and work at the mines ceased on Oct. 16, except that certain men were allowed to continue at work for keeping the mines in order.

The strike was debated in the House of Commons on Oct. 19; and tentative suggestions for a settlement were made by Mr. Brace (at that time a member of the executive of the South Wales Miners' Federation), and by other members. Informal conversations, and then formal negotiations, followed between the Government and the miners' representatives, to which at a later stage the mine-owners also were called in; and an agreement was reached on Oct. 28 which the miners' representatives undertook to submit to their members, with a recommendation of acceptance "as a temporary measure." The agreement pledged the miners and the mine-owners to coöperate with the view of increasing output; also to prepare a scheme for the future regulation of wages, "having regard, among other considerations, to the profits of the industry, and to the principles upon which any surplus profits are to be dealt with." Pending the preparation of this scheme an immediate advance of 2s. a shift was to be granted

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to persons of 18 years of age and over, with corresponding advances to persons under that age; and from Jan. 3 1921, until the new scheme was ready, the advance would be automatically adjusted, at monthly intervals, in accordance with the surplus output in excess of 219,000,000 tons a year. The ballot upon these terms showed a small majority against acceptance (346,504 to 338,045), on a reduced total vote; but at the miners' delegate conference at which the result was announced it was decided that work should be resumed on Nov. 4, or as soon after as possible, in view of the rule of the Miners' Federation which requires a two-thirds majority for the continuance of a strike.

A strike in the *building* trade of Scotland occurred in May, June, and July 1920. During the war wages in the Scottish building trade had been regulated by awards given every four months, as in the engineering and shipbuilding trades. A claim for an advance of 6d. an hour, as from April 1 1920, came before the Industrial Court in March under this agreement, and was refused. The joiners in the west of Scotland, influenced by the high rate of wages given to joiners in the shipyards, had withdrawn from the National Agreement, and claimed the advance of 6d. independently of the other building trades operatives; and, when this award was given, they came out on strike, to the number of about ten thousand. Negotiations with the employers ensued; and at the beginning of July about a third of the operative joiners had obtained their demand for a rate of 2s. 6d. an hour. Bricklayers and masons and their labourers had also obtained an advance in the west of Scotland; but at Edinburgh and Dundee, and in Ayrshire, they were out on strike. As delay to housing schemes was feared through the strike, further conferences were held under the chairmanship of an officer of the Ministry of Labour; and an agreement was reached on July 8 giving all classes of operatives an advance for the period from July 9 to Nov. 30. The parties also agreed to meet again, to consider a scheme for levelling up rates between sections, and for the grading of districts.

Shipyards joiners and carpenters came out on strike on Dec. 1 1920, against a proposed reduction in wages of 12s. a week. (This was the first strike, on a considerable scale, against a reduction of wages since those of 1908, mentioned above.) The employers alleged that the ship-joiners had received a special additional bonus during the preceding time of pressure in the shipyards, over and above that given to other shipyard workers, because it would have been impossible otherwise to obtain the necessary labour, in view of the intense competition from the building trades; and that the exceptional circumstances which had justified the advance had now come to an end. The number involved at the end of Dec. was about ten thousand.

A strike of *piano workers* in London, to the number of about 6,500, began on April 10 and lasted for three months. The employers sought to introduce a system of payment by results, which was objected to by the workers. Work was resumed on the systems of payment existing in each factory; with a provision that a ballot vote should be taken within three months to determine the future system of payment for the entire trade.

A strike of *electricians*, which was of great importance owing to the principle involved, began on July 2 and ended on Sept. 16 1920. The members of the Electrical Trades Union came out on strike at an engineering works at Penistone (Yorks), against the employment of a foreman who was not a member of their trade union. The Engineering Employers' Federation replied by a lock-out of all members of the union employed in federated firms throughout the country. The Government appointed a Court of Enquiry, under the Industrial Courts Act, to enquire into the dispute; but the day after the Court had begun taking evidence the Electrical Trades Union notified to the Joint Industrial Council for the Electricity Supply Industry their readiness to withdraw the question of principle, *i.e.* the claim that foremen must be members of a trade union. The dispute was settled on these lines on Sept. 16, the men withdrawing their strike notices and the employers the lock-out notices. The number of men involved by the lock-out was about seven thousand.

A strike of *shirt and collar makers* in Belfast, Londonderry, Coleraine, Dublin, and other towns, began on June 12 1920, and lasted for over two months. The cutters only were directly involved, to the number of about 302; but about 17,000 other workpeople were thrown out of work. The cutters demanded higher wages, and the strike was settled by a compromise.

A strike in the spinning branch of the *cotton* trade began at Oldham on Sept. 15 1920. During the war an agreement had been made for the employment of female "creelers" (who carry away the finished yarn) to help the spinners in cases where "little piecers" (boy assistants) were not available; and it was part of the agreement that the spinners should receive extra payments, in compensation for the additional work thrown upon them when "creelers" were employed instead of "little piecers." In Sept. 1920, an agreement was signed between the master spinners and the Operative Spinners' Trade Union withdrawing, in part, these extra payments. A large number of the spinners came out on strike against this agreement, in defiance of the executive of their union. The strike began on Sept. 15, and the maximum number on strike was reached a week later, when the number was about 20,000; and about an equal number of cardroom workers and others were thrown out of work by the dispute. The men gradually went back to work on the terms of the agreement; most of them were back by Oct. 5, but the strike was not quite at an end until the end of that month.

Coal Strike of 1921. The first seven months of 1921 were notable for a rapid and continuous increase in the number of trade disputes concerning proposals for reduction of wages. The strike of shipyard joiners and carpenters against a proposed reduction of 12s. per week, which had begun on Dec. 1 1920, and came to involve directly some 10,000 workpeople, continued until Aug. 1921, when a settlement was reached on the basis of a reduction of 9s. per week, to take effect in two stages. Among other important disputes in this period was the strike in Feb. 1921 of some 5,000 nut and bolt workers in the Black Country against a proposed wage reduction, which lasted five weeks, the employers' terms being then accepted. In March 3,500 vehicle builders and 2,170 waterproof garment finishers came out on strike against proposed reductions of wages; the former dispute lasted four weeks and ended in the acceptance of a modified reduction; the latter lasted five weeks and ended in the acceptance of the reduction on condition that it should take effect in two stages. In June a national engineering strike was threatened but avoided at the last hour, while 10,000 engineering apprentices in the Manchester district struck against a proposed reduction in wages, which three weeks later was accepted. In June, also, a new wages agreement in the cotton textile industry, involving an immediate reduction of about 19% on actual wage rates, was only made after a dispute which lasted three weeks and involved some 375,000 operatives.

None of the strikes of 1921 against proposed reductions in wages compares, however, in magnitude or consequence, with the great national coal strike, which began on April 1, and ended on July 1 in an agreement which was to last until Sept. 30 1922, and thereafter, until terminated by three months' notice on either side. The position at the end of the coal strike of 1920 has already been described. Briefly a temporary settlement has been made under which the wages of miners varied according to the total output of coal from the mines of Great Britain: the more the output, the higher were the wages to be received. The miners and owners were under an obligation to prepare a scheme not later than March 31 1921, for the future regulation of wages in the industry, "having regard, among other considerations, to the profits of the industry and to the principles upon which any surplus profits are to be dealt with." The industry was still under Government control, and the "control" powers of the Mines Department of the board of trade did not expire, in any event, until Aug. 31 1921.

The coal industry, however, did not escape the effects of the general industrial depression, which indeed may be dated from the coal strike of 1920. The values of exported coal fell heavily, while the demand for coal for industrial or domestic consumption at home also decreased. The output figures for each of the

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four months from Dec. 1920 reflect the changes in the current demand. In the five weeks ended Dec. 25 the output for Great Britain was 25,406,700 tons; while in the five weeks ended Jan. 29 1921, it was 21,803,600 tons. In the four weeks ended Jan. 29 it was 18,540,500 tons; while in the four weeks ended Feb. 26 it was 17,369,100 tons, and in the four weeks ended March 26, 16,435,200 tons. An incidental result of this decreased output was the disappearance as from Feb. 28 of the wages advances granted under the settlement of Nov. 1920. In so far as the position, as affected both by the decreased output and by the reduction in values of export coal, may be judged from the Mines Department statistics, in Feb. 1921 the average loss over the whole of the collieries of Great Britain on every ton of coal disposed of commercially was 5s. 11¾d. In two districts, namely Yorkshire, and Derby, Nottingham and Leicester, there were small credits of 3½d. and 1½d. per ton respectively; while the debit balances ranged from 4s. 0½d. per ton in Durham to 18s. 1½d. per ton in South Wales.

In these circumstances the Government decided to terminate their control of the mining industry on March 31. This was the date at which the agreed scheme for the future regulation of wages in the industry was to be ready, but it was five months earlier than the date at which decontrol had been expected. On the one hand, the fall in the price of export coal to such an extent that there was no appreciable difference between the export price and the inland price, made it no longer necessary to regulate the pit head prices and the distribution of coal, and all such regulation was withdrawn as from March 1. On the other hand, the continuance of financial control, which had been a corollary of the regulation of prices and distribution was only involving the Government in heavy financial liabilities. The Coal Mines (Decontrol) Act, 1921, "an act to curtail the duration of and amend the Coal Mines (Emergency) Act, 1920," was therefore passed. The Act received Royal Assent on March 24, and its effect was to terminate the special interest the Government had hitherto had in the Mining Industry, as regards, for example, output and prices, wages and profits. Control at that moment meant financial assistance to the industry, and the removal of that financial assistance on March 31 made the formulation of a new wages agreement a matter of imperative urgency, if the work of the mines was to be continued after decontrol.

The decision of the Government to decontrol was communicated by the president of the board of trade to the mine-owners and miners, *i.e.* the Mining Association and the Miners' Federation of Great Britain, on Feb. 23. At the time the announcement was made, the Mining Association and the Miners' Federation were in the midst of negotiations with regard to the permanent scheme for the regulation of wages, which under the agreement of Nov. 1920, they were to complete by March 31 1921. On Feb. 25 the two bodies met again, and agreement was reached upon a considerable number of important points. But on one fundamental issue it was found impossible to agree. The representatives of the Miners' Federation insisted upon the necessity of a national wages scheme, with some form of a national pool, for the industry. The representatives of the owners insisted that wages must be based upon the wage-paying capacity of the districts, national discussion being confined to the enunciation of certain general principles which might provide the districts with some uniform method of determining their wage-paying capacity.

A definite conflict of principle had thus occurred. It was clear however that no scheme designed to be permanent would be applicable without modification to the abnormal position in which the industry would find itself on decontrol on April 1. It was therefore conceivable that agreement might be reached on a temporary scheme applicable strictly to the emergency period, leaving the points of difference on the permanent scheme for further discussion. In this way the occurrence of a dispute immediately upon the cessation of control might be avoided. Following upon a joint meeting of the two sides held on March 17, the National Delegate Conference of the Miners' Federation decided to ascertain the opinion of the districts as to whether or not they were prepared to abandon temporarily the policy of a national wages board and a national pool, and to empower the national executive to proceed with the negotiations with a view to establishing a temporary agreement on a district basis. On March 24 the Conference reassembled to receive the replies of the several districts, and these indicated that a very large majority of the Federation were against the proposal to enter into any temporary agreement on a district basis. There was thus no movement towards the owners' position. Notices terminating on March 31 contracts of employment at the existing rates having already been issued by the owners, the Executive Committee of the Miners' Federation met on March 30, and sent out the following instruction to the districts:—"That all notices must take effect regardless of occupation in every mine and plant in the Miners' Federation." Practically the whole of the men ceased work in accordance with this instruction at the close of the last shift on March 31. There was, however, some divergence in the districts on the question of withdrawing the pumpmen and enginemen who were covered by the official instruction of the Federation. These men were not withdrawn in all cases.

At this stage it may be noted that there were some points of agreement between the owners and miners. The agreement of Nov. 1920, envisaged a permanent scheme for the regulation of wages which would have regard "to the profits of the industry and to the principles upon which any surplus profits are to be dealt with." Working from this basis, by the time of the joint meeting of Feb. 25, four further principles had been agreed upon as follows:—

1. Wages must conform to the capacity of the industry to pay.
2. The receipt of a standard wage should justify a corresponding minimum profit to the colliery undertakings.
3. Any surplus remaining after these, and, of course, the usual working costs, had been met, should be divided between the men and the owners in agreed proportions, the workpeople's share to be an addition to their standard wages.
4. Joint audits of the owners' books by accountants representing each side should be made to ascertain all the data necessary for the periodical determination of wages.

On all other matters arising out of the proposed permanent scheme there were differences of considerable importance between the two sides. The following account of the main differences is based upon the draft agreement approved by the Delegate Conference of the Miners' Federation of Great Britain on March 10 (*i.e.* at the first available opportunity after the joint meeting of Feb. 25), and the report of the mine owners on the situation which was submitted after approval by the Central Council of the Mining Association, to the president of the board of trade on March 25 (*i.e.* immediately after the refusal of the miners to enter upon negotiations with a view to a temporary settlement on a district basis):—

1. The miners proposed that there should be established a National Board, consisting of 16 representatives of each side, which should determine all questions of wages and profits affecting the mining industry as a whole, *i.e.* the national regulation and distribution of wages. The National Board would take over the powers and duties of the existing district conciliation boards with regard to the fixing of general rates of wages. The owners would agree to maintain in production by the means of a national profits fund all existing collieries, and all collieries developed subsequently, until such times as the National Board might decide to the contrary.

On these points, the owners' position was that the idea of a "national profits fund" was abhorrent to them, that they wished district conciliation boards to be the sole authorities for fixing wages, and that national discussions should only deal with questions of principle, so as to provide the districts with a uniform method of determining wages.

2. The miners proposed that the new standard wage should be made up by incorporating all the existing percentage additions to district basis rates with those district basis rates, special allowance being made in favour of the men who were benefitting under the flat rate minimum advance which was guaranteed with the 20% wages advances of March 1920. The owners proposed that the new standard wages should be the district basis rates, *plus* the percentage additions prevailing in July 1914, *plus* the percentage additions made consequent upon the reduction in hours from 8 to 7.

3. The miners proposed that against their standard wages should be set, as minimum profits to the owners, a sum amounting in the aggregate to 10% of the sum paid as standard wages. The owners proposed that this figure should be 17%.

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4. The miners proposed that any surplus remaining after meeting standard wages, other costs and minimum profits, should be divided between miners and owners in the proportion of 100 to 10. The owners proposed that that proportion should be 80 to 20.

5. The miners proposed that their share of this surplus should be distributed by means of national uniform flat rate additions to their standard wages. The owners proposed that the miners' share of the surplus as ascertained in each district should be distributed as a percentage addition to the standard district rates.

6. Whereas the miners' proposals meant that the whole mining industry in Great Britain should be treated as one unit within which wages would be varied uniformly, the owners proposed to take as the units of uniform variation, the 25 districts among which the collieries of Great Britain are distributed by the Second Schedule of the Mining Industry Act, 1920.

With regard to the question what modifications, if any, might be introduced to meet the abnormal conditions of the period following immediately on control, the owners expressed their willingness to waive their share of the surplus in favour of the workmen, on condition that ascertainment of the proceeds of the industry in each unit should be made at monthly periods during the continuance of the concession; but they insisted that it was inevitable that wages should go down on decontrol. From the miners' point of view it was evident that the introduction of their scheme at that moment might mean the loss to the men of war wage and Sankey wage, and the miners' argument therefore was that the Government's obligation to pay war wage or Sankey award did not cease by the decision to decontrol the trade on March 31. The war wage had been given to meet the increased cost of living when the latter was only 80 per cent in excess of the pre-war figure, and (though the Government rejected this interpretation) under the terms of the award the miners claimed that the wage was liable to revision only when the cost of living fell again to that point. With regard to the Sankey wage, the argument of the miners was that the Government had accepted the Sankey Commission's recommendations for an advance in wages of 2s. per day, and if the Government now proposed that these conditions should be abandoned, it would be guilty of a breach of faith. The miners reiterated at all times from Feb. 23 to March 31 their demand that the Government should abandon its decision to decontrol the industry, or at least should continue to subsidize it during the existence of the depression from which it was suffering.

The general argument of the miners at this time was that the situation demanded a full national settlement of the wages and profits problem for the industry. The trade as a whole needed uniform peace and security, and district or local negotiations must result in strife. The workmen and their families had to live in the poor districts as well as in the rich, and for uniform expenditure of energy there should be uniform reward. This had been recognized by the Government, first by the payment of uniform war wages to meet the increased cost of living, and, secondly, by the acceptance of the decision of the Sankey Commission to raise uniformly the wages of all coal miners to meet the agreed case for a uniform advance in their standard of living. A National Wages Board, exercising the right to distribute nationally both wages and profits, need not necessarily result in a uniform profit for all undertakings, but by means of a small levy upon the total tonnage raised in every mine, money would be made available for maintaining poor collieries in production as long as their coal was in demand.

The view of the owners, on the other hand, was that the wide variations in the losses of different coalfields made anything in the nature of a national settlement of wages impossible. While there were such divergencies between district and district, each district must determine its own wages by its ability to pay, and the individual who could not pay the wages so determined must decide for himself whether to close his pits or to bear the loss. The country could not afford to keep unprofitable pits working.

From the opening of the strike on April 1, four whole months passed before an agreement between the owners and miners was reached. The first difficulty to secure a resumption of negotiations encountered was in the Government insisting that the first subject to be discussed should be the return of the safety men to the mines, while the miners held that negotiations were useless if their demands for a wages settlement along national lines, and a national profits' pool, were totally unacceptable. But the influence of the other members of the Triple Alliance secured a modification of both points of view, and joint negotiations were resumed on April 11 and 12. On April 12 the view of the Government was outlined that, while the miners' demand for a national settlement of wages might be practicable, their demand for a national pool of profits was impracticable. A pooling arrangement for the equalization of wages in the industry was declared not to be possible without the resumption of complete and permanent control by the State of the mining industry. A national settlement of wages, however, was suggested, by which the 2nd, 3rd, 4th and 5th points at issue between the owners and miners as outlined above should be determined by the joint conference, whilst subsequent differences of interpretation should be referred to a national joint committee of owners and miners. The prime minister explained the Government's proposals as regards the abnormal period following upon decontrol, as follows:—

"If and when an arrangement had been arrived at between the coal owners and the miners as to the rate of wages to be paid in the industry, fixed upon an economic basis, the Government would be willing to give assistance, either by loan or otherwise, during a short period, in order to mitigate the rapid reduction in wages in the districts most severely affected."

These proposals were fully discussed, but the miners' officials intimated their inability to accept them or to abandon their former position, and the conference thereupon ended. This failure at once brought to a head the question whether the other two members of the Triple Alliance, namely, the National Union of Railwaymen [1] and the National Transport Workers' Federation, would take sympathetic strike action in support of the miners. A general meeting of the National Union of Railwaymen, and a full conference of the executives of unions affiliated to the National Transport Workers' Federation, were summoned, and remained in session until April 16, when the question of sympathetic action was finally settled. The mediatory efforts of the railwaymen and transport workers on April 9, which secured the resumption of negotiations between owners and miners, had been supported by a decision that a sympathetic strike should take place on the night of April 12 unless negotiations between the miners, owners and Government were reopened before that date. This strike of April 12 was avoided by the resumption of negotiations on the 11th, but on the 13th, the day after the failure of the resumed negotiations, the railwaymen and transport workers determined to strike at 10 P.M. on April 15 in support of the miners. This sympathetic strike of April 15 was avoided, however, at the last moment. In the late evening of the 14th a group of private members of the House of Commons, after hearing a statement by Mr. Evan Williams, president of the Mining Association, dealing with the effect on the miners' actual earnings of the owners' proposals, invited Mr. Frank Hodges, the secretary of the Miners' Federation, to make a similar statement on behalf of the miners. In the discussion which followed his speech, it was understood from Mr. Hodges that the miners would be prepared to discuss a temporary wages settlement, provided that a period of time were fixed for the negotiation of a permanent settlement, to contain the principles of a national pool and a national wages board. The Prime Minister was at once communicated with, and on the following morning he invited owners and miners to meet him again for a further consideration of the wages question. The executive of the Miners' Federation, to general surprise, abruptly declined this invitation, and Mr. Hodges, whose "offer" was thus ignored, tendered his resignation (though it was afterwards withdrawn). The leaders of the railwaymen and transport workers, however, in these circumstances decided not to proceed with the sympathetic strike, and a breach was created in the Triple Alliance.

The next stage in the history of the dispute was a second series of joint negotiations between owners and miners, from April 22

[1] The Associated Society of Locomotive Engineers and Firemen before the close of this episode joined the other railwaymen and the transport workers in the discussions and the decisions on the question of sympathetic strike action.

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to 28, as a result of a further invitation from the Prime Minister. This conference produced a further set of proposals from the owners, and the first detailed proposals for a settlement made by the Government in the course of the dispute, but these were rejected on the 28th by the National Delegate Conference, on the ground that they did not concede "the fundamental principles of a National Wages Board and a National Pool." No definite progress had been made as regards the proposed establishment of a permanent scheme for the regulation of wages in the industry. The Government suggested that the period of the permanent scheme should be one year from the close of the temporary period, subject thereafter to 3 months' notice on either side. This suggestion became part of the final settlement of July 1. They declared that a national pool or levy would involve legislation and must be regarded as a political issue; but they would accept a "National Wages Board" entrusted with the tasks of drawing up a schedule of districts and determining the principles by which wages should be adjusted in the districts, as well as with the duties of interpretation. The owners also spoke at this time of "areas" rather than "districts," the "areas" being the six divisions of Great Britain, among which the 25 districts are distributed by the Second Schedule of the Mining Industry Act, 1920. On the other hand, as a result of the statements of the owners and the Government, substantial progress was made with the preparation of a detailed temporary scheme for the emergency or abnormal period. The main points of these proposals may be summarized as follows:—

1. The duration of the temporary scheme was to be three months.
2. In each of the three months, a maximum sum per shift should be fixed, and the wages of no miner should be reduced by more than that maximum sum. The maximum reduction would be expressed as a national flat rate.
3. For the first month a maximum reduction of 3s. per shift was proposed and for the second month, one of 3s. 6d.
4. The Government were prepared to make a grant of £10,000,000 as their share in the cost of the scheme, and it was suggested that a portion of this grant might be carried forward into a fourth month.
5. The owners were prepared to waive all share in the surplus in any area, if the taking of that share would have the effect of reducing the rates of wages in one month as compared with the previous month. This was an elaboration of the proposal of the owners as regards the emergency period given above, and made public on March 25.
6. The owners were also prepared to agree that, during the period of the temporary scheme, deficiencies in standard profits should not be carried forward from one accounting period to another.

The miners, however, were as much opposed to this proposed temporary scheme as to the owners' permanent scheme. They could not accept a temporary settlement which was related to district settlements; they could not accept reductions which would force their wages below the cost of living level; and they maintained their demand that the Government should render financial assistance to the industry so as to prevent this occurring. On a cost of living basis they argued that the maximum reduction in the first place should be 2s. per shift: whereas the Government proposed a first reduction of 3s. per shift.

From the close of the second series of joint negotiations on April 28, a whole month elapsed before official negotiations were resumed. A third series of negotiations was then begun on May 27, an address being made by the Prime Minister to a joint assembly of the central committee of the Mining Association and the executive committee of the Miners' Federation. Proposals for a settlement were submitted by the Government separately to the two sides on May 28, and on June 3 the observations of owners and miners on these proposals were communicated to the Prime Minister. The reply of the Miners' Federation, drawn up by their executive committee, was to the effect that in every instance the districts had rejected the proposals. On June 4 the Prime Minister announced that the Government's offer of a grant of £10,000,000, intended to mitigate the reductions in wages and allow of a gradual scaling down of wages until they reached an economic level which the industry could sustain, would be withdrawn unless a settlement were reached within 14 days. This announcement was followed by joint meetings between owners and miners on June 6, 7, 8 and 9, and on June 10 the National Delegate Conference of the Miners' Federation adopted a recommendation of their executive to refer the alternative courses of action to a ballot vote of their members. The alternatives were put to the men as follows:—

"(1) Are you in favour of fighting on for the principles of the National Wages Board and National Pool, with loss of Government subsidy of £10,000,000 for wages if no settlement by June 18 1921?
"(2) Are you in favour of accepting the Government's and owners' terms as set forth on the back of this ballot paper?"

The result of the vote was known on June 17: the first question was answered in the affirmative by 435,614 members, and the second question by 180,725. The previous decisions of the representative bodies of the Federation were thus emphatically confirmed. The Government therefore announced their withdrawal of the proposed subsidy, and the basis for a temporary settlement had for the time being disappeared.

From the point of view of the final settlement, however, this third series of negotiations was important for the modifications which were made in the owners' permanent scheme. The owners definitely adopted the Government suggestions regarding the duration of the permanent scheme and the establishment of a National Wages Board; they proposed the establishment of similarly constituted district boards to determine district questions; they accepted a proposal made by the Government that if the rates of wages as fixed under the permanent scheme did not provide a subsistence wage to low-paid day wage workers, additions in the form of allowances per shift worked should be made by the decision of the district wages boards; and they were prepared to guarantee that the miners should receive during the first year of the agreement a minimum percentage addition of 20% to the standard wage as proposed by the owners.

The final period from June 17 to July 1 was remarkable for the marked changes in the attitude of the executive of the Miners' Federation. On June 18 an invitation was issued to the executive committees of all unions affected by wages disputes to meet the miners' executive at the earliest possible date, with the object of taking joint national action with the miners to secure their several demands. The meeting was arranged for June 25. Meanwhile the annual conference of the Labour party held at Brighton on June 21–4 showed plainly that no support for extended militant action would be given by other trade unions. The projected meeting of June 25 was therefore abandoned, and the Prime Minister was again approached by the miners' executive with a view to securing a satisfactory wages settlement. Joint negotiations between miners and owners were accordingly resumed on June 27, and on the evening of that day it was reported to the Government that an agreement had been reached, upon the assumption that the Government would reopen their offer of a grant of £10,000,000 to the industry. On June 28 the Government expressed their willingness to subsidize wages as required, during the temporary period, up to a maximum of £10,000,000. The miners' executive then referred the proposed terms to their districts; and their recommendation that the terms should be accepted was indorsed at the district meetings. On July 1 the final agreement between the Miners' Federation and the Mining Association was signed, the House of Commons voting, on the same day, a subsidy in aid of wages in the form offered by the Government on June 28. Work in the coal mines throughout Great Britain was resumed as rapidly as the circumstances at each colliery permitted.

The agreement largely incorporated the terms of the interim proposals. With regard to the temporary period of three months, it was agreed that the maximum national flat-rate reductions should be 2s. per shift in the first month, 2s. 6d. in the second month, and 3s. in the third month; and that, in those districts where it was not necessary to enforce the full maximum reduction, the wages payable during the temporary period should be calculated in terms of uniform district flat-rate reductions, and not in terms of basis rates *plus* percentages. On the other hand, the Government subsidy was now a maximum sum, and any balance not issued in respect of the temporary period of three months was no longer available to ease any further reductions

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which might be necessary in the fourth month after the settlement. With regard to the permanent scheme the settlement provided that standard profits should be 17% of standard wages, and that 83% of the surplus proceeds should be applied to the payment of wages above the standard rates. The duration of the guarantee that the miners should receive a minimum percentage addition of 20% to the standard wages, was extended from one year to the whole period of the permanent scheme. In other respects the permanent scheme was the one first outlined by the owners before the beginning of the strike, but it included the important modifications and safeguards introduced in the course of the third series of joint negotiations.

The outbreak of the strike had led to the Government passing an Emergency Powers Act into law, to enable exceptional provision to be made for the protection of the community when "any action has been taken, or is immediately threatened by any person or body of persons, of such a nature or on so extensive a scale, as to be calculated . . . to deprive the community, or a substantial portion of the community, of the essentials of life." On March 31 a proclamation was made under this Act declaring a "state of emergency" to exist, and by successive renewals at monthly intervals the "state of emergency" was continued until the settlement of July 1. Within this general period a state of more intense emergency occurred from April 8 to June 2. During this latter period the Reserves were embodied, and in addition to the enrolment of special constables, a Defence Force was enlisted with the object of supporting the police in providing protection to volunteers who were maintaining the mines in condition, or who might be required to carry on transport work in the event of the extension of the coal strike to railway and transport services. During the state of emergency, a series of emergency regulations were in force under which the Mines Department of the board of trade controlled the supply, consumption and movement of coal, and the police authorities in the various parts of the country were endowed with special powers for the suppression of sedition.

(B) Foreign Countries

A brief account is given below of the most recent statistics of the strikes and lock-outs in the principal European countries, other than the United Kingdom, available in 1921.

France.—Detailed statistics of strikes and lock-outs for the years 1890 to 1912 and summaries for the years 1913 and 1914 had been published by the French Ministry of Labour. The following are the totals for the years 1907–14:—

Year	Number of Disputes	Number of Workpeople directly affected	Aggregate Duration in Working Days
1907	1,279	198,136	3,563,237
1908	1,104	124,248	2,307,120
1909	1,036	169,509	3,581,928
1910	1,511	290,899	4,887,837
1911	1,474	230,795	4,037,475
1912	1,120	268,230	2,335,891
1913[1]	1,073	220,448	2,223,781
1914[1]	672	160,566	2,192,078

[1] The figures for the years 1913 and 1914 relate only to strikes.

The principal groups of industries affected by the disputes were in 1907 the transport group involving 43,248 workpeople; in 1908 and 1909 the building trade group involving 56,691 and 42,658 workpeople respectively; in 1910 the transport group involving 83,025 workpeople, and the building group involving 75,695 workpeople; in 1911 the building group involving 93,660 workpeople; and in 1912 the mining and quarrying group involving 137,602.

During the years 1907 to 1912, 46% of the total number of workpeople affected were involved in disputes concerning wages, 19% in disputes concerning hours of labour, 10% in disputes concerning the employment of particular classes of persons, 11% in disputes concerning working arrangements and the remaining 14% in disputes due to other causes. The results of disputes during the period under survey were as follows: disputes involving 12% of the total number of workpeople directly affected terminated in favour of the workpeople; disputes involving 44% in favour of the employers; those involving the remaining 44% in a compromise.

Germany.—From 1899 statistics of strikes and lock-outs other than in agriculture have been published annually by the German Federal Statistical Office. The figures for the period 1907 to 1918 are summarized below:

Year	Number of Disputes	Number of Workpeople directly or indirectly affected
1907	2,512	280,016
1908	1,524	119,781
1909	1,652	130,883
1910	3,228	390,706
1911	2,798	385,216
1912	2,834	493,749
1913	2,464	323,394
1914	1,223	98,339
1915	141	15,238
1916	240	128,881
1917	562	668,032
1918	772	1,325,897

The principal groups of industries affected by disputes in 1913 were the metal and engineering group involving 81,025 workpeople, the mining and smelting group involving 78,221 workpeople, and the building trades group involving 69,899 workpeople. In 1918 the principal groups were the mining and smelting group with 336,378 workpeople involved, and the metal and engineering group with 279,921 workpeople involved.

Of the total number of disputes occurring during the period 1907–18, 52% arose on questions of wages, 16% on questions of hours, and the balance on questions of the employment of particular classes of persons, working arrangements and miscellaneous matters. During the same period 15% of the total number of disputes were settled in favour of the workpeople, and 39% in favour of the employers, while 46% were compromised.

Belgium.—Statistics of strikes and lock-outs are published by the Belgian Ministry of Industry, Labour and Supplies. The table given below shows the number of strikes and lock-outs, and the number of workpeople directly affected, in the period 1908 to 1919, with the exception of 1914 to 1918.

Year	Number of Disputes	Number of Workpeople directly affected
1908	118	17,085
1909	123	23,469
1910	110	27,257
1911	162	57,203
1912	206	63,772
1913	167	23,752
1919	372	164,030

The mining and quarrying and the textile industries accounted for 6,096 and 3,114 respectively of the workpeople affected in 1908, for 6,456 and 2,846 of the workpeople affected in 1909, for 21,103 and 2,388 in 1910, for 34,417 and 9,089 in 1911, and for 38,479 and 5,856 in 1912. In 1913 the textile industry accounted for 10,158 of workpeople affected, and in 1919 the mining and quarrying industry for 99,035 of the workpeople affected. The causes of the disputes during the period 1908–13 were mainly questions of wages, 52% of the workpeople being involved on this account. Of the total number of strikes during the same period 13% ended in favour of the workpeople, 59% ended in favour of the employers, and 28% resulted in a compromise.

Holland.—Statistics of disputes in Holland are published by the Central Statistical Bureau. The figures for the years 1907–19 are given in the table below:—

Year	Number of Disputes	Number of Workpeople directly affected	Aggregate Duration in Working Days
1907	154	15,154	4,366,691
1908	135	7,165	91,860
1909	189	8,455	272,013
1910	146	13,238	334,595
1911	217	20,005	435,992
1912	283	21,672	367,751
1913	427	30,161	787,876
1914	271	25,569	361,400
1915	269	15,179	165,247
1916	377	18,127	249,442
1917	344	31,317	526,507
1918	325	39,640	607,236
1919	649	61,667	1,051,884

During the period 1911–5 the proportion of disputes due to questions of wages was 55%; it was 58% in 1916, 55% in 1917, 57% in 1918, and 58% in 1919. The results of the disputes during the period 1910–9 were as follows:—22% ended in favour of the workpeople, 28% ended in favour of the employers; 44% were compromised; and 6% were either indeterminate or the result unknown.

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Sweden.—The Swedish labour department has published statistics of strikes and lock-outs since 1903. Figures for 1908 to 1919 are shown below:—

Year	Number of Disputes	Number of Workpeople directly affected
1908	302	40,357
1909	138	301,749
1910	76	3,671
1911	98	20,576
1912	116	9,980
1913	119	9,591
1914	115	14,385
1915	80	5,119
1916	227	20,711
1917	475	46,701
1918	708	61,223
1919	440	81,041

Of the disputes recorded during the period 1910–9, 63% were caused by questions of wages. In the same period 28% of the disputes were settled in favour of the workpeople, 28% in favour of the employers, and 42% were compromised.

Spain.—Statistics of strikes are published annually by the Spanish Institute of Social Reforms. The figures for 1905–18 are given below:—

Year	Number of Strikes	Number of Workpeople directly affected
1905	130	20,176
1906	122	24,394
1907	118	12,671
1908	127	12,748
1909	78	6,683
1910	151	35,897
1911	118	22,154
1912	169	36,306
1913	201	84,316
1914	140	49,267
1915	91	30,591
1916	178	96,882
1917	176	71,440
1918	256	109,168

Questions of wages were the main causes of 48% of the strikes during the period 1910–8. In the same period 32% of the strikes terminated in favour of the workpeople, 34% in favour of the employers and 34% were compromised. In 1918, 29% of the workpeople directly affected were employed in agriculture and cattle breeding, 11% in the textile industry, 10% in the mining industry, and 9% in both metal and engineering and clothing trades.

(C) British Dominions

Canada.—Statistics of disputes are published by the Department of Labour. The following table shows the number of disputes, the number of workpeople involved and the aggregate duration in working days during the years 1908–19:—

Year	Number of Disputes	Number of Workpeople directly or indirectly affected	Aggregate Duration in Working Days
1908	68	25,293	708,285
1909	69	17,332	871,845
1910	84	21,280	718,635
1911	99	30,094	2,046,650
1912	150	40,511	1,099,208
1913	113	39,536	1,287,678
1914	44	8,678	430,054
1915	73	9,140	106,149
1916	75	21,157	208,277
1917	148	48,392	1,134,970
1918	196	68,489	763,241
1919	298	133,988	3,942,189

Of the 449 disputes recorded during the period 1911–5, 128 occurred in the building trades, 103 in the metal trades, 51 in the clothing trades, 39 in the general transport trades and 29 in the mining industry. The majority of the disputes during the same period were due to questions of wages and hours, about 70% of the disputes being due to this cause. With regard to the results of the disputes during this period 139 or 30% resulted in favour of the workpeople, 164 or 36% in favour of the employers, 79 or 17% were compromised and in the remaining 67 cases the result was indefinite.

In 1919 the industry most affected by disputes was the metal and engineering, in which there were 45 strikes, involving 70,268 workpeople and a time loss of 1,993,704 working days. Forty strikes, involving 10,779 workpeople and resulting in a loss of 287,146 working days, occurred in the building trades. Of the 298 disputes recorded in 1919, 223 were due to wages. In the same year 157 of the disputes terminated in favour of the workpeople, 88 in favour of the employers and 23 were compromised.

Australia.—The systematic collection of statistical data regarding strikes and lock-outs in Australia was initiated by the Commonwealth Bureau of Census and Statistics at the beginning of 1913.

The following table shows the number of strikes and the number of workpeople directly and indirectly affected in the years 1913–9:—

Year	Number of Disputes	Number of Workpeople affected
1913	208	50,283
1914	337	71,049
1915	358	81,292
1916	508	170,683
1917	444	173,970
1918	298	56,439
1919	460	157,591

In 1919 the total number of working days lost on account of strikes and lock-outs was 5,652,726. (J. H.)

(D) United States

In Nov. 1909, more than 25,000 shirt-waist makers struck in New York City; in July 1910 the cloak and suit makers in the same city; and in Oct. the men's clothing workers in Chicago. These strikes were remarkable for the numbers involved, and for the plans of adjusting grievances which resulted.

The joint agreement of the bituminous mine operators with the United Mine Workers expired April 1 1910. Disagreements as to district boundaries prevented its renewal without friction. On April 1 about 300,000 miners struck. In most districts the operators soon granted the wages increases demanded. Some 45,000 miners remained out. In July the union concluded an agreement with the remaining operators, only to have it rejected by referendum of the strikers. The miners returned to work in Sept.; the union had paid out $674,216 in strike benefits. The same year, in Columbus, O., the street-railway employees struck three times, in April, May and July, because of discharges of union members. The state Board of Arbitration considered the company responsible. The strikes were marked by violence; much of the company's property was destroyed and a number of lives were lost. Twice the militia were used to restore order.

In 1912 there were strikes led by the Industrial Workers of the World among the silk workers of New Jersey, the lumbermen in Louisiana, and the textile workers in Lawrence, Mass. (*See* Trade Unions.) The Lawrence strike lasted for nine weeks and affected 12 mills. On Jan. 11 about 14,000 employees walked out, and during the strike the number increased to 23,000. The cause of the strike was the announcement by mill owners, when the state law went into effect limiting the hours of women and children to 54 a week, that the reduction in hours would not be accompanied by an increase in the hourly rates of pay. At the beginning of the strike only a small number of the operatives were organized; the paid-up membership of the I.W.W. in Lawrence was not more than 300. During the strike the I.W.W. claimed 14,000 members; but the next year the membership had dwindled to one-half. Violent acts by strikers, greatly exaggerated by the press, and violent acts by deputies, police and militia, scarcely mentioned by the press, embittered the struggle. Early in the strike Haywood, Ettor and Giovannitti, I.W.W. organizers, went to Lawrence. Their coming resulted in a reduction of violence, for they preached passive resistance; however, threats to prevent strikebreakers from working probably continued. A business man of Lawrence, not connected with the strikers, was arrested and fined for placing sticks of dynamite in various parts of the town, presumably to discredit the strikers. The American Federation of Labor contributed $11,000 to the strike relief fund, the Socialists $40,000 and the I.W.W. $16,000. Two hundred children of the strikers were sent to New York to be fed by other workers in order that their parents might hold out longer. Ettor and Giovannitti were arrested in connexion with the murder of a woman, and used their trial for propaganda. The I.W.W. urged a general boycott of Lawrence. As a result of the strike 30,000 employees received wages increases of from 5%

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to 20%, and an increased rate for overtime. The largest increases were given to the unskilled workers.

The anthracite coal strike, beginning March 31 1912 lasted seven weeks. About 170,000 men and boys were out. The results were wages increases, abolition of the sliding scale and provision for a grievance committee. A strike of the coal-miners of Paint Creek and Cabin Creek in W. Virginia lasted from April 1912 to July 1913, and was marked by violence and lawlessness. Thirteen lives were lost. It has been estimated that the employers lost $2,000,000 because of the strike, the strikers $1,500,000 in wages and that the strike cost the taxpayers of the state or county $500,000. Miners in other states contributed $602,000 to the strike fund. The U.S. Senate ordered an investigation.

In 1913 business was active, the cost of living was rising, and there were many strikes. A strike of silk workers in Paterson, N.J., beginning in Feb. involved 293 establishments and over 25,000 workers. The strike was in protest against the introduction of the three- and four-loom system, and to enforce shorter hours and increased wages. After the strike began, the I.W.W. sent in their leaders. They succeeded in holding the workers together during the five months of the strike. The attempt by the American Federation of Labor to organize the workers and effect trade agreements with the employers failed. The strike was lost through exhaustion of the workers. A strike in the copper mines of upper Michigan, for recognition of the Western Federation of Miners and to compel the enforcement of certain state laws, began in the summer of 1913 and lasted until April 1914. The men were taken back with the promise of wages increases and reduction of hours, but on condition that they give up membership in the union.

In Sept. 1913 a strike broke out among the employees of the Colorado Fuel and Iron Co. for recognition of the United Mine Workers' Union, wages increases and the enforcement of state mining laws. In Dec. a Federal grand jury indicted many of the union officials for violating the anti-trust Act by trying to create a monopoly of labour. Mine operators were also indicted for violating state mining laws. In Jan. 1914 the Federal House of Representatives ordered an investigation. Early in the strike the state militia had been sent in and martial law declared. Both sides were guilty of violence. The strikers had moved from the houses owned by the company to tent colonies on land leased by the union. One of the largest of these was at Ludlow. On April 20 1914 militia fired into the tents, which were ignited, and 7 men, 2 women and 11 children perished. Each side accused the other of initiating the attack. John D. Rockefeller, Jr., on behalf of the employing company, refused to go to arbitration with the union, which he believed to be controlled by eastern agitators. President Wilson then sent 2,000 Federal troops to restore peace. They took the place of the militia, who withdrew, and disarmed the strikers and mine guards and deported the strikebreakers. In Sept. President Wilson proposed that the company should take back the strikers not guilty of violence and establish grievance committees and a committee of appeals to effect arbitration. The proposal was accepted by the miners but rejected by the operators. Early in Dec. 1914 the President appointed a commission to settle future disputes in the Colorado mines, made up of representatives of the employers, the union and the public. The union then voted to call off the strike and on Dec. 30 part of the Federal troops were withdrawn. At no time during the strike did the directors of the company visit the property, but after investigation by the U.S. Commission on Industrial Relations, John D. Rockefeller, Jr., visited Colorado. The result was the introduction of a system of employee representation. The miners voted to accept the plan, which provides for annual election, by the workers in each camp, of representatives to meet in conference with the employers' representatives. Each district conference names committees on conciliation, safety, sanitation, health and housing, education and recreation. A supervisor of welfare work was appointed. The workers were granted the basic 8-hour day and check-weighmen. A promise was given that union men would not be discriminated against, but the union was not recognized.

A lock-out of 16,000 coal-miners in Ohio which lasted more than a year was settled in May 1915, by Federal mediation. For a year after the war broke out in Europe, business was depressed in the United States, and many workers were competing for employment; but with increasing demand for labour on war contracts strikes again became numerous. In 1915 there were 102 strikes and 6 lock-outs of machinists in the four months July to Oct.; in nearly every case the basic 8-hour day was gained. In 1916 there was rioting in connexion with strikes in the oil refineries at Bayonne, N.J., of iron and steel workers in East Youngstown, O., and of 30,000 workers of the Westinghouse Electric Co. in Pittsburgh. Unorganized iron miners on the Mesaba range in Michigan were on strike from June to October. In the same year there were also strikes of longshoremen on the Pacific coast, and street railway employees in several cities. Coal strikes affected 350,000 men. Some 10% of the strikes that year were in New York City where more than 300,000 workers were out, chiefly in the garment trades.

After the United States entered the war the American Federation of Labor discouraged strikes in essential industries. Disputes were settled by negotiation. A number of strikes did occur, however, in some cases involving large numbers of workers; the great majority were settled by Government committees. Those responsible for war labour administration were of the opinion that the period of the war should be one of truce in the industrial field. Demands for closed shop or for radical social change were barred. The truce was not always respected by workers or employers, but on the whole it was adhered to. Local machinists' unions in Bridgeport and Newark came under radical socialist leadership. As many of the Allies' war orders were placed in Bridgeport there was great demand for machinists and the town became overcrowded. The men were dissatisfied because their pay was lower than that of men in the shipbuilding yards, and because employers discriminated against the unions. In the summer of 1917 the men demanded the 8-hour day, 10% increase in wages with certain minimum rates of pay for each class of workers, right of union membership and shop committees for the adjustment of grievances. The answer of the employers was to ask the U.S. attorney-general for criminal action. Various Federal agents were sent to Bridgeport but were unsuccessful in preventing the strike which occurred in May 1918. The strikers, however, were persuaded by the Federal mediator to return to work. Hearings were held in Washington before a special board of the Ordnance Department, and on June 8 the award was made public. After some protest the workers accepted it, but the employers refused, with the result that the men again went out on strike June 26. The War Labor Board took up the matter, but unsuccessfully, an umpire was appointed, who granted the 8-hour day, arrangements for collective bargaining, and wages increases for the most poorly paid workers; but not classification of workers with minimum wage rates. The men felt that the Government should have sustained its earlier award, and they refused to accept the second, which seemed to them to be a compromise with the employers. A third time they went out on strike. President Wilson then wrote to the strikers threatening that unless they returned to work immediately, they would be refused employment in any war industry in their community, they might not claim draft exemption on the grounds of employment in an essential industry, and that the U.S. Employment Service would refuse to find them work in other localities. On Sept. 17 1918 the men voted to return to work. The President also required the employers to reinstate all strikers. The collective bargaining machinery provided by the award never functioned.

In the summer of 1917 the entire lumber industry of the north-west was disorganized by strikes. The chief demand was for the 8-hour day. The President's Mediation Commission was unsuccessful in its attempt to settle the difficulties. The employers continued the 10-hour day, but they had difficulty in keeping men, and those who did accept employment practised sabotage. In the shipyards workers refused to handle "10-hour lumber." These conditions continued until Col. Brice P. Disque, sent into

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the field by the "spruce division" of the War Department, effected the organization of the Loyal Legion of Loggers and Lumbermen made up of both employers and employees and with the aim of improving conditions by mutual agreement. Members signed a pledge of loyalty to the U.S. Government. On March 1 1918 the employers introduced the 8-hour day without reduction of wages. A sanitary survey of the camps was instituted, and other improvements in living conditions were made. Labour turnover decreased and output increased considerably. Although at first it had aroused suspicion, the organization won support of most of the employers and men, but both A. F. of L. unions and I.W.W. continued to oppose it.

In many places the public, in sympathy with the employing interest and angered by the philosophy of the I.W.W., attempted to prevent strikes by arresting labour organizers as these came into a locality. Some were thrown into jail and sometimes kept there for long periods without trial. Among the strikes in connexion with which violence occurred were those of the miners in Arizona, in 1917, who struck near Jerome (May) and Bisbee (June) and also in two other districts. The chief demands were for higher wages and grievance committees. Mine owners charged the I.W.W. as responsible, although an A. F. of L. international union was actually in charge of the strike. About 100 miners were deported from Jerome by the employing interests, in cattle-cars. The train was turned back at the California state line, and the men were kept in jail for three months. On July 12 1917 in Bisbee, 1,200 strikers were dragged from their beds by armed citizens, compelled to march, and then confined in a ballfield and loaded on cattle-cars. The train was sent through the desert until taken over by soldiers camped at Columbus, N.M. Here they lived on army rations for three months, and then scattered. One-third of these men were members of the I.W.W. In July 1919 county officials arrested 107 men, prominent citizens of Bisbee, charged with kidnapping and assault, in connexion with the deportations of two years before. Civil suits for damages were filed against mining companies and the railways by the men who had been deported; these were settled out of court.

In the six months following America's entrance into the war 3,000 strikes were reported; in the first six months of 1918 the number was 1,771. When the Armistice was signed, the War Labor Board had on hand several hundred cases awaiting hearings. Now that the national emergency had passed, many employers and employees ceased to cooperate. Strikes began again. As in 1916 and 1917, the greatest number of strikes in 1918 and 1919 were in the metal trades, building, clothing, textile, transportation and mining. The largest number of workers in any one strike in 1916 was 60,000, in the men's clothing strike in New York; in 1917 no strike involved as many as 40,000; in 1918, 60,000 machinists were on strike in northern New Jersey. The strikes of 1919 were remarkable for the number of workers included; the total number was reported to the Bureau of Labor Statistics as 4,112,507. Not many strikebreakers were employed; the labour reserve was still depleted owing to business prosperity of the war period. Many of the larger strikes occurred in New York City and its vicinity; 176,000 struck in the clothing trades; 150,000 textile workers in New Jersey and New England; 16,000 marine workers struck in New York harbour in Jan.; 17,000 in March; and 20,000 longshoremen in March. In July 40,000 marine workers of the Atlantic coast struck; 100,000 were out sometime during the year. In 1919, also, 65,000 struck in the stockyards in Chicago; 100,000 in the shipyards of New York and vicinity; 151,000 in the New York building trades; 43,000 anthracite miners in Pennsylvania.

After the Armistice, war labour adjustment boards, one after another, were dissolved. Workers who had been prevented from striking by the promise of peaceful settlement of grievances, felt that the Government and employers had broken faith. The result was widespread unrest, and a number of spontaneous strikes by the rank and file of union membership, not authorized by the union officials. Demands both for the closed shop, and for the open shop were pushed without thought of compromise. Employers discriminated against union men, and recourse was had to force. In accordance with a resolution of the convention of the A. F. of L. in June 1918, the 24 international unions which claimed jurisdiction over the trades in the steel industry cooperated to organize all the workers in that industry. Mass meetings were held in Sept. in mill towns. The companies replied by discharging union members; the U.S. Steel Corp. ignored the request of President Gompers of the A. F. of L. for a conference. On July 20 1919 the committee of the 24 unions decided to submit a strike vote to their membership. Twelve demands were made. The real issue was recognition of the union. Wages in the industry were high, but the hours long. In 1911 the stockholders of the Steel Corp. had ordered an investigation of conditions of work. The report showed that 50% to 60% of the employees in rolling-mills, open hearth and blast furnaces worked a 12-hour day. The committee recommended a reduction in hours, but the recommendation was quashed by the finance committee. In Sept. 1918 the basic 8-hour day was granted, which resulted in increased pay, not shorter hours. The communities in which steel workers lived were ruled politically by company influence. In W. Pennsylvania organizers were denied free speech and assemblage by local authorities. The unions voted to strike. The call to strike on Sept. 22 1919 was published in seven languages, to all workers in iron and steel mills and blast furnaces not bound by trade agreements. The companies prepared for battle. At McKeesport alone 3,000 citizens were sworn in as special police subject to instant call. The mills of the Pittsburgh district were fortified and provisioned. On Sept. 21 rioting and arrests began. The next day 365,000 men stayed away from work. The state constabulary were sent in. Gradually the men went back to work. On Jan. 8 1920 the national committee for organizing the workers permitted the 100,000 men still out to return to the mills. Those who were taken back were required to give up their union cards. The national committee reported that 156,702 union members paid initiation fees between Aug. 1 1918 and June 31 1920, and estimated at 250,000 the total number organized.

February 6 to 11 1919 there was a general strike in Seattle Wash., involving 60,000 persons, in sympathy with shipyard employees who were striking for an increase in pay. The general strike was carried out by craft unions of the A. F. of L., although I.W.W. propaganda in the interest of industrial solidarity may have helped to put the workers into the spirit for such a mass demonstration. On the first day 110 unions stayed out; some workers had permits from the strike committee to work in the interests of public health and safety; garbage was collected and milk was delivered to distributing stations. A Labour guard patrolled the streets to preserve order. The business men viewed the strike as a "revolution." The mayor announced that unless the strike were called off on the morning of Feb. 8, he would declare the city under martial law. This threat was not carried out; although citizens armed themselves, and the governor sent troops and machine-guns. On Feb. 11 the strike was called off. Workers had been returning, indeed, since the second day and a month later all were back, without wages increases.

The New York harbour strike of Jan. 1919 arose spontaneously as the result of local initiative and comprised practically all the 16,000 or 17,000 men employed on harbour craft. As a result 50,000 longshoremen also were idle. The harbour had been the scene of industrial dispute since 1917. The immediate cause of the 1919 strike was the refusal of the employers to appear for arbitration before the War Labor Board to which the men had appealed for the 8-hour day and increased pay. The employers were persuaded by President Wilson to accept arbitration, and the men returned to work. The award did not provide for the 8-hour day, and the men struck again. The Railroad Administration then made concessions to the men on boats, and they returned to work. Other Government employees followed, and by April the private employers settled for the original 10-hour day but with wages increases. On Oct. 7 the railway men struck again. The longshoremen joined them, against the orders of their national officials. They wanted increased pay; the strike dwindled away and was over by November.

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In Aug. 1919, although forbidden by their national officers, the railway shopmen called a strike because of the delay of the Wage Adjustment Board to reach a decision on the demands of the men for increased pay. The strike began in Chicago and spread to New York and Boston; 250,000 men went out. After six days the strike was called off and the men returned to work. At the request of President Wilson the demands for wages increases were postponed. Other strikes not authorized by national officers of the union were those of employees of the General Electric Company in four cities in 1918 and of the New York local of the International Typographical Union in 1919. For 1917, 72 "unauthorized strikes" were reported, 58 for 1918, and 125 for 1919. Those in 1919 involved 1,053,256 strikers.

In Nov. 1919 435,000 bituminous coal-miners struck for wages increases of 60%. They also demanded the 6-hour day, and the 5-day week in order to distribute the work through the year. The miners at first refused to arbitrate the dispute as they feared the delay would give advantage to the employers. An injunction was issued to prevent the use of union funds for strike benefits. An award of an impartial committee was accepted in March 1920, which granted an average of 27% increase in wages, but the 8-hour day was retained.

About 93% of the policemen of Boston struck in Sept. 1919 for the right to organize and affiliate with the American Federation of Labor. The city was subject to rioting and crime until the National Guard restored order. President Wilson declared a police strike to be a crime against civilization. The police commissioner filled the places of the strikers with other men. In Aug. 1919 there was also an actors' strike, in which the stage hands and musicians joined in sympathy. An "outlaw" strike on the railways in April 1920, due to the delay of the President in appointing the Labor Board provided by the Transportation Act, was opposed by the brotherhoods. In 1919 and 1920 there were strikes on the Brooklyn Rapid Transit road, and in 1919 also on the Interborough Rapid Transit of New York.

A strike and lock-out in the men's clothing industry in New York of six months' duration was settled June 2 1921. The settlement may be regarded as a victory for the union, and for the principle of trade agreements. Since Sept. 1920 negotiations had been carried on between the employers' association and the union. Business depression gave an advantage to the employers, for whom a lock-out would not mean such a loss as if it had come a year earlier. On. Dec. 2 the employers presented an ultimatum to the union stating that unless piece work, a reduction in wages and the employer's full control of employment and discharge were accepted before Dec. 6 the manufacturers would put their own programme into effect, regardless of the decision of the impartial board. The union rejected the ultimatum. The reply of the employers was an announcement that the impartial machinery had ceased to function. Stoppages of work by employees and lay-offs and shut-downs by employers followed. By Dec. 13 the union instituted picketing. An offer of mediation by the state Industrial Commission was accepted by the union, but rejected by the manufacturers. The manufacturers' association resigned from the national federation. In Jan. 1921 one of the employers began suit for an injunction against picketing, $500,000 damages, and dissolution of the union because of its alleged revolutionary character. The suit for dissolution was dismissed on March 29. By March 27, 425 shops had reopened under agreements with the union, so that 25,000 of the 60,000 clothing workers were again at work. On April 5 the union announced that $1,000,000 had been raised toward their defense fund. Early in May certain of the employers resigned from the association, and the remainder reached an agreement with the union, by which the bargaining machinery with the impartial chairman was reinstated. The workers accepted a 15% cut in wages. The union brought suit for $1,000,000 damages against the employers on the charge of attempted boycott of union members.

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STRINDBERG, AUGUST (1849–1912), Swedish author (*see* 25.1038), died at Stockholm May 14 1912. His plays have been translated into English by E. and W. Oland (1912–3) and H. B. Samuel (1914).

See A. Henderson, *European Dramatists: August Strindberg* (1914); C. D. Marcus, *Strindbergs Dramatik* (1918); C. L. Schleich, *Erinnerungen an Strindberg* (1917).

STRYPA-CZERNOWITZ, BATTLE OF.—The fighting in the area between the River Strypa and Czernowitz (the capital of the Bukovina) in the winter of 1915–6 comprised an important series of operations on the eastern front between Russia and the Central Powers.

In the middle of Nov. 1915 the fighting activity in the Russian theatre of war had died down (*see* EASTERN EUROPEAN FRONT CAMPAIGNS). Both for Austria-Hungary and for Germany the war against Russia became of secondary importance in proportion as the war of annihilation against Serbia progressed. The Central Powers had for the moment no offensive in view against Russia, who was exhausted after the heavy fighting which had gone before. Both belligerents now settled down to a war of position, which enabled them to restore their armies. This lasted until Christmas.

In the middle of Dec., Ivanov, who was in command of the Russian S.W. front, prepared for a new great offensive. This was, no doubt, with the view of raising their fallen prestige and regaining the confidence of the wavering Balkan States; above all to relieve Montenegro, whose overthrow by Austria-Hungary was imminent; and not least to serving the advantage which a Russian victory would have in influencing Rumania, which was still vacillating, to join in against the Central Powers.

Three Russian armies—the VIII. under Brussilov, the XI. under Shtcherbachev and the IX. under Lechitski, with 32 infantry and 13 cavalry divisions as well as some *Reichswehr* formations—attacked the Austro-German front S. of the Polesic in E. Galicia and in the Bukovina. From N. to S. there stood opposed to the Russians the main body of Linsingen's group of armies, Böhm's group of armies and Bothmer's and Pflanzer-Baltin's armies, counting roughly 40 infantry and 13 cavalry divisions. The approximate strength expressed in rifles was in the proportion of 450,000 Austro-Hungarian to 480,000 Russian. The Austro-Hungarian infantry divisions were on a lower establishment than the Russian.

Whereas on the N. wing and in the centre no particular actions took place, the main attack, assigned by Ivanov to Lechitski's and Shtcherbachev's armies, was delivered against Pflanzer and Bothmer on a front stretching from the Rumanian frontier to Burkanów on the Strypa. The main burden of the attack fell on Pflanzer-Baltin's army, which was fighting with 8 infantry and 5 cavalry divisions against the Russians' 10 infantry and 6 cavalry divisions.

Not without reason had the Russians selected the S. wing as the point of attack. A success which should give them back the capital of Bukovina could not have failed in its effect on Rumania. And besides, an advance into Bukovina was the shortest cut to the Carpathians, the reacquisition of which was among their most cherished ambitions. They hoped, by defeating Pflanzer's army, to roll up Bothmer's and Böhm's fronts.

The preparations for the attack on the Bessarabian front had been evident since the middle of December. Lechitski had during that month assembled 4 corps in front of Pflanzer's S. wing between the Pruth and the Dniester. A sharp watch was kept on this section by the XI. Corps under von Korda, general of infantry, with 3 infantry divisions and 1 of cavalry. Pflanzer was prudently preparing for the anticipated attacks by organizing the positions so strongly as to compensate for the deficiency in numbers. Reinforcements did not arrive until later.

On Dec. 23 an attack on Papp's brigade was repulsed with heavy Russian losses. In the following days small enemy attacks multiplied themselves at numerous points of the front. On the 26th heavy artillery fire began, and on the morning of the 27th, heralded by a heavy bombardment from at least 200 guns, the Russian mass attack was launched on the Bessarabian frontier

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and to the N.E. of Zaleszczyki, having as its centre of gravity the positions N. of Toporowce. In the afternoon also the Russians flung themselves six times on the Austro-Hungarian positions, 15 or 16 rows deep, but in vain. They were driven back with heavy losses either by artillery fire or in hand-to-hand fighting.

On the 28th they repeated their ruthless attacks, which, as at Toporowce and Bojan, became exceedingly violent. The S. wing of the S. army was attacked on the same day by the Russian XI. Army, now commanded by Gen. Sakharov in place of Shtcherbachev. At Burkanów an Austro-Hungarian outpost on the Mogila height had to be brought back to the main position. On the 29th the battle reached its height. Not only the XI. Corps but also the VI. Corps and the 36th Inf. Div., defending the heights on the E. bank of the Strypa, were furiously attacked.

The Russians had brought up fresh forces from Odessa and Kherson for the attack on the N. wing of Pflanzer's army. The Russian VII. Army, with 5 to 6 divisions of the Caucasian V. Corps and the II. Army Corps, pushed in between Lechitski's and Sakharov's armies, and in addition the II. Cav. Corps came over from Lechitski's S. wing. Considerably reinforced by these new forces, Ivanov continued to bring fresh masses into the attack on the Austro-Hungarian VI. Corps and the 36th Inf. Div. But as on the previous days all these attacks, courageous as they were, broke down. Sakharov's S. wing met with the same fate in attacking the Burkanów bridge-head. Here the 132nd Inf. Bde. of Hoffmann's Corps heroically repulsed one onslaught after another and brought 900 prisoners behind the lines, leaving as many Russian corpses in front of the obstacles.

On the 30th and 31st the Russians, after hours of preliminary bombardment, renewed their attempts to break through opposite the VI. Corps. But Arz, reinforced by the 38th Honved Inf. Div. which had been brought up from the S. army, repulsed all the assaults. On the 31st the Russians, having had no success, and considerably weakened by their enormous losses, withdrew in the evening. On the Dniester front and the Bessarabian frontier they confined themselves on both days to moderate artillery fire, being greatly exhausted by the preceding days. On the II., I. and IV. Army fronts also, only artillery duels took place.

On New Year's eve and the morning of Jan. 1 1916 the attacks on Pflanzer's S. wing in Bessarabia increased in intensity. But Korda repulsed all the Russian IX. Corps attacks in hand-to-hand fighting, with the help of the 9th Inf. Bde., which had come up from the Italian theatre. In the afternoon 6 Russian infantry regiments returned to the assault at Rarancze, and succeeded in forcing back the Austro-Hungarian position by about 300 paces on a breadth of 1,200 paces. A counter-attack was at once put in hand, but could not penetrate owing to renewed Russian attacks. Arz's and Bothmer's S. wing, which was attacked by the Russian XXII. Corps at Sokolov, repulsed all attacks on New Year's day.

On the 2nd the Russians repeated their efforts to break through at Rarancze, but failed in each case. But in view of the Russians' superior numbers, the Austro-Hungarian higher command renounced the idea of winning back the lost position.

On the 3rd and 4th the battle burst forth again on the Dniester front. At Toporowce and Rarancze furious fighting again took place. But the Russians' efforts remained fruitless, their attacks being frustrated by the striking bravery of the defenders in close fighting. Here the brave Croats of the 16th Inf. Reg. played a most glorious part. At Ocna, too, and at the bridge-head of Michalcze, N.W. of Uscieczko, the front and flanks of which were already surrounded by the Russians, all attacks were untiringly repulsed. On the 5th, after these assaults, a short lull set in once more in E. Galicia and on the Bessarabian frontier.

On Jan. 7, the Russian Christmas Day, which was also the opening day of the attack on Montenegro, the Russian storm-masses again attacked the VII. Army. At Dobropole a counter-attack by the 12th Inf. Div. drove the troops of the 3rd Turkestan Div. out of a captured line of trenches. At 11 A.M. the Russians opened a heavy bombardment on the Korda's XI. Corps, following it up at one o'clock with an infantry attack on the Toporoutz and Rarancze positions. But this again brought no success.

On the 8th, 9th and 10th, it seemed as if the Russians had again to pause and take breath. Austro-Hungarian airmen reported the approach of new Russian reinforcements opposite the N. wing of Pflanzer's army. On all these three days, however, the Russians continued to fire on the positions. On the 10th the firing at Toporowce and Rarancze became considerably more vigorous, and when it reached its greatest intensity on the 11th, and finally resolved itself into a bombardment, Korda again prepared for a most determined resistance. From three o'clock in the afternoon until ten in the evening, the Russian masses stormed the Austro-Hungarian positions unceasingly in the attempt to break through. But each new attack ended in a precipitate retreat, thanks to the excellent artillery defence.

Pflanzer's front had meanwhile been reinforced by the 40th Honved Inf. Div., the 2nd Cav. Div. and the 24th Inf. Division.

It was not until the 13th that the Russians girded themselves for a fresh attack. With their divisions filled by fresh troops, they launched against Korda's positions eight violent assaults before the evening of the 14th, but were obliged to retire each time with heavy losses. This was their last effort. Their strength seemed broken, and on the 15th, except for some firing on the positions, there was peace.

The failure of the Russian attacks, and the cessation of hostilities against Montenegro which followed on the 17th, indicated the close of the New Year's battle. There were still a few isolated attacks in the next few days, but the need for rest on both sides brought about a speedy return to the war of positions. The embittered attacks of the Russian S. army persisted with only a few intervals for 24 days, ending in a complete victory for Austria-Hungary along the 130-km. battle-front of the VII. Army. At Rarancze only was a small portion of the front given up, whereas the Russian masses paid heavy tribute before the strong Austrian positions.

Thus the Russians failed to achieve their great aims. Their offensive was not able to save Montenegro from her fate, the Austro-Hungarian front had not been forced back, and the failure of the attack, which cost the Russians at least 170,000 dead and wounded and 6,000 prisoners, could not definitely influence Rumania's policy. (E. J.)

STUART, JAMES (1843–1913), British educationist and politician, founder of the university extension movement, was born at Balgonie, Fife, Jan. 2 1843, the son of Joseph Gordon Stuart, a manufacturer. He was educated at St. Andrews and at Trinity College, Cambridge, where he was third wrangler in 1866. In 1867 he was elected a fellow of Trinity, and became a mathematical tutor. The same year he lectured in astronomy to women teachers at Liverpool, and such was the success of these lectures that he was invited to repeat them at other centres. From this small beginning arose the university extension movement, which, though undertaken at first merely as an experiment, has now attained a very great success. In 1875 Stuart became first professor of mechanism and applied mechanics at Cambridge, and in this capacity was responsible for the organization of the university workshops and the teaching of engineering generally. In 1882 he unsuccessfully contested Cambridge University as a Liberal, but in 1884 was elected for Hackney. He held this seat till 1885. From 1885 to 1900 he was member for Hoxton and from 1906 to 1910 member for Sunderland. He was created a privy councillor in 1909. For many years he was a Progressive member of the London County Council, and was also interested in the management of the *Star* and the *Morning Leader*. Stuart married in 1890 Laura Elizabeth, the daughter of J. J. Colman, head of the great firm of mustard manufacturers, and became a director of the firm in 1898. He died at Norwich Oct. 13 1913.

STUART, RUTH McENERY (1856–1917), American writer, was born in Avoyelles parish, La., in 1856. She was educated in private schools in New Orleans and in 1879 married Alfred C. Stuart, a planter. Her first story, *Uncle Mingo's Speculations*, appeared in 1888 in the *Princeton Review*. She moved to New York City in 1891 and soon became known for her stories of negro life in the South. She also wrote much verse for magazines.

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She often appeared as a public reader of her own works, which were characterized by humour and pathos. Tulane University, New Orleans, conferred upon her in 1915 the degree of Litt.D. She died in New York City May 6 1917.

Her numerous books include *Carlotta's Intended* (1894); *Sonny* (1896); *In Simpkinsville* (1897); *Moriah's Mourning* (1898); *Napoleon Jackson, the Gentleman of the Plush Rocker* (1902); *The Second Wooing of Salina Sue* (1905); *Sonny's Father* (1910); *The Unlived Life of Little Mary Ellen* (1910); *Daddy Do-Funny's Wisdom Jingles* (1913) and *Plantation Songs and Other Verse* (1916).

STUBBS, CHARLES WILLIAM (1843–1912), English divine, was born at Liverpool Sept. 3 1843, and educated at the Royal Institution school, Liverpool, and Sidney Sussex College, Cambridge. His father and grandfather were Yorkshire agriculturists, and throughout his life he took a strong interest in the welfare of the agricultural labourer, publishing three volumes on the subject, *Village Politics* (1878), *Christ and Democracy* (1883) and *The Land and the Labourers* (1890). He was a strong Liberal with somewhat socialistic views, and was preferred by Mr. Gladstone to the living of Stokenham and Chivelstone in Devon in 1884. In 1887 he was transferred to Liverpool, becoming rector of Wavertree. In 1893 he became dean of Ely, remaining there till 1905, when Sir Henry Campbell-Bannerman nominated him to the bishopric of Truro. He was Hulsean lecturer at Cambridge in 1904, and published his lectures under the title *The Christ in English Poetry* (1905). His other works include *A Creed for Christian Socialists* (1896); *Charles Kingsley and the Christian Social Movement* (1898) and a *Handbook to Ely Cathedral* (1898). He died at Truro May 4 1912.

STURDEE, SIR FREDERICK CHARLES DOVETON, 1ST BART. (1859–), British Admiral, was born at Charlton, Kent, June 9 1859, the son of a naval officer, and entered the navy in 1871. He was promoted lieutenant (1880), commander (1893), captain (1899), rear-admiral (1908), vice-admiral (1913), admiral (1917) and admiral of the fleet (1921). He saw service in Egypt (1882) and in Samoa (1898–9) when he was in command of the Anglo-American force. He was assistant-director of Naval Intelligence to the Admiralty (1900–2) and chief of staff, Mediterranean Fleet (1905–7) and Channel Fleet (1907). In 1910 he became rear-admiral of the first Battle Squadron, and commanded the 2nd Cruiser Squadron (1912–3). During the World War he was commander-in-chief, on the "Invincible," of the squadron which won the battle of the Falkland Is., Dec. 8 1914, and he took part in the battle of Jutland. He was created K.C.B. (1913), and K.C.M.G. (1916); and a baronetcy was conferred on him in 1916, with the title "of the Falkland Is." In 1918 he became commander-in-chief of the Nore.

STURDZA, DEMETRIUS (1833–1914), Rumanian statesman (*see* 25.1051), died in 1914.

STÜRGKH, CARL, COUNT (1859–1916), Austrian prime minister from Nov. 3 1911 to the time of his murder, was born on Oct. 30 1859, of an ancient noble Styrian family, and in 1881 he became an official of the Statthalterei at Graz, and later of the Ministry of Education. He left the State service in 1891, when he was elected as a representative of the loyal land-holding interest to the Reichsrat. He attached himself to the Left of the German party, and came forward as a keen opponent of universal suffrage. He was from Feb. 10 1909 to Nov. 3 1911 Minister of Education, and a zealous advocate of the humanistic education traditional in the gymnasia. Stürgkh was one of the committee of five ministers who decided on the dispatch of the ultimatum to Serbia and the declaration of war, which brought on the World War. He was killed on Oct. 21 1916 by a shot fired by the Social Democrat Friedrich Adler, a son of the Social Democrat leader, Viktor Adler, as a protest against Stürgkh's government without parliament. (*See* AUSTRIAN EMPIRE.)

STÜRMER, BORIS VLADIMIROVICH (1849–1917), Russian politician, was born in 1849, the son of an emigrant—his father being captain of a fire brigade at Tula. He studied at the university of Petrograd, and there made friends with Count Bobrinsky, a member of one of the leading Russian families, who introduced him into the upper circle of Petrograd society. His affable manners and his ability to win the confidence of important people are the only explanation of his brilliant success in a circle to which he did not belong by birth or fortune. He started his career in the Chamberlain's department of the Imperial Court, but he held at the same time different situations in the Senate, the Ministry of Justice and elsewhere. When in 1892 the Government rejected the candidate nominated to the presidency of the executive board of the Tver Zemstvo, Stürmer, whose name was on the list of the Tver gentry, was appointed to this office. It was the first case of a president of the Zemstvo being appointed instead of being elected. In 1894 Stürmer was appointed governor of the Novgorod, and later of the Iaroslavl province. Subsequently he was in charge of a department of the Home Office. In 1904 he was created member of the State Council, but he never took an active part in the legislative work. Meanwhile he won the confidence of the Court, and he was made prime minister in Jan. 1916, at a period when the Emperor, avoiding strong personalities, wished to secure the fulfilment of his orders by devoted servants. As prime minister Stürmer's reactionary attitude provoked a strong opposition in liberal and patriotic circles; rumours accusing him of connexions with Germany were widely spread without real proof. These accusations were finally brought to the tribune of the Duma by M. Milyukov and resulted in Stürmer's resignation in November. After Sazonov's dismissal Stürmer took the portfolio of Foreign Affairs, and his activities in this department resulted in the premature declaration of war by Rumania, so disastrous for that country and for Russia. He was arrested after the revolution, and he died in prison of disease in Sept. 1917.

STYRIA (*see* 25.1058), an Austrian territory bordered on the E. by the Southern Slav State and that part of Burgenland which belongs to Austria; on the N. by Lower and Upper Austria; on the W. by Salzburg and Carinthia; and on the S. by the Southern Slav State. The part of Styria included in the Southern Slav State has an area of some 2,366 sq. m. and had, in 1910, a pop. of 433,000. The Austrian territory extends over some 6,304 sq. m., of which the greater part is mountainous and almost the whole lies in the Eastern Alps. Styria had formerly three large divisions:—Northern or Upper Styria; Middle Styria; and Southern or Lower Styria. Lower Styria and the southern part of Middle Styria, up to the Posruck range and to the Mur have, however, been taken over by the Southern Slav State. Middle Styria is surrounded on the W. and N. by a semi-circular mountain range which joins the Cetic and a part of the Noric Alps and has recently become known as the "Steierische Randgebirge." The pass through which flows the river Mur between Bruck and Graz unites it to Upper Styria. The northern part of Upper Styria is occupied by the heights of the *Nördlichen Kalkalpen*. The eastern part of the Noric Alps, the Bachern together with the Posruck, now belongs to the Southern Slav State.

Population.—The pop. of the Styria of to-day was, in 1910, 952,590; in 1920 it had decreased to about 946,720 (151 per sq.m.). It is almost purely German. The proportion of males to females in 1910 was as 1,000 to 983; in 1920 as 1,000 to 1,053. While Styria lost some 75,000 Germans, among whom were 9,000 belonging to the exclusively German-speaking districts, she has now only about 5,000 Slovene inhabitants. In 1910 the pop. of the present-day Styria was as to 97·4% Roman Catholic and 2·1% Evangelical.

For administrative purposes, Styria is divided into 16 districts and the autonomous city of Graz, the capital (pop. 157,032 in 1920). Other important places are:—(pop. figures are taken from the census of 1920) in the Traun and Enns district of Upper Styria—Bad Aussee (pop. 1,370); Eisenerz (pop. 6,337); Mariazell, the famous resort of pilgrims (pop. 1,881); in the Upper Mur district—Judenburg (pop. 5,668); Fohnsdorf (pop. 7,199); Zeltweg (pop. 3,682); Knittelfeld (pop. 10,672); Leoben (pop. 11,231); Donawitz (pop. 15,087); Vordernberg (pop. 2,352); Bruck an der Mur (pop. 8,490); —in Mürz-Thal—Kappenberg (pop. 12,576); Mürzzuschlag (pop. 6,483);—in Middle Styria—Köflach (pop. 2,655); Voitsberg (pop. 3,283); Eggenberg bei Graz (pop. 15,554); Weiz (pop. 3,620); Fürstenfeld (pop. 5,649) and the Gleichenberg Spa, Kurort Gleichenberg (pop. 872).

Education.—Styria has three higher educational establishments, namely the university and the technical college of Graz and the Montanist College in Leoben.

Notwithstanding the great unevenness of the surface, only 8·0% of the present Styria could be reckoned as unproductive in 1900. Of the productive parts, 19·1% was arable; 0·9% gardens; 0·5%

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vineyards; 11·8% meadows; 13·3% grazing lands; 54·4% was, however, forest. This territory is justly called "green Styria." Cattle-raising has greatly developed and farming is actively carried on on the high lands. Nevertheless, in 1918 there were only 358,108 head of cattle (of which 170,630 were milch-cows) and 344,188 swine. A good breed of horses exists in Ennsthal and considerable attention is devoted to poultry-farming in Middle Styria, where the shooting and fishing are good. The forests yield a great variety of timber.

Minerals.—Styria is so rich in iron ore that it has been called the "land of iron" (*eiserne Mark*). Lignite is also abundant. Of the total output of the mines of present-day Austria (51,000,000 kronen in 1915) 71% (36,000,000 kronen) is attributed to Styria; its output of iron (1·8 million tons in 1915) is over 94% of the Austrian total. Iron-mining is almost exclusively confined to the Erzberg between Eisenerz and Vordernberg. The manufacture of iron in Austria is now almost entirely confined to Styria (538,753 tons out of a total of 541,004 tons). The most important iron-smelting works are in or near the above-named region and at Hieflau, Trofaiach and especially Donawitz; in the lignite districts, in Zeltweg and Knittelfeld, near the lignite diggings of Fohnsdorf and in Eibiswald; also in Mürz-Thal (Kapfenberg, Mürzzuschlag). The Mürz-Thal is also the centre of the newly created scythe-making industry.

The lignite produced, 1·8 million tons or over 74% of the Austrian total, is found in many places. The most important mines are at Fohnsdorf in Upper Styria; the product of those near Leoben is used by the great metal works of Donawitz and others—and there are smaller mines in Mürz-Thal; in Western Middle Styria in the districts of Höflach and Voitsberg and those of Eibiswald and Wies.

Styria also produces salt; 28,000 tons, some 17% of the whole Austrian output, was obtained near Aussee in 1915. It yields also almost the entire Austrian output of graphite and some sulphur, lead and zinc ores, clay and building stone. The output of magnesite has become especially important; Styria alone almost supplies the world, chiefly from the neighbourhood of Veitsch, Trieben, Kraubath, in the Breitenau near Bruck and elsewhere.

Water-power.—The plentiful and accessible supply of water-power has caused the installation of great electrical stations of which, however, full advantage has not been taken. The electrical works of Weiz are world-famed.

Manufactures.—Notable Styrian manufacturing industries are those of the iron works at the places already named, also at Pallen-Thal (Rottenmann, Trieben) and at and near Graz. These turn out a great variety of iron goods; small articles as well as scythes, machinery, locomotives (Graz), bicycles (Graz) and wagons. Graz makes carriages and automobiles and also holds an important place in the wide-spread wood industries (including furniture). The manufactures of lignite and cellulose, pasteboard, paper (Gratkorn, near Graz, and other places), also of beer (Graz), tiles, flour, leather, explosives (Deutsch-Landsberg and other places) are considerable. Less important are flour-milling, and the textile, glass, tobacco and chemical industries.

Communications.—The new frontier cuts through the Marburg-Unterdrauburg line so that the connexion between Middle Styria and Carinthia goes a long way round, causing considerable inconvenience. Mariazell is now connected by rail with Vienna.

SUBMARINE CABLE TELEGRAPHY (*see* 26.527).—In 1921 there were over 298,000 nautical miles of telegraph cable in operation at the sea bottom, made up of some 3,000 separate lengths, of which about 2,540 were administered by the various governments concerned, whilst the remainder were the property of private (mainly British) companies. Of the world's cables, over 130,000 n.m. are owned by British companies, 71,000 by American companies, and 24,000 by companies of other countries. How much the Allied countries—especially Britain—were indebted to submarine telegraphy in connexion with the World War will probably never be fully realized. Had British communication with the Dominions been cut off at the outset by the enemy, months would have elapsed before arrangements could have been completed for the despatch of the overseas contingents which rushed to British aid. On the other hand, within four hours of the declaration of war, Germany was entirely deprived of direct telegraphic communication with the United States. A British cruiser effected the required interruption in the English Channel by cutting both the cables running between Emden and New York via the Azores, one being taken in to Penzance (Cornwall). Then in March 1917 they were both cut at points 643 and 610 n.m. respectively from New York, one of them being diverted by a British P.O. telegraph ship into Halifax, Nova Scotia. Since July 1917 this has been at any rate temporarily turned to account as a connecting link with the All-British Pacific Cable system. The other line was handed over to France and taken in to Brest.[1] Altogether 20,000 n.m. of ex-German cables were captured during the war, covering practically every one of those passing through the English Channel.

Remarkable indeed were the achievements of submarine telegraph cable-laying and repairing authorities during the war. Despite the active German submarine warfare, a vast number stand to the credit of British ships, largely to meet immediate strategic requirements. Whilst some of these were effected by cruisers of the Royal Navy provided with the necessary apparatus and the required length of cable, they were in the most part carried out by specially designed telegraph ships, though accompanied as often as possible (where especially desirable) by a man-of-war as escort. In addition to manufacturing 20,000 m. of trench telephone cable, the Telegraph Construction and Maintenance Co. made 19,000 m. of submarine cable, and its ships were actively engaged on highly dangerous work in the way of laying, repairing and diverting cables. The "Telconia"—perhaps the most efficiently designed telegraph ship in existence—made 75 cable repairs and laid 24 new lines around the English and Irish coasts whilst in commission for H.M. Post Office.

The first entirely new cable to be laid during the war was that by the Telegraph Construction Co.'s T.S. "Colonia" between Montevideo and the Falkland Is. in 1915, under the auspices of the British Admiralty. In the same year, this company also laid, under Post Office supervision, a direct Anglo-Russian cable from Peterhead (Aberdeenshire) to Alexandrovsk (about the nearest Arctic Ocean coast point to Petrograd). In both instances this was the earliest occasion on which a cable had been brought to the farther point. The first line had purely strategic objects in view, but the second was more especially to meet the fact that communication between Britain and Russia had previously been only effected across countries that were now to a great extent enemy countries; indeed, the Indo-European Telegraph Co.'s land line system had become practically inoperative ever since the outbreak of the war. This work was a truly remarkable feat. The cable was laid in the winter and was landed on Russian territory at the time of year when the sun does not rise above the horizon in those northern latitudes. In fact, the entire undertaking had to be carried out in darkness, as well as in seas infested with enemy submarines. It was conducted with every possible secrecy, it being arranged for the "Colonia," in order to mislead the enemy, to go on a preliminary cruise in an entirely different direction. With land lines at each end and special repeaters, direct telegraphic communication was thus established between the Central Telegraph Office in London and the corresponding building in Petrograd. Moreover, many telegrams from countries S. of Russia—Greece, for instance—passed over this cable in making their circuitous journey from the Levant to various quarters of the globe. This was the first piece of ocean cable work that the British Post Office had ever had to do with. Thus, for its purpose, Post Office engineers and clerks were initiated, at short notice, in the art of deep-sea cable-laying and long distance cable-working at the hands of the contractors, as well as by a staff of the Eastern Telegraph Co. provided for working the cable.[2]

The other more especially important piece of British cable work was the putting through of one of the Emden–New York cables as the first Imperial Atlantic cable to link up with the All-British Pacific line. The path taken by what now constitutes a completed "All Red" route to Australasia is London, Penzance, Fayal Isle, Azores (mid-Atlantic), Halifax, Bamfield (Vancouver), Fanning I. (a small, mid-Pacific, coral formation), Suva (Fiji Is.), Norfolk I., from whence there are two branches, one to Southport, Queensland (Australia) and the other to Auckland (New Zealand).

The Atlantic section of this "All Red" cable system was being worked in 1921 by the Post Office. Thus it has come to pass that a Government department, that, conjointly with the great cable companies, had opposed in turn the scheme for an All-British

[1] Owing to the enemy's submarine activities, the late German Atlantic cables could not be attended to for some 14 months.

[2] The Post Office Engineering Department's previous experience of cable work was closely confined to short Channel lines, etc.

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Pacific Cable and then later that for an All-British Atlantic Cable, has been called upon itself to put into practice the latter, and now appears as an exponent of "All Red" cables generally. The department in question did much fine work during the war. At the very outset—on the eve of Aug. 4 1914, indeed—its principal telegraph ship, the "Monarch," set forth for the N., where many emergency cables were forthwith laid. It was not long, however, before she met her glorious end, and her "shattered bones" are now lying on the bed of the English Channel—the scene of most of her work. She was one of the very first vessels to be especially designed for cable-laying and repairing.

Another telegraph ship that met her end over the war was the "Dacia," owned by the Silvertown Company. This vessel had accomplished a great deal in her time, and during July 1915–Feb. 1916 she effected cable communications between Brest (France) and Casablanca (Morocco), by cutting in at suitable positions and picking up and relaying part of the Borkum–Teneriffe cable belonging to Germany. Nearly 450 n.m. of cable were picked up and relaid on this occasion, part of it in a depth of 2,000 to 2,500 fathoms. She then proceeded to establish communication between Casablanca (Morocco) and Dakar (W. Africa), by cutting in, picking up and relaying portions of the Teneriffe–Monrovia cable belonging to Germany. Eight hundred n.m. of deep-sea cable were on this occasion recovered and relaid in an average depth of over 2,000 fathoms. We have here a "record" in cable work. It was undertaken for the French Administration, and Casablanca had not up to that time been connected to Europe by submarine cable. The cable facilitated the sending of troops to France by Morocco and Senegal when greatly needed.

Messrs. Siemens Brothers' unique and highly efficient telegraph ship "Faraday"—originally designed by the late Sir William Siemens, F.R.S.—also achieved much during the course of the war on behalf of the British Post Office, which had at one time in commission practically every telegraph ship available, including the largest (T. S. "Colonia").

Even though observing constant vigilance, a telegraph ship, when effecting a repair, being deprived of manœuvring powers by attachment to the cable, is peculiarly vulnerable to anything like a torpedo attack. It is, therefore, something to be able to say that the Post Office kept Britain and the European continent in continuous electrical communication. During the early part of the war telegraph ships went about their business alone and unattended, but with the development of intense submarine warfare naval escorts had to be provided by the Admiralty. Escorts are not, however, a safeguard against submerged mines, and so it was that the old "Monarch" met her fate, going down with her flag flying. On one occasion a telegraph ship on repairing work hove up a mine with the cable, but beyond damage to machinery and breakage of crockery, no harm was done.

Apart from the disposal of four of the world's telegraph fleet,[1] there were only two instances of Germany getting the best of things in the matter of cable communication. Within the first year of the war, a German man-of-war landed a party on the deserted beach of Fanning I., and this party succeeded in cutting the All-British Pacific cable there. The other case was that of the "Eastern" cable landed at Keeling-Cocos. Here again the attacking party from the "Emden" succeeded in cutting the cables,[2] but an alarm signal which had been got through led to the "Emden's" final doom. In this case great enterprise was shown by the "Eastern" Co.'s superintendent, and in neither instance was the interruption very serious or lengthy. Though there were only these two cases of enemy disturbance of the Allies' cables, many were rendered dumb from the wear and tear of four years, during which time it was impossible to effect repairs, for lack of suitable ships and the risk of exposing slow-moving vessels to enemy attack.

[1] The total number of such vessels in 1921 was 49, of which some half dozen were owned by contractors for the original laying of ocean cables, the rest being smaller vessels, of the cable working companies, for subsequent repairing operations.

[2] The officials in charge had, however, prepared a ruse by utilizing some spare cable as a dummy, and this dummy the Germans solemnly cut.

During the latter part of the war, the American submarine cables on the Pacific and Atlantic Ocean coasts were taken under control of the United States Government. *Inter alia* there was a feeling that considerable advantage would attach to the coördination of all the telegraph systems throughout the country. Eventually (Nov. 2 1918) the U.S. Postmaster-General also assumed administrative control of all cable landing on U.S. territory, after the necessary negotiations with other countries concerned had been carried through. Control ended on May 2 1919.

Post-war Developments.—War wastage, the banning of private codes, considerable general increase of traffic[3] (partly owing to absence of mails) and voluminous Government messages, were all responsible for an appalling cable congestion during the war, the result being several days'—sometimes even weeks'—delay in the transit of messages on most of the more important trunk lines. Though, after the Armistice things became somewhat easier, with the withdrawal of the censorship and the renewal of private codes, the ultimate delivery of cablegrams was even in 1921 a very slow business. When the Marconi Trans-Atlantic wireless service was re-established some measure of relief was felt. Unfortunately, however, it was only capable of dealing with a small proportion of the ordinary prevailing cable traffic. The hampering of trade, during the war, by the prohibition of most private cable codes, was very considerable. To take an example, a certain firm had been in the habit of sending every week some 40 cablegrams at an average of £1 each. The cost of the same messages in plain English would have been some £320.

Most of the cables requiring repairs after the war had been attended to by 1921, but there was still considerable delay on cablegrams, even though the lines were being worked at their full capacity, day and night.

When it is remembered that in the year before the war (1913) 826,000 messages passed through the two Atlantic cables then connecting the United States with Germany,[4] it will be realized what it meant to American commerce alone to be deprived of these direct cable connexions. In 1921 it was planned to lay a new Atlantic cable between the two countries, and to extend the German cable that had been taken into Brest by the French, as a compromise, to central or northern Europe with a landing *en route* off Denmark.

Ever since all of what were formerly British Atlantic cables passed, in 1912, into the administrative hands of the Western Union Telegraph Co. of America, the British Government had been strongly urged—as, indeed, for many years previously—to establish a State Atlantic Cable as a connecting link with the All-British Pacific Cable. The war only served to accentuate this view. Whilst the capture and diversion of the German Atlantic Cable (taken into Penzance and Halifax) went some way to meet requirements, this line had not only been irregular in its performance but much congested with traffic, largely American. When therefore, in 1919, the Western Union Co. brought to an end their lease of the Direct United States Co.'s cable system—between Ballinskelligs (Ireland), Halifax (Nova Scotia) and Halifax–Rye Beach (United States)—on the ground of it being so constantly out of operation—the British Government entered into negotiations, towards the end of 1920, for the purchase of the line at a cost of £570,000, or scarcely more than half the value of a new cable. When this is given effect the line—together with the Imperial Pacific Line—will form a complete and strictly "All Red" route between the Mother Country and Australia. Though the line (originally laid in 1874) is even of more ancient order than the ex-German cables, British Imperial needs will, to a great extent, be met. The shortcomings will be further met when a Canadian land line, connecting the All-British Atlantic and Pacific Cables, is provided.

The All-British Pacific Cable, first laid in 1902, has more than justified itself. During its first year scarcely more than 200,000

[3] In the case of the Eastern Co.'s system this was more than doubled by the war. Thus, the annual gross receipts of the company were about £2,000,000 more than previously, and much the same applies to others in the same group.

[4] In actual fact these cables accounted for 32% of the total traffic of the Commercial Cable Company.

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words were sent. Ten years later, the volume of traffic had been increased ten-fold. The war brought this up to some 26,000 words per day, or about 9,500,000 words per annum. Notwithstanding the large capital cost of this line (£2,000,000) it produced a gross profit of £94,000 for the year 1920, whilst its reserve fund stood at nearly £1,107,000. To illustrate the high strategic value of the line, during the war, if the Allies had happened to be—even temporarily—deprived of naval control, the British Mediterranean cables would undoubtedly soon have been cut, which would have meant that British inter-imperial telegraphic communication could only have been secured by means of the All-British Pacific line. It had been felt for a long time that, since the Imperial Pacific cable was laid as far back as 1902, steps must be taken to duplicate it in order to provide against complete breakdown, as well as for dealing with over-congestion. In 1921, however, owing to the necessity for economy and to the high cost of materials, it seemed probable that this duplication would require to be limited, for the present, to the duplication of the long, slow working, section in very deep water, *i.e.* the 3,458 n.m. between Bamfield (Vancouver) and Fanning I., which runs into a depth of 3,400 fathoms (nearly 3½ n.m.), and brings down the resultant speed on the whole line to a low figure.

Perhaps nothing contributed more in the past to the leading commercial position of Britain than her enterprise in the matter of telegraph cables. Fortunately, too, she also recognized that the problem of Empire is largely a problem of communication. Arising out of the war to some extent, there has been a general demand for a great deal more inter-communication, not only between different branches of the British Empire, but also between distant foreign countries. This demand must be met in the first place by a considerable addition to the world's cable system over and above those that were in operation previous to hostilities. The part of the British Empire which in 1921 was more especially badly served in the matter of telegraphic communication was the West Indies, where, largely owing to the nature of the sea bottom, the existing inter-insular lines (originally laid in 1870) were constantly breaking down.[1] But for "atmospherics" in these tropical regions, this would be an ideal case for "wireless." As it is, it would seem that an efficient air service would do most to improve prevailing shortcomings—at any rate for mail purposes, the steamer service being also very deficient. From a world standpoint, however, probably the most acute need for additional cable facilities is in the Pacific Ocean, for, while the traffic over the N. Atlantic cables has been practically quadrupled since 1913, Pacific cable traffic has increased nearly nine-fold.

The war also aroused the United States to her disadvantage in the matter of cable communication as compared with her trade rivals. Thus, on April 26 1921, the U.S. Senate passed a bill "to prevent unauthorized cable landings in the United States or any of its possessions." The bill gives the President sweeping authority also to issue, withhold and revoke licences as to cable landings, as well as for obtaining concessions for the United States in other parts of the world. Section 2 of the bill enables the President "to withhold or revoke such licence when satisfied such action will assist in obtaining for the landing or operation of cables in foreign countries or in maintaining the rights or interests of the United States." The President may grant such licence on such terms as will assure just and reasonable rates. The licence is not to give the licencee exclusive rights of landing or of operation, in the United States. The policy appears to be based chiefly upon considerations that shall guard against consolidation or amalgamation with other cable lines, while insisting upon reciprocal accommodation for American corporations and companies in foreign territory. In 1920 the U.S. authorities refused to allow a cable laid for the Western Union Co. to be landed at a point on the coast of Florida on the ground that it was intended for connecting up, *via* Barbados, with the "Western Telegraph" system (at Maranham) of a British company.[2] The American Government considered that allowing such a cable to be laid would have lent colour to the British company having sole rights of communication between the United States and Brazil. As a matter of fact, another American company (All America Cables, Inc., of New York)[3] was also preparing to lay a cable to the Brazilian Coast, and it was thought by the U.S. Government that by acceding to the application of the Western Union Co., the claims to a monopoly being possibly established thereby might prevent the other cable being laid—a cable greatly to the interests of American trade with Brazil. The United States had evidently determined to establish its own system of cables throughout the world, partly for high national reasons, but also with a view to developing trade, especially with S. America.

France also has shown a disposition to be increasingly active and enterprising in this matter; likewise Japan.

International Cable Conference, 1920–1.—Probably no telegraphic conference has ever been the scene of such acute disagreement on essential points as that which held sittings during parts of 1920 and 1921 at Washington. This was perhaps natural, when we remember (*a*) that Germany had been relieved of practically all her cables, (*b*) that the destiny of these cables was of first-rate importance to all the principal powers.

Soon after the confiscation of the German cables an agreement was entered into between Great Britain, France, Italy and Japan, whereby these ex-German lines were to be severally distributed amongst them. The United States having come into the war some time later, it was proposed at the Conference, that these cables should, as a substituted arrangement, become the joint property of the five Allies.

The actual diversion of the German Atlantic cables was completed by Great Britain in July 1917, and by France in Nov. 1917—in both instances after the United States had joined the Allies. The American view was, therefore, that neither of these appropriations of cables between the Azores (Portuguese possessions) and the United States could be justified, seeing that both the United States and Portugal were already allied with England and France in the vigorous prosecution of the war. Then again, no single section of the ex-German cable in the Pacific touched Japanese soil, but one landed on American territory (Guam). Thus it was argued that it was something of an anomaly that the Japanese should ever have seized the German cable system, to the great detriment of American trade with China and the Philippines—and correspondingly to their own (Japanese) advantage.

There were probably few matters that could, in principle, be dealt with so suitably by the League of Nations as those associated with international telegraphic communication. But that could only apply if, and when, the United States joined the League, or, on the other hand, in instances where America was in no way concerned. With ex-German islands and cables, however, it was quite clear that the United States was very much concerned. Further, there was no nation whose interests were liable to be so much affected by the mandate as regards Yap—more especially in reference to the cable—as the United States. The control of telegraphic communication between that island and China meant much to Japan. On the other hand, such an arrangement was regarded as contrary to American interests. In these circumstances, seeing that the United States was one of the "principal Allied and Associated Powers," the question was raised why such a mandate was ever granted to Japan without the assent of the United States. However, the Yap difficulty was eventually settled, so as to preserve American rights, at the Washington Conference in Dec. 1921 (*see* JAPAN; also WASHINGTON CONFERENCE).

[1] *Report of the Royal Commission on Trade between Canada and the West Indies* (Cd. 5369, 1910).

[2] The prospects of trade with S. America are, in fact, so attractive that telegraphic communication therewith has been made a special consideration of recent years both in Britain as well as in the United States. Thus, in order to improve the then existing facilities, a cable was laid in 1910 by the Telegraph Construction & Maintenance Co. between St. Vincent, Ascension and Buenos Aires, these sections now forming a part of the Western Union Telegraph Co.'s system. In 1920, the same company laid a cable between Maranham and Barbados.

[3] Formerly the Central & S. American Telegraph Co., with lines down the W. coast of the American continent.

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It was perhaps in the nature of things that those countries—such as the United States—which were in a less favourable position in the matter of cable ownership should especially desire the internationalization or neutralization of cables. Certainly, the neutralization and internationalization of cable systems might have one advantage, *i.e.* bring to an end the suspicions, right or wrong, that messages concerning another country were delayed, scrutinized, tampered with, etc. Such charges were largely due to keen commercial rivalry, and principally—if not entirely—a question of news agencies rather than cable companies. Any foundation they had was probably more or less closely limited to the war, when certainly Canada was very ill-supplied with news from Europe—or indeed, with reference to Imperial matters—whilst over-abundantly informed of trouble in Ireland.

Strategic Cables.—Unless the strict neutralization of cables becomes the order of the day, under the League of Nations or otherwise, the best principle would probably be that every country should—partly for strategical reasons—establish for itself many more cables on a variety of routes well clear of foreign soil. These should be worked on a low rate basis for the general encouragement of intercommunication, but especially for developing commerce and trade. They should be supplemented by wireless, which is already in use as feeders to the cable systems. There can be no question that messages passing through cables touching foreign territory are insecure. If the cable lands on an enemy's country, the message is stopped or read off, and if on neutral soil, it runs the chance of also finding its way to the enemy, if only because a country which is neutral to-day may be unfriendly to-morrow. A clear distinction must be observed between an international submarine cable and a national cable. An international cable is one which connects the territory of different independent states; a national submarine cable is one which unites the territory or the colonial possessions of a single independent state. The character of the charter or ownership of a submarine cable determines whether it should be deemed foreign or national in respect to a particular state. Apart from their great strategic value, the Chambers of Commerce of practically every important town in the United Kingdom have, on strictly business grounds, loudly urged for a system of All-British cables worked at comparatively easy rates. The same course has also been taken at various influential congresses of the Chambers of Commerce of the British Empire, partly with a view to ensuring against enemy interruptions and eavesdropping. Promoters of private enterprise are indisposed to undertake the laying of cables of a strategic, rather than commercial, order. On the other hand, the cables on the trade routes—through the Mediterranean, etc.—are especially liable to interruption, much more so than those in the open ocean.

Cable Tariff.—The ordinary cable rates, though showing material reduction from those of the earliest days, were in 1921 still very high from the public standpoint.[1] For financial reasons, they were largely based on the length of cable involved (see accompanying table), whereas it is just in the case of especially great distances that the cablegram is at an advantage against the mail boat. Here is a striking case where public (*i.e.* national) and private interests necessarily clash, and where, of course, national interests should be made supreme. This, it is to be feared, can be done only by adequate state control.

In the final report (Cd. 8462) of the Dominions Royal Commission in 1917 expression was given to the view that "charges are very high, the scales extremely complicated and their justification difficult to recognize." The report goes on to say: "The popularization of the cable service can only come with a simplification of the charges and their radical reduction; at present outside its commercial use cable communication is a luxury."

In 1912 a system of half rates for plain-language cablegrams deferred in transmission for 24 hours was introduced after many years' outside pressure. This reform marks something of an epoch in the history of cable telegraphy, and has, in due course, become universal. Week-end cablegrams at a reduced rate were also introduced a little later, this being further supplemented by reduced rates for press messages between Britain and her Dominions. There is also now the "cable letter" service which offers even more favourable rates.

[1] Some of the more recent reductions may possibly be due in part to the competition—such as it is—of wireless telegraphy.

Principal British, etc., cable route stations, with approximate cable distances from London, and tariff, ordinary rate, therefrom.

Station	Approximate cable mileage	Ordinary rate
		s. d.
Madeira	1,617	1 0
St. Vincent	2,744	2 2
Ascension	4,519	2 0
St. Helena	5,307	2 0
Cape Town	7,199	2 0
Gibraltar	1,501	0 3
Malta	2,618	0 4
Alexandria	3,483	1 0
Port Said	3,636	1 0
Aden	5,065	2 0
Bombay	6,910	1 8
Colombo	7,328	1 8
Penang	8,735	2 10
Singapore	9,135	2 10
Labuan	9,869	2 10
Hong-Kong	10,657	3 0
Shanghai	11,584	3 0
Zanzibar	7,024	2 0
Seychelles	8,145	2 0
Mauritius	9,210	2 6
Fremantle	14,289	3 0
Adelaide	15,834	3 0
Melbourne	16,500	3 0
Tasmania	16,700	3 0
Bathurst	3,319	2 6
Sierra Leone	3,785	2 6
Accra	4,807	3 0
Lagos	5,079	3 0
Bonny	5,400	3 0
Newfoundland	2,410	1 0
Nova Scotia	2,727	1 0
Halifax	3,150	1 0
Montreal	3,777	1 0
Vancouver	6,677	1 6
Fanning Island	10,358	2 6
Fiji (Suva)	12,401	2 8
Norfolk Island	13,383	2 8
Queensland	14,220	3 0
Auckland	14,101	2 8
Nelson	14,550	2 8
Sydney	15,352	3 0
Bermuda	4,000	2 6
Jamaica	5,264	2 6
Colon	5,894	2 8
Barbados	6,542	2 6
Trinidad	6,621	2 6
Pernambuco	4,606	1 7
Rio de Janeiro	5,973	2 7
Montevideo	7,135	2 9

With practically all the great cable companies, the tariffs were maintained throughout the war at the same normal figure, whilst considerably more business was done than under peace conditions. A great increase in Government messages occurred, and the suspension of private codes added vastly to the length of most business telegrams, not to mention the continuous flow of extensive press "cables" relating to the war. Then, again, an enormous number of messages were sent such as in normal times—free from postal shortcomings—would be limited to ordinary written correspondence or to "deferred" traffic, which was abandoned by most of the cable companies throughout hostilities. The net result was that these organizations, unlike railway companies, not only maintained their reserves, but very materially added to them during the war. The best explanation here is to be found in the fact that cable repairs to be faced after the long period of warfare were altogether abnormal, though it must be remembered most of the companies concerned already had enormous reserves. The principal exception is the case of the Central and South American Telegraph Co., combined with the Mexican

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Telegraph Co. (the former operating what are now known as the All-America Cables), which, during the war, made large reductions in their tariff, even though, on the greater part of their route, holding a monopoly. The directors expressed their conviction that (*a*) the cable performs a very special mission during warfare, and (*b*) it plays a highly important part in the fostering of trade relations. They were, therefore, determined to aid in every way possible the efforts to maintain and extend the already large trade between the United States and the countries of Central and S. America.

It must not be forgotten that an essential accompaniment to a low telegraph tariff is many more communicating strings; otherwise, the congested condition only becomes worse congested. On the other hand, it is also only by great developments—of one sort and another—in our means of communication that an increased, as well as cheaper, telegraphic output can be secured.

Nationalization.—One result of the Dominions Royal Commission's exhaustive inquiry was the following expression of opinion.[1] "We feel bound, however, to record our opinion that at no distant date the nationalization of the private cable companies will become one of the most urgent problems for statesmanship." Their report states further:—"It appears difficult, if not impossible, to attain the desired cheapness of cable communication, as to the importance of which we hold the strongest views, without interfering with the rights of private companies." Again:—"The urgency of placing cable communication on such a footing that it would be available, not only to the rich, but to all classes, not only to the merchant, but also to the private individual, is manifest and imperative."

But it must not be forgotten that the world is indebted, in the first instance, to the enterprise of private companies for the establishment of submarine cable communication. Some of the companies have certainly been assisted in their enterprise by large Government subsidies.[2] Moreover, these companies have met with rich returns over their enterprise.

Telegraph Control Board.—Whether State ownership should ever be adopted by a country is, of course, a large question, but it seems obvious that in national and imperial interests a measure of State control is desirable in the matter of inter-imperial communications generally. A controlling organization of one sort or another appears to be called for, if only for watching and securing public interests, where clashing with private interests, in return for favours granted by the State.

In the case of Great Britain there are no less than seven Government departments (in addition to the Treasury) concerned in this matter. Hitherto one of these alone (the Post Office) has been acting for the Government, and all questions regarding other departmental interests had to be submitted to the Post Office. This was never very satisfactory in the result.

A British inter-departmental board to deal with inter-departmental telegraphs of all sorts has been advocated for many years. By this scheme, all the Government departments concerned were to be represented and to meet periodically to discuss and settle all important matters as they arose. The war made it clear to the British Government that something of the sort was necessary; and Jan. 1 1919 saw the establishment of such a committee, the whole coming under the *ægis* of the Committee of Imperial Defence. Such a control board, or committee, becomes increasingly desirable in these days of wireless development, for a nice sense of impartiality and discrimination may be required for deciding what should be effected by cable and what by wireless.

[1] Final Report (Cd. 8462 of 1917).

[2] These are as follows:—

Name of Company	Amount of Subsidy	Period of Subsidy	Cables for which Subsidy granted
	£		
Eastern Telegraph Co.	4,500	20 years from April 24 1901.	Sierra Leone-Ascension.
Eastern & S. African Telegraph Co.	28,000	20 years from Nov. 1893.	Zanzibar-Seychelles-Mauritius.
	13,500	20 years from Jan. 1 1900.	Three S. African cables.
Eastern Extension Co.	4,000	Indefinite.	Chefoo-Weihaiwei.
Direct West India Co.	8,000	20 years from Feb. 1 1898.	Bermuda-Jamaica.

Working Developments.—The development of the art of submarine telegraphy was considerable during 1907–21—not so much in relation to the cable itself as to the electrical apparatus for working it. These include the introduction of automatic relays (associated more especially with the names of the late Dr. Alexander Muirhead, F.R.S., and Mr. S. G. Brown, F.R.S.) on the Eastern, Western Union, All-British and Commercial Pacific cables, as well as other wide-spread cable systems.

These have almost entirely superseded manual retransmission between cable sections. Secondly, the introduction of magnifiers (or amplifiers, as they are sometimes called), by rendering the signals more legible, has enabled the carrying capacity of the cables to be enormously increased, at the same time adding to their reliability in the matter of accuracy. Such devices are based on the published experiments of Charles Curtis in the United States and Edward Raymond-Barker in England, and emanate in turn from K. C. Cox, T. B. Dixon, Walter Judd, Angus Fraser, E. S. Heurtley and Axel Orling. The Heurtley magnifier has been very widely adopted by the Pacific Cable Board, the Eastern Association Companies, etc. In vastly improving the character of the signals, this type of apparatus achieves the net result of adding to the effective working speed in the same degree. Indeed, the later results with the Orling magnifier point to a speed increase of as much as 200 per cent.

Thirdly, automatic printing apparatus has been introduced on the land lines worked in conjunction with cables. This apparatus is for the most part due to Mr. F. G. Creed.

Then again, Maj.-Gen. G. O. Squier, Chief Signal Officer of the U.S. army, has experimented with alternating current generators for cable telegraphy, and his researches point to results of a highly advanced—as well as revolutionizing—character.

The Imperial Cable section of the "All Red" route is associated with some of the latest developments in cable telegraphy. The transmission both at London and Halifax is effected by what are known as converter cable transmitters. These are entirely automatic in their working, and, by the use of a switch, will take either Morse or cable type of perforation. There are automatic repeaters at each of the intermediate stations. One of these sections, *i.e.* Bamfield–Fanning, 3,458 n.m., is the longest existing cable length, and has always been a source of great difficulty in the matter of speed as well as from a commercial point of view generally. In the circumstances, the results that have been achieved, by means of recent electrical devices, are very remarkable. It is, indeed, highly creditable that the score of a cricket match can be got through from Melbourne to London within 15 minutes, despite the six intermediate retransmitting points, over so great a total length. A few years earlier, such retransmissions were always effected manually. Now, however, automatic (machine) repeaters are gradually becoming general for all extensive systems with a number of intervening cable sections. The average duplex working speed on the entire route (controlled by that of the long section) was formerly 18 words per minute,[3] but it has been very considerably increased by means of the Heurtley amplifier or magnifier. Something like a 40% increase in the simplex working speed (or 20% duplex) is claimed on this apparatus, which converts the microscopic signals associated with a long cable worked at high speed into characters of reasonable size. On the Atlantic sections some of the very latest devices have been introduced for the purposes of efficient and high speed working, such as had previously been adopted by the Eastern Associated Telegraph Companies. In the main, the plan is that of Morse working in connexion with the Gulstad Relay, so that the speed of connecting land lines is brought up to that of cable code working.[4] The Eastern Compa-

[3] Nearly all long cables are now worked on the duplex system.

[4] On the Indian Government (Persian Gulf) system between Basra and Karachi, the speed for land line Morse was actually raised from 35 to 75 words per minute.

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nies have further greatly added to the efficiency of their system by means of the Creed Printer, which is also installed on the Atlantic section of the "All Red" route, as well as in connexion with Wheatstone high-speed working on the Pacific cable land line system between Melbourne and Sydney.

A Stock Exchange Telegraph Service of a highly efficient order was established some years ago between London and New York. So efficient is this that messages are got through within ten minutes. Something like 2,500 such messages are transmitted between the two Stock Exchanges during an afternoon.

Cables and Commerce.—In pre-cable days each country was, in large measure, an independent commercial unit. The submarine cable has done much to alter that state of things. Whereas in 1870 the total value of the commerce between the United States and Great Britain was about £90,000,000, in the fiscal year ending June 30 1920 it was as much as £525,000,000. Besides the enormous increase in volume of business brought about by the extension of telegraphic service across the oceans, this quickened communication has also brought a complete change in business methods. It has, indeed, introduced an element of stability into international trade such as was seriously lacking when intercourse depended solely on the mail.

The World War has tended also to increase cable traffic because of changed business habits. During the early months of the conflict a rigorous censorship on cable messages was enforced by the Allied Governments. At first codes of all kinds were prohibited, and although this regulation was subsequently modified to allow the use of ordinary commercial codes, private codes and lighter messages were stopped. As a result, many business firms discovered that for much of their cable business the time and labour spent in coding and decoding—as well as the errors which are inevitable in the transmission of unintelligible matter—made messages in plain language only slightly more expensive than code. The result after the war has been a considerable increase in the percentage of plain-language messages. Another factor in the greater traffic has been the increased use of the cables for transactions which were formerly carried on by mail. This has been due partly to changed conditions which have made speedy communication more than ever necessary, and partly to the fact that the business houses, which were forced to increase their use of the cables during the war, have continued to do so on discovering the great convenience of cable communication in comparison with the mail.

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SUBMARINE CAMPAIGNS.—At the beginning of the World War the submarine was a comparatively new weapon of untried possibilities, whose ultimate place in naval warfare it was hard to foresee; and there ensued a period of tentative effort, confined at first to the North Sea, which lasted from Aug. 1914 to Feb. 1915. Germany started the war with 28 submarines, but the unreliable nature of the Korting engines fitted in the first 18 boats (U1–U18) had given her a low opinion of their merits. This was accentuated by the result of the first operation of the war consisting of a sortie by 10 boats up the North Sea, in which U15 was rammed by the light cruiser "Birmingham" on Aug. 9 1914 and U13 disappeared. On the British side some 56 submarines were available, the newest boats of the D and E class being attached to the 8th Flotilla (18 boats) employed under Commodore Roger Keyes in guarding the approach to Dover Straits with a couple (E6 and E8) reconnoitring in the Bight.

Early Days of the War.—Submarines did not play a decisive part in the Heligoland Bight action on Aug. 28. The six British submarines present were disconcerted by the unexpected appearance of British light cruisers, and the German submarines were retained off Heligoland guarding the approach to the rivers. The first British warship to be sunk by submarines was the "Pathfinder," a small cruiser torpedoed by U21 (Otto Hersing), off the Forth on Sept. 5, an incident which aroused little comment beyond emphasizing the danger of old ships patrolling on regular beats. The sinking of the "Cressy," "Hogue" and "Aboukir" off the Dutch coast on Sept. 22 1914 was a much heavier blow. They had been sent to patrol on the Broad Fourteens, between England and Holland, and were steaming slowly in line abreast two miles apart at 6:30 A.M. when the "Aboukir," "Hogue" and "Cressy" were torpedoed in quick succession. This was the work of Otto Weddingen in U9, and the wholesale disappearance of Cruiser Force C within an hour with a loss of over 1,400 men came as an unpleasant shock, and definitely established the power of the new weapon. By the end of Sept. submarines were pushing past Dover Straits into the Channel, and on Oct. 16 1914 the fear of the new weapon reached a climax, when on a false alarm of one in Scapa Flow the British Grand fleet hastily put to sea at night and proceeded to Lough Swilly where by a freak of misfortune the "Audacious" ran on a mine and was lost. Oct. 20 1914 had seen the sinking of the first merchant ship, the ss. "Glitra," off Norway by U17, but it was not until Nov. 23 that U18 actually attempted to enter the Flow. The Grand fleet were at sea at the time and U18 was rammed by a minesweeper, the "Dorothy Gray," close to the Hoxa entrance. She went down to 11 fathoms with her hydroplanes damaged, and coming to the surface later was rammed by the destroyer "Garry" and forced to surrender, the first and (with the exception of UB116 in 1918) the last attempt to enter Scapa Flow.

Defensive Methods.—The war found the British navy almost destitute of defensive methods against the submarine. A committee had sat on the subject but had evolved nothing but the modified sweep—a somewhat clumsy contrivance consisting of a line of explosive charges towed astern, regulated in depth by a water-kite and fired from inboard. The defence of Scapa had been mooted as early as 1912, and Adml. Jellicoe, then at the Admiralty, had taken an important part in discussions on the subject, but nothing had been done beyond allocating a small sum for the purpose in 1913, which was diverted to Dover to build a wall on the breakwater, in pursuance of the pre-war tendency to try and fit prospective wars into the existing naval ports. By the end of 1914 Cromarty had been supplied with Capt. Donald Monro's boom, but Scapa with all its entrances was not secure till Feb. 1915. Counter measures at this stage of the war were confined to an extensive development of the Auxiliary Patrol organization, the tentative supply of defensive armament to merchant shipping, and the equipment of a comparatively small number of vessels with the modified sweep. The trawlers of the Auxiliary Patrol played an important part in minesweeping and in escort work, but were too slow and too poorly armed to be really effective in offensive operations against the submarine. By the end of 1914 the submarine was generally recognized as a new and powerful weapon in naval warfare, though its tremendous potency as an instrument of the *guerre de course* had not been fully realized. Germany had lost 7 and with the addition of 11 had 30 now available, with 42 U boats and 127 UB and UC under construction and on order. Von Tirpitz, fully alive to their possibilities, was already building great hopes on them.

The early morning of New Year's Day 1915 saw the old battleship "Formidable" (Capt. A. N. Loxley) fall a victim to U24 off Start Point while patrolling up and down with the Channel fleet at 10 knots. The captain went down with the ship. Only 141 were saved out of a crew of over 800, and the incident demolished once and for all the opinion of a certain school of naval thought that the submarine could be ignored.

They were now going farther afield. Otto Hersing in U21 made his first cruise to the Irish Sea in Jan. 1915, and this month too saw the first instances of a ship being torpedoed without warning in the case of the British s.s. "Tokemaru" and s.s. "Ikaria" off Havre on Jan. 30 by U20 (Schwieger, who was to earn an unenviable reputation for ruthless warfare).

Campaigns of 1915.—Feb. 4 1915 saw the close of what may be termed the preliminary phase of submarine warfare. The German naval staff now decided to conduct a general campaign against merchant shipping, and on this date the German Government issued a declaration constituting all waters round Great Britain and Ireland a war zone (*Kriegsgebiet*), in which from

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Feb. 4 all enemy merchant ships would be destroyed without it being always possible to avoid danger to passengers or crew, and where even neutral vessels would be exposed to danger of attack. This evoked on Feb. 11 a strong protest from the United States denouncing it as an indefensible violation of neutral rights. The date was postponed to Feb. 18 and the order modified to the extent that neutral ships were to be spared, though in adjudging their neutrality all circumstances and not the flag only were to be taken into account. March 18 1915 saw the end of Otto Weddingen in U29 which was on her way home round Great Britain, about half-way between Kinnaird Head and Norway, when she was rammed by the battleship "Dreadnought" after attacking the battleship "Marlborough." The inauguration of the new campaign was followed in March by the establishment of the Flanders flotilla, which at first consisted of small UB and UC boats working chiefly round the Thames and east coast. By Oct. 1915 it had grown to 16 boats, and was contributing a fair proportion of the ships sunk.

The Flanders flotilla had hardly started its career when it met with a formidable obstacle in Dover Straits. Experiments had been proceeding for some months in the use of steel wire nets to indicate and obstruct the passage of submarines, and the admiral at Dover (Rear-Adml. Hon. Horace Hood) now succeeded in closing the Straits by this means for over four months. The nets used were in lengths of 100 yds. and 60 or 30 ft. deep, shot by drifters, and by Feb. 13 1915 he had some 30 drifters riding to their nets in the Straits. Bad weather took a heavy toll of the equipment, but the results were surprisingly successful to an extent hardly appreciated at the time. U8 fouled one of these nets on March 8 1915 off the Varne and was forced to come up by the destroyer "Ghurka," which exploded a modified sweep over her. U37 went down the Channel later in the month and never returned. Early in April U32 got caught in a net, and had so much difficulty in getting clear that she went home northabout. She drew a formidable picture of the obstruction, and on the strength of her report the Bight flotillas received instructions to go northabout, and the Flanders boats following their example also eschewed the Straits for over four months. It was thought at first that in the net a permanent antidote to the submarine had been found, and net bases were established at several ports, particularly at Larne for the North Channel, but technical difficulties (clips and indicator buoys) supervened, and the Germans overcame the lighter form of net by net cutters.

The sinking of the liners "Falaba," "Lusitania" and "Arabic" constituted three beacons in the 1915 campaign. The former, an Elder Dempster liner of 4,806 tons on the way to Sierra Leone, was torpedoed with five minutes' warning on March 27 by U28 off the south of Ireland, and sank in eight minutes with the loss of over 100 lives. The indignation arising from this incident had hardly subsided when it was fanned to fever heat by one of the most momentous incidents of the war. On May 7 1915 Schwieger in U20 was off the Old Head of Kinsale (south of Ireland) when he sighted a great liner homeward bound. This was the "Lusitania" going only 18 knots, her decks crowded with women and children. At 2:15 P.M. he sent two torpedoes into her without warning and she went down in 20 minutes with the loss of 1,198 lives, while Schwieger "moved with mixed feelings" watched the terrific scene. A chorus of applause arose in Germany, but the deed can be seen now as an error of the first magnitude, which set on foot the whole train of circumstances which brought America into the war. The controversy between the German naval staff and the Chancellor immediately reached a crisis. The latter refused to be responsible for such acts, and on June 5 1915 an imperial order was issued forbidding the sinking of large passenger vessels. Von Tirpitz, the Secretary of State, was furious, and he and Bachmann, the chief of the naval staff, both sent in their resignations, but were commanded bluntly to remain at their posts.

Meanwhile Otto Hersing, the pioneer in distant fields, had sailed on April 25 in U21 for the Mediterranean. Arrangements had been made to provide him with oil on the way, probably in the vicinity of Tangiers, but they broke down, and he arrived at Cattaro on May 13 with only half a ton of oil fuel left. He reached the Dardanelles on May 25 and instantly made his presence felt. The "Vengeance" was missed by a torpedo that day; the old battleship "Triumph" supporting the Anzacs off Gaba Tepe was hit by two torpedoes at 12:30 P.M. and turned turtle in nine minutes with a loss of over 200 lives. Two days later (May 27) the "Majestic," supporting the troops inside the Straits, was hit and capsized with the loss of 49 men. The whole system of naval bombardment received a severe shock, though it was not till Aug. 13, when the "Royal Edward" was sunk near Kos by UB14, that the transports began to suffer.

By this time another counter to the submarine had been found in the decoy ship, whose early type consisted of trawlers or vessels with submarines in tow. Three submarines were sunk in this way during the summer of 1915 (U40 on June 23 by C24, U23 on July 20 by C27, and U36 on July 24 by the "Prince Charles"). Aug. 19 1915 saw the destruction in the approach to St. George's Channel by the decoy ship "Baralong" of U27, while she was attacking the "Nicosian." Several German sailors had boarded the latter vessel, and the American cattlemen in her, when they saw the submarine disappear, fell on them and threw them overboard. Germany gave vent to a roar of indignation, undisturbed by the fact that the very day U27 was sunk U24 (Schneider) met the White Star liner "Arabic" outward bound off the south of Ireland and sank her without warning with the loss of 44 lives. Indignation in America flamed up anew. Again at great headquarters von Tirpitz wrestled with the Chancellor and again the Chancellor won the day. The use of decoy ships and defensively armed merchantmen, by increasing the danger of coming to the surface, provided the German naval staff with a strong argument for unrestricted warfare, but the imperial decision went in favour of the Chancellor, and orders were issued on Aug. 30 that no liners were to be sunk without warning and due regard for the safety of passengers. This was a bitter blow to the partisans of submarine warfare, and Adml. Bachmann, the chief of the naval staff, who had not been consulted on the issue, resigned and was succeeded by Adml. von Holtzendorff. The commander-in-chief of the High Sea fleet, Adml. von Pohl, also asked to be relieved, but to no purpose. He was told he did not understand the political situation. On Sept. 20 1915 further orders were issued to suspend submarine warfare on the west coast and in the Channel. The campaign now languished in British waters. From Sept. 1915 to Feb. 1916 activity against merchant shipping practically ceased in the Bight and was transferred to the Mediterranean.

During the year Feb. 1915 to Jan. 1916 a total of 394 Allied and neutral ships had been sunk by submarines with a gross tonnage of 1,059,141 tons; of these 225 (760,449 tons) were British, 54 of which had been sunk in the Mediterranean. Some 60 merchant ships had been sunk without warning during the year and 17 submarines had been destroyed, an average of one submarine for 23·1 ships.

The Baltic.—Meanwhile British submarines had been active in the Baltic and the Dardanelles, where a great field had opened to British heroism. In the Baltic E9 (Comdr. Max Horton) and E1 (Comdr. N. F. Laurence) were the first to penetrate early in 1915, and proved a valuable addition to the Russian (Adml. Essen's) force. On July 2 1915, when the Russians sank the minelayer "Albatross," E9 sent two torpedoes into the old cruiser "Prinz Adalbert" and drove her back to port. On Aug. 4 1915 E13 ran ashore on the Danish island of Saltholm while passing the Sound. Before the 24 hours given her by the Danes to get off had elapsed two German destroyers appeared and, opening fire on her, killed half the crew, an act which did not pass unavenged. The Germans at the time were making a determined attempt to force the Gulf of Riga with a view to operating on the Russian flank, and the battle-cruisers of the 1st Scouting Group with the 1st Battle Squadron and a number of light cruisers had been lent for this purpose by the High Sea fleet. E1 now appeared on the scene, and the very day that E13 received its deadly hail of fire sent a torpedo into the battle-cruiser "Moltke" off the Gulf of Riga, driving her back to port.

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Winter did not stop the activity of the British submarines. In the latter part of 1915 E8, E9 and E19 (Comdr. F. A. N. Cromie) attacked the important iron ore trade from Lulua (Sweden) to Germany, and between Oct. 11 and 23 sank 14 large German steamers engaged in it. The "Prinz Adalbert" too was sunk by E8 on Nov. 8, and on Dec. 12 the light cruiser "Bremen" and destroyer V191 were sent to the bottom. The Germans now set to work vigorously to devise counter measures. Minefields were laid in the Sound off Drogden, in the Flint-Rinne at the southern end of the passage on the Swedish side and at Falsterbo; an old battleship was stationed to defend them; torpedo flotillas were despatched to patrol the entrance to the Baltic, and convoy flotillas were organized for the Swedish trade with the result that British submarine activity suffered a severe check and the difficulty of entering the Baltic was greatly increased. The work of submarines there was also seriously hampered by the inability of the Russian dockyards to cope with their demands, an unmistakable indication of the probable failure of any attempt to conduct a big campaign in that sea.

The Mediterranean.—In the Mediterranean the ability of submarines to assist the Dardanelles campaign by interfering with Turkish transport in the Sea of Marmora was fully realized, but the passage of the Dardanelles was not an easy proposition. Twenty-seven miles long with a width of only a mile in the famous Narrows (the 3½ m. stretch between Chanak and Nagara) lent itself easily to defence, and could be transformed into a veritable trap for submarines. It is impossible to give the details of every passage where every passage was an heroic venture. Lt.-Comdr. Norman Holbrook had made the passage on Dec. 11 1914 in B11 and torpedoed an old battleship, the "Messidiyeh." E15 (Lt.-Comdr. T. S. Brodie) was now the first to go up on April 15, but grounded in Kefez Bay (on the Asiatic side some 10 m. up) and was lost, his ship being torpedoed later by a picket boat under Lt.-Comdr. Eric Robinson, to prevent it falling into the hands of the Turks. E14 (Lt.-Comdr. E. C. Boyle) followed, passing Chanak on the surface and running submerged for forty-four hours. She sank three ships, including the transport "Gul Gemel" with 6,000 troops, bringing her commander a V.C. AE2 (Lt.-Comdr. H. H. G. Stoker) made the passage on April 25, diving under the minefields, but on the 30th broke surface suddenly, and coming under fire was forced to the surface and sunk. On May 1 the French submarine "Joule" attempted the passage and succumbed to a mine. E11 (Lt.-Comdr. M. E. Nasmith) passed safely at the end of May, sank 10 ships, penetrated into the Bosporus and torpedoed the transport "Stamboul" and an ammunition ship there. Passing Kilid Bahr on his way back, her commander found a large mine perched in the bows which he dropped neatly by dipping and going astern, and won a V.C. in its place. E12 (Lt.-Comdr. Kenneth M. Bruce), E7 (Lt.-Comdr. A. D. Cochrane), E2 (Comdr. David Stocks), E20 (Lt.-Comdr. C. H. Warren) and H1 (Lt. Wilfred Pirie) followed, doing the same heroic work in difficult and dangerous waters. E14 was up again in July and sank 22 ships, great and small, including a 5,000-ton steamer on Aug. 7, and clearing the Sea of Marmora. He was assisted in this task by E11, who sank the old battleship "Hairredin Barbarossa" the same day and the transports "Chios" and "Samsoun" with the ammunition ships "Espahan" and "Tenedos" a week or so later. By this time a powerful barrage had been laid at Nagara, greatly increasing the risk of the passage. The French submarine "Marriotte" encountered an enemy submarine and was sunk (July 26) and E2 on her way in got badly entangled in the Nagara obstruction, but managed after 10 minutes' plunging about to get clear. E7 was not so fortunate. Going up on Aug. 4 she got enmeshed in the nets, and after the explosion of three mines in her vicinity was forced to the surface and sunk. E12, who followed in Sept., remained up 40 days with E20 and H1 in her company for a time and sank 37 ships. On the way down she fouled a net in the Narrows and went down to 245 ft., with the hydroplanes jambed and the conning tower flooded; finally she struck the chain moorings at Kilid Bahr which swept away the entanglement, and though she broke surface and came under fire managed to win through. The French submarine "Turquoise" was sunk by gunfire on Oct. 30 1915, and a final toll of British boats was taken in E20 (Lt.-Comdr. C. H. Warren) which fell a victim to stratagem after passing through the Narrows. With the help of an Allied code probably taken from a captured submarine she was inveigled to a rendezvous and torpedoed by UB14 on Nov. 6. E11 remained up a record period of 48 days in Nov. and Dec., sinking 46 ships of different sizes. The last submarine to make the hazardous passage was E2, which was recalled on Jan. 2, a week before the final evacuation, and got safely through.

For the latter part of the year 1915 two submarines had usually been working in the Sea of Marmora at a time. Altogether some 32 passages had been made or attempted by submarines, and though they had incurred the loss of 7 of their number (E15, AE2, E7, E20, "Joule," "Mariotte" and "Turquoise," their efforts had met with a large degree of success. The Sea of Marmora had been made unsafe, the Turks had been forced to send their troops by a roundabout route—by rail to Rodosti and then a three days' march to Gallipoli. Their tale of losses included two old battleships, one destroyer, 12 sloops and small craft, 7 transports, and no less than 197 vessels of all sorts and sizes, steam and sail, of which 36 were over 1,000 tons. This was the end of the Dardanelles submarine campaign, whose record fills a golden page in the annals of the navy.

In the autumn of 1915, when activity in British waters diminished, five more German submarines were sent to the Mediterranean. With them went Max Valentiner in U38 and Arnauld de la Perière in U35, two of the most distinguished German submarine commanders. The result was immediately evident. Valentiner, on his way from Gibraltar to Cattaro alone sank a round dozen of ships, including the Italian liner "Ancona" with a loss of over 200 lives, and the sinkings in the Mediterranean in Nov. went up to 23 chiefly off Crete, Malta and Tunis. They were nearly all merchant ships. No more men of war fell to them, and out of 242 transports only three were lost, the "Royal Edward" (Aug. 13, loss of life 955), "Ramazan" (Sept. 19) and the "Marquette" on Oct. 23. On Dec. 30 1915 Valentiner sank the P. & O. liner "Persia" (7,974 tons) off Crete without warning with a loss of 354 lives, but Germany refused to admit that it was one of her submarines and tried to transfer the responsibility to Austria. This brought the year 1915 to an end, a year fertile in hope and speculation, begetting vast promises of further success. To all Germany the future of her navy lay beneath the waters, though few could read the riddle as far as the bottom of Scapa Flow.

Types of German Submarines.—A short digression may be inserted here on the general types and characteristics of German submarines. They comprised four main classes—converted mercantiles (Deutschland class), U boats, UB and UC. The converted mercantile numbered a bare half-dozen (U151–U155) and were used chiefly off the Azores and in 1918 off the coast of America. They were about 213 ft. long, large, slow and clumsy, going about nine knots only on the surface, but capable of remaining out for three to five months. They had a good armament of two 5·9-in. guns, six torpedo tubes (4 bow, 2 beam) and 30 torpedoes. The U boats were the principal type, and were large boats which did most of their work in the Atlantic approaches. They were 210–225 ft. long, could go 14½–17 knots on the surface, and 8–9 knots submerged. They could only maintain this speed submerged for an hour or so, but could continue at a speed of about two knots for as much as 48 hours; then, like all submarines, they had to come to the surface and recharge their batteries with the help of their Diesel motors. They carried two guns (usually one 4·1 in. and one 22-pounder), with 4 to 6 torpedo tubes and 8 to 12 torpedoes, and remained out generally from 25–30 days. There was also a special class of U minelayers, which originally numbered 10, viz. U71–U80, carrying 36 mines and 2 torpedoes. They had only a single hull and were slow boats, rarely cruising at more than 5 knots. Though the work on the west coast of Scotland and off the Dutch coast in 1918 was done by these boats they were not as a class very successful, and by 1918 there were only 5 of them left. The UB boats were originally built for coastal work, and the first 17 were small boats capable of being sent in sections overland. The earlier boats could remain out from 7–14 days, the later boats from 14–24 days. They carried one gun forward (a 4·1 in. or 22-pounder) and the earlier boats 2 to 6 torpedoes, which were increased to 5 tubes (4 bow, 1 stern) and 10 torpedoes in the later type. The UC boats were essentially minelayers, carrying one 22-pounder forward, 3 tubes with 4 to 6 torpedoes, and 18 mines. They remained out

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from 10–20 days in the North Sea, but when working in the Channel from Flanders rarely more than twelve. Submarines cruised normally on the surface. When attacking they usually proceeded at periscope depth (about 45 ft. for U boats), cruising at 65–85 ft., and going to 150 ft. if attacked. The fact that a periscope was rarely visible, even with glasses, at over a mile, emphasizes the difficulty of counter-attack.

German Submarine Flotillas.—The flotillas were distributed in four principal commands—the North Sea (or High Sea fleet) flotillas working from the Bight and usually termed the North Sea flotillas; the Flanders flotillas working from Zeebrugge; the Mediterranean based on Pola, Cattaro and Constantinople, and the Baltic (or Kurland) flotilla working from Baltic ports. The Flanders flotilla consisted wholly of UB and UC boats and was allotted a definite area of operations, which extended on the east coast of Great Britain as far as Flamborough Head (Yorks), and in the Channel as far as 7° W. (about as far as Waterford) and down to the Gironde. At the beginning of the year 1916 the strength of the various flotillas was approximately North Sea 16, Baltic 6, Flanders 18, Mediterranean 12. There were 16 boats approaching completion, and 161 boats building and being delivered at the rate of 8 to 10 a month.

Campaign of 1916.—The year 1916 was marked by another long-drawn-out controversy between the German Chancellor and the naval staff. The Chancellor stood out against unrestricted naval warfare (that is sinking at sight); the naval staff fought for it. Nor were their arguments lacking in force. If a submarine came to the surface at a distance a ship could run away, if it rose close at hand it was exposed to fire from an armed merchantman or decoy ship. In Jan. 1916 the German naval staff presented a memorandum claiming that unrestricted warfare would force England to make peace in six months. It stated that from Feb. to Oct. 1915 one or two steamers, averaging 4,085 tons, had been sunk daily by each submarine. This was an exaggerated estimate, for the figures for British ships in 1915 were more nearly one-third of a ship per submarine per day, but on this basis they calculated a loss of 631,000 tons a month, at which rate it was estimated that England would be reduced to her knees in six months. A definitive audience took place at Great Headquarters on March 6 1916, when it was decided to postpone its execution till April 1 in order to bring all possible means of persuasion to bear on the United States in the attempt to reconcile them to the idea.

Von Tirpitz, in despair at the continual frustration of his plans, resigned, and his place was taken by Admi. von Capelle. Five days before the prescribed date UB18 (Steinbrinck) torpedoed the "Sussex" on March 24 1916 on her way from Folkestone to Dieppe with 25 American citizens on board; and though she remained afloat, the forepart of the vessel was blown up and some 80 passengers were killed and injured. America's patience now came to an end, and on April 18 President Wilson threatened to break off diplomatic relations. The German Government gave way, and abandoning the idea of ruthless warfare issued an order on April 25 precluding submarines from sinking any merchant ship at sight, and requiring them in their war against trade to act in strict accordance with the methods prescribed by prize law, which entailed stopping a ship, examining her papers and giving all the crew and passengers an opportunity to leave her before proceeding to any act of destruction.

Meanwhile the chief of the naval staff at Berlin had issued an order, which came into force on Feb. 29 1916, that armed merchantmen were to be regarded as warships, and the attention of German submarine commanders was called to a clause in the prize regulations under which all merchantmen which might attack a German or neutral ship were to be regarded as pirates. This found its sequel on March 28, when Capt. Fryatt in his ship the "Brussels" attacked U33 on her way to Holland, and, being captured with his ship by a German destroyer on June 23, was tried and shot (July 27 1916).

The decision against unrestricted warfare came as a bitter disappointment to Admi. Scheer, who received the order on his way to carry out the Lowestoft raid on April 25 1916. He immediately recalled all the High Sea fleet submarines and ordered them to cease operations against merchant shipping. He refused to have anything to do with what he called the blunt edge of the weapon, and had decided that if they were not to be used in unrestricted warfare he would use them only in fleet operations. The Flanders command followed suit with most of its boats, and the Mediterranean flotillas were left to continue the campaign against commerce alone. Just as Admi. Scheer's order went out an extensive barrage was being laid off the Belgian coast (April 24) by the Dover Patrol (Vice-Admi. Sir Reginald Bacon). This was an effort on a large scale to cope with the submarine by a combination of mines and mine-nets. It consisted of some 18 m. of moored nets fitted with net mines, supported by lines of mines running parallel to and about 12 m. off the Belgian coast. It was completed by May 7 1916 and a patrol was maintained on it by day from May to October. It is difficult to estimate its precise value, for the diminished activity ascribed to it at Dover was undoubtedly due to the cessation of submarine operations on political grounds from May to Sept. 1916. No doubt it made work more difficult for Flanders submarines, but the mines were poor and notoriously ineffective. A single boat (UB3) was destroyed in its vicinity the day it was laid by a lance bomb thrown from a drifter, the "Gleaner of the Sea." Another (UB10) ran into it and took eight hours to clear with net mines exploding all round her, and though the work entailed in the barrage deserves a generous meed of praise no submarine was actually destroyed by it in 1916, and it certainly never prevented the entry and exit of the Flanders boats.

Steinbrinck, of the Flanders flotilla, was now sent to cruise in the Channel to report on the feasibility of warfare on the lines of prize law, which involved the stoppage and due warning of ships before destruction. His report was unfavourable, and during the summer the Flanders boats worked only on the E. coast. Scheer meanwhile used his Bight flotillas (reinforced with Flanders boats) in fleet operations, of which the most important were those of Jutland and Aug. 19, when the "Nottingham" and "Falmouth" were sunk by U52 and U66. It was on this latter occasion that E23 (Lt.-Comdr. Robert Turner) torpedoed the German battleship "Westfalen" on its way out of the Bight. This was at 5:30 A.M., and on rising to the surface later at 10:10 A.M. he reported the German fleet to the C.-in-C., then some 180 m. off, an incident which first brought into prominence the possibilities of the submarine in fleet reconnaissance work. During the summer the chief of the German naval staff was trying to persuade Scheer to modify his "harsh professional conception" of submarine warfare, and resume restricted war against commerce in accordance with prize law. The Mediterranean submarines had continued working on these lines with good results; the Flanders flotilla had recommenced on a small scale in Sept. 1916, and the operations in concert with the fleet had only resulted in the sinking of two light cruisers. The "Deutschland," under Capt. Paul König, tried a trading venture across the Atlantic during the summer, reaching America on July 9 1916 and returning on Aug. 23 with a cargo of rubber, nickel, and tin, but the "Bremen" which followed her in Sept. was lost. U53, under Lt.-Comdr. Hans Rose, a skilful and chivalrous commander, crossed the Atlantic (leaving on Sept. 17 and arriving on Oct. 7) and sunk five merchantmen off Newport News. The "Deutschland" made a second trip across, arriving in New London on Nov. 1 and reaching Germany safely on Dec. 10 1916. There her mercantile career ended, and she was fitted out as a submarine-of-war and went off to work in the Azores. Archangel too became a sphere of activity for a time, and seven ships were sunk there in Oct., but the initial success did not continue, and in Nov. U56 was sunk by Russian patrols. The German naval staff now decided that all flotillas were to resume the campaign against commerce in accordance with prize law, and orders to this effect were issued on Oct. 6 1916. Scheer had underestimated the power of legitimate warfare. The monthly average of all Allied and neutral merchant ships sunk by submarines had been 76 ships and 153,521 tons (gross) from Feb. to Sept. 1916. From Oct. 1916 to Jan. 1917 the average rose to 173 ships and 346,405 tons, and the campaign was extended with success to the Azores, Canaries and Madeira, where Funchal was bombarded on Dec. 3 by a converted mercantile.

"Unrestricted" Warfare, 1917.—But during the autumn Scheer and the naval staff found powerful allies for the policy

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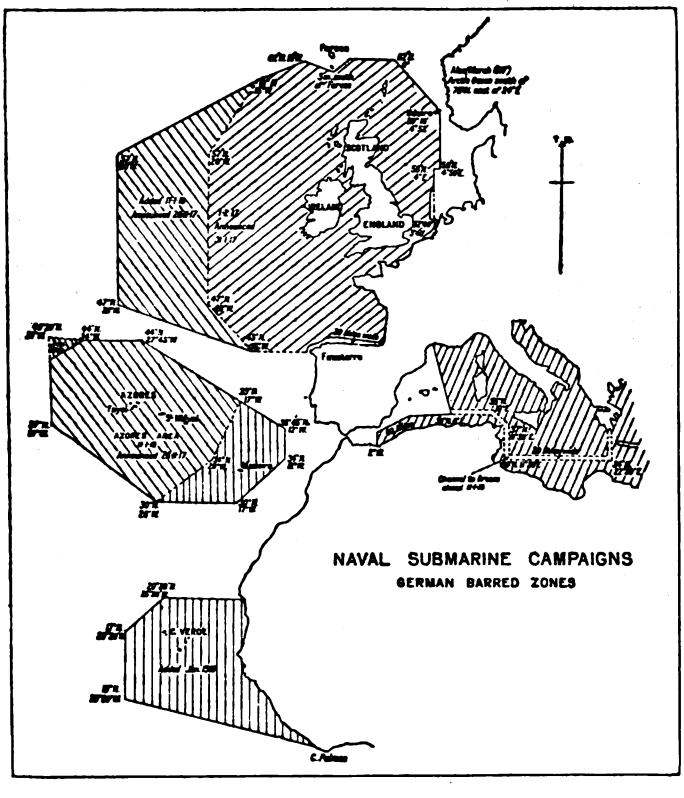
of unrestricted warfare in Hindenburg and Ludendorff. The topic was again discussed on Sept. 3 1916 at Great Headquarters at Pless in the presence of the Chancellor, Hindenburg, Ludendorff and Adml. von Holtzendorff, and it was finally decided to postpone it till an effort had been made to come to terms. Then followed the note of Dec. 12 1916 calling on the Allies to avoid further bloodshed, and on Dec. 22 the naval staff presented another memorandum in which it was hoped to reduce British shipping by 39% in five months, on a basis of 600,000 tons monthly, an estimate which turned out to be excessive, for by June 1917 British shipping had been reduced only from 18·2 to 16·6 million tons, a reduction of only 9·1%. The offer to negotiate was rejected by the Allies, and it was decided on Jan. 9 to commence unrestricted warfare on Feb. 1 1917. All Germany was waiting for the decision. The Reichstag listened to the Chancellor's announcement in breathless silence, and on Feb. 3 the American ambassador left Berlin. Germany now had 148 submarines, of which 28 were in the Mediterranean and some 20 in Flanders. She had commenced with 28 and had lost 51. The repairs incurred at Jutland, the provision of patrol vessels and the vacillations of policy had reacted on submarine building, and von Capelle had only laid down 90 boats to Tirpitz's 186, but during 1917 269 more were ordered and it was hoped to keep pace with the demand. The barred zone announced by Germany on Jan. 31 1917 in which all shipping was liable to be sunk extended roughly from Terschelling (Holland) to Udsire (Norway), thence to the Faroe Is. and passing down the meridian of long. 20° W., 350 m. from the coast of Ireland, went on to Finisterre. It also included the Mediterranean with the exception of its western portion round Majorca and a narrow track 20 m. wide as far as Greece. The area round Archangel was added to it



in March 1917, and on Jan. 11 1918 it was extended to the meridian of long. 30° W., 720 m. from the coast of Ireland, and two large areas were added round the Azores and C. Verde Is.

The effects of the new campaign were quickly felt. The system under which traffic approached Great Britain on routes patrolled by ships and trawlers with a sprinkling of destroyers proved incapable of meeting the emergency. Losses of Allied merchant ships rose from 171 in Jan. to 234 in Feb., 281 in March and 373 in April. This was the black month of the war. At this rate one ship in every four that left British shores did not return, and by Nov. 1917 the irreducible margin of shipping would probably have been reached. The effects were most severely felt in the Channel, Mediterranean and the routes south of Ireland (called the Fastnet and Scilly approaches), which were strewn with the hulls of sunken ships. The outlook was dark and perplexing to those who saw the Grand Fleet remaining mistress of a sea which was becoming a cemetery for British shipping, and had not realized the fact that the battle fleets were becoming subsidiary factors in a new form of the *guerre de course*. The efforts to deal with the situation took a threefold form. Firstly, a convoy system (*see* CONVOY) was introduced involving the escort of merchant shipping at sea and the control of all shipping movements; secondly, the naval staff was reorganized so as to insure a due status for the convoy system, and a planning section and anti-submarine division were added to it (*see* ADMIRALTY ADMINISTRATION); thirdly, invention and research were speeded up in the technical fields of mines, depth charges and hydrophones. These efforts were successful. Gradually the losses of ships went down and the losses of submarines crept up.

The enemy's operations can only be broadly described; his principal areas were the approaches to the Channel and Irish Sea, the North Sea (particularly off the Yorks. coast), the Channel and Mediterranean. The number of submarines operating varied. As a rule there might be two or three (converted mercantile) operating in the Azores and on the Dakar (W. Africa) coast, 8 or 9 U boats in the Atlantic approach (from longitude 7° to 12° W.) and on their way there and back, 4 or 5 (including a couple of Flanders UC) in the Channel and its approach, with 5 UB (Flanders) and 2 UC (Flanders) in the North Sea. In the Mediterranean there were usually 4 to 6 submarines at work, including 1 or 2 on the N. African coast, 1 or 2 round Italy, 1 perhaps off Salonika, 2 off Egypt, Syria and Crete. This gives a total of some 25–30 submarines at work. The tonnage sunk per submarine varied. Curiously enough the average bag was considerably more in the time of restricted warfare than it was in 1917–8. In the former period it was probably something like 16,000 tons a trip. U49 on her first trip in Nov. 1916 in the Channel and Bay of Biscay sank 40,000 tons, and Forstmann, Arnauld de la Perière and Max Valentiner in the Mediterranean thought little of 20,000 tons a trip in 1916. But in 1917 the average bag was probably not much more than 8,000 tons for a U boat and 3,000 for a UB or UC. In the North Sea in Jan. 1918 a U boat was fairly fortunate to get 4,000 tons, and in the Channel 6,000 tons had become a fair bag.

Progress of Counter Measures.—In the anti-submarine campaign great progress was made in technical devices, and larger depth charges were supplied in greater quantities. Type D charge (300 lb. T.N.T.) entirely superseded type D^x (120 lb.), and the output was increased. Destroyers carried five or six instead of one or two; some were equipped with as many as 20 or 30, and the number of submarines sunk by depth charges rose from 8 in 1917 to 15 in 1918. Decoys (generally designated Q ships) continued effective in 1917, and five submarines were sunk by them during the year. These were merchant ships manned with a trained crew and armed with guns carefully concealed by special devices. On a submarine opening fire the ship would stop and a portion of the crew called the " panic party " took to the boats, lowering them carelessly and hurriedly in the hope that the submarine would approach and board the vessel. If she did the bulwarks fell and a deadly fire was poured into her at close quarters. Capt. Gordon Campbell was the most successful exponent of this stratagem. U38 fell to his ship, the " Pargust," on Feb. 17 1917 off the southwest of Ireland, and UC29 was sunk by her on June 7 in the same area, bringing him a V.C. His last ship, the " Dunraven," sank on Aug. 10 after a heroic action with U61, in which the after gun's crew remained steady at their post with the poop blazing under them and were blown up with the gun rather than betray the nature of their ship. The " Prize," (Lt. Wm. Sanders) and the " Stonecrop " (Comdr. Morris Blackwood) were also gallant ships, the former sinking U88 out in the Atlantic on Sept. 17 and both being sunk by submarines. By Sept. 1917 the decoy had lost its efficacy, though four were

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still in use in the early part of 1918. From first to last it achieved the destruction of 13 submarines with the loss of some 20 decoy ships, great and small, some like the "Prize" and "Vala" with all hands. Its place was now taken by the seaplane and P boat. The latter were low boats not easily seen in mist or at dawn and were responsible for no less than four submarines in 1917. Aircraft now began to be really effective, and in 1917 six submarines succumbed to the 300-lb. bombs of large Handley-Pages in the southern portion of the North Sea. British submarines too were constantly on patrol, and were able to count six submarines to their credit by the end of the year (G13 sank UC43 off the Shetlands March 10; E54 U81 in the Atlantic May 1; D7 U45 north of Ireland Sept. 12; E45 UC79, Oct. 19; E52 UC63 Nov. 1, in the North Sea, and C15 UC65 Nov. 3, in the Channel). The hydrophone, an instrument designed to detect submarines by sound waves under water, also developed greatly, but was more useful as a detector and in controlled minefields than in actual pursuit.

The whole system of staff work was overhauled. Direction of convoys became one of the principal functions of the naval staff and the machinery of Intelligence was adjusted in this light. Intelligence of first-rate importance derived from wireless directionals had hitherto been shrouded in secrecy and locked away in drawers for the edification of the very few. The director of Naval Intelligence (Rear-Adml. Sir W. R. Hall) at last obtained control of it, and spread it abroad and circulated it to every command. The movements of all enemy submarines hitherto veiled in secrecy were displayed on a great chart in the Convoy room, and subjected to careful analysis by the new Plans Section. In Oct. 1917 this division prepared a large mine-net operation based on careful observation of submarine tracks in September. In spite of bad weather and unfavourable circumstances three large submarines (U50, U66 and U106) found their way into the minefield and were sunk, causing a scare in the Bight which sent submarines round by the Kattegat for the first time.

Plans were prepared too for mining the Bight, but it was not till Sept. 1917 that the new mines were ready in sufficient quantity. Gradually the whole strength of the High Sea fleet had to be concentrated on getting submarines in and out. An armada of minesweepers, barrier breakers, escort forces and outpost forces were constantly at work trying to keep a passage open for them along ways which extended as far as 150 m. from Heligoland. Dover still remained a thorn in the flesh. The cessation of submarine activity in April 1916 had been erroneously attributed there to the Belgian coast barrage, and a similar barrage had accordingly been laid across the Straits in the latter part of 1916. It was composed of mine-nets 60 ft. deep with a minefield in support. But the mines were of the old defective design. They dragged into the nets, sank British ships, and had to be swept up in June and July 1917. The barrage entailed enormous labour but did not close the Straits, and from Feb. to Nov. 1917 enemy submarines passed at the rate of at least 24 passages a month. This was a serious matter, for the Dover passage saved a Flanders boat eight days on the double journey to the Channel approach out of its trip of 14 days, and a Bight boat six days out of its trip of 25 days. In Oct. the whole question became acute, for Flanders boats were responsible for some 22 ships a month in the Channel. The proper antidote was a strong minefield, and the vice-admiral at Dover had suggested in July 1917 laying a deep minefield from the Varne to Gris Nez, but the new mines were not ready and could not be supplied to Dover till Nov. It was partly laid on Nov. 21, but it was not constantly and intensively patrolled so as to make the submarines dive, with the result that between Nov. 21 and Dec. 8 21 submarines made the passage in safety. This was a severe disappointment, and instructions were sent to establish a strong patrol equipped with flares and searchlights to force the submarines down. This was done to a limited extent, and on the 19th the new minefield took its first toll in UB56. But difficulties arose in the execution of the plans and the urgency was so acute that before the end of the month Rear-Adml. Sir Roger Keyes, Director of Plans, was sent to Dover to assume the command, and the next four months saw nine submarines destroyed in the Dover area. By Feb. 1918 the Bight boats had ceased to use the Straits, and by May the activity of the Flanders boats in the Channel had been enormously reduced; the blocking of Zeebrugge contributed to this result, and the losses in the Channel were reduced to six a month, the minefields laid by the Flanders boats falling from 404 in 1917 to 64 in 1918.

The year 1918 saw the commencement of a much more ambitious scheme—the Northern Barrage—which aimed at nothing less than mining with 120,000 mines the huge stretch of 240 m. between the Orkneys and Norway. (*See* MINESWEEPING AND MINELAYING.) This was really an immense task, complicated by a deep gut some 60 m. wide on the Norwegian side where the depths ran to 150 fathoms. The credit for its conception and execution lies largely with Adml. Sims and the U.S. navy. It was an American enterprise performed by American sailors in American minelayers. As it was only commenced in April and was barely completed in Oct. its value is difficult to appraise, but the loss of some half-a-dozen boats can be attributed to it in Sept. and Oct. 1918. United States destroyers too were doing invaluable work in escorting convoys, and had been doing it ever since May 1917, during the dark months of 1917 when destroyers were more valuable than battleships.

The losses in the Mediterranean had given rise to serious concern, and the First Lord (Sir Eric Geddes) and the director of Naval Intelligence proceeded there in person to arrange for an extensive reorganization of the commander-in-chief's staff. Its clear waters, too deep for mines, and its regular tracks had been an ideal hunting ground for submarines. During 1917 only two German submarines had been lost there, and in the black month of April 1917 the Mediterranean had supplied one-fifth of the tonnage sunk. The arrival of some 14 Japanese destroyers in the summer brought the losses down about 10%, but in Dec. 1917, when vigorous action had greatly reduced the losses at home, the Mediterranean was still contributing 147,000 tons a month or over one-third of the whole. The convoy system was now introduced in the Mediterranean, the Otranto barrage was established and reinforced, and in May 1918 no fewer than four submarines were destroyed there. The effect of these measures was soon felt. Our losses in that sea were reduced from 95 ships a month in the last quarter of 1917 to an average of 43 in July, Aug. and Sept. 1918.

The U-boat zone had been extended to the Azores in Nov. 1917, and one or two boats had been working regularly there with fair results and comparative immunity till May 11 1918 when U154 was torpedoed by E35 about 150 m. west of Cape St. Vincent, an exploit directly due to improved intelligence.

Adml. von Capelle had been confident that his submarines would be able to prevent the U.S.A. troops reaching Europe, but actually not a single transport was lost up to Feb. 5 1918, when the "Tuscania" was torpedoed with a loss of only 44 lives out of 2,404. To stop the ceaseless flow of troops four large submarines were sent across the Atlantic, but though they destroyed over 60 ships they did not get a single loaded transport, and U156 was lost in the Northern Barrage on her way home. On July 19 1918 the great liner "Justicia," 32,234 tons, was hit by a torpedo from UB64 at 2:30 P.M. off the Skerryvore (Scotland, W. coast), and attacked again by U54 and UB124 the next morning. A whole armoury of depth charges was dropped round UB124 by the "Marne" and other destroyers, forcing her to the surface to surrender. All this time the mining of the Heligoland Bight went steadily on with the help of the gallant 20th Destroyer Flotilla (Capt. Berwick Curtis), and its exits were occasionally entirely closed. The Flanders flotilla felt the full force of the increased activity at Dover and suffered heavily. In Jan. 1918 it numbered 29 boats; it lost no less than 24 during the year and its strength dropped to 13. By the middle of 1918 it had earned the dread name of the "Drowning Flotilla," and its boats could reckon on a life of only three or four trips.

The Kattegat still remained open. In April 1918 a deep minefield was laid there, and had it been possible to keep it patrolled the submarines would have had to face another serious danger. How far this was practicable is a moot point.

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The reports of destruction in 1918 gradually began to fall into four categories. Either a mine demolished the boat wholesale, or an aeroplane swooped down on it with 300-lb. bombs, or a volley of depth charges forced it to the surface, or a torpedo from a British submarine brought its career to a sudden end. Depth charges competed with mines as the principal instrument of destruction (destroyers and patrols 39%, mines 30%); then came the submarine 8%, with aircraft a bad last.

It is impossible to narrate the long story of destruction. UB81 may be mentioned as an example of the unenviable career of a German submarine. On her way down Channel on Dec. 2 1917 she struck a mine off the Owers (near Portsmouth) and water began to enter by the stern. An attempt was made to bring her to the surface, but the after-tanks would not blow and her stern sank to the bottom in 90 feet. The gauges showed the bows to be out of water, and with the boat lying at an angle of about 60° a torpedo was lowered from the bow tube, and a man rammed up its narrow length. The sea cap was opened cautiously and it was found that the mouth of the tube was a couple of feet above water. Men were rammed carefully up and seven men had dragged themselves painfully out, only to find the cold so bitter and the strain so great that most of them elected to go back and join those who were seeking oblivion and death in the oxygen flasks. P32 patrolling in the vicinity saw the bows above water, but in the endeavour to get alongside the wind and waves bumped her against the submarine, which went to the bottom, leaving only a solitary survivor. Two little drifters contributed their quota to the tale. On April 17 1918 a little drifter, the "Pilot Me," whose jolly name was in itself an omen of success, working in the North Channel, suddenly sighted the periscope of UB82, 150 ft. off, and turning quickly dropped four depth charges on it. The submarine came up at an angle of 45°, and three other drifters, the "Young Fred," "Look Sharp" and "Light," all opened fire on her. She went down and the "Young Fred" dropped four depth charges on her, bringing her to a final end.

Statistics of Submarine Warfare.—The dreary dreadful tale of ships sunk and attacked is too long to give (for dates and names see *Admiralty Return of British Merchant and Fishing Vessels Captured or Destroyed*, Aug. 1919, H.C. 199). It includes the names of nine hospital ships, all, with one exception, large ships whose character was unmistakable ("Asturias" March 20 1917, Channel, beached, 44 lives lost; "Gloucester Castle" March 30 1917, Channel, towed in; "Donegal" April 17 1917, Channel, sunk, 41 lost; "Guildford Castle" April 10 1917, Bristol Channel, hit by dud torpedo; "Lanfranc" April 17 1917, off Havre, with 167 wounded Germans, sunk, 34 lost; "Dover Castle" May 26 1917, Mediterranean, sunk, 7 lost; "Rewa" Jan. 4 1918, Bristol Channel, sunk, 4 lost; "Glenart Castle" Feb. 26 1918, Bristol Channel, sunk, 95 lost; "Llandovery Castle" June 27 1918, Atlantic). Of these the attack on the "Llandovery Castle" by U86 (Patrig) was probably the most flagrant breach of the principles of humanity. She was homeward bound from Canada 116 m. from the Fastnets (S.W. point of Ireland). The enormous red cross of a hospital ship was lit on her side, glowing in the twilight like a lustrous jewel, when she was attacked and sunk; of the 258 persons on board, including 14 nurses, all except a boatload of 20 perished.

Allied and Neutral Merchant Ships Sunk, 1914–8.

	1914 (5 mths.)	1915	1916	1917	1918 (10 mths.)
By Surface Craft	55	23	32	64	3
" Submarines	3	396	964	2,439	1,035
" Mines	42	97	161	170	27
Total	100	516	1,157	2,673[1]	1,065[2]
Total Tonnage (in 000's)	303	1,277	2,348	6,184	2,627
German Submarines sunk	5	19	25	66	74[3]

[1] Also three by aircraft.
[2] Also one by aircraft.
[3] Not including 14 blown up on evacuating Flanders and the Adriatic.

Allied and Neutral Merchant Ships Sunk, 1917–8.
A.—Allied and neutral merchant ships sunk by submarine.
B.—Gross tonnage of merchant shipping sunk by submarines, in 000's.
C.—Submarines sunk.

	1917			1918		
	A	B	C	A	B	C
Jan.	145	291	2	121	298	9
Feb.	209	464	4	114	315	4
March	246	507	4	163	231	5
April	354	834	2	107	261	6
May	264	549	6	110	290	17
June	272	631	4	95	240	3
July	210	492	6	95	259	6
Aug.	178	489	4	102	270	6
Sept.	149	315	10	78	186	9
Oct.	150	429	8	50	106	5
Nov.	113	259	9	..	..	4
Dec.	149	353	7	..	..	..
Total.	2,439	5,613	66	1,035	2,556	74
Total*	2,673	6,184	..	1,065	2,627	..

* (Including losses by surface craft and mines.)

In Oct. 1918 Flanders was evacuated and the remains of the flotilla blown up. It was a Flanders boat UB116 (Lt. Emsmann) which made a last desperate effort to enter Scapa on Oct. 28. It was heard on the hydrophones, and seen for a moment in the search-light beam. Then came the heavy shock of an explosion and the last of the Flanders flotilla found a fitting end in the very gates of the enemy.

When the Armistice was under discussion, Scheer, who was now chief of the German naval staff, recalled all the submarines, intending to make use of them in a last desperate sortie with the fleet, but he found himself suddenly confronted with mutiny, and the fleet never sailed, though the submarines remained true. Meanwhile in the British navy the evolution of the submarine had followed a different path. Here there was a tendency to produce a type useful in reconnaissance work and able to act in tactical conjunction with the fleet. Of E class, which did yeoman service, 49 were built and 27 lost. They were vessels of 180 ft. long with three to five 18-in. tubes and a speed of 15 knots on the surface and 10 submerged. They were followed by G class (10 built in 1916, 4 lost) with better seagoing qualities and double hulls, armed with one 3-in. anti-aircraft gun and 5 tubes (four 8-in. and one 21-in. astern); their speed was 14 and 10 knots. Of J class 7 were built in 1916–7 and 1 lost. They were 270 ft. long, carried one 4-in. and six 18-in. tubes and could do 18 knots on the surface. K class were designed for fleet work, and were completed in 1917–8 (16 built, 3 lost). They were steam-driven on the surface, attaining a speed of 22 knots, 334 ft. long, and carried one 4-in., one 3-in. A.A. gun and eight 18-in. tubes. L class carried one 3-in. A.A. and six 21-in. tubes. They were 222 ft. long with a surface speed of 17 knots. Some 25 were complete in 1918 (2 lost). Of M class only 4 were ordered. They were about 200 ft. long and carried a single 12-in. 35 calibres gun which could be fired only in the direction of the bow. The design was "freakish" and displayed a lack of tactical, strategical sense. Only one was completed. R class, of which 12 were completed (none lost), was specially designed for anti-submarine work. They were short and built for quick diving and rapid manœuvring. They carried one 3-in. gun and four 18-in. tubes. Of British submarines 54 were lost during the war: —

By enemy destroyers	3
By mines	4
By enemy submarines	4
Unknown (probably by enemy)	21
Aircraft	1
Sunk in error by British craft	3
Wrecked	4
Scuttled	10
Accident (collision)	4
	54

The question arises, How nearly did the German submarine campaign attain its aim? The increase in submarine destruction and the decrease in shipping losses possess little meaning apart from the figures of output in either case. In spite of strenuous

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British effort the German submarine output more than kept pace at first with their destruction. In 1917 the net gain in submarines was approximately 45, but in 1918 the two exactly balanced (74 added, 74 lost). The shipping position depended largely on the irreducible margin which would have fulfilled British needs. This may be taken as 12½ million tons, and in addition there was always some 600,000 tons of British shipping under repair (from enemy and marine damage), requiring a total of, say, 13,000,000 tons (gross). By the end of 1918 there were 3,391 British steam vessels of over 1,000 tons, with a gross tonnage of 14,049,000.

The British shipbuilding capacity remained much the same (about 1·2 million tons a year, 1·310 million tons gross for Jan. to Oct. 1918), but net losses had been reduced to about 33,000 tons gross per month, which meant that the submarine could no longer attain its object within a reasonable time. It is true that the German output of submarines would have increased 20 or so monthly in 1919, but there is every reason to believe that the Allied navies could have dealt with it. The really critical time from Aug. 1917 to Dec. 1917 had passed. The submarine campaign had failed. On three grey Nov. days they filed along Germany's *via dolorosa* towards Harwich, bringing to a grim and sordid conclusion one of the most tremendous chapters in the history, not only of naval warfare, but of the world.

Final Tale of German Submarines in Nov. 1918.

	U.	UB.	UC.	Total.
Building and fitting out	28	15	26	69
Surrendered	59	53	26	138
Inspected	12	7	7	26
Blown up	4	5	5	14
Sunk and interned	66	68	57	191
Various	—	3	—	3
	169	151	121	441

See Comdr. A. Gayer, *Die deutschen U Boote* (1920); Scheer, *Germany's High Sea Fleet in the War* (1920); Archibald Hurd, *The Merchant Navy* (vol. i., 1921); Comdr. J. G. Bower, *Story of our Submarines* (1919); Henry Newbolt, *Submarine and anti-Submarine* (1918); Comdr. Émile Vedel, *Quatre années de Guerre Sousmarine* (1919). (A. C. D.)

SUBMARINE MINES (*see* 26.1).—It was the Russo-Japanese War 1903–4 which saw the first use of what has been called deep-sea mining—that is to say, the application of the submarine mine to strategic and tactical uses quite distinct from its previous application for coast defence; and that war led to the intensification of development in all maritime countries.

In the World War 1914–8 Great Britain laid a total of 130,389 non-controlled mines, 1,192 controlled mines and 25,983 of a small special type of net mine; in addition, 899 British non-controlled mines were laid by a U.S. minelayer. As showing the growing intensity of mining as the war developed, British minelayers were engaged on an average number of days in each month of 2½ in 1915, 5½ in 1916, 11 in 1917, and 20 in 1918. A mine barrage across the Dover Straits contained 9,373 mines. The great Northern Barrage from the Orkney Is. to the coast of Norway contained 69,766 mines; of this number 56,033 were American mines and laid by the U.S. minelayers. The British minelayers, who were chiefly employed elsewhere, laid the remainder. British submarines laid 2,469 mines. (*See* generally MINELAYING AND MINESWEEPING.)

The chief naval war losses in surface ships due to the action of mines were:—

	Battleships	Cruisers	Destroyers and Torpedo Boats
Great Britain	5	3	22
France	1	1	5
Russia	1	—	6
Italy	1	—	2
United States	—	1	—
Japan	—	—	1
Germany	—	2	20
Austria	—	—	3
Turkey	—	2	—

Mines, as distinct from depth charges, accounted for the known loss of 35 German (or Austrian) submarines.

The loss of the British mercantile marine due to mines was 673,417 gross tons, besides a loss in fishing vessels of 8,545 gross tons.

Classification of Mines.—Submarine mines can be divided into two general types, controlled and non-controlled. These may be again divided, each into two divisions, contact and non-contact, and these may be further sub-divided into three classes, moored, drifting and ground. A ground mine is one which is laid actually on the bottom; it is chiefly useful in shallow waters. Drifting mines may be submerged and oscillate between set depths, may float on the surface, or may be suspended below a float; they are especially suitable for employment in river warfare. A moored mine which is the type most frequently used, is a buoyant mine anchored to the bottom by a heavy weight or "sinker," the mine being attached to its "sinker" by chain or wire rope. The "sinker" may be automatic in its working and, following an adjustment which is capable of being readily made by the layer, it will take the mine to the desired depth below the surface. The depth adjustment will be made by the layer in accordance with the draft of the enemy's ships.

Controlled mines are those which have their firing source outside the mine and directly controllable by human agency. An electric current, provided by a dynamo or battery, is conveyed to the mines by cables led along the sea bottom from a control station on shore where the current may be switched on or off as desired. In the case of contact controlled mines a break in the controlling circuit, inside the mine, is completed when the mine is struck. Sometimes this is arranged by the crushing of a horn or it may be arranged by mechanism which acts due to the inertia of the blow. In the case of non-contact controlled mines, the firing is accomplished either by the direct observation of the operator or the mines themselves are made their own observers. In the first case the observer follows the enemy vessel through a telescope, which works over a prepared chart having metal strips on it corresponding to the positions of the mines; when a plunger on the training arm attached to the telescope comes into contact with one of the metal strips, the circuit is completed to that particular mine or line of mines and the mines are fired. Where the mines are their own operators, each contains mechanism, such as a microphone, which will pick up the sound of a ship's propellers and will indicate to the operator the moment when he should fire. The observation current from the mine is conveyed to the operator by the same cables that are used to fire the mine.

Controlled mines are specially applicable to the defence of harbours, where, by nature of their control, passage of friendly ships can be permitted but, at any time if necessary, can be denied. Contact controlled mines are used chiefly in side channels, because, although they can be put to "safe," they nevertheless foul the ground and friendly ships passing might damage them or tear them from their moorings; used channels have, therefore, to be mined with non-contact controlled mines, moored at a depth below the draft of the deepest draft ship using the channel.

Controlled mines are very costly to install and maintain and they require a large personnel to tend and operate them. (*See* PLATE, figs. 6 and 7, for types of non-contact controlled mines.)

Non-controlled mines are those which are automatic when once laid. They carry their own firing source or obtain it from the sea and have no further dependence on any human control. Mechanism is usually fitted which renders them safe during laying and for a short time afterwards, or at any time should they break adrift from their moorings. They may also be fitted with mechanism rendering them safe or disposing of them by explosion after a determined interval, and unless so fitted they must be swept up when no longer required.

There are several methods by which contact non-controlled mines are fired:—(i.) Inertia, where the momentum of the blow displaces a weight or pendulum inside the mine, causing the release of a percussion firing mechanism. (ii.) Mechanical lever, where the contact with a vessel displaces a rod or lever on the outside of the mine which first cocks and then releases a percussion firing mechanism. (iii.) Hydrostatic, where the contact with a vessel admits water, usually by the crushing of an external horn, into a valve inside the mine, which acting under the water pressure releases percussion firing mechanism. (iv.) Electrical, which is usually of the well-known "Hertz" horn type, where contact with a vessel crushes an external horn which contains within it a bichromate solution in a glass tube. When the glass of this latter is broken, the solution flows to the plates of an electric battery, previously inert, situated within the mine at the base of the horn. The solution energizes the battery, which is electrically connected to the mine detonator, thus firing the mine. This type, though electrical in action, carries the energy in a chemical form.

In the case of non-contact non-controlled mines, firing can be accomplished by an observing mechanism, as for instance a microphone, within the mine; as a vessel approaches, the sound of her propellers is picked up by the microphone and by means of relay mechanism the mine can be made to fire when a pre-determined intensity of sound has been reached.

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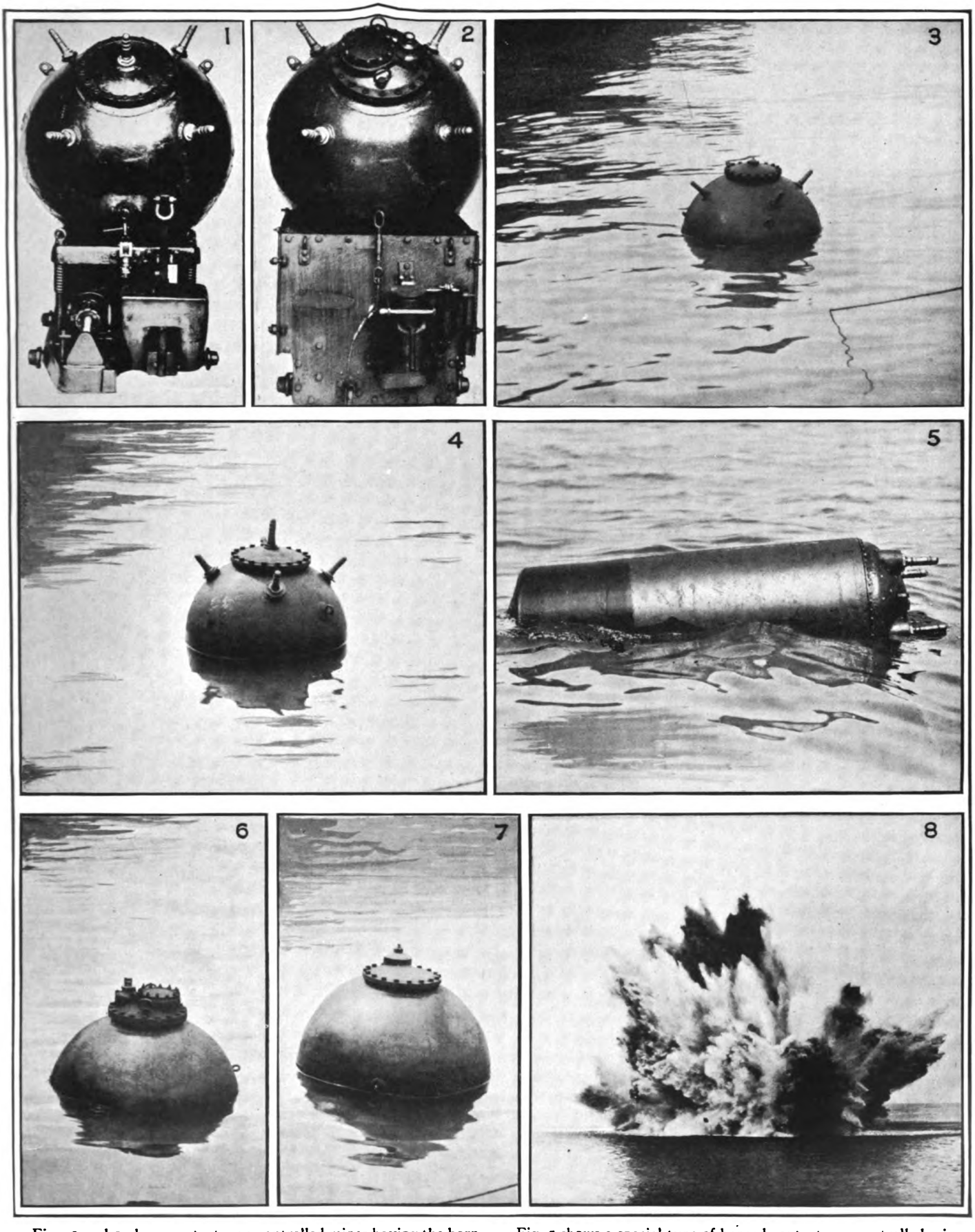
SUBMARINE MINES



Figs. 1 and 2 show contact non-controlled mines having the horn type of firing mechanism and attached to their automatic sinkers as they would appear on board the minelayer when ready for laying. The small wheels on each side of the sinkers at the bottom engage on the rail track laid along the minelayer's deck.

Figs. 3 and 4 show similar types of mines as they would appear when broken adrift from their moorings and floating on the surface.

Fig. 5 shows a special type of horned contact non-controlled mine adapted for discharge out of a torpedo tube of a submarine.

Figs. 6 and 7 show types of non-contact controlled mines as they would appear when broken adrift from their moorings and floating on the surface.

Fig. 8 shows the explosion of a depth charge fired at a depth of 40 feet.

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The object of such an arrangement is to increase the probability of the mine, but since in this case the mine is fired out of actual contact with the ship's hull, explosive effect is sacrificed for the gain in probability, a failing common to all types of non-contact mine. (Various types of non-controlled mines are shown in the accompanying Plate, figs. 1–5.)

Minefields.— Controlled minefields, on account of the complicated nature of material, etc., are applicable only to a limited defence of friendly shores. The mines are usually laid by small special minelayers in short lines or small groups, all the mines of a line or group being fired simultaneously where these are of the non-contact type.

Non-controlled minefields on the other hand are required on an extensive scale and in all depths of water, both for offence against the enemy and defence of friendly coasts. They may consist of "barrages" to prevent the passage of enemy vessels through definite and particular areas, "independent minefields" to inflict loss on the enemy where there is a reasonable possibility of doing so, and "mined areas," which are built up of individual minefields to inflict loss on the enemy in areas which he is obliged to use when his ships put to sea for operations or exercise. Mines are laid in lines which are either continuous or broken up into groups, but variations of a single line are more often used, especially when several minelayers are taking part in the operation together, the more usual variations being two or more parallel lines, single indented or stepped line and dog's leg line.

There are also some special forms of mining, such as the laying of "connected mines" where two or more non-controlled mines are connected together, or where, as an anti-submarine measure, the mines are suspended in nets. The object of all such systems is to increase probability, but the latter is only gained, in these cases, by complication of the material and the laying of it out.

Minelayers.—Various classes of vessels are employed for laying non-controlled minefields:—(*a*) Large minelayers with large carrying capacity for laying "barrages." (*b*) Fast minelayers of moderate capacity for laying "mined areas" or "independent minefields" in enemy waters. (*c*) Very fast minelayers and submarine minelayers for laying small minefields close in to vulnerable points.

Submarine minelayers require special laying apparatus. Surface minelayers are usually provided with narrow-gauge rails running along the deck and ending in a discharge "trap" at the stern. The "sinkers" have two pairs of wheels which fit the rail gauge and each mine rests on top of its own sinker. The mines and sinkers are disposed in long tiers along the rails and as the minelaying proceeds the tiers are gradually hauled aft towards the traps, electrical power being usually employed for this purpose. On nearing the "trap" each "unit" is hauled off the face of the tier in succession and pushed into the "trap" from whence it is let go by order.

The spacing of the mines apart varies according to circumstance, but the least distance at which mines can be spaced apart is limited to the distance at which one mine, if exploded, will not damage or countermine the next adjacent. The spacing on board the minelayer is regulated by time; the interval between successive mines being let go varies according to the speed at which the vessel is steaming and the spacing being used. Where a minelayer has more than one set of rails, it is usual to drop mines alternately from each set; this is for convenience and gives more time for the loading of each "trap." (H. D. B.)

Depth Charges.—A development of submarine mines which came in during the World War is the engine known as a depth charge.

This, as its name implies, is a charge of explosive which is detonated on reaching a given depth.

The explosive is carried in a mild-steel plate "charge case," to which rings are secured at the top and bottom for handling. A primer for detonating the main charge is secured in the centre of the charge case, round which primer lies the great bulk of the explosive charge and immediately above the primer is secured the "pistol." The pistol is arranged to fire the charge at varying depths.

One principle by which a depth charge may be fired consists of admitting water to a chamber containing a hydrostatic diaphragm. The pressure of the sea-water acts on the diaphragm and at the set depth causes a striker to act, thereby exploding the charge. A suitable safety arrangement is of course provided, and this consists of a safety key which cannot be withdrawn until the depth charge has been adjusted for a depth setting.

Depth charges are carried in the stern of vessels, either in chutes or on a tilting tray, and can be released either hydraulically from the forebridge, or by hand. As the depth charge sinks at a rate of 10 ft. per second, it is clear that the laying vessel must maintain a certain minimum speed to ensure herself against damage by the depth charge she has dropped. This is 10 knots.

In addition to the two methods of carrying and dropping depth charges already mentioned, an alternative is provided in some ships in the form of a depth charge thrower. This consists of a steel barrel and an "expansion chamber." Into the expansion chamber is screwed an explosion tube which on firing sets up a pressure which will throw the depth charge a distance of 40 yds. with a time of flight of four seconds.

The introduction of the depth charge was brought about in 1915 owing to the complete immunity enjoyed by a submarine immediately on submersion, notwithstanding the knowledge of a surface vessel that the submarine was in its immediate vicinity. The introduction and rapid development of the depth charge entirely removed this sense of security, and quite apart from the destruction of 34 submarines actually achieved by this means, it produced a very great moral effect upon hostile submarines, and hampered them in attacks upon surface craft, owing to their perception of the risk of allowing their periscopes to be sighted, and thus drawing down a rain of these depth charges upon them.

Though depth charges generally cannot be depended on to vitally damage a submarine outside a range of about 30 ft. (depending on the weight of the charge), the effect on the nerves of a crew of a series of heavy explosions at a greater distance than this fatal limit is very marked, and may be regarded as one of the great uses of this weapon. In many cases in which British submarines have been subjected to a depth charge attack, the force of the explosion has caused an immense concussion inside the boat. Fig. 8 in the accompanying Plate shows the explosion of a depth charge at 40 feet. (B. A.)

SUDAN (*see* 26.9).—The countries of the western and central Sudan are treated under their distinctive names; the present article deals with the Anglo-Egyptian Sudan, which, following official usage, is called the Sudan simply.

The area administered by the Sudan Government, enlarged during 1910–6 by the addition of the Lado Enclave and Darfur, was officially given in 1921 as 1,014,000 sq. miles. In the same year the pop. was estimated at over 4,000,000, which compared with an estimate of 1,853,000 in 1905. Nearly half the people are primitive negroid tribes living in the equatorial belt. Khartum, including Khartum North, had 39,056 inhabitants in 1921; Omdurman 59,429.

Economic and Social Conditions.—The years 1910–2 were years of prosperity, so much so that in April 1912 Lord Kitchener declared that "there is now hardly a poor man in the Sudan." But in that year the country experienced low floods and poor rains, while the 1913 Nile flood was one of the lowest on record. The rains, scanty at the best, failed altogether in some districts. The result was that 1913 and 1914 were years of acute agricultural and trade depression—1914 was described as perhaps the most difficult, from the point of revenue and the economic situation, experienced in the history of the Sudan. Trade suffered another shock with the outbreak of the World War. Abundant rains in the autumn and a high Nile happily resulted in providing the country with an ample supply of food-stuffs. Yet 1915 was little better than 1914. War conditions and the scarcity of shipping had caused a much lessened demand for the produce of the country. The cultivators, who form the majority of the people, "while they had enough to eat, were short of ready money" and hard pressed to pay their taxes. European conditions were indeed closely reproduced in the Sudan so far as commerce and economics were concerned. This was seen in 1916 when a period of comparative prosperity set in, though this was also due in part to abundant rains and a good flood in 1915. "The influence of the war," said the official report issued in 1920, "which had had such a depressing effect on trade in 1914 and 1915, began to operate in the reverse direction, and a great impetus was given to the export trade through an unprecedented demand for Sudan products. The presence of a large body of British troops in Egypt requiring grain and live stock, the demand created on the Arabian coast for Sudan millet, and in England and Allied and neutral countries for cotton and gum enabled all these commodities to be disposed of freely."

The experience of 1916 was repeated in 1917 and 1918 and, although there was a low Nile and poor rains in 1918, the country suffered no serious setback in 1919. Conditions in 1920 were influenced by the world depression in trade, nevertheless the year (following average rains and a medium flood in 1919) proved one of fair prosperity.

In considering the productivity and industry of the country it should be remembered that the Sudan consists of three natural zones, the desert zone in the north, where cultivation is only possible in a narrow strip on either bank of the Nile; a central zone where there are large areas of fertility, including the rainlands of Kassala and of Tokar, the Gezira plain, the pastures and gum-forests of Kordofan; and a southern belt, where the soil is richest and the rain tropical. But this southern

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belt up to 1921 yielded very little, for the negroid tribes which inhabit it showed scant inclination to do more than supply their own needs, while the lack of communications over enormous distances and the difficulties of administration rendered development by outside agencies extremely hazardous. Timber was, however, obtained from the forests of the Bahr el Ghazal and Lado and a (diminishing) quantity of ivory.

Apart from the tribes of this southern zone—and even among them progress in civilization was made—the people of the Sudan, negro and "Arab,"[1] showed willingness, in many cases eagerness, to benefit by Western civilization. Their standard of living became more exacting and their desire for education greater. Moreover, the possibilities and advantages of trade, through the World War, had been brought home to a larger number of the population than before. "There has been," wrote the governor-general, Sir Lee Stack, in April 1920, "an advance in energy and initiative, particularly among those who make their living by cultivation."

Products and Trade.—Gum arabic is perhaps the most characteristic product of the Sudan, which provides the bulk of the world's supply. Formerly the only Sudan product in which Germany had a direct interest, the largest share of the gum trade is now with Great Britain. In 1913 the export of gum was 336,000 kantars, it fell to 258,000 kantars in 1915 and was 344,000 kantars in 1919 (a kantar equals 99·049 pounds). The value of the gum varied in the period named from £E314,000 to £E744,000. The principal crops are durra (millet) and cotton. As the area cultivated depends upon an uncertain rainfall and an equally uncertain Nile flood, the amount produced is liable to great variations. In 1915 the total area under cultivation was 2,463,000 feddans, in 1916 it fell to 1,489,000 feddans, was over 2,000,000 in 1917 and but 1,669,000 in 1919 (a feddan equals 1·038 acre). Nor in respect to durra does the export correspond to the crop raised. Much of the grain is home-consumed and only the surplus sent abroad. The durra exported in 1913 was 2,080 tons; in 1914 only 530 tons. Exports rose to 84,000 tons in 1917 and fell to 1,650 tons in 1919. The total export of durra for the five years 1915–9 was 245,300 tons, against 53,500 tons in 1910–4.

Great expectations were held as to the development of the area under cotton by irrigation, but the financial situation created by the war rendered any large extension impossible for the time being. The variation in output was great—9,400 bales (of 400 lb.) in 1914; 23,900 bales in 1915; 12,300 bales in 1919. The total export of cotton in the 10 years 1910–9 was 161,000 bales. The yearly fluctuation was mainly due to the variation in the crop of flood-grown cotton in the Tokar district, Red Sea province. Only by irrigation works and by the building of railways to afford the cotton districts rapid and cheap means of access to the world's markets could any great increase of the crop be expected (see below: *Irrigation* and *Communications*).

Besides gum, cotton and durra the chief exports were cattle and sheep, hides and skins and sesame. The extent to which the export of live stock was stimulated during the war is shown by the following figures: Total number of cattle exported 1910–4, 64,400; in 1915–9, 129,500. In the same periods the number of sheep exported was 459,000 and 648,000 respectively. The export of hide and skins, however, decreased, being 1,928,000 in the five years 1910–4 and 1,552,000 in 1915–9. The very large number of camels exported for the use of the Egyptian Expeditionary Force is not included in the trade returns. Supplies of ivory decreased; 2,792 kantars were exported in 1913 and only 1,105 kantars in 1919. Dates, wood, charcoal, gold and senna were minor exports.

Three-fourths of the total exports go in the first place to Egypt, whence a considerable proportion is reëxported to Europe. Nearly all the rest of the exports go to Arabia, Abyssinia or Eritrea. Imports consist mainly of textiles and food-stuffs. An indication of the increased purchasing power of the people was the rise in the value of the imports of cotton fabrics, sugar, tea, coffee and spices. Those imports were valued at £E684,000 in 1914 and at £E2,062,000 in 1918. Imports come mainly from Great Britain and Egypt (each about 30%) and India and Aden (about 15%). South Africa (chiefly coal and sugar) and Abyssinia supply most of the other imports.

The following table shows the value of external trade (excluding specie) in the years named:—

Year	Imports	Exports (including Reëxports)	Total
1910	£E1,348,000	£E 977,000	£E2,325,000
1913	2,109,000	1,278,000	3,387,000
1918[2]	4,024,000	4,210,000	8,234,000
1919[2]	4,805,000	3,009,000	7,814,000

[1] Most of the "Arab" tribes in the Sudan are of Hamitic stock.
[2] Includes for 1918 Government imports £E988,000, and for 1919 Government imports £E1,804,000.

Irrigation.—The cultivator in the Sudan depended mainly on the rainfall and only to a less extent on the Nile flood and on artificial irrigation. While these conditions continued the area cultivated, in a year of good rains, could not much exceed 2,500,000 feddans, while cultivable land, given irrigation, has been estimated as high as a fourth of the total area of the Sudan. The Sudan Government elaborated schemes for irrigating a small portion of this uncultivated land, namely the Gezira plain and the Tokar area. In addition they embarked in 1909 on a scheme for irrigating an additional 100,000 feddans in the Dongola province by annual flooding on the basin system. In 1917, as an emergency measure to meet war needs, some 19,000 feddans in Berber and Dongola provinces were put under cultivation by means of pump irrigation.

The Gezira scheme was of much importance. The Gezira (=island) is the land lying between the White and Blue Niles. It was originally proposed to irrigate 100,000 feddans. Experiments undertaken in 1911 at Tayiba, near Wad Medani, on the Blue Nile, having proved conclusively that Egyptian cotton of the best quality could be grown commercially in that district, irrigation work was started early in 1914, with funds advanced by the British National Debt Commissioners. The intention then was to raise in London a loan of £3,000,000 to meet the expense of the work, but owing to the World War the scheme had to be held in abeyance. Eventually, in 1919, a loan of £6,000,000 was authorized by the British Parliament, £4,900,000 to be spent on the Gezira works. Meanwhile it had been decided to increase the area to be irrigated to 300,000 feddans. The Gezira scheme provided for the erection of a dam on the Blue Nile at Makwar, near Sennar, so as to raise the river to a level sufficient to feed a great canal excavated across the plain. Work on the canal, the levelling survey and the necessary buildings was continued at a snail's pace (owing to war exigencies) until 1917, when a fresh start was made. In the interval the Egyptian Government had intervened with irrigation projects intended for the benefit of Egypt, and in 1916 investigations were conducted in connexion with the water supply of both the Blue and White Niles. The result was a larger project, for which Sir Murdoch Macdonald, then adviser to the Egyptian Ministry of Public Works, was responsible. In addition to the Gezira scheme it was decided to build a dam across the White Nile at Gebel Aulia about 24 m. south of Khartum, which should be able to hold up nearly double the quantity of water stored by the Aswan dam—this White Nile dam being for the benefit of Egypt. Drawings of the two dams, both engineering works of the first magnitude, were completed in 1917. Cement having been found at a convenient spot near Makwar, a factory was erected there in 1919, and the preliminary work pushed forward on both dams, some of the workmen engaged being brought from the Yemen. Sir William Willcocks, the engineer of the Aswan dam, having very severely criticized the schemes, a Nile Projects Commission, composed of eminent engineers unconnected with the Egyptian or Sudan services, made a thorough investigation during 1920. The commission reported that both schemes were sound and the last obstacle to the building of the dams appeared to be overcome. In 1921, however, the Egyptian Government was compelled, owing to the serious financial situation, to order the discontinuance of work on the Gebel Aulia dam; the Gezira operations were continued but at a greatly reduced rate. Up to June 30 1921 some £E3,264,000 had been spent upon the Gezira schemes. Meanwhile a proposal to increase the Sudan loan to £9,500,000, owing to the increased cost of labour, material and transport, had been rejected. The Tokar area irrigation works, for which only £140,000 was estimated to be needed, were continued.

Communications.—As a corollary to the irrigation schemes at Tokar a railway from that town to the seaport of Suakin was sanctioned in 1919. The distance is about 60 miles. The railway south from Khartum to Sennar and thence, crossing the White Nile at Kosti, westward to El Obeid, the capital of Kordofan—a distance of 428 m.—was completed in 1911. It had the immediate effect of stimulating the trade in gum arabic for which Kordofan is famous. Both railways and steamers are State-owned; in 1918 the steamers department, which controlled the whole of the river traffic on the White and Blue Niles and their tributaries south of Khartum, was incorporated with the railways department, which had taken over the administration of the harbour of Port Sudan in 1914. The chief difficulty of the department during 1914–20 was in maintaining regular services efficiently. Great difficulty was experienced in keeping the Bahr el Ghazal free from sudd blocks, which caused much delay to steamers.

The upkeep of existing roads and the building of new roads entailed heavy labour and expense. In the northern and central zones wells had to be dug to make many of the tracks usable; in the south there was superabundance of water and dense forests to be cut through. One of the most important trade roads was that from Rejaf—the southern limit of navigability of the Nile from Khartum—westward to the Belgian Congo border. Good work was done on this road in 1916–8. Eighty streams had to be crossed in 125 m.; a single-span steel bridge 193 ft. long was erected over the river Yei. The difficulty of keeping the roads practicable in the equatorial regions in the long rainy season was great. It was largely on the opening-up of roads, and more roads, that the complete pacification of the southern provinces depended. From 1916 onward experiments

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were made in the use of motor tractors and cars on the roads, with at first but moderate success. In 1920 the use of aeroplanes by officials for visiting distant posts was first recorded. This followed the laying-out in 1919 of a number of aerodromes and the passage in Feb. 1920 of aeroplanes engaged in the first Cairo to Cape flight. This flight led to the discovery, from the air, by Dr. Chalmers Mitchell, of the volcanic character of a range of hills in the Bayuda desert (*see* AFRICA: *Exploration*).

On the conquest of Darfur the telegraph system was extended to its capital El Fasher. Telephone exchanges are established in the chief towns. The first wireless telegraphic stations were erected in 1915—at Port Sudan, Malakal, Nasser and Gambeila, a chain extending from the Red Sea to S.W. Abyssinia. In 1916–8 five other wireless stations were erected, three in Darfur, the others in the far south, at Wau and Mongalla.

Finance.—The subvention in aid of civil expenditure made to the Sudan by the Egyptian Government, which began in 1899 with an allocation of £E.156,000, reached its maximum in 1902 with £E.268,000, after which it was gradually reduced. In 1912 it stood at £E.163,000. In 1913 it ceased to be paid in accordance with an arrangement by which the Egyptian Government credited the Sudan with the amount of the customs collected in Egypt on goods entering and issuing from the Sudan, estimated at £E.85,000. The Egyptian Government, however, continued to defray military expenditure on account of the Sudan, estimated at £E.172,000. The insufficient rains and low floods with other external factors exercised an adverse effect on the economic situation just when the subvention was withdrawn. Nevertheless, the Sudan budgets of 1913–4–5 closed with a slight surplus. The more prosperous conditions which followed eased the situation and allowed an increase of taxation without impairing trade. Revenue, which in 1911 stood at £E.1,664,000, rose in 1919 to £E.2,950,000, with a surplus over expenditure of £E.267,000. The budget for 1920 was balanced at £E.3,500,000. A traders' tax was imposed in 1913, the trading community as a class having up to then paid nothing in direct taxation. In 1919 £E.6% was payable on assessed annual profits exceeding £E.500. In 1917 an excise duty was imposed on sugar, in 1919 the duty on tobacco was raised; heavy increases were made in railway and steamer rates both for goods and passengers. The railway and steamer services yielded a substantial profit (£E.210,000 in 1915, £E.286,000 in 1919). The rise in the price of all commodities was the main cause of the increase in taxation. The surpluses obtained since 1916 were passed to a reserve fund, the only source available, apart from borrowing, for capital expenditure. On Jan. 1 1920 the reserve fund amounted to £E.426,000 only, the "reserve" being almost wholly expended year by year on necessary works.

Education.—The Government schools are all in the northern or Moslem half of the Sudan; the only schools among the pagans in the southern half are those of the missionary societies. In the north there was a considerable increase in the number of boys attending elementary vernacular schools, while the sending of girls to school became more popular with parents. There were in 1919 five elementary girls' schools, besides higher schools for girls managed by missionaries. There was after the war a considerable demand for boys with a technical or industrial education. In 1920 over 400 boys trained in the Gordon College workshops were in employment, as to three-fourths in Government service. (F. R. C.)

Political History.—The political status of the Anglo-Egyptian Sudan remained in 1921 as defined by the treaty between Great Britain and Egypt of Jan. 18 1899. Although the country passed through a period of depression in 1913–5, comparing 1920 with 1910 there was a distinct advance in the well-being and resources of the people. The recovery from the disastrous rule of the Mahdi and Khalifa was shown by the large increase in population. The period 1910–20 was also notable for a marked growth of confidence in the Government. The loyalty of the leading chiefs and notables was never in doubt, and throughout the World War the vast majority of the people remained peaceful and contented. The number of minor operations undertaken both before and after the war were mainly against primitive tribes in the far south and did not affect the more highly developed provinces.

By the annexation of Darfur in 1916 (see below) the area under the control of the Sudan Government was increased to over 1,000,000 sq. miles. This vast region was administered in 1921 by some 110 British officers and officials, assisted by a technical staff. The military establishment included 14,000 men of the Egyptian army, with one British infantry battalion and a detachment of garrison artillery at Khartum. A new unit, the Western Arab Corps, was raised for service in Darfur.

The Lado Enclave (*see* 16.60) was transferred in 1910 from the Belgian Congo to the Sudan and added to the province of Mongalla. In the same year an outbreak of the old fanatical spirit had to be suppressed in Sennar, and during 1910–2 minor expeditions dealt with local disturbances in Kordofan and Mongalla. Others were also undertaken in 1914–8 to deal with turbulent elements in the Nuba Mountains—traditionally obnoxious to authority—and to keep order in the equatorial regions, where the Nuer and Dinka tribes gave a good deal of trouble. The most important of these operations was in the Nuba province in 1917–8. After a number of collisions, in which Capt. R. W. Hutton was killed (April 1917), a considerable force was sent in the autumn of that year and after a somewhat arduous campaign the hill tribes were in Feb. 1918 reduced to submission. In 1918 the Sudanese troops aided in operations against the warlike Turkana, a tribe, much given to raiding, living on the Sudan-Uganda border. Unfortunately neither the Sudan nor the Uganda Government had forces to spare to station troops permanently in this remote area.

An incident at Kassala towards the end of 1918 of no political importance is yet noteworthy as illustrative of the sporadic outbursts of fanaticism to which parts of the Sudan were liable. It was thus officially recorded:—

"Without a word of warning and in the dead of night a band of some 40 fanatics, led by a religious lunatic, suddenly rushed the guard and inlying picket furnished by the Egyptian unit on the fort and then proceeded to attack the lines of the camel company of the Eastern Arab Corps. No longer aided by the element of surprise, the band suffered heavily in killed and wounded at the hands of the latter unit. The leader was amongst the killed and the few that escaped were ultimately accounted for by the camel company and the police."

Aggressive action by the Aliab section of the Dinkas in Mongalla province led to the despatch of a small force in 1919 under Maj. R. F. White, which was accompanied by the governor, Maj. C. H. Stigand. An attack by spearmen in the long grass led to the death (Dec. 8 1919) of these two valuable officers and other casualties, entailing a punitive expedition in the following year.

The completion of the railway from Khartum to El Obeid, the capital of Kordofan, in 1911 enabled the Government better to control Darfur, where 'Ali Dinar ruled as a Sultan tributary to the Sudan; and, after the French occupation of Wadai, negotiations were in 1912 opened with France for the determination of boundaries by the inspector-general, Sir Rudolf von Slatin, on behalf of Great Britain and Egypt.

In Jan. 1912 King George and Queen Mary paid a visit to Port Sudan on their return journey from India, and a review was held at Sinkat by the King, at which representatives from almost every section of the Sudan were present. The scanty rainfall and abnormally low Nile of 1913 caused famine conditions in portions of Dongola and the Blue and White Nile provinces. Relief measures and the importation of large quantities of millet from India made a most beneficial impression on the populations affected. In April 1914 an exchange of certain districts on the Upper Nile was effected, in the interests of both administrations, with the Uganda Protectorate (*see* UGANDA).

On the outbreak of war with Turkey in Nov. 1914 the various provinces of the Sudan, notwithstanding the Moslem character of the majority, displayed perfect loyalty to the administration. In Darfur, on the other hand, the Sultan 'Ali Dinar renounced his allegiance, and, instigated by Turkish emissaries working through the Senussi sect, contemplated an invasion of the Sudan. His communications with the Senussites were cut off by posts of irregulars, and early in 1916, military operations were undertaken which led to the defeat and subsequent death of 'Ali Dinar (for the military operations, *see* SENUSSI). Darfur was thereafter administered as a province, and an Anglo-French convention, signed at Paris on Sept. 8 1919, at length settled the common frontier of Darfur and Wadai. The occupation of Darfur was followed by an expedition in coöperation with the French in the region north of Darfur against marauders of the Guraan tribe, who had given considerable trouble to both administrations. A garrison for Northern Uganda, whence troops had been withdrawn to meet the menace from German East Africa, was for a brief period provided by the Sudan Govern-

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ment. Except in Darfur, the war did not, externally, touch the Sudan at any point, and its administration continued on normal lines. The Prince of Wales visited the Sudan in 1916 and the Duke of Connaught in the following year.

The disturbances which broke out in Egypt in 1919 interrupted direct communications with Cairo, and the temporary cessation of Nile traffic caused a certain loss of trade. The Sudanese populations were not concerned with the aspirations of Egyptian nationalism, and the large Egyptian official community, while by no means indifferent to the development of events in their own country, did not actively display sympathy, so that this period of crisis passed without incident. Nor did the Armistice and the negotiations which followed the victory of the Allies occasion special comments. A delegation of Sudanese notables proceeded to England to offer congratulations on the successful termination of the war and returned with pleasant impressions of their visit. The only remaining centre of unrest in 1921 was the Abyssinian border, where raids and hunting parties of chiefs, nominally but not effectively under Abyssinian control, continued to give difficulty.

The outstanding event in Sudanese history during the war period was the withdrawal of Sir Reginald Wingate from the governor-generalship, on his being called to Cairo in Dec. 1916 as high commissioner for Egypt. He succeeded Lord Kitchener as Sirdar of the Egyptian army and governor-general in Dec. 1899, after an almost continuous service with the Egyptian army since 1883. Under his able and sympathetic administration the Sudan had emerged from the chaotic condition to which Mahdist misrule had reduced it, and gradually developed into a peaceful and contented country. His name will long be remembered by the people to whose regeneration he devoted the best years of his life. Another historic association with the Sudan was terminated by the outbreak of war between Great Britain and Austria-Hungary, when Sir Rudolf von Slatin, the inspector-general, whose advice in all native affairs had been most valuable, was inevitably compelled to resign. Mention may also be made of the resignation of Sir Edgar Bonham-Carter in 1917 after 18 years' service. He had been responsible for the creation and development of the whole legal and judicial system of the Sudan.

Col. (afterwards Maj.-Gen. Sir) Lee Stack, civil secretary to the Sudan Government, succeeded Sir Reginald Wingate as governor-general and sirdar; Slatin Pasha's post was not filled.

See the Annual Reports on the finances, administration, etc., of the Sudan, issued annually in London up to 1913, and the Report for 1914–9, issued 1920, which is of special value. The *Sudan Almanac* and *Handbook to the Sudan* are also official publications. Murray's *Guide to Egypt and the Sudan*, and Macmillan's, Baedeker's and Lock's guide-books may be used with profit. See also Y. P. Artin, *England in the Soudan* (1911); and *Sudan Notes and Records*, an excellent serial publication begun in 1918. The Survey Department, Khartum, issues a map of the Sudan, in many sheets, on the scale of 1:250,000. (J. R. R.)

SUDERMANN, HERMANN (1857–), German dramatist and novelist (*see* 26.20). His novels include *Das hohe Lied* (1909); and *Litauische Geschichten* (1917); while in 1911 appeared a volume of short stories, *Die indische Lilie*. His later plays include *Strandkinder* (1910); *Der Bettler von Syrakus* (1911); *Der gute Ruf* (1913); *Die Lobgesänge des Claudian* (1914), and *Das Höhere Leben* (1919).

SUESS, EDUARD (1831–1914), Austrian geologist (*see* 26.21), died at Vienna, April 25 1914.

SUEZ CANAL (*see* 26.22).—The five years 1909–13 witnessed a considerable increase in the traffic passing through the canal. The World War greatly restricted the use, particularly in 1917.

In the following table the figure for receipts is obtained by taking 25 francs as equal to £1 sterling except for 1920, when the rate is reckoned at 50 francs to the £1:—

	No. of vessels	No. of passengers	Net tonnage	Gross receipts
1909	4,239	213,122	15,407,527	£4,782,724
1913	5,085	282,235	20,033,834	£5,140,403
1917	2,353	142,313	8,368,918	£2,880,761
1920	4,009	500,147[1]	17,574,657	£5,329,213

[1] This abnormal increase was due to the movement of troops.

In Feb. 1915 the Turks, who had traversed the Sinai peninsula, attacked the Suez Canal at various points, and it was not until after the battle of Romani in Aug. 1916 that all danger to the canal was ended. Throughout this period traffic was interrupted on two occasions only, and then for very brief periods. During the World War, under Adml. Robinson as Director-General of the Egyptian Ports and Lights Administration, 1,239 transports and men-of-war, totalling over 8,000,000 tons, were passed in safety through the canal, and 965 transports, 43 hospital ships, 36 store ships and 307 colliers were dealt with at Port Said.

Striking differences in the pre-war and post-war shipping were the elimination temporarily after 1914 of German vessels (which in 1911 had 13·4% of the tonnage) and the increasing number of Japanese and United States ships using the canal. Japanese vessels represented before the war 1·7% of the tonnage; in 1920 their tonnage had increased to 9·1%. United States vessels, rarely seen in the canal before the war, in 1920 represented 4·1% of the tonnage. British ships continued to provide the bulk of the tonnage, the proportion in 1920 being 61·7% compared with 62·2% in 1911. In 1920 three passages were made by steamers of over 23,000 tons gross, a figure never before reached, and one vessel had a length of 669 ft., the longest registered in the canal. The quantity of goods passing through the canal in 1920 was 34% below the figures of 1913. There had been some change in the character of the merchandise, foodstuffs diminishing sensibly in volume, though corn from Manchuria and China made its appearance. Imports of coal from S. Africa and Australia were particularly marked in 1919 and 1920.

A scheme to extend the concession of the Suez Canal Co.—the existing concession does not expire until 1968—was rejected by the Egyptian General Assembly in 1910, not on its merits but in an effort to discredit the British administration. The Suez Canal Co. coöperated heartily with the British authorities in Egypt during the war. To meet the increased costs caused by the war the Company in 1916 and 1917 imposed higher tariff charges, which, after the war, acted in restraint of traffic and were not of permanent benefit to the Company. In 1919 the Company asked to have put into operation at Port Said the free zone regime provided for in an agreement made in 1902 between it and the Egyptian Government. It held that the transit trade would be stimulated if an area were set apart in which goods could be handled, or remain, uncontrolled by the customs. An agreement on the subject was drawn up in 1920.

It is noteworthy that in 1919, and to a much more marked extent in 1920, the Company benefited by the decreased value of the franc. This was made possible as shipping dues were collected in Egypt and were paid in money less depreciated than the franc, and profits earned in Egypt were used in the purchase of francs at current rates. In 1920 the benefit from these operations amounted to 101,772,000 francs, or over £2,000,000 at average rates of exchange.

The annual reports of the Suez Canal Co., published in Paris, give full statistical information. (F. R. C.)

SUGAR (*see* 26.32).—In the year 1910–1 the world's production of sugar amounted to 16,951,000 tons, of which 8,391,000 tons were produced from cane and 8,560,000 tons from beet, including that grown in America. For 1913–4 the world's total production reached 18,486,000 tons, of which the cane production was 9,577,000 tons—an increase of 1,186,000 tons of cane. The beet crop for the same period was 8,909,000 tons, of which 655,000 tons were grown in America—an increase of 349,000 tons. These were the highest figures reached during the decade 1910–20, for after the outbreak of the World War in 1914 the European production declined yearly, until in 1919–20 the world's beet crop reached only a little over 3,200,000 tons, of which 653,000 tons were American. The world's crop of sugar for 1920–1 was estimated at about 16,475,000 tons, of which cane was estimated to produce over 11,828,000 tons, and beet 4,647,000 tons, of which 935,000 tons were American.

Owing to the British Government recognizing at once the importance of securing to the nation a supply of sugar sufficient for the wants of the people, sugar was the first commodity to be controlled in the United Kingdom during the war (*see* FOOD SUPPLY), and within a few days of its outbreak the Government had bought several thousand tons of sugar. In Aug. 1914 a Royal Commission on the Sugar Supply was formed. It took over the duties of buying and selling sugar. These operations were done through the ordinary channels of trade, and everyone was guaranteed a

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supply on the basis of his trade before the war, the actual quantities being fixed from time to time in proportion to the sugar held by the Government; and it is not too much to say that the sugar control was the most successful of the many Government controls.

It may be noted that in the Final Report of the Commission issued in June 1921 it was stated that: "The wisdom of the Government in at once taking over in 1914 responsibility for the sugar supply was, in our opinion, fully proved in the sequel. But while we recognize that in the special circumstances State management was a necessity, our experience does not lead us to think that State control is a desirable thing in itself in the region of trade in commodities."

The total consumption of sugar sold under control was approximately as follows:—

	Tons
1915	1,818,488
1916	1,314,910
1917	1,219,761
1918	1,109,905
1919	1,595,004
1920	952,408

The stocks held by the Commission on March 31 1921 were 390,479 tons of raw and 57,787 tons of white.

The Commission had desired to carry out their operations free of cost to the Exchequer. "This aspiration cannot now be realized," they add, "but the fault is not ours. From time to time since the middle of 1919 the Commission has on various occasions pleaded for an increase in the selling prices of its sugars, so as to build up a reserve to meet the loss which it foresaw as probable on the liquidation of its stocks on the conclusion of its operations. But on no occasion has a rise been authorized until weeks or months after it was recommended, and then not always to the extent recommended.

"From a calculation we have made we are able to say that if our recommendations (which were always kept as low as possible in view of the reluctance shown by the Cabinet to an increase in prices) had been approved at the time they were made our receipts would have been £16,000,000 more than they have been in fact. Even that sum is less than the deficit which it is probable that the Exchequer will have to meet on our operations, and which we estimate at not less than £24,500,000. Some may perhaps hold that it is not of material importance to the public whether it has to bear a burden of this kind in its capacity as a taxpayer or in that of a consumer of sugar. But to us it is a matter of regret that we shall not be able to claim that we discharged the duties imposed upon us without having recourse to the funds of the Exchequer otherwise than for the purpose of the temporary financing of our operations. The advances made to us under this latter head by the Treasury stood on March 31 at £27,281,937."

The cost of the establishment of the Commission from 1914 to 1922 is given as £103,239.

The year 1920 stands out as having the most violent fluctuations the sugar trade has probably ever experienced. The British Royal Commission on the Sugar Supply and the American Equalization Board acted conjointly in 1919, and by their actions controlled both the American and European markets. Prices were kept between 30s. and 63s. per cwt. for Java 96° F.L., but there was some hesitation in the autumn with regard to the continuation of the operations of the American Equalization Board, which did not decide on further action until December. In the meantime a good deal of the Cuban crop had been sold to Europe and the East on a basis of 6½c. per lb., and when the American Equalization Board decided to continue control it was too late to secure the Cuban crop. The planters, having sold a certain quantity of sugar, were independent, and prices were forced up to 12c. (equal to 76s. 9d. per cwt.) at the end of January. In Feb. there were, however, large offerings on the part of the Cuban planters, owing to supplies of sugar coming into the market, and quotations declined to 9c. (equal to 59s. 3d. per cwt.). In March the American refiners began to buy freely, and this increased demand was intensified by two serious reductions in the estimate of the Cuban crop. Wild speculations took place, and in May as much as 23½c. (equal to 136s. per cwt.) was paid. Large purchases were also made in Jan. and May of Manila sugar for shipment during the summer months. The effect of these inflated prices brought its own remedy; consumption decreased rapidly both in England and in America, and by the end of July Cuban prices had fallen to 16c. which was equal to a fall of 40s. per cwt. This fall continued until, at the end of the year, Cuban sugar was actually sold at 3⅛c. per lb., or equal to a total fall from the highest point of over 110s. per cwt. The result of these heavy fluctuations caused a financial crisis in the trade. Enormous losses were suffered by the American and Canadian refiners, who had bought and sold heavily for the autumn months, and these forward sale contracts were largely repudiated when the time came for delivery. The British refiners, being still under control, escaped these violent losses.

The values of refined sugar in 1910 varied from 17s. 3d. to 23s. 6d. per cwt. for Tate's cubes, and in 1911—the year of exceptional drought—prices continued to advance to 27s. 6d., but towards the end of 1912 prices declined to 19s. 3d. and with slight fluctuations prices were further reduced at the outbreak of war to 17s. 9d. There was then a steady rise, and in 1914 cubes were sold at 35s., and granulated at 30s. per cwt.; in 1915 cubes were 50s. and granulated 33s., and then by gradual stages till, for domestic consumption, cubes in 1920 reached 116s. and granulated 112s., but, under the voucher system which was in vogue during control, the prices of sugar for manufacturing purposes were from 160s. to 164s. per cwt. Refined sugar produced by the British refineries from 1910 till the outbreak of war averaged about 45% of the total consumption, but after the war the production was about 74%. The British duty from 1910 till 1914 was 1s. 10d. per cwt., in 1915 9s. 4d. per cwt., in 1916 14s. per cwt., and in 1918 it was increased to 25s. 8d. per cwt., at which it remained in 1921. This was out of all proportion to the value of the sugar, and naturally checked consumption.

In 1913 the British Government withdrew from the Brussels Convention, which had been adopted in 1903, after many years' endeavour on the part of Great Britain to counteract the effect of the system of continental bounties on beet sugar. The adoption of the Convention had undoubtedly saved the British West Indian sugar trade from extinction, and British sugar refiners were able to compete on more equal terms. At the same time there was still strong opposition in England from the Free Trade party, who were anxious to have sugar at any price, whatever injustice might be inflicted on the British colonies and the home refiners. In 1911 there was a serious falling-off in the European beet crop, and there was a large deficiency in the world's supply, so that an inevitable rise in price took place. Russia, however, had large stocks on hand, which, under the Convention, could not be imported into England owing to the fact that prohibition was in force instead of countervailing duties. Had there been countervailing duties the sugar would have been shipped to England and the difference in duty paid. Giving way to pressure from those who were anxious to get cheap sugar irrespective of the reason for the cheapness, Mr. Asquith's Liberal Government gave notice in Aug. 1912 to withdraw from the Convention. The curious feature was that, as the result of this notice, Russia was permitted to send a considerable quantity in excess of the limit laid down by the Convention, but the quantity she sent had very little effect in making up the shortage of about 1,700,000 tons of the world's production.

In 1919 Mr. Lloyd George's Government (with Mr. Chamberlain as Chancellor of the Exchequer) took a further step in accordance with the views of the British West Indian planters, and agreed to give preferential treatment to sugar produced within the British Empire, in the form of a reduction in its case of one-sixth off the import duty on sugar. The British preferential duty on raw sugar at 96° polarization is equal to a preference of about 3s. 9d. per cwt., and on white sugar of a polarization over 98° 4s. 3.33d. It was too soon in 1921 to know what permanent effect this concession would have upon the production of sugar in the British colonies, but it was hoped that it would enable their planters to compete with Cuba and other countries where costs are considerably less, and consequently secure a larger share of the sugar trade of the United Kingdom.

Since 1910 serious attempts have been made to grow beetroots in England for the manufacture of sugar. A factory was erected in 1911 in Cantley, in Norfolk, but was worked only one season, and was closed during the war. It was purchased by a private Liverpool firm in 1920. A fair quantity of beetroots was grown in the immediate neighbourhood, but the high price which was given for the roots made it impossible for the purchaser to make a profit on the sugar produced. As a matter of fact a loss of from £60,000 to £70,000 was incurred. A further and more ambitious attempt was in 1921 being made at Kelham, Notts, where a large factory was erected, considerable quantities of beets having been planted in the neighbourhood. The British Government not only subscribed £250,000 of the capital, but also guaranteed interest on the amount of public capital raised at 5% for 10 years, and took £125,000 of second debentures.

See also FOOD SUPPLY and RATIONING. (L. A. M.)

SUKHOMLINOV, VLADIMIR (1848–), Russian general and war minister, was born in 1848. He passed through the cavalry school in St. Petersburg, and in 1867 was given a commission in the Guard Ulans. He graduated from the Academy of the General Staff in 1874. He took part in the war with Turkey in 1877–8 as an officer of the general staff, and was awarded the St. George Cross of the fourth degree. From 1884 to 1886

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he commanded a dragoon regiment and from 1886 to 1897 he was the head of the officers' cavalry school in St. Petersburg, having meantime in 1890 been promoted to the rank of general. His next appointment was as commander of the 10th Cavalry Division. In 1899, while commanding the troops of the Kiev military district, Gen. Dragomirov appointed him as his chief-of-staff and later as his assistant. His close connexion with Gen. Dragomirov, who enjoyed enormous prestige in the Russian army, ensured Sukhomlinov's future career. After the death of Dragomirov, he was appointed commander in Kiev.

From 1909 to 1916 he was Russian war minister, and it was under him that two Russian orders for mobilization were given at the outbreak of the World War. Self-confident and ambitious Sukhomlinov played a disastrous rôle in the administration of the Russian army. Notwithstanding the discovery, even in Oct. 1914, that there was an insufficiency of shells, rifles and cartridges, he assured the Duma that everything was all right. It was only in 1916, under strong pressure of public opinion, that the Tsar Nicholas II. dismissed him from office. Finally he was brought up for trial on a charge of treason. The court found him guilty of offences in office, and he was sentenced to penal servitude. Later Sukhomlinov was freed by an amnesty granted by the Bolsheviks and went to Finland. In 1921 he began the publication of his memoirs. (N. N. G.)

SUN YAT-SEN (1867–), Chinese leader of the revolutionary movement which ended in the abdication of the Manchu dynasty in Feb. 1912, was born in Kuangtung province, the son of a native Christian. He studied at the College of Medicine in Hong-Kong from 1887 to 1892, and there took his degree in medicine and surgery. He practised his profession first at Macao and then at Canton, but from the outset of his career displayed more interest in politics than in medicine, being by temperament an iconoclast, an organizer of secret societies and a leader of conspiracies against the established order of things. Inspired by his semi-European training, with bitter resentment against the Manchus, whom he regarded as responsible for China's humiliation at the hands of Japan, he first raised the standard of rebellion and of Cantonese independence in 1895; but the *coup* failed and Dr. Sun was compelled to seek safety in exile. Henceforward all his energies were directed towards stimulating the anti-dynastic movement, first by the collection of funds from the Chinese communities in the United States, Hawaii and the Straits Settlements, and then by organized propaganda work conducted by secret agents throughout the Empire. He received considerable assistance and encouragement in Japan, where he founded a society known as the Tung Men-hui, which played a prominent part in Chinese politics after the establishment of the Republic. Although an exile, he was generally regarded by the "Western-learning" section of Young China as its leader, especially after the Chinese Government's attempt to kidnap him in London, in 1896. In 1911, when the revolution broke out prematurely at Wuchang, Dr. Sun was in England; but he hurried back to China and arrived at Shanghai on Christmas Eve, in time to be acclaimed as the originator of the Republican programme and elected Provisional President by the delegates to the National Convention assembled at Nanking. On Jan. 5, after having taken the oath of office, he issued a Manifesto (countersigned by Wu Ting-fang as Minister for Foreign Affairs) in which the purposes and policy of the Republican Government were proclaimed. On Feb. 12 an Imperial edict announced the abdication of the Emperor; it surrendered the reins of government to the representatives of the sovereign people and declared that henceforth the constitution should be Republican; at the same time, the organization of the new form of government was entrusted, "with full powers," to Yuan Shih-k'ai. On the 14th, Sun Yat-sen resigned the Presidency and in the name of the Nanking Assembly invited Yuan to accept the position of Provisional President. His action was applauded by Young China at the time as evidence of patriotic self-abnegation, but events proved that it was chiefly inspired by recognition of the fact that he and the Cantonese group of politicians who had joined him as leaders of the Republican movement, did not yet carry sufficient weight to justify them in attempting to form a national government.

Relations between Sun Yat-sen and Yuan Shih-k'ai were never cordial, but until the ejection from Peking of the Kuo Min-tang Radicals by the President Dictator in 1913, they preserved the appearance of goodwill, and towards the end of 1912 Sun accepted a highly paid appointment as Director of National Railways at Shanghai. After the failure of the Kuo Min-tang's "war to punish Yuan," Sun wandered again in a wilderness of conspiracies. Eventually, after the death of the Dictator (1916) he became one of the Cantonese group of politicians which waged continual warfare against the party in power at Peking. Because of the futility and sordid intrigues which characterized the independent Military Government at Canton, he, whose reputation in 1912 had stood high at home and abroad, came gradually to be regarded as an irreconcilable conspirator, whose personal ambitions were largely responsible for the continuance of the senseless civil strife between the North and the South. By the vehemence of his rhetoric, by the fervour of his grandiose schemes for the remaking of China at the time of the revolution, he captured the imagination of considerable sections of the public, especially in the United States; but his subsequent career failed to justify his own belief in himself as a heaven-sent reformer. In April 1921, a special session of the Southern (Canton) Parliament elected him to be President of the Chinese Republic, his supporters declaring the Canton "Military Government" to be the only lawfully constituted government in the country; but the influence of these Cantonese "Constitutionalists" over the other southern provinces had then become almost insignificant, and the "Military Government," prohibited by the Foreign Powers from interfering with the revenues of the Maritime Customs, was confronted by financial problems of a kind which threatened not only its reforming activities but its continued existence.

SUPAN, ALEXANDER GEORG (1847–1920), Austrian geographer, was born at Innichen, South Tirol, March 3 1847. He was educated at the Laibach gymnasium, and in 1870 took his doctor's degree at Graz, afterwards becoming a teacher in the Oberrealschule at Laibach. In 1872 he left Laibach and studied geography at Vienna, Dresden and Halle, returning in 1877. In 1881 he was appointed professor of geography at the university of Czernowitz, and in 1884 became editor of *Petermanns Mitteilungen*, retaining this post until 1909, when he accepted the chair of geography at Breslau. Under Supan's editorship *Petermanns Mitteilungen* was more concerned with reports and accounts of geographical work in every sphere than with original papers and records of discovery, and a feature in which the editor was much interested was the publication of supplements to the *Mitteilungen*. An account of the economic produce of N. America, 1880–5, appeared in this manner in 1886, and *Die Bevölkerung der Erde*, founded 1872 by Hermann Wagner and Behm, was continued by Supan as a supplement from 1890 to 1910. In 1889 he became editor of the statistical calendar of the *Almanach de Gotha*. His original contributions to geographical science are chiefly concerned with climatology and oceanography, and his published works include *Lehrbuch der Geographie* (1873); *Statistik der unteren Luftströmungen* (1881); *Grundzüge der physischen Erdkunde* (1884); *Deutsche Schulgeographie* (1895; latest ed. 1915) and *Die territorialische Entwicklung der europäischen Kolonien* (1906), besides many papers in *Petermanns Mitteilungen*. He died at Breslau July 6 1920.

SUPPLY AND TRANSPORT, MILITARY (*see* 26.113).—During the World War, the administrative services—*i.e.* the management of transport, supply, welfare and salvage—became of vastly increasing importance. The struggle was between groups of nations bending to the task of war the whole of the resources of a highly complex scientific civilization, and using in its prosecution every material and moral factor at their command. Some note of the working of the administrative machinery (especially at the culminating point of the struggle) is necessary to give a true picture of the war. Attention will be given here in the main to the British organization in 1918—with illustrative references

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to other armies and to prior dates. For the feeding of the British army, *see* FOOD SUPPLY.

When the armies first took the field in 1914, Germany was at a clear advantage in administration. That was to have been expected. It was her war, and she had prepared for it with meticulous care. The equipment of the German soldiers comprised several novel ideas for greater comfort and efficiency. Examining some of the German dead who had fallen in the early reconnaissance affairs in front of Tirlemont on Aug. 14, the writer had the first uneasiness that Germany might win, so strong was the evidence their equipment gave of a patient and thoughtful preparation. The impressive sweep of the German host through Belgium showed, too, that the German railway organization was superb, and the way the guns kept up proved that there had been a clear thinking out in advance of the new problems of ammunition-supply which the free use of heavy artillery as field pieces had brought to the fore. German staff documents published since the war by Gen. Ludendorff indicate that these matters of administration had been studied from 1910 onwards and that the German staff were confident that their inferiority in numbers would be compensated by a superior organization in supply. The French administrative services in 1914 appeared much weaker if examination were confined to plans and *matériel*. The troops were not as well provided for, the transport organization not so well planned. But if the human factor were taken into consideration much of the handicap was made up. The French showed a genius for improvisation on the actual battle field, and an astonishing faculty for "getting there" with inferior means. Their food scales for man and beast (to give an example) spelt scarcity in German or in English eyes; but they sufficed. In the battle the French soldier was never inferior in energy and endurance; and the French transport was generally up to time. The national *élan* overcame material deficiencies; and a genius for quick improvisation showed constantly, never more dramatically than in the mobilization of Gen. Galliéni's "Taxi-cab Army" which moved out to the defence of the capital at a critical juncture. The British administrative services in 1914 were lavish both of supplies and transport. But the British force was a small one, and though its scale of transport was extravagant compared with the French, the total was only 250 motor cars, 950 motor lorries and 40,000 horses. With railway transport it then had no concern: the French managed its railway transport. Indeed the British force in France in 1914 did not completely "administer" its own affairs. Though it was a distinct army in command it was dependent on the French organization for essential services of transport.

The Trench War.—A long period of trench warfare followed the battle of the Marne, and the administrative systems of the three armies were adapted to new conditions, the chief of which were an enormous increase of ammunition expenditure, the introduction of poison-gas as a weapon, calling for entirely new supplies of offensive and defensive material, and a simplification of the problems of transport, which in a stabilized warfare could follow almost a civilian routine, disturbed only by the chances of shell fire. The trench war was, of course, punctuated by heavy attacks on both sides, but the shift of ground was never great. Administration, whilst it had to cope with the enormous progressive increase in the scale and variety of supplies per division, was thus given ample time as a rule to increase its transport facilities. It could add to its broad-gauge railway tracks, supplement them by light railways and tramways as well as by motor-roads, and develop the canal systems as useful adjuncts.

In this period of trench warfare the Germans suffered from a steady deterioration as compared with the French and the British. The war had become a contest of *matériel* in which Germany could not keep up. The French were able to develop their supply on more generous lines with the help of British and American resources. The British transformed their system completely. The nation took the view that "money was no object" in securing for the troops the best possible chance of victory and the best possible comfort in the trenches. The growth of supplies (and therefore in transport) was almost incredible. The British force in 1914–5 suffered from a shell and gun shortage as compared with its enemy, because it had been trained and equipped for a different type of warfare. It had very little H.E. shell, and what it had was not really "high explosive" owing to poor fuzes. The patient search for a "fool-proof" fuze had been so successful that what little H.E. shell they had spluttered off rather than shattered off. The production of high explosive in 1914 was almost negligible. The whole year's supply would not keep the guns of 1918 going for a day. In 1915 Britain began to produce high explosive on a large scale. In 1916 she had increased the 1915 amount sevenfold. In 1917 she had increased that 1916 amount fourfold. From March 1915 to March 1917 the increase was twenty-eight fold. With the increase in the production of high explosive went a corresponding increase in big guns and in field pieces. The expenditure of ammunition in time reached to huge figures. The following are the biggest day records in tons:—July 1 1916 (Somme) 12,776; April 9 1917 (Vimy) 24,706; June 3 1917 (Arras) 17,162; June 7 1917 (Messines) 20,638; July 31 1917 (Ypres) 22,193; Sept. 20 and 21 1917 (Polygon Wood) 42,156; Aug. 8 and 9 1918 (general attack) 15,598 and 23,706. Ordinarily the British depots in France kept a reserve of 258,000 tons of ammunition, and the issues in a normal month ran to about that figure, though it varied a good deal month by month. Thus the average daily expenditure during the last months of 1918 was:—May, 5,478 tons; June, 4,748 tons; July, 5,683 tons; Aug., 9,046 tons; Sept., 8,576 tons; Oct., 4,748 tons; Nov., 3,158 tons. (*See also* MUNITIONS.)

Gas Warfare.—The introduction of poison-gas was, after the growth of ammunition expenditure, the chief factor in the increase of supply. It was constantly presenting new problems for the administrative services. At first British and French work was solely defensive—the provision of masks, the wearing of which would give immunity, the detection of new gases so as to provide new means of defence. But in time the Allies took the gas offensive, and then their gases were more potent and more plentiful than the enemy's, and for lack of material he could not give his men perfect gas protectors. The last form of gas warfare was the introduction of mustard-gas, a powerful corrosive discharged from shells, which infected the ground on which it fell for many hours. The use of mustard-gas by the enemy raised many problems of supply. The disinfection of contaminated ground with chloride of lime, a prompt change of clothing and bath treatment for men affected, proved efficacious in dealing with mustard-gas. There was, too, safety in protective overalls of oilskin. Mustard-gas affected the veterinary service heavily, there being many casualties to horses and mules through passing over ground infected with the gas.

Big-gun ammunition and gas-warfare munitions were, however, only two items of supply. Rifle and machine-gun ammunition, food for man and beast, trench stores, engineering stores, were other items, all of which had a tendency to grow. In the total during a spell of intense fighting, the British administrative services would carry up to the battle-line 1,934 tons of supplies of all kinds per day per mile of front. The intense battle-front might stretch over 10 miles or more, calling for some 20,000 tons of munitions, food and equipment per day for that 10 miles, much of it passing through furious shell fire before reaching its objective.

The French administrative services never reached the same scale of supply as the British. They expended less ammunition, issued a ration of less weight to man and beast, and dispensed with much of the "comforts" equipment of the British force. But in facing such a German effort as the Verdun attacks of 1916 they had a tremendous problem of transport, which was met by a motor lorry mobilization, the success of which was one of the great feats of the war.

British System Reorganized.—From 1914 up to the date of the first battle of the Somme (July 1916) the British administrative services had had no very severe test (unless the battle of Loos could be so counted, and the organization then was not good).

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But by the middle of 1916 the British force in France considered itself completely organized. In munitions it was better supplied than any other force in the field. It had taken over control of its own railway services, supplementing the French broad-gauge railway system, which it had taken over and increased, it had a system of light railways and a greatly increased scale of motor transport. But the Somme battle showed many serious weaknesses. Supply had been increased beyond the scale that transport could cope with. There followed in Nov. 1916 a reorganization of the system. One feature of this organization was good. The division of authority, which put the administrative services under two heads, one for the battle area and one for lines of communication, was done away with. The military railways, which had been hitherto starved, were reorganized, and were generously supplied with staff and material. But what proved in the result to be a mistake in organization was made: railways were separated from the control of the quartermaster-general (who kept control of other forms of transport), and put under an independent directorate of transportation. Thus the commander-in-chief had two separate transport authorities to deal with.

There followed after the battle of the Somme a period when the line was practically stable for a long period; and whilst the almost stationary trench warfare continued, the weakness of this division of authority, and the mistake of allowing any but the military idea to rule in an essential part of the army organization, were not apparent. When the Germans attacked in the spring of 1918 those errors showed very clearly, and the railways had to be brought again under the control of the quartermaster-general, after an interval during which they were under a committee of the staff. But the transport situation then was very critical. The German advance had brought the British front lateral line—St. Just–Amiens–St. Pol-Hazebrouck—under shell-fire at many points. The Germans, whose strategy under Gen. Ludendorff was dominated largely by transport considerations, sought to paralyze completely the whole railway system by continuous air-attack on the British rear lateral—Eu–Abbeville–Etaples,—especially at the points where it crossed the rivers Canche and Somme. Whole-hearted work in building "avoiding" lines and bridges, and the efforts of the motor transport, just kept the position in hand until a British advance in front of Amiens relieved the front lateral. It was a happy circumstance that a new quartermaster-general of the British army in France, Lt.-Gen. Sir Travers Clarke, had just brought to completion the building up of a G.H.Q. reserve of motor lorries. He thought in the winter of 1917–8 that the battle of Passchendaele had exposed a weakness in light railways—that they had to work along defined tracks which could be intensively shelled by the enemy. The British army therefore decided to trust more to the motor transport. There was effected a complete reorganization of it, with the central idea of doing away as far as possible with the "earmarking" of motor vehicles for particular units or particular tasks, and making its total strength completely mobile and liquid. Vehicles saved by this "pooling" were formed into a G.H.Q. Motor Reserve. This proved of great strategical benefit in the spring of 1918. The G.H.Q. Motor Reserve was able then to take up part of the traffic load, and was largely responsible for saving the situation. There were lorry drivers who held the wheel for 36 hours at a stretch, and were lifted from their seats fainting or asleep; a few—who carried on until no longer able to see through their bloodshot eyes—ran their cars into trees or walls or ditches. There were many casualties, but the situation was saved at a time when the railways could not meet the work of supply.

Passchendaele, terrible ordeal as it was for the British army, gave valuable hints as to the proper place of light railways in an administrative system. Light railways at one stage of the war were perhaps over-estimated. There was an inclination to regard them as all-sufficing. The British administrative services ultimately gave them their proper rôle, recognizing that they were most valuable when the line of battle was stabilized for some length of time, but tended to be less valuable as the war became one of movement. In the spring of 1918, the British army had 920 m. of light railways in operation; in the summer 100 m. less. Its great advance was planned on the principle of concentrating labour upon pushing forward the broad-gauge railways and the roads forward from them, trusting to motor transport and to horse transport to carry on the load from broad-gauge railhead. Earlier in 1918 controversy on the subject was keen, and the French were inclined to take a differing view. The Germans, of course, were tied to light railways, for they had not the means to extend their motor traction. The position on Nov. 11 1918 seemed to justify the British view.

By the summer of 1918 the British administrative services were so confident of their machine that they were supporting strongly in favour of trying for a "knock-out blow" as against the alternative plan of devoting the winter to final preparation for an overwhelming campaign in the spring of 1919. "Administration" covered at this stage a wide scope. It arranged the supply, from England, and from its own workshops and local civilian workshops, of all the varied equipment of the forces, from a tank and a 15-in. howitzer to a tin of dubbin. There came to the ports of France every month for the B.E.F. about 800,000 tons of material. The men to be fed totalled over 2,000,000 and the animals about 500,000. The transport system in addition to half-a-million horses and mules, had about 20,000 motor lorries running over 9,000,000 motor miles per month; it carried on its light railways about 544,000 tons a month, and ran every day 250 trains on its broad-gauge lines. It was constantly building new railways and new roads, and developing new harbour facilities. It ran canal and sea barge services, forestry and agricultural services, and repair shops, on a gigantic scale. It supplied the medical stores for wounded and sick, the veterinary services, the laboratories for the defence of men and animals against poison-gas and for the gas counter-offensive. In the last year of the war it produced timber from French forests for four-fifths of its total needs. It grew vegetables and other food and fodder stuffs, and helped as tiller and harvester in the French fields (in 1918 it saved the crops on 18,000 acres, harvesting at night, the soldiers having to work sometimes in gas masks). It was its tailor, bootmaker, laundryman and even ragpicker. The soldier on going out of the line had clean underwear waiting for him at his divisional baths; his soiled garments were disinfected, cleaned and repaired for reissue; his socks darned, buttons replaced, rents patched; and the garment beyond repair was shipped away as rags for the shoddy mills of Dewsbury.

This administrative army was caterer for men and horses. The civilian world throughout Europe might be suffering from scarcity of food supplies, but to the very last the British soldiers and horses enjoyed good rations. This was only made possible by an organization that eliminated every form of waste.

As banker this administration dealt with every currency and note-issue of the world. It had savings banks and an investment organization for British troops, and even special savings banks for the Chinese. It insured its civilian labourers against death and accident; it negotiated the payment of *octroi* to towns where its troops were stationed, and paid compensation of French property owners for the leases of their lands and buildings and the war damage to their property.

The Complexity of Administration.—This wide range of activities, though it had to be carried on under conditions which varied from day to day, fell with minor variations into three main categories. (1) *Maintaining a stabilized position.* This was comparatively easy. The traffic demand was known. Wastage of horses and material could be calculated with some certainty and replaced by a routine process. (2) *Preparing a big attack.* This made the greatest strain on transport and supply, and the necessary conditions of secrecy added complications. In preparing an offensive the traffic tonnage more than doubled per division. This was due to the necessity for making new railways and new roads, and the accumulation of defence material to fortify a new line. But the accumulation of ammunition was also a factor. On a quiet sector two divisions could be

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served by three trains daily. For the preparation of a big attack ten divisions might be concentrated on that sector, and those divisions in the preparatory stage of the attack would need about 33 supply trains a day, and during the offensive about 27 trains a day. And these trains would carry material only to broad-gauge railhead. After that most of it had to go farther forward by light railway, motor and horse traffic, and in some cases even by the "Yukon pack," *i.e.* by man porterage. (3) *Resisting a big attack.* The difficult element here was its unexpectedness. The amount of supplies per division necessary to go up from base would be 25% less than in the case of the preparation of a big offensive. There was always carried a good reserve of ammunition, food and engineering stores, close behind the line, and a further reserve of ammunition already loaded on trains at appropriate railway centres. In case of emergency, ammunition could start to move up as soon as a locomotive could be coupled to a standing train. The German offensive in 1918 showed that the British carried near the front line too great reserves, and there were unnecessary losses in food, stores and ammunition, as a consequence. Forward "dumps" were thereafter reduced.

The organization at the front in 1918 to cope with this work in the British army, had at its head the quartermaster-general (Lt.-Gen. Sir Travers Clarke) and two deputy quartermaster-generals (Maj.-Gen. Ford and Maj.-Gen. May). The headquarters staff consisted of about 40 officers, and the detailed work was divided under the following departments:—Director of Agricultural Production (Brig.-Gen. Earl of Radnor); Director of Army Postal Services (Brig.-Gen. Price); Deputy Controller of Canteens (Col. E. Benson); Director of Engineering Stores (Brig.-Gen. Sewell); Director of Forestry (Brig.-Gen. Lord Lovat); Director of Hirings and Requisitions and President of Claims Commission (Maj.-Gen. L. B. Friend); Controller of Labour (Brig.-Gen. Wace); Director of Ordnance Services (Maj.-Gen. Sir C. M. Mathew); Paymaster-in-chief (Maj.-Gen. Sir C. A. Bray); Director of Remounts (Brig.-Gen. Sir F. S. Garrett); Controller of Salvage (Brig.-Gen. Alexander Gibb); Director of Supplies (Maj.-Gen. Carter); Director of Motor Transport (Maj.-Gen. Boyce); Director-General of Transportation (Maj.-Gen. Crookshank); Director of Veterinary Services (Maj.-Gen. Moore); Vice-Chairman Imperial War Graves Commission (Maj.-Gen. Fabian Ware); Director of Works (Maj.-Gen. Sir A. M. Stuart). Subsidiary directorates under the Director-General of Transportation were:—Director of Construction (Brig.-Gen. Stewart); Director of Docks (Brig.-Gen. Wedgewood); Director of Inland Water Transport (Brig.-Gen. Luck); Director of Light Railways (Brig.-Gen. Harrison); Railway Traffic (Brig.-Gen. Murray); Roads (Brig.-Gen. Maybury).

A comparison of this organization with the French administrative services would suggest that the British was over-elaborate. But consideration must be given to these important facts: that the British army was operating in a foreign country, and moreover in the country of an Ally where there must be the least possible friction with the inhabitants; that by custom both men and animals in the British force required a particularly generous ration; that the British force expended far more ammunition than the French, and in its campaign methods kept up a permanent minor offensive even on quiet sectors, as was not the custom with the French. When in the course of the operations early in 1918, French and British troops were intermixed in the battle line, it was found by experience impracticable to supply British units through the French system, and, except as regards such items as hay and petrol, which were kept in a common pool, the supply and transport had to be duplicated, a British system being set up side by side with a French.

Salvage.—An account of the administrative system in the World War would be incomplete without some reference to the salvage activities of 1917–8. The submarine war began to have its cumulative effect just when there came the most peremptory reminders that supply was going to be the determining factor of the final struggle. Munitions, food, equipment, railways, roads, ships—these had become the most important factors, and victory would incline to the force which could best concentrate the means to maintain an overwhelming force at some particular point, and could best develop, conserve, and transport its material. From 1915 to the middle of 1917 it was only necessary for the British army to ask and it received. Later in 1917, and in 1918, there came requisitions which could not be met. Just before the German attack in 1918 (to give one example) there were desperate calls for barbed wire, to make up an actual shortage of 8,000 tons in the minimum requirements for safety; but it was not available. In food, forage, clothing, timber, metals, the world-shortage had now become acute. The administrative services of all armies sought to better their position, in Europe, by the organization of a department of salvage. As the British salvage department explained, "the shortage of almost every kind of raw material used for war supplies makes salvage an important administrative service. Without a well-organized and thorough salvage system, the full maintenance of our force in the field would be made difficult. . . . The salvage organization is not intended to take the place of, or in any way discourage, a consistent effort on the part of every supply department to recover for repair and re-issue its own articles and its own empties. It is intended to supplement that effort; to collect and put to use what would otherwise become derelict; to insure that nothing utilizable is allowed to go to waste. . . . There is nothing of the debris of the battlefield which we cannot put to some use." Some of the items of salvage values taken from a monthly return show the wide range of the department—swill for piggeries, £600; solder from old tins, £300; cotton waste, £500; tin-plate (won by unrolling old biscuit tins, etc.), £2,500; old lead, £400; various by-products £200,000. The old rags collected did a great deal to help the cloth shortage at home. The old bones collected made glycerine for explosives. In Sept. 1918 the British army saved £4,000,000, and the American army £3,000,000 by salvage.

The Animals of the Force.—The administration of the animals of the British force—the largest mobilization of animals known to history—calls for a special note. The worst difficulty in their case was mud. From early in autumn until late in spring the mud season lasted. Off the *pavé* roads all the fighting area of Flanders was semi-liquid, and the problem at horse-lines was first to secure a solid "standing," next to secure a solid road in and out to that standing, and finally to secure a solid road to and from a solid watering-place. Standings were usually made of bricks, and the army requisitioned all the brick yards in the occupied area. Shell-ruined villages were another source of brick supply. The bricks had to be set properly; rubble was lost in the soil within a week. Losses from enemy action were not very high among the animals until the last phase. There was little cavalry work except at the end of the campaign and at its very beginning. But horses and mules suffered greatly when the enemy began to use mustard-gas (1917–8). The ground where a mustard-gas shell had fallen was infected for long afterwards. If horses were picketed on it, or even passed over it, casualties were high. The irritant poison of the gas attacked their hoofs and their skins wherever the hair was thin and caused sloughing wounds. An effective curative treatment was found in a dressing, the chief ingredient of which was chloride of lime. From the spring of 1918 the animals suffered severe attacks from the air. The enemy devoted much of his air-force to bombing attacks on horse-lines, with a view to lessening British transport strength. At first these attacks had serious effects. Then horse-lines were camouflaged; the animals were separated into small groups; the lines were protected by bomb-proof traverses of earthwork, which localized the effects of explosions. In the summer of 1918 the wastage of animals by sickness had been cut down to a very low rate (7·7%), as the result of skilful horse-mastership. At this time forage difficulties were acute, but there had been close organization for grading fodder in army and line-of-communication areas, and the animals always had sufficient rations. British administration was able to take a considerable part of the burden of horsing the American units which arrived in France in 1918. Nearly 25,000 animals were made available by reductions of the horse-strength of artillery units. A further 14,000 were saved by giving 6-in. howitzer and some 60-pounder batteries mechanical transport. Another means of economy in horse flesh was the setting up of a "category B" for animals which were not quite fit for arduous work with a fighting unit, and were withdrawn to units whose demands on them were less exacting.

Some Comparisons.—As between the three administrative machines, the French, the British, and the American in the autumn of 1918, certain points of difference may be noted. Both French and American systems still kept a dividing line as regards administration between the base and the fighting line. The British system had abolished this (together with the post of Inspector-General Lines of Communication) in 1917. The French divided the zone of the armies into the zone of the advance and the zone of supplies (with sometimes an intermediate zone). In the zone of their advance administration was in charge of the *Aide major-général chargé de la direction de l'arrière* at G.H.Q. But his administration had no functions of procurement, only of distribution. In some points of administra-

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tion the dividing line between the zone of advance and the zone of supplies was abolished; *e.g.* all motor transport and all light railways, wherever operating, were under a D.A. at G.H.Q. The French system of supply and distribution was fashioned for war in the home-country or near to it; when it was transplanted (for instance, to Salonika) it had to be modified somewhat on the lines of the British system. The American system put administration in the fighting line under an assistant chief-of-staff (G.4) at G.H.Q.; and on the lines of communication under a general commanding S.O.S. (corresponding to the former British I.G.C.). Under the American system the chiefs of the supply services were not at G.H.Q. but at the H.Q. of S.O.S. With both the French and the American systems evacuation and hospitalization of casualties were purely "Q" services: in the British army they were under the adjutant-general assisted by the quartermaster-general. Some other differences came from geographical reasons. France itself was really the supply-base for the Americans, whereas the British had the United Kingdom for this purpose; so the Americans held great stocks in depots—15 days of supplies in advance depots, 30 days supplies in intermediate depots, 45 days supplies in base depots. The American army naturally relied more largely on local purchases (from the Allied armies and from European civilian sources) than did the armies with their home bases nearer at hand. General Pershing founded a general purchasing agency to control these purchases. In 1918, out of 17,600,000 ship-tons used by the American army only 7,600,000 tons came from the United States and 10,000,000 tons were purchased locally, and to the end of the campaign the American army drew largely upon British and French supplies.

The British administrative machine in one particular point was inferior to the American machine in 1918. Under the British system the navy had control of all supplies by ship until they left the transport. The navy could put a supply-ship into any port it pleased, and naturally was guided chiefly by shipping considerations. Thus supplies for the southern area might go to a northern port. The American system put the supply ships under army direction when they came within the three-mile coast limit, and they could be directed to the port of supply which was most convenient from the army point of view. The French and the Americans used the railway regulating stations as depots; the British used them as sorting stations only. The British used the base-ports for sorting goods to a great extent; the Americans did not. In the autumn of 1918 the Americans found their one great depot, and sorting and regulating station, at Is-sur-Tille insufficient for the needs of their growing army, and they were proceeding with the organization of another station when the Armistice came.

The general staffs of the various combatant nations were in 1921 still working out the lessons of administration as taught by the World War. One principle seems to be generally accepted, that it is wise to centralize as far as possible all administration under one staff officer over the whole war area, trusting to him to devolve and coördinate. That was the final principle of the organization of the administrative services in the British army in 1918. In the first phase of the war the French organization did a large portion of the work of transporting the British army and its supplies. As the British force grew in strength, and the problem of its administration grew in complexity, the experiment was tried of dividing responsibility between the quartermaster-general of the force and the G.O.C. lines of communication. "Q" tasks were under different control in battle areas and at the base. This did not work satisfactorily, and the next experiment was to divide responsibility between the quartermaster-general and the director-general of transportation (the latter having control of the broad-gauge railways, the former of all other transport). This arrangement broke down in the spring of 1918, when the British army was put into serious jeopardy through the transport situation; retirement south of the Somme had to be contemplated, at one stage as probable, and the details were actually arranged for the destruction of the ports of the Pas-de-Calais so as to deny their use to the Germans. In the summer of 1918 the British administrative services from the coast line to the trench-line were put under one head, the quarter-master-general, for experience suggested that the commander-in-chief should have one man to whom he could confide the responsibility of the administrative side of his army's operations: to divide the responsibility was not to simplify but to complicate the task. (F. F.)

SURVEYING (*see* 26.142*).—The most striking feature to be recorded in connexion with surveying generally is the greatly increased importance which it acquired during 1910–20 from a military standpoint. This was chiefly due to the stationary character of the World War on the western front, but other factors contributed, notably the introduction of air-photography. The use of photographs, taken from aeroplanes, to determine the position of enemy trenches and other detail inside the enemy's lines, made a considerable difference in the technique of modern war and reacted upon the methods of peace-time surveys. But not only photographs from the air, but also photographs taken on land have been pressed into the service of surveying, and the applications of photography to surveys of mountainous regions such as the higher Himalayas have been greatly extended.

In exploratory surveying the conditions have been changed and simplified by the introduction of wireless telegraphy, for the determination of longitude; the accurate fixing of his longitude, long the explorer's bugbear, is now no more difficult than taking a latitude. In the more regular branches of the subject the principal matter demanding attention is the development (in which many countries have taken part) of accurate methods of levelling, particularly of precise or geodetic levelling.

Surveying in War

Geographical and topographical surveys are well known adjuncts to military operations. The war of 1914–8 showed that all other classes of land surveying, *i.e.* geodetic triangulation, levelling, and large scale surveying may be called upon to assist in the development of scientific and mechanical warfare. It is not possible to forecast whether future developments may demand an enhanced accuracy of survey, or whether the increasing importance of aviation, amongst other factors, may not prevent a recurrence of the stationary operations which prevailed over the western front for four years. A description of the more important duties of the Survey battalions on the western front, offers the best record of an intensive large scale military survey.

The Trigonometrical Control.—The extent of the line, liable to periods of intense activity throughout its length, and the constant changes of army and corps fronts made it necessary to provide a homogeneous and complete system of triangulation upon which to base the maps and the local surveys called for.

Five separate and distinct triangulations already covered this area before the outbreak of war, viz:—

1. The French main arcs and subsidiary triangulations of 1800–50.
2. The new French Paris meridian and Amiens parallel and their subsidiary orders of 1890–1900.
3. The French Admiralty coastal triangulation.
4. The Belgian national triangulation.
5. The German national triangulation.

All these triangulations were eventually combined into a single coherent system, but not until just before the Armistice and too late to assist in operations. The surveyors of the various armies kept in the closest touch with each other, but discrepancies arose nevertheless, and time was wasted in fresh observations and recomputation. It was realized somewhat late that the adjustment of the discrepancies of local triangulations is the best preliminary to military surveys.

Many of the stations of the triangulations enumerated had been destroyed or built over before the war and many were destroyed during its progress. Numbers of new stations had, therefore, to be established and the trigonometrical observer was employed in intersection and interpolation, rather than new triangulations.

This patched and reconstructed triangulation stood then as a basis for all the military surveys of the western front.

Provision and Issue of Maps.—The British Expeditionary Force took the field equipped with the 1/80,000 *carte de l'état major* of France and the British 1/100,000 maps of Belgium. Topographical maps of this sort were accurate enough for mobile operations in which no heavy guns were employed. Directly the operations tended to become stationary first on the Aisne, and then in Flanders, staff, gunners, and infantrymen demanded a map of such accuracy and

** These figures indicate the volume and page number of the previous article.*

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scale that administrative arrangements, lines of fire, and trench systems could be shown upon it. Such a map did not exist except in the Belgian area, and elsewhere had to be made. The earlier war surveys were made upon the plane table on a scale of 1/20,000 and were completed up to the British trench lines. The subsequent development of air-photography, and the discovery of the manuscript sheets of the cadastral communal surveys, made it possible to compile reliable maps, not only of territory in British occupation, but of all that portion of north-eastern France occupied by the German armies.

The trench zone was mapped on a scale of 1/10,000, and forward and back areas at 1/20,000. In all 6,000 sq. m. were surveyed.

A reliable map of the physical and artificial features of the country is not sufficient in itself. The positions of defensive works of the enemy batteries, of the points of administrative importance, and of many other objects must be shown on frequently recurring editions. From 12 to 20 editions embodying such information on various scales were kept up for the actual area of operations, whilst during the progress of a battle daily editions were brought out.

To cope with this volume of printing it was found necessary to provide for the rapid reproduction of trench maps at the Ordnance Survey Office at Southampton and for small but complete lithographic establishments in each army and at G.H.Q. Zinc plates were prepared by the Vandyke process or by helio-zincography, and flatbed printing machines, preferably motor-driven, were used for printing in the field. The French and German armies had well-equipped printing trains which were used for increasing printing facilities in important areas. The French, for example, dispatched a printing train to Italy in 1917. Towards the end the Americans employed a well-designed printing plant in lorries.

A scale of issue of about two copies per officer engaged, of each important map, was maintained, but experience showed that this scale should be increased. During the whole period of operations about 34,000,000 maps were printed for issue to the British troops, of which about two-thirds were printed by the Ordnance Survey in England and a third in France.

For the use of large scale maps in trench warfare a well-thought-out system of coördinates, based on a suitable projection, was needed.

It must be possible to read off at sight the coördinates of any desired point from a " grid " or network of lines printed on the map. All the armies had such systems. Experience proved that for ease and accuracy of reference the "grid" should be in squares, the sides of which can be divided decimally by eye. The artillery often desire coördinates of the same accuracy as the surveyor—*i.e.* on the scale of nature. The system adopted should therefore be based upon the coördinates used by the surveyor, with an easy form of abbreviation to be used by all arms to define map positions. Accuracy of bearing from any one position must be maintained together with as near an approach to linear accuracy as possible, whilst the system must allow of extension over the whole area of operations.

The considerations which influence the choice of a reference "grid" have already pointed to the desirability of an orthomorphic projection. For the conduct of surveys constantly in progress it is equally important. Computations must be cut down to the minimum, and this is best secured by working on a projection in which the position on the ground and the position on the map can be calculated in one process without sensible error.

From the cartographic point of view the question is not so important, and there are many projections which would provide a sensibly accurate map over large areas.

It was decided late in the war to adopt an orthomorphic projection with two standard parallels which had recently been adopted in the French armies, but the decision came too late, and the Bonne projection continued in use in the British army until the Armistice.

Surveys for Artillery Purposes.—Other things being equal, that artillery will dominate its adversary which has the quickest and most accurate knowledge of hostile battery positions and which can open most quickly an accurate and unexpected fire upon them. The construction and calibration of guns and howitzers, the homogeneity of ammunition, and the measurement of those atmospheric elements which affect ballistics are involved; but accurate survey of the relative positions of gun and target is essential.

The positions of British heavy batteries were, therefore, fixed with a theodolite, each battery was supplied with a chart or " artillery board " on which the map was pasted down, in sections, upon a zinc or three-ply wood surface, and special " bearing pickets " were inserted in numbers in the battery zone. The bearings from these pickets to surrounding objects, suitable as reference objects, were tabulated and distributed.

The positions of hostile batteries were also surveyed with as much dispatch and accuracy as possible by one or other or both of the following methods:—

(*a*) Intersection of three or more rays observed upon the flash of discharge, the reflection in the sky of this flash, or, upon the smoke puff from the muzzle. This operation, commonly known as flash spotting, was carried out by units, each of which manned four survey observation posts, or instrument stations, and one headquarter post. Each section had its own internal telephone system and was in direct communication with an artillery headquarters.

Observations were directed by an ingenious controlling exchange upon hostile guns in succession. This method, independent of the map, gave very good results but depended for success upon good visibility. Flash-spotting units could survey the positions of the bursts of our own shell and were, therefore, also used extensively for ranging and for calibration.

(*b*) *Sound-ranging.*—A sound, in still uniform air, spreads outwards from its origin with an equal velocity in all directions, and the sound waves may therefore be likened to the ripples spreading outwards on a pond from the point at which a stone has fallen into it.

If we now imagine a row of surveyed pegs, more or less tangential to a ripple, projecting from the surface of the water, if we measure the times at which the ripple strikes each peg and know the velocity of the advance of the ripple we shall have all the data necessary for fixing the position of the origin of the disturbance. All armies engaged on the western front had some system for determining the position of a gun from the sound of its discharge, embodying the above principle. It is unnecessary here to describe the British system, except in so far as the survey of the sound-receiving stations is concerned. A sound-ranging base was generally, though not invariably, laid out on the arc of a circle, the centre of which lay in the zone of the enemy's heavy artillery. There were usually six sound-receiving stations about 1,000 metres apart. The coördinates of the selected spot for each station were computed in the office, and the surveyor had to find and mark the corresponding points on the ground. Errors of more than one metre in position resulted in sensible errors in sound-ranging.

Sound-ranging is naturally unaffected by bad visibility, but is put out of action by a moderate wind blowing from base to gun and is interfered with by any high wind. As in the case of flash spotting, a good telephone connexion to the artillery headquarters is essential.

Surveying by Air-photography

Air-photography, or, to be more precise, photography of the ground from the air, has been recognized as a possible method of survey since the middle of the 19th century.

Experiments in photographing the ground from balloons had been made by Col. Laussedat, Major Elsdale and others from 1859 onwards, but air-photographs played no part in any important survey before the outbreak of war in 1914. During the course of the war the difficulty of producing maps on medium scales was enhanced by the inaccessibility of the most important areas. It was due to this fact, and to the development in 1915 of photography from aeroplanes, that large areas in many theatres of war were mapped by the aid of air-photographs. But no full examination of the possibilities was made, and for peace surveys the method still remains in the experimental stage.

Optical Principles.—Provided that the optical axis of the camera is vertical at the moment of exposure, the resulting photograph of a flat level area will be an accurate plan at a scale determined by the equation

$$\frac{f}{h}=s$$

where f is the focal length, h is the height of the camera above the ground at the moment of exposure, s is the representative fraction of the scale.

Such photographs will be called vertical photographs. As a rule, however, the photograph is not exactly vertical, but the axis is tilted at an angle to the vertical. The photograph then becomes an inclined perspective view. (*See* Fig. 1.)

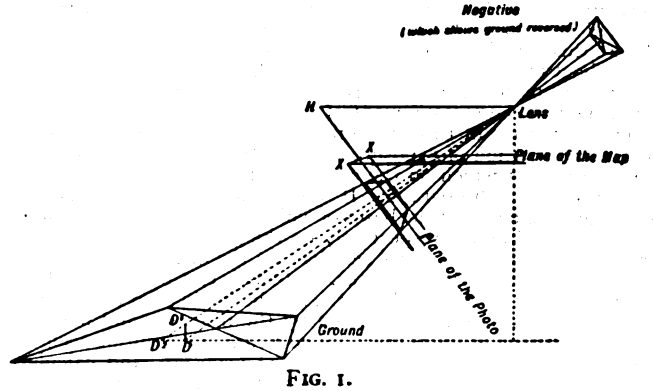

FIG. 1.

If the direction and magnitude of the tilt of the axis were recorded at the moment of exposure it is obvious that the photograph could be projected optically or photographically on to the plane of the map, although it would remain unfixed in position and orientation. If the direction and magnitude of tilt are unknown then the projection on to the required plane, or " rectification," is secured by comparing the relative positions of four surveyed points on the

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ground and on the photograph, which is then also fixed in position and orientation. Where the tilt is known, approximately three points common to map and photograph will furnish a solution. Two further points of importance are that (1) straight lines upon a plane remain straight lines upon any perspective view of that plane; (2) at any point on an inclined perspective view the scale is not the same in directions parallel to and perpendicular to the axis of tilt.

In plotting detail from vertical photographs certain errors, due to instrumental imperfections, may arise but are seldom of sensible magnitude. These are due to (1) a change in the relative position of plate lens and area photographed, due to the shutter moving so comparatively slowly that the movement of the aeroplane becomes noticeable on the plate; (2) distortion due to optical imperfections of the lens.

Construction of the Map.—In order to explain how a map is built up, wholly or partly, from air-photographs it is advisable to take some illustrative cases. The simplest case is where it is desired to produce a map of an area in which a sufficient trigonometrical control already exists and of which there is available a complete collection of cadastral plans, which are, however, much out of date. Ground features are low and gently undulating, extreme difference of altitudes being two or three hundred feet only.

In such a case topography can be brought up to date from air-photographs taken with the axis as nearly vertical as possible, and fitted upon the cadastral framework by one or other of the methods described below. When this is complete the map is contoured in the field, names are added and the topography examined for omissions or mistakes.

The most difficult case arises when the area to be mapped is rugged and mountainous, and the inhabitants hostile: the positions and heights of a few peaks in it, visible from accessible ground, have been fixed trigonometrically, but no reliable map exists.

As a preliminary measure oblique photographs are taken from a variety of points of view. The positions of the camera in space are calculated, and from measurements on each photograph a number of rays are drawn to noteworthy points in the valleys and on the hills. Positions and heights are thus determined for a subsidiary control. With the axis vertical a series of photographs of valleys and of watersheds are taken, pasted together, and fitted to the control. When the map has been thus built up, form-lines are added from the oblique photographs and upon the fixed heights. In the majority of surveys difficulties will be of an order intermediate between those of the foregoing two cases.

Applications of Air-photography.—In any particular survey air-photographs may be used then for any or all of the following processes, viz.:—(1) Air-photo control, (2) Air-photo-topography, (3) Air-photo contouring.

In taking vertical photographs for air-photo control, exposures are so regulated as to ensure a substantial overlap, generally amounting to 50% at least. Each successive photograph may therefore be fitted to its predecessor, and lines or traverses of photographs may be mounted and scaled between fixed points. Any two or more traverses of different and independent lines may be made to intersect over some topographical object, the position of which may be determined as the simple, or weighted, mean of the individual positions from each traverse. Traverses may also be made to converge and end upon some prearranged and hitherto unfixed object. This method has given fairly accurate results in flat country on the scale of 1/40,000, and is dependent upon the ability of the pilot to maintain an even keel and a constant height.

In broken and hilly country no method can be regarded as trustworthy which does not take into account differences of altitude. We must then be content to limit the use of each photograph to the measurement of horizontal and vertical angles and to fix the positions of new points by intersection from two or more photographs. Where this principle is decided upon there remains no advantage to be derived from the vertical photograph, and oblique photographs are used in preference as covering larger areas and allowing greater refinement in the measurement of vertical angles.

The first stage of this photo-topography from the air is to interpolate the position of exposure in space from three or more points, the positions of which on the earth's surface are known, and which appear on the photograph. If we consider the pyramids whose apices are the lens and the bases of which are the triangles formed by the three fixed points respectively on the ground and on the photographic plate (*see* fig. 2), we see that (*a*) the angles at the apex are a function of the lengths *ab*, *ac*, *bc* (which can be measured upon the plate), and of the focal length; (*b*) the inclination of the ground pyramid to its base is determined by the direction and magnitude of tilt; at the present time there are no means of measuring accurately the tilt of the plate at the moment of exposure, and calculation follows by successive approximations from a preliminary estimation; (*c*) the position of O in space can be calculated and plotted in its correct projection on the plane of A, D, C; (*d*) angles may be measured upon the plate and rays drawn to additional points from O.

From the nature of the case air-photo control must be limited to the provision of a few supplementary points.

Where the area to be mapped contains a sufficiently close control the filling in of topographical detail is more easily done from vertical than from oblique photographs, providing that the area in question is not markedly hilly. The scale on which photographs are taken may be larger or smaller than that of the map, but it must be sufficiently large to allow of clear identification of detail.

The area to be mapped is photographed from a prearranged height in strips allowing for an overlap in all directions. Much depends upon the training of the pilot in maintaining his height and his overlap. It is usual to arrange for a mechanical control of exposures regulated according to the ground speed of the aeroplane.

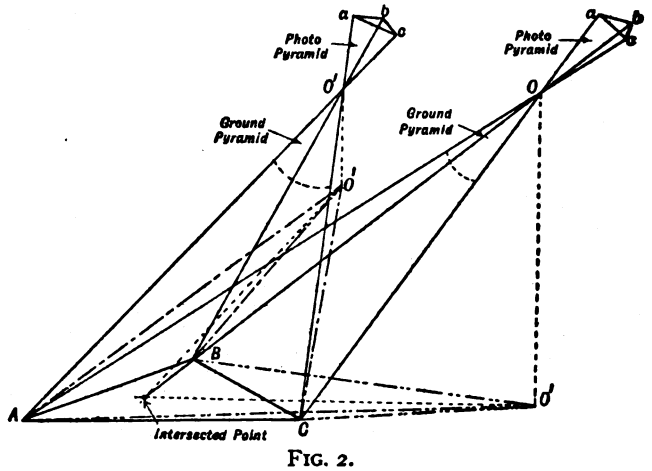

FIG. 2.

The plotting of detail from these photographs would be simple if the axis of the camera could be maintained in a vertical position. It would then be necessary only to bring the photograph to the scale of the map. No means of ensuring this verticality has, as yet, been evolved. It often becomes necessary, therefore, to fit photographs individually upon the control points. This can be done graphically, or optically by the *camera lucida*, or by the enlarging camera.

The graphic method depends upon the principle that as straight lines on one plane remain straight lines on any perspective of that plane the position of a point which lies upon the intersection of two lines common to the ground and to the photograph may be readily determined. Within narrow limits the proportional compass set to the difference of scale between map and photograph at this point may be used to fix additional points. It is more accurate, however, to maintain the straight line principle and to cover the map and photograph with a "grid" of corresponding lines, as in fig. 3.

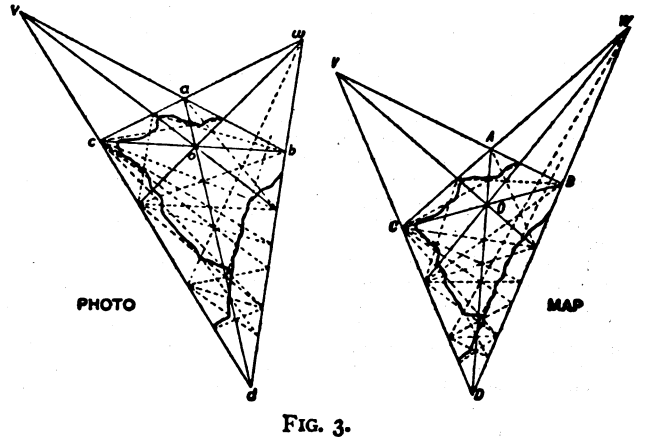

FIG. 3.

The photograph is mounted on a sheet of paper—*a*, *b*, *c*, *d* and A, B, C, D are four points the positions of which are known and are also identifiable on the photograph. Subsidiary common points at *oO* are established by drawing the diagonals, and four subsidiary quadrilaterals may then be formed by drawing lines through *oO* from *vV* and *wW*—the intersections of the prolonged sides of the quadrilaterals. The same principle may be applied to any polygons formed by joining up any number of points (more than four) which are fixed on the ground and identifiable on the photograph. Detail may be sketched in by eye.

A useful method of plotting, known as the four-point method, is as follows (fig. 4): It can be proved that the cross ratios of four points which lie upon a straight line are the same upon any perspective view of that line, hence we can readily plot the position of a fifth point (S) if we know the positions of four points A,B,C,D.

Let A, B, C, D be four known points on the photograph and *a*, *b*, *c*, *d* their positions on the map, and let S be a point on the photograph the position of which on the map is to be found.

Join A B, A C, A S, and A D, *a b*, *a c*, and *a d*.

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Lay a piece of paper with a straight edge, in any position cutting the lines A B in B′, A C in C′, A S in S′ in A D in D′ and mark these cutting points on the paper.

Now lay the paper strip on the map and fit it upon the lines *a b*, *a c*, and *a d*, so that B′, C′ and D′ lie upon these lines.

Mark on the map the position of a point *s′* opposite the mark S′ on the paper strip. Join *a s′*. Then *s*, the position of point S, upon the map, lies upon the line *a s′*.

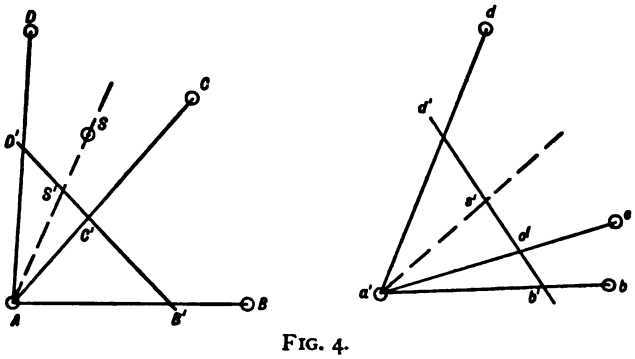

FIG. 4.

Repeat this proceeding from B, C, or D, and another line *b s′*, *c s′*, or *d s′*, will be secured, the intersection of which with *a s′* will define the position of S.

The *camera lucida* (*see* 5.104) has been used extensively for plotting. The upright carrying the prism is mounted on a stand upon which are also mounted two boards roughly at right angles to each other called respectively the map and photograph boards. Movements are added to allow of rotating the photograph in its own plane, of tilting the map (or tracing of control points) around an axis parallel to a marked horizontal line on the photograph board, and of increasing or decreasing the distance between the prism and the photo board (fig. 5).

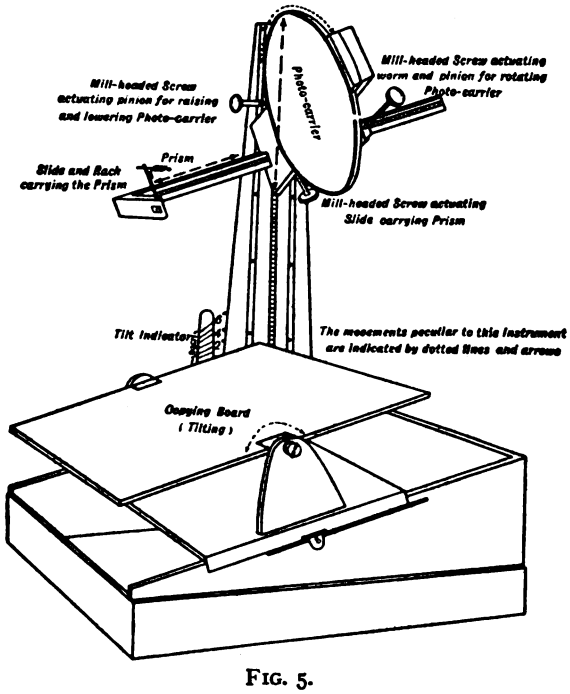

FIG. 5.

Graphic and optical methods are tedious and lengthy compared with a photographic rectification. The ordinary enlarging camera can be made to answer the purpose with little modification. It must provide, in addition to its focussing movements, as follows:—

1. The negative must be capable of rotation in its own plane around its centre.
2. The copying board and negative carrier must be capable of rotation around parallel axes which are at right angles to the optical axis of the lens.
3. The copying board and negative carrier must be capable of movement along the line axis of the lens.
4. The negative carrier must be capable of a movement bodily at right angles to its axis of rotation.

By means of these movements a coincidence can be obtained between the four control points on the map and on the photograph, and a " rectified " print may be obtained.

Little contouring has as yet been based on air-photographs. It must be recognized at the outset that it is impossible to calculate relative heights from measurements taken from a single photograph; for the accurate determination of relative heights we must have at least two photographs taken from different places. An outline of photogrammetry from the air has already been given and mention has been made of interpolation in space, and of the survey of new points by intersecting rays. A short additional step—the measurement of vertical angles on the plate—makes it possible to calculate the height of these new points.

Stereo-photogrammetry from the air may develop in the future, but has not been made use of hitherto. On the other hand much use has been made of the stereoscopic effect visible on two photographs of the same area taken from different positions. Such information is not of an exact nature but gives a valuable indication of ground forms and brings out the system of drainage.

Until 1920 mapping from air-photographs had been confined almost entirely to war time, and to areas already covered by a trigonometrical control, hence there had been little opportunity of comparing the cost of this method with that of any other, or of laying down definitely its possibilities and limitations. Clearly its greatest value lies in the mapping of inaccessible country.

So far as can be judged, the chief fields of usefulness open to air-photo-topography are, the surveying of native towns on scales of about 1/10,000, or 6 in. to 1 m.; the surveying of deltas and intricate water channels; and the surveying of ancient sites, on which the indications of a former civilization become far more evident in the air than on the ground. Topography on ordinary small scales, and accurate large scale cadastral mapping are, so far, ruled out. But it appears that developments may very well be looked for in each of these directions.

Photographic Surveying

The idea of applying photography to surveying was originally due to Col. Laussedat (1819–1907), who made some experiments in the matter in 1859, and continued during his long life to expound and develop the method. Although the system originated in France not much was done in that country in the way of its practical application, and, if we except some minor work by MM. J. and H. Vallot in the Mont Blanc region in 1892 and some similar mapping by M. Flusin in 1905, it is to Canada that we must go for its first use on any considerable scale.

In 1895 Mr. E. Deville, surveyor-general of Dominion Lands, published his important work on photographic surveying, which remains a complete exposition of the subject if we exclude some recent departures. Between 1886 and 1892 photographic surveys were confined to the Rocky Mts. in the neighbourhood of the Canadian Pacific railway, but in 1893–4 the method was used by Mr. W. F. King in the survey of the Canada-Alaska frontier. In 1901–2 Mr. A. O. Wheeler carried out a very successful photographic survey of the Selkirk range, British Columbia, on the scale of 1/60,000; this was published, with an interesting account of the range, in 1905.

In the U.S. photo-topographic surveys had been made use of on the International Boundary Survey and reports made by Mr. M. A. Flemer of the U.S. Coast and Geodetic Survey in 1897–8. Stereo-photo surveys (*see* below) were employed in the survey of Tutuila, Samoa, by the U.S. Hydrographic Office in 1916; and an innovation in the shape of a panoramic camera was first used by Mr. C. W. Wright in Alaska in 1904 and extended by Mr. J. W. Bagley who wrote an important treatise on the subject in 1917 (Washington, Government Printing Office).

In 1907–8 Lt. M. Weiss, of the expedition commanded by Duke Adolphus of Mecklenburg, made a photo-survey of the volcanic Mfumbiro Mts. to the N. of Lake Kivu. Other fragmentary surveys in various parts of the world have been carried out by the aid of photographic methods; most of them, as well as those mentioned above, were in mountainous country.

Outline of the Method.—Assuming that a photograph is a true perspective view, that the plate was vertical when exposed, and that the horizon-line and focal length of the lens are known, it is clearly possible to determine the horizontal and vertical angles from the point where the camera was set up to all objects represented in the photograph, the horizontal angles being measured from some known, represented object. If two such photographs are taken from two points, at known distance apart, we have the means of determining the distance and height of all points shown on both photographs.

It will therefore be necessary in planning a photographic survey, to arrange for a triangulation to fix the relative positions of points at which the camera will be set up, and the first stage in the office work will consist in the plotting of the triangulation. A camera

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station need not, however, be a trigonometrical point, provided that its trigonometrical position can be measured from the photograph. To use the photographs for plotting the detail, from each camera station A draw, at its correct angle, the central line of view. Along this line draw A x, equal to the focal length of the lens; through x draw a line at right angles to A x and plot from x the projections of the distant points, as measured on the horizon-line of the photograph. The intersection of rays from A to the points so obtained, with rays to the same objects from other stations, will give their positions.

It is an almost universal rule of photographic surveying from the ground to maintain the photographic plate in a vertical position, because any inclination of the perspective plane of the plate adds difficulties to the plotting.

A supplementary order of triangulation is usually added contemporaneously with the field work of photogrammetry, both to fix camera positions and to add a few bearings and vertical angles from which the photographic data may be checked.

For many years cameras specially designed for surveying work have been available, a good example being the Bridges-Lee photo-theodolite. The essential features of these are, that the focal length should remain constant (for which purpose the sensitized surface of the plate should be pressed firmly against the frame of the camera), that the position of the optical centre, and of the horizon and principal planes should be deducible from marks on the plate, and that the lens should be free from distortion and aberration. It is also important to provide levels by means of which to ensure the verticality of the plate. The later photogrammetric cameras are either interchangeable with transit theodolites on the same portable stands, carry eccentric telescopes, or else combine the two instruments by substituting a telescopic lens for the usual photographic lens, and by inserting an eyepiece in the back of the camera. The field work demands a high standard of topographic training, for it is not easy to select the minimum number of views sufficient to cover the country whilst leaving no gaps. Valleys and low-lying areas constitute the main difficulty. One or two stations *per diem* are all that have been occupied by the same party in the photogrammetric surveys of the Canadian N.W. frontier, whilst a supplementary triangulation was carried on concurrently.

The office work takes two or three times as long as the field work and consists in plotting positions, calculating heights, and drawing contours from data measured on the developed plates.

The picture trace will naturally assume the form of the arc of a circle if a panoramic camera is used such as that employed during 1910–6 by Mr. J. W. Bagley in Alaska.

There are several plotting devices on the market, such as the perspectograph, but they have not been largely employed. On the other hand vanishing scales and perspectometers (grids showing the perspective on a vertical plane of a series of squares on a horizontal and lower plane) can be readily constructed.

Stereo-photo Surveying.—The most recent development of photographic surveying consists in the employment of the stereoscopic principle. The stereoscope as a toy has long been known, but Dr. Pulfrich of the firm of Zeiss of Jena, and Col. von Hübl of the Austrian military geographical service, conceived the idea of applying the stereoscopic principle to the service of exact surveying. Other pioneers in 1907–8 were the late Capt. F. V. Thompson, R.E., and Mr. Conrady. In 1913 Mr. G. Muller carried out a successful stereo-photo survey for part of the proposed Hankow-Ichang railway. In order to carry out a normal photographic survey successfully it is necessary to arrange for stations far apart and for intersections of some 30 degrees or so. But in stereo-photo surveying two stations can be occupied on the same hill-top and their distance apart need only be some 50 to 300 feet.

In the simplest case let two vertical photographic plates be exposed from two points, say 100 ft. apart; let the plates be in the same plane and their centres on the same level. Then if these plates are put into a stereoscope provided with a system of lenses and prisms such that the eyepieces are brought to a convenient distance for seeing, we shall clearly get a very much magnified stereoscopic effect as compared with what is obtainable with the naked eyes. In the diaphragm of each eyepiece let there be a similar movable mark, or line on glass. On looking through the eyepieces the marks in question will appear as a single mark floating in space, and by vertical and horizontal adjustments this mark can be made to touch any given object in the picture. We have, thus, a means of measuring small parallaxes and vertical angles, and these can be read off graduated micrometer heads.

A stereo-comparator as above described gives angles from the centre of the plate, distances and vertical angles; but the reading is laborious and the map has to be constructed point by point.

In 1907 Lieut. von Orel, of the Military Geographical Institute of Vienna, attempted the construction of a machine which should quasi-automatically draw the map, and in 1909 such an instrument was made by Zeiss of Jena. A further model of 1911 permitted the automatic drawing of contours and the outline of detail. The instrument is called the stereo-autograph; several have been made and are in existence in Austria, Germany and France. A stereo-autograph is, of course, an expensive instrument and requires a skilled operator and good plates of even density. But, given these conditions, practical results have been obtained and the method is one to be reckoned with in the future. Generally with stereo-photography we are not limited to a country with marked features, as is the case with normal photo-topography. Provided that the view is clear, gently undulating or flat country can be as well surveyed and contoured as a mountainous region. The method has some obvious applications, but it is useless in forest-clad country or in towns and its value largely depends upon good view points. The old, photographic surveying has as its chief field of usefulness a well-marked mountainous region. The new is not so limited but its rôle has not yet been fully determined.

Bibliography of Photographic Surveying.—In 1895 Mr. E. Deville was able to quote the titles of 26 works on photographic surveying; in 1911 Dr. Pulfrich in his *Stereoskopisches Sehen und Messen* mentions 276 works, chiefly in German, on stereo-photography alone! The following books may be recommended: *Photographic Surveying*, E. Deville, Ottawa, 1895; *Hints to Travellers*, vol. 1. R.G.S., 1906; *The Use of the Panoramic Camera in Topographic Surveying*, James W. Bagley, Washington, 1917; *Revue Générale des Sciences*, March 1914, Paris, for stereo-photo-topography.

Longitude by Wireless Telegraphy

The chief technical difficulty which explorers and surveyors in new countries have hitherto experienced has been in the determination of longitude in regions unprovided with a telegraph system. This applies to almost all the unexplored, or little explored, parts of the world. Since 1910, however, the great advance made in the transmission of signals by wireless telegraphy has completely done away with this source of difficulty and error. Wireless "receiving" sets are now made of a very portable character; so much so, that one mule or one porter can carry the whole apparatus. Frequent practical use is being made of this method of obtaining time signals, as the following instances will show. In the year 1912 Comm. Edwards fixed positions during the Bolivia–Brazil boundary commission by wireless signals from Washington and intermediate stations; in 1913–4 Cav. Dr, Filippo de Filippi in an expedition to the Karakoram used wireless signals from Lahore and from Italy; Major A. J. Woodroffe in 1913–5 determined longitudes on the Peru–Brazil boundary commission by wireless signals sent from Senna Madureira, Brazil; in 1914–7 the French explorer, Lt.-Col. J. Tilho, used wireless signals from Paris to determine longitudes in his explorations of Tibesti, Borku, Erdi, and Ennedi; in 1917 Capt. A. J. Bamford determined the longitudes of Bagdad and Kermanshah by wireless signals from Fao, which had previously been connected with Basra; in 1919–20 the American traveller, Dr. A. Hamilton Rice, made use of wireless signals from Annapolis, Washington and Darien, to determine longitudes during his Amazonas expedition. Fig. 6 illustrates the wireless receiving set used by Dr. Hamilton Rice in 1919–20; it was designed by Mr. J. W. Swanson and Mr. P. F. Godley, and was found quite satisfactory and very portable.

It is safe to say that, in future, no properly equipped exploring expedition will be without its wireless receiving set. The designs of these sets will change from time to time and, no doubt, improvements will be made; but the method has proven to be thoroughly practical, and the extra amount of transport required is already of a negligible character. One of the greatest difficulties of the explorer has thus been removed.

Levelling

Since 1910 much progress has been made in the development of a sound system of levelling, especially with regard to precise, or geodetic levelling, *i.e.* that levelling which provides the framework on which all national levels depend. The now defunct International Geodetic Assn. laid down some wise rules on the subject of the precision of work of the highest standard. The admirable treatise of M. Ch. Lallemand, *Nivellement de haute Précision*, marked a great advance on previous text-books; and the production of the modern geodetic levelling instruments of France, the U.S. and Switzerland afforded the means of greatly increasing the accuracy of observation. To this should be added the introduction, by the Ordnance Survey of the United Kingdom, of a specially devised kind of permanent bench-mark, which did away with a weak element in the old levelling, the instability of the ground marks.

Levelling Instruments.—As a type of the instruments in use for levelling of high precision the level designed by Dr. Wildt, and made

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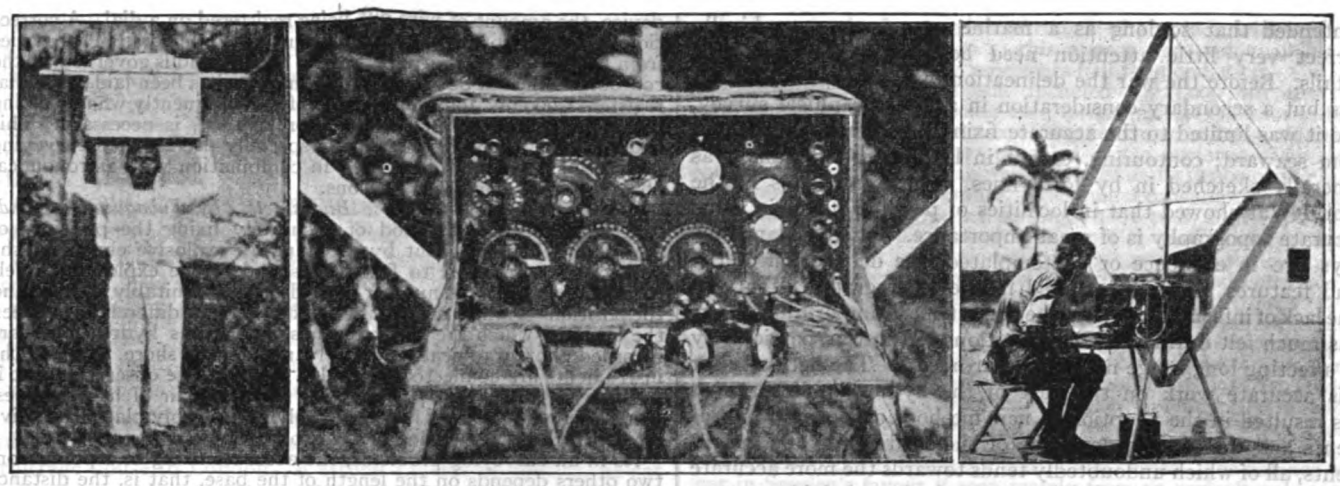

Set packed for transport. Receiver and Loop set up ready for use. Receiving Signals.

FIG. 6.—Portable Receiving Set.

by the Carl Zeiss optical works of Jena, may be taken. Levels of this kind are also manufactured by Messrs. T. Cooke & Sons of York and Messrs. E. R. Watts & Son of London. The instrument includes the following modern improvements which distinguish it from the levels used for rougher surveys or engineering work; the bubble is read from the eye end of the telescope, so that it is not necessary to disturb the instrument by walking to its side and bending over to read it; the final levelling of the instrument is effected by means of a slow-motion screw which slightly tilts the telescope; and the level is provided with a micrometer attachment in the form of a plate of glass with parallel faces in front of the object glass and this attachment can be tilted by means of a screw, the amount of the tilt being read on a graduated drum. The use of this micrometer attachment enables readings to be made by the intersection of graduations on the staff, instead of by estimation. It is essential in using this attachment that the sights should be of equal length. Various patterns of staves have been used by different survey departments. The Ordnance Survey, for the new geodetic levelling of England and Wales, used staves manufactured by the Cambridge Mathematical Instrument Company. These staves are 10 ft. long and the graduations are marked on a strip of invar (an alloy of steel and nickel which has a very low factor of expansion); fixed to each staff is a circular level, for the staff-holder to keep it vertical.

Ground Marks.—The ground marks to which the observations are taken in the field are of various kinds and are known in British surveying as bench marks. The bench marks in use on the Ordnance Survey are: first class or fundamental; second class, which consist of flush brackets made of bronze let into a wall or other vertical surface, and fixed with cement; rivets, let into horizontal surfaces, such as pavements; and, third class, bench marks cut with a chisel in brick or stone walls, of broad-arrow shape.

The fundamental bench marks are new. It is well known that bench marks of the ordinary type are in general unstable; walls or houses are pulled down, or are subject to settlement, bench marks on isolated stones have been known to be moved and set up in new positions, marks on pavements or kerbs are shifted. None of the old types of bench marks is satisfactory as constituting permanent records of height and position. Moreover, in certain localities, such as mining areas and clay hillsides, the ground itself is unstable. It was therefore decided in planning the geodetic levelling of England and Wales that fundamental bench marks would be devised which should be of a very stable nature. These are established at intervals of about 25 m. from each other; the sites are carefully chosen and no bench mark of this kind is placed on loose soil or rock liable to local disturbance. In constructing such a mark a pit is dug through the soil, sub-soil and loose rock, until sound rock, or hard chalk, is found. The bottom and sides of the pit are lined with concrete, and two reference marks are placed in the bottom concrete, one of bronze and one of polished flint; these are covered with removable caps of metal. When the observations have been finished the pit is filled with sand or other suitable dry material. The internal marks described are those which are used for departmental purposes; but, for the public, an external mark is also provided. It is hoped that these marks will last for many hundreds of years and will, in the future, afford valuable information with regard to vertical movements of the crust of the earth.

Method of Observation.—The system of carrying out the observations in the field is based on the following principles. In order to minimize the effect of systematic error the levelling of any line is carried out once in each direction; the interval of time between successive levellings should be as short as possible; to minimize the effect of inclination of the line of sight the distances from the instrument to the fore and back staves should be as nearly equal as possible; to enable the graduations on the staves to be read easily the length of a space between the two staves is not in precise work to exceed 100 yds.; to reduce the effect of refraction, no reading is allowed even with the lower stadia hairs nearer than 6 in. from the lower end of a staff; observations are not allowed in bad or windy weather; the level is to be shielded from the direct rays of the sun.

It is on the observance of these and other common sense rules that the accuracy of the work will largely depend, and great attention must be paid to details, such as keeping the staves truly vertical or not letting the staff fall heavily on the picket or bench mark.

Errors.—The errors to which levelling is subject may be divided into those due to the staff, those due to the level, those due to the staff-holder, those due to the observer, and those due to the state of the ground, atmospheric conditions and unknown causes. The system of observation above described is directed towards eliminating, as far as possible, all errors not purely personal. Ultimately, when everything is done to evolve a sound system, it is the human element which tells most in the result, and the observer should possess excellent eyesight, a good stock of patience and be scrupulously honest; for in this, as in all scientific measurement, there must not be the least bias or wish to obtain a particular result. If the errors were all accidental and subject to the ordinary law, the probable error should increase as the square root of the distance levelled. There is, however, in levelling, a factor known as the "systematic error," by which the far end of a line constantly tends to appear the lower. If this systematic error were quite uniform, then double levelling would completely eliminate it; but this is not quite the case, and in the result, we are left with errors mainly accidental, plus an unknown amount of error not strictly subject to the law of accidental errors. A careful investigation by the Ordnance Survey has shown that the safest course, and that most in accordance with the conditions of the case, is to treat the whole error as accidental and as accumulating in proportion to the square root of the length of the line levelled. This is contrary to French practice. The probable error of 1 m. of double levelling is usually calculated from the formula $e=0{\cdot}67\ (\Sigma d^2/4M)$, where Σd^2 is the sum of the squares of the discrepancies between the forward and back levelling from mark to mark, and M the length of the line in miles. The value of the probable error so obtained will usually be less than that obtained from a consideration of the closing errors. In recent Ordnance Survey precise levelling the value of e, from the above formula, is found to be somewhat less than ·003 ft., whereas the value found from a discussion of the actual errors of closure of the level net-work is ·0077. The probable error accumulated in the net-work between Newlyn in Cornwall and Dunbar in Haddingtonshire, two places separated by about 700 m. of levelling, is 0·16 ft., or about 2 in. This figure will serve to give an idea of the accuracy of modern precise levelling.

AUTHORITIES.—See Close & Cox, *Text Book of Topographical and Geographical Surveying* (H.M. Stationery Office, London, 1913); Middleton & Chadwick, *A Treatise on Surveying* (1911), chiefly of value for engineering surveys; W. Norman Thomas, *Surveying* (1920). (C. F. CL.; H. S. L. W.)

NAUTICAL SURVEYING

Although the World War restricted hydrographic surveying work, it led to improvements in methods and in instruments.

So far as the British Naval Surveying Service was concerned, it had generally been considered before that a marine survey need not be carried out with the degree of accuracy which is rightly considered necessary in purely land surveys; it being

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contended that so long as a marine survey was graphically correct very little attention need be paid to topographical details. Before the war the delineation of topographical details was but a secondary consideration in a hydrographical survey, and it was limited to the accurate fixing of objects conspicuous from seaward; contouring, except in large harbour plans, was generally sketched in by form lines. The experiences in the World War showed that in localities of possible strategic value accurate topography is of great importance. Where no land surveys are in existence or contemplated, the delineation of the land features must be included in the hydrographical survey. The lack of information due to the neglect of this important subject was much felt during certain operations of the war, particularly as affecting long range naval bombardments. The necessity for this accurate work on the part of the hydrographic surveyor has resulted in the adoption of new methods and of new instruments and the more general use of the land surveyor's instruments, all of which undoubtedly tends towards the more accurate charting of the seas. The elaborate methods and rigid accuracy of a triangulation on shore have been recognized by marine surveyors, although the refinement necessary for so-called first-class triangulation work does not often present itself.

Instruments.—Theodolites in current use (1921) are 4 in., 5 in. and 6 inch. The majority of these, formerly graduated to one minute, read to 20 sec. by Vernier, and micrometer theodolites read to 10 seconds. The use of the theodolite for astronomical and tacheometer work largely increased. Sextants for observing, with stand and artificial horizon, continue in use, but improvements in the sextant such as an endless tangent screw and electric light for night work have been adopted. More portable folding stands with slow-motion screws for movement of the sextant in azimuth and altitude are also supplied, and in addition amalgamated troughs, consisting of gold-covered plates on which a thin film of mercury is floated, have superseded the old artificial horizon consisting of a mercury bath; the new pattern is far less sensitive to earth tremors caused by surf, traffic, etc.

The Astrolabe à Prisme, a very precise instrument for finding position, enables altitudes of any stars at the exact altitude of 60° to be observed (see John Ball and H. Knox Shaw, *A Handbook of the Prismatic Astrolabe*, published by the Egyptian Government, Cairo Government Press, 1919).

Measuring chains have been almost entirely superseded by 100-ft. and 500-ft. steel measuring tapes, which are supplied with standardization certificates. The "10-ft. pole" has been supplemented by a "20-ft. pole" operated by two men and consisting of two boards connected by a wire 20 ft. in length and used in conjunction with a sextant. This method of measuring distance is, however, being gradually superseded by the use of tacheometers and tacheometer staves marked according to the Admiralty pattern, with which distances up to over 2,000 ft. can be very accurately measured.

One-metre base range-finders are useful in measuring short bases for plans of harbours, etc., when time or circumstances do not permit of a more accurate method.

Of the various forms of heliostat the Galton sun signal has proved a most excellent instrument, and fitted to theodolites it allows of the sun's rays being expeditiously and accurately directed to, and kept on, the station desired, whether the latter is visible or not.

Ship sounding has been greatly improved by the introduction of the Douglas Schäfer sounding gear, which enables ship sounding to be carried out under way in any depth up to about 40 fathoms with great speed; other methods of sounding such as the "Somerville" gear have also been adopted, and, in addition, far greater attention has been paid to sweeping for rocks, shoals, etc., the method used for mine-sweeping having been adapted to this purpose.

Other entirely different methods of sounding were also due to experience gained during the war. The most popular method under trial in 1921 was "Acoustic Depth Sounding" which depends on the principle of the acoustic echo, the depth being measured by the time taken for the shock of an explosion or other impulse produced in a ship to reach the bottom and be reflected back as an echo to a receiver on board the ship. By this device it was hoped to obtain either a single indication of the exact depth at any moment or a continuous indication of the depth registered automatically at any selected position. The importance of this method of sounding from a ship under way at any speed, without the necessity of casting the lead, needs no insisting upon.

Taut wire measuring gear was in 1921 fitted or being fitted to all British surveying ships. This method of measuring distances at sea in comparatively shallow depths had proved most successful and was adopted after having been extensively used in connexion with mine-laying during the war. The ship preserves a steady course and at a constant speed over the distance to be measured and at the same time runs out a thin piano wire from a drum which carries many miles of the wire. It is laid taut by means of a special brake device, the amount of wire out being registered on a dial. A correction (always subtractive) must be made for errors. This varies from 1,000 to 3,000 ft. in a distance of 100 m., and is governed by the contours of the sea bed upon which the wire has been laid. The dial registers 1,000 rev. for a mile of 6,080 ft., consequently when plotting in sea miles a second correction, for latitude, is necessary. This method of determining distance is specially useful when surveying out of sight of land, and is used in combination with astronomical observations and moored beacons.

Fixing Positions of Ships, Buoys, etc., by Subaqueous Sound-ranging.—This new method of accurately fixing the positions of buoys, etc., is carried out by dropping an explosive charge at the position it is required to fix. The sound of the explosion travels through the water to a number of hydrophones suitably placed, and the positions of which are accurately known. The differences between the times at which the shock reaches the various hydrophones are recorded photographically by a galvanometer on shore, to which the instruments are connected by cables. From these observations it is possible to calculate a position line for each pair of hydrophones. Three or four such lines from hydrophones suitably placed will give a cut, which is the position of the explosion.

As in all surveying problems, the accurate fixing of a point from two others depends on the length of the base, that is, the distance between two known points, so does the accurate fixing by sound through the water depend on the hydrophones, or groups of hydrophones being such a distance apart, commensurate with the distance at which it is required to fix the buoy, etc.

Chronometers.—Surveying ships are now supplied with from 8 to 12 chronometers of the box type, with pocket chronometers for use outside the chronometer room. The chronometers supplied are selected instruments which have successfully passed most exhaustive tests at the Royal Observatory, Greenwich. For astronomical work on shore, the portable Lindqvist chronograph is employed. In this instrument, a chronometer fitted with special contact pieces automatically sends an electric current every two seconds through an electro-magnetic coil, and thus, by suitable mechanism records every alternate second as a perforation on a paper tape, which is kept moving at a uniform rate by means of clockwork. The closing of a switch by the observer operates a second coil, which records the instant of observation in a similar manner by making an additional perforation in the tape.

Wireless Telegraphy for accurate time and obtaining meridian distances has been adopted, and in this connexion the wireless Vernier time signals made by Eiffel Tower may be mentioned.

Amongst minor improvements introduced in surveying appliances since 1910 may be mentioned the standardization of the markings of leadlines, improved buoys for beacon work, light filters for fitting to the eyepieces of sextant and theodolite telescopes.

By 1921, platinised and stainless steel mirrors for sextants and sun signals were under trial; electrical lighting arrangements to sextants and theodolites; eye shields for use in observing to assist in perfect orientation of the head; sextant supports to facilitate observations at sea; the arcless sextant which enables angles to be taken and read off (on a drum) without the necessity of removing the eye from the telescope; wireless telegraphy outfits for use of detached parties, and the gyro compass, were all in various stages of experimental development. The Pillsbury current meter was entirely superseded by the Ekman current meter, and other meters such as the Daisy and Gurley were in use.

In calculating triangulations considerable time is saved in correcting for false station by use of the station corrector diagram, by which the correction can be obtained very quickly to any accuracy required (generally about 5 sec. of arc) and the tedious trigonometrical calculation avoided. The slide rule has come far more into prominence for small rough calculations. As the result of modern inventions, it has been found necessary in recent years to produce special charts for the use of submarines and for other purposes in addition to the ordinary navigational chart. Charts for submarines indicate graphically the nature of the sea bottom, so as to indicate where vessels can rest with safety.

The introduction of wireless direction-finding stations as an aid to navigation has necessitated the production of charts drawn on the gnomonic projection, by the use of which positions can be more accurately determined. Additional charts are also required for testing range-finders and compass adjusting. Physical charts indicate the direction of prevailing winds and ocean surface currents at different periods of the year, localities and time where ice may be fallen in with, and the direction and force of the stream and drift currents of the oceans.

Considerable gain in accuracy has been obtained by printing charts directly on backed paper, whereby the distortion incidental to the old system of subsequently mounting them is largely eliminated. (H. P. D.)

SUTTNER, BERTHA, Baroness von (1843–1914), Austrian writer (*see* 26.171), who in 1911 became a member of the advisory council of the Carnegie Peace Foundation, died at Vienna June 21 1914.

See H. v. der Mandere, *Bertha Suttner* (1909).

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SUTTON, SIR HENRY (1845–1920), English judge, was born Jan. 10 1845. He was educated at Rugby and Christ's College, Cambridge, where he graduated in 1868. He was called to the bar in 1870, in 1890 was made junior counsel to the Treasury, and in 1905 was raised to the King's Bench division, being knighted in 1906. He retired in 1910, and died in London May 30 1920.

SVENDSEN, JOHANN SEVERIN (1840–1911), Norwegian composer (*see* 26.175), died at Copenhagen June 14 1911.

SWAN, SIR JOSEPH WILSON (1828–1914), English physicist (*see* 26.179), died at Warlingham, Surrey, May 28 1914.

SWAYTHLING, SAMUEL MONTAGU, 1ST BARON (1832–1911), British financier, was born at Liverpool Dec. 21 1832, and came of a Jewish family named Samuel, but afterwards took by royal licence the name of Montagu. Beginning in early life in a very humble way of business he gradually acquired great wealth by enlarging its scope, and he rose to the head of the most important arbitrage house in London. A strong Liberal in politics, he sat in Parliament for the Tower Hamlets from 1885 to 1900; he was a member of the Gold and Silver commission of 1887–90, being himself a bimetallist. He was created a baronet in 1894, and raised to the peerage in 1907. Throughout his life he was a zealous promoter of Jewish interests, founding the loan fund of the Jewish board of guardians, the Jewish working men's club and several synagogues, and for his work on emigration schemes for the persecuted Russian Jews he made many journeys in Europe and America, succeeding Sir Julian Goldsmid as chairman of the Russo-Jewish Committee. He also helped to establish a modern secular school for Jews at Jerusalem in 1875. He died in London Jan. 12 1911, being succeeded in the title by his eldest son, Louis Samuel Montagu (b. 1869). His second son, Edwin Samuel Montagu (b. 1879), entered politics, and, after having been Under-secretary for India (1910–4), Chancellor of the Duchy of Lancaster (1915), Financial Secretary to the Treasury (1914–6) and Minister of Munitions (1916), was made Secretary of State for India in 1917. His fourth daughter, Lilian Helen (b. 1873), became a well-known social worker and was appointed J.P. for the County of London in July 1920.

SWEDEN (*see* 26.188).—The Swedish census of 1910 showed an increase since 1900 of 7·5%, from 5,136,441 to 5,522,403 inhabitants. The pop. on Jan. 1 1920 was 5,847,037 (2,868,395 males and 2,978,642 females), of whom 1,701,249 were living in cities, distributed as follows: Norrland (northern division) 1,018,009, Svealand (central division) 1,879,146 and Götaland (southern division) 2,949,882. The density of pop. is rather low; in Götaland 34, Svealand 23 and Norrland only 4 inhabitants per square kilometer. The chief towns with a pop. exceeding 20,000 inhabitants (Jan. 1 1920) were Stockholm (415,201), Gothenburg (200,577), Malmö (111,931), Norrköping (57,377), Helsingborg (45,805), Gävle (36,092), Örebro (35,096), Eskilstuna (30,103), Västerås (29,530), Jönköping (28,875), Upsala (28,041), Karlskrona (27,029), Linköping (26,300), Borås (23,941) and Lund (22,827).

The excess of births over deaths is low: 10·6 per 1,000 in 1910, 6·9 in 1915 and 5·2 in 1919. The birth-rate for 1919 was 19·6 per 1,000. There were 24,704 emigrants in 1906, 27,816 in 1910, 7,512 in 1915, 10,571 in 1916, 6,440 in 1917, 4,853 in 1918, 7,337 in 1919. During the war emigration was naturally difficult. The immigration figures were: 6,357 in 1915, 6,713 in 1916, 5,811 in 1917, 4,932 in 1918, 7,809 in 1919. The United States received the largest contingent of the emigrants, but Norway, Denmark and Canada also received considerable numbers. Swedes resident abroad number between 2,120,000 and 2,245,000, of whom 1,500,000 are in America and 370,000 in Finland.

Occupations.—Agriculture, fishing and forestry provided 48·4% of the pop. with their livelihood in 1910; in 1900 the percentage had been 54·4, and in 1890 61·51, the decline having been progressive since 1840, when the percentage was 80·9.

Those dependent on employment in industry, mining, trade and communications represented 45·8% of the pop. in 1910, as against 38·8% in 1900, 31% in 1890 and 10·7% in 1840. Those following the so-called "free crafts" (*fria yrken*) or engaged in the public service (*allmän tjänst*) represented 5·8% in 1910 (6·8% in 1900, 7·5% in 1890 and 8·4% in 1840). The most significant feature in this development is the increased importance of the industrial section. The census figures for 1920 in this respect were not available in 1921, but this section now represents half the population.

Agriculture.—Cultivated soil included 3,723,000 hectares in 1915, 1,715,000 hectares being used for grain, 1,411,000 for fodder stuffs, 26,100 for root crops, 3,000 for other crops, and 333,000 being left fallow. Gardens in 1915 occupied 47,533 hectares. The total value of the harvests in 1914 was estimated at 1,112,000,000 kr. and in 1920 at 2,012,000,000 kronor. The annual consumption of wheat increased from 47·7 kgm. per person in 1891 to 87·8 in 1915. The consumption of rye diminished from 110·6 in 1891 to 98·1 in 1915. The country's own production of corn has not been sufficient, and large supplies have been imported. During the decade previous to the war about 50% of the wheat was imported, and from 10% to 15% of the rye. The ease with which corn could be imported militated against all attempts to make the country self-supporting in this respect, and efforts came to be concentrated on stock-raising. The number of horses in 1916 was 701,099, of cattle 2,913,159, and of pigs 1,065,396. It was the agricultural policy of the country before the war to import a considerable amount of the corn required and large supplies of maize, oilcakes and other fodder stuffs, and in their place to export live stock, butter and cheese. The balance was not in Sweden's favour if seen merely from an agricultural standpoint. In 1913 there was an exportation surplus for live stock of 16,500,000 kr. and for butter and cheese of 46,700,000 kr., but there was an importation surplus for other animal products of 25,400,000 kr.; for grain, potatoes and seed corn of 58,600,000 kr.; for fodder stuffs of 22,800,000 kr. and for manure of 14,800,000 kr. The balance showed an importation surplus of 58,300,000 kr. Some decades earlier the country was as good as self-supporting, but the great industrial population has come into being since then and conditions of life have been radically changed thereby.

A more intense cultivation of the soil has been carried out with great energy. The splitting up of the land for the most part into small holdings has been a disadvantage to a certain extent. The large farms lead the way, and in localities where modern methods of agriculture sufficiently prevail the small farmers join together in coöperative societies. The scientific study of plant-growing and of manures is carried on in different parts of the country under the guidance of a central institute in Stockholm. Seeds have been greatly improved under the influences of the seed society in Svalöv (in Skåne), which also exports seeds. The Swedish moss cultivation society, which has its headquarters in Jönköping, has taken the lead in the systematic cultivation of the country's wealth in bogland.

Fishing contributes considerably towards the support of the population. The value of a year's catch may be estimated at between 20,000,000 and 30,000,000 kronor. Export of fish provides a balance of gain to the country of some millions of kronor a year. During the years of the World War measures were taken to promote the consumption of fish in Sweden itself.

Forestry.—Out of Sweden's total land area, which amounts to 41,000,000 hectares, 21,400,000, or nearly 52%, constitute forest-bearing land, whereof about 4,900,000 hectares, or 23·1%, are public property. In 1913 the output of sawed or planed timber was estimated at 7,800,000 cub. metres, mechanical wood pulp 326,000 tons, chemical wood pulp 860,000 tons, charcoal 4,300,000 cub. metres, and other products 18,500,000 cub. metres. In the same year the exports of plain sawn and planed wood were valued at 186,900,000 kr., of partly worked wood at 28,600,000 kr., and of wood-pulp at 99,700,000 kr., or 315,200,000 kr. altogether. These exports amounted to 38·6% of the total exports of the country. In certain years the exports of the products of the forests have amounted in value to half the total exports of Sweden. The economic world crisis after the war naturally caused a great diminution in export.

Industry.—Sweden is also rich in iron ore, and her water-falls make her well equipped for industrial enterprises. But coal is to be found in only one province, Skåne, and she is obliged to import large supplies of both coal and coke. The great distances for transport, moreover, entail heavy freight costs. Workmen enjoy a correspondingly high standard of living.

In 1915 the products of manufactories and mines had a value of something over 3,000,000,000 kronor. The extent to which Swedish industries had developed may be seen from the fact that the amount of horse-power in machinery per 1,000 workers had increased to 3,532 in 1915, from 2,841 in 1911 and 1,980 in 1906. The most important wood-sawing industries are found on the coast of Norrland, notably around Sundsvall and Hernösand. The timber is floated down the big rivers from the forests. Paper pulp is one of Sweden's most important exports. Paper is another. The exports of mechanical wood-pulp (dry weight) in 1915 amounted to 150,103 tons, of which 80,783 went to Great Britain. In the same year Sweden exported 721,786 tons (dry weight) of chemical paper-pulp, of which 298,056 went to Great Britain. The iron industry is to be found within a broad belt of land nearly level with Stockholm and a little farther to the north. The use of charcoal has helped to make practicable the manufacture of Swedish high-quality steel. In 1915 there were 135 iron-works (with 28,868 workmen), of which 78 had in all 120 furnaces in use, producing 748,928 tons of pig-iron and 11,773 tons of castings. The exports of iron and steel in 1915 had a value of 97,600,000 kr., as compared with imports of 27,800,000

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kronor. Foundries and mechanical engineering works in 1915 had an output of 339,600,000 kr.; exports were valued at 115,600,000 kr., as compared with imports of 41,400,000 kronor.

During the war some industries throve exceedingly, as, for instance, those of iron, paper-pulp and paper; others suffered appreciably at times from the lack of raw materials, as, for instance, the textile industry. During the second half of 1920 and in 1921 industry was hit hard by the economic crisis.

Commerce.—Sweden's foreign trade in 1910–20 presented a curious picture, inasmuch as the value of her exports during the war period exceeded that of her imports. In 1910 her imports amounted to 669,200,000 kr. and her exports to 592,900,000; the corresponding figures for 1914 were 726,900,000 and 772,400,000. The figures for the subsequent war years were as follow: 1915, imports 1,142,500,000 kr. and exports 1,316,400,000 kr.; 1916, imports 1,138,600,000 kr. and exports 1,556,400,000 kr.; 1917, imports 758,600,000 kr. and exports 1,349,600,000 kr.; 1918, imports 1,233,300,000 kr. and exports 1,350,400,000 kr. After the war the picture changes. In 1919 the figures were: imports 2,534,000,000 kr. and exports 1,575,700,000 kr.; in 1920 imports 3,373,500,000 kr. and exports 2,293,600,000 kr. It will be noted how goods were regularly drawn out of the country during the war, while the imports were inadequate. The circumstance that home-grown wood was to a great extent used instead of imported coal also counted. When the war came to an end the country lacked reserve stocks and needed many articles of consumption. Importation increased, in part on speculative lines, from Germany and Russia, and with results which for the most part were unfortunate.

It may be interesting to give figures illustrating Sweden's commercial relations with the leading belligerent Powers. In 1913 imports into Sweden amounted to 846,500,000 kr.; exports from Sweden to 817,300,000. Her imports from Great Britain amounted to 206,800,000 kr. and those from Germany to 289,900,000 kr.; her exports to Great Britain amounted to 237,300,000 kr. and those to Germany to 179,100,000. Her transactions with Germany were somewhat in excess of those with Great Britain, but the latter country came first as purchaser of Swedish products. During the war a great reduction came. Imports into Sweden from Great Britain amounted to 183,800,000 kr. in 1914; 213,500,000 kr. in 1915; 164,400,000 kr. in 1916; 65,100,000 kr. in 1917; 148,700,000 kr. in 1918 and 668,900,000 kr. in 1919. Imports from Germany came to 238,600,000 kr. in 1914; 251,500,000 kr. in 1915; 420,200,000 kr. in 1916; 288,200,000 kr. in 1917; 447,900,000 kr. in 1918 and 269,100,000 kr. in 1919.

Exports to Great Britain amounted to 258,300,000 kr. in 1914; 329,600,000 kr. in 1915; 320,100,000 kr. in 1916; 216,100,000 kr. in 1917; 252,600,000 kr. in 1918; 509,900,000 kr. in 1919. Exports to Germany came to 174,800,000 kr. in 1914; 486,400,000 kr. in 1915; 437,500,000 kr. in 1916; 352,100,000 kr. in 1917; 292,800,000 kr. in 1918 and 130,800,000 kr. in 1919. During the war years British coal imports into Sweden declined, and Germany largely made good the deficiency, being naturally anxious to secure imports from Sweden. The figures for the Swedish importation of coal and coke, in thousands of tons, during the years 1913–7 were: from England, 4,916; 4,683; 2,816; 1,707 and 604; and from Germany, 431; 335; 2,174; 4,281 and 1,708. It will be seen how energetically Germany came forward in Great Britain's place as exporter to Sweden.

Shipping.—The Swedish commercial fleet in 1910 included 1,214 steamers and motor-boats, of 842,460 total tonnage deadweight; in 1915 1,278 vessels, of 984,799 tonnage; in 1918 1,238 vessels, of 894,260 tonnage. The figures for sailing vessels were in 1910 1,635, of 204,624 tonnage; in 1915 1,422, of 161,650; and in 1918 1,295, of 141,396. The diminution was due partly to war-losses.

Communications.—The Swedish railway system had in 1910 a length of 13,829 km., and in 1919 of 15,154, whereof 4,418 and 5,496 respectively were State railways. Through the thinly populated inner region of Norrland there runs a State railway line which has been opened for traffic between Östersund and Vilhelmina. A single-line railway along the coast of Norrland has been planned out and begun with aid from the State. During the war the railways were sometimes quite overloaded, so that locomotives could not be repaired to the extent they needed, and lubricants and good coal ran short. The increased costs drove up passenger and goods rates.

During 1909–16 the Trollhätte canal was reconstructed and deepened to four metres. The Södertalje canal was in 1921 in process of reconstruction and of deepening to five metres. Through the former operation navigation was made possible to the great Lake Venner and thus between Gothenburg (Göteborg) and the Western mining district, and through the latter a good waterway was being created to the harbour of Lake Mälar.

Social Conditions.—Democracy has a strong hold on the Swedish people, owing to the high degree of education reached by the masses and to their inherited respect for the sanctity of law. Familiarized from an early date with self-government, Sweden had begun already in the closing decades of the 19th century to build up a kind of network of nonconformist religious associations, Anglo-Saxon in their character, temperance unions and friendly societies. When, as the outcome of advances in industrialism, the labour movement began to take shape, it was able to utilize these habits of organization and thus secure a position of considerable power comparatively quickly. Now more than 60% of Sweden's wage-earners belong to trade unions; at the beginning of 1921 these had over 400,000 members, of whom 280,000 combined to constitute the so-called "Lands Organisationen," which may be translated as "The National Organization," while simultaneously the political side of the labour movement, Social Democracy, became a force of the first order. Swedish Social Democracy has relied more and more on parliamentary methods of reform, thereby awakening opposition on the part of the labour extremists, with the result that in 1917 a new Socialist party of the left came into existence, formed for the most part of young men, a large number of whom were strongly influenced by Russian Bolshevism. In the spring of 1921 these latter formed a Communistic party connected with the Third International in Moscow. The bulk of Swedish workmen, however, hold aloof from revolutionary tendencies, thanks to the great extension which has been attained by coöperation. While workmen constitute a typical class party, another class party formed by the association of farmers and countryfolk, under the title of the "Böndeförbund," dated its origin from 1917.

In 1913 a law was passed instituting compulsory old-age and disablement insurance for the entire population. In 1916 a similar accident insurance law was passed. The law passed in 1919 for an eight-hour day was the most advanced of any in Europe. The national administration includes a special social department, as well as a number of boards for dealing with social questions.

The communes also, especially the large towns, have instituted important social reforms; for instance, by creating public labour exchanges, which have been State-endowed since 1907 and are under State guidance and control. In common with the State, moreover, the communes contributed to the general pensions insurance. The guardianship of the poor used to rest on the primary communes, but, through a new Poor Law, passed in 1918, this burden is now in certain cases transferred to the provincial assemblies (Landsting) and the State.

The first decade of the 20th century was marked by the creation and swift growth of employers' associations (notably that known by the name "Svenska Arbetsgivare Föreningen," whose members in 1920 employed nearly 300,000 workmen) and also of associations of landowners; and in several great conflicts, as, for instance, in a five-weeks' general strike in the summer of 1909, in which 300,000 workmen took part, the victory fell to the employers. For a long time the State's only action in the matter remained the passing of a law in 1906 for the intervention of a Conciliation Court in labour disputes. By reason of the high standing, however, of the trade-union organizations, and as the result of frequent collective agreements on both sides, certain conventional methods of treaty came into vogue in the field of labour disputes. In 1920 the Riksdag passed a law instituting a central State conciliation and arbitration court, as well as local courts of the same kind, to pronounce judgment in labour disputes on the basis of their collective agreements.

The Liquor Question.—For close on a century past the alcohol question in Sweden has been a subject for the most serious consideration and for constant measures of reform. The unhappy results of the excessive consumption of gin at the beginning of the 19th century called forth an energetic temperance movement, led by a clergyman named Peter Wieselgren (1800–1877), a "domprost," or dean, of the Lutheran Church; and in 1855 a law was passed which abolished the right to manufacture gin for home consumption and which granted concessions to companies, with no financial interest in the traffic, to sell alcoholic drinks under public control. This "Gothenburg System," as it was designated, brought about considerable improvements in many respects, and the great temperance societies, with a total membership of 450,000, have worked in the same direction. It was, however, only by the new law regarding the sale of liquor which was passed in 1917, and which came into force in 1919, that the underlying principle ("disinterested management") of the Gothenburg System was consistently put into general practice. By this law the selling to individuals of drinks containing more than 3·6% of alcohol was confined exclusively to the so-called "systembolag" ("system company"), with about 150 branches, over the management of which the State authorities have decisive control and which pays over all its profits to the State Treasury except for 5% interest on the capital invested. The controlling of this "system company" is entrusted to a central institution known as "Kontrollstyrelsen." All persons who wish to purchase such liquors for home consumption are registered and receive a pass-book; the total amount of liquor allowed to them being limited to a maximum of four litres a month. The abuse of alcohol is attended by further restrictions or by the absolute withdrawal of the right to purchase. The amount of liquor which may be sold to a customer in a restaurant is also strictly limited and confined to meal-times. This system of liquor-dealing, which was set on foot in Stockholm in 1913 and organized by Dr. Ivan Bratt (coming to be known as the Bratt system), was supplemented by a special measure regarding the treatment of alcoholists. The system had remarkable results, proportionate in large degree to the activity of the leading members of the various companies. The consumption of spirits decreased in many places, for instance in Stockholm, by nearly 50%. The number of cases of drunkenness, which was formerly somewhat high, was reduced throughout the country—in Stockholm and in cer-

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tain other places by 60%—and so was the number of persons suffering from alcoholism. Much opposition from the side of those who regard the restrictions introduced as altogether excessive was brought to bear against the system; on the other hand, a tendency arose among the temperance associations to believe that total prohibition was the only way towards the solution of the alcohol problem. Smuggling and illegal manufacture of spirits developed to a disquieting degree in the years 1917–8. There were signs, however, in 1921 of a return to a better state of things.

Finance.—In 1910 the state budget amounted to 265,200,000 kr., in 1915 to 415,400,000, in 1920 to 929,400,000, and in 1921 to 1,131,100,000. For 1920 and 1921 the so-called "tilläggsstater," *i.e.* supplementary military budgets, are included. The tax revenue in 1921 amounted to 579,200,000 kronor. The consolidated national debt amounted at the end of 1920 to 1,280,600,000 kr.; in 1910 it had been 543,400,000 kronor.

Apart from the national bank, the Riksbank, which alone issues bank-notes, there were in 1910 17 private and 63 joint-stock banks, which in 1920 had decreased to 11 and 30 by amalgamations. Their total paid-up capital and reserve funds amounted in 1910 to 562,600,000 kr. and in 1920 to 1,084,000,000 kronor. At the end of 1920 the Riksbank balanced its revenue and expenditure at 1,017,500,000 kr. and the other banks' balance stood at 7,662,300,000 kronor. The leading private bank is Stockholme Enskilda Bank; the largest joint-stock banks are Skandinaviska Kreditaktiebolaget, Svenska Handelsbanken (formerly Stockholms Handelsbank) and Aktiebolaget Göteborgsbanken.

The circulation of paper money increased from 206,500,000 kr. in 1910 to 759,900,000 kr. in 1920. During the war years the Riksbank was relieved from its liability to meet notes with gold, and also to receive gold in ingots (*see* EXCHANGES, FOREIGN).

The Swedish savings banks in 1919 numbered 477; their deposits amounted to 1,870,800,000 kr. and their capital to 107,100,000 kronor. The post-office savings bank, a State institution, had deposits amounting to 84,400,000 kr. at the end of 1920.

Constitution.—The Swedish Parliament, the "Riksdag," consists of two elected Chambers, the First Chamber being composed of communal representatives. A constitutional change of a radical kind took place in 1907 and was confirmed by the Riksdag of 1909. The communal suffrage was on a scale proportionate to income, the graduation was now limited so that no person could have more than 40 votes, the bulk of the middle classes thus acquiring a preponderance. Absent voters could delegate their voting rights to others. Women had the communal suffrage in proportion to the degree in which they themselves were liable to taxation. Proportional representation was introduced in the case of both Chambers. Members of the First Chamber, in common with those of the Second, were paid. The suffrage in the case of the Second Chamber became universal and remained, as before, equal for all.

By Riksdag resolutions in 1918, 1919 and 1921 the constitution was further developed in a markedly democratic direction. Under these reforms the First Chamber consists of 150 members, elected by proportional representation by the provincial assemblies, *i.e.* either by "Landstingen" or by specially formed bodies of electors, chosen also by proportional representation by those possessing the communal suffrage. The communal suffrage is universal and equal; it is no longer graduated and it is personal. When it was graduated in proportion to income, business companies possessed the communal suffrage. Anyone who fails to pay his taxes for three successive years forfeits his right to vote. Women have the same voting rights as men. The age at which the voting right is acquired is 23, but the age is 27 for the right to vote for the members of the provincial assemblies which elect the First Chamber. The right to vote by proxy is abolished, but a husband may deliver a wife's vote in a closed envelope, or a wife a husband's. Similarly, in the case of both the communal elections and the elections to the Second Chamber, soldiers on active service, absent seamen and fishermen, and employees of railways, ports, customs and pilot services may send in their votes by post.

The number of the voters in the communes has been more than doubled. After the reform the communes' lists of voters contained nearly 3,300,000 names, *i.e.* more than 56% of the pop., and of these about 1,600,000 were men and 1,700,000 women. In March and April 1919 took place the new communal assembly elections: in two 'Landsting' out of 25, and in 20 towns out of 107 (among them Stockholm), the Social Democrats and Socialists of the Left together won absolute majorities. In ten 'Landsting' and 38 towns the Social Democrats were the strongest party. The election periods are eight years for the members of the First Chamber, one-eighth of whose number are elected each year; and four years for the Second Chamber's 230 members, who are all elected at one time. Women as well as men are eligible as members of both Chambers. The age at which a person becomes eligible for the First Chamber is 35, for the second 23. To be eligible for the First Chamber a person must have a certain specified income or property. If a member can no longer perform his duties, his place is taken by a substitute elected at the same time as himself. The Riksdag is called together every year on Jan. 10 for its ordinary meeting.

In 1921 the Riksdag passed an Act to provide that a consultative referendum shall be had recourse to when the Government and the Riksdag think it desirable to take the opinion of the people direct by plebiscite on some important question before its decision by the Riksdag. The proposal decided on must be submitted once again after a new Second Chamber election before it becomes binding. Another constitutional change was involved in the creation of a foreign affairs committee, which the Riksdag shall elect every year, and with which the Government shall take counsel regarding foreign affairs. The Riksdag's right to share in decisions regarding agreements with foreign countries has been extended. Yet another constitutional novelty is the right given to women to hold office under the State where no special hindrance lies in the way.

HISTORY.—On the death of King Oscar on Dec. 8 1907 he was succeeded by his eldest son Gustav V. Rear-Adml. Arvid Lindman had been at the head of the Government since May 1906, with Erik Trolle, former Swedish minister at Berlin, as Minister of Foreign Affairs; Carl Swartz, a manufacturer, as Minister of Finance; Maj.-Gen. Lars Tingsten as chief of the Department of National Defences, and Alfred Petersson i Påboda, a landowner, as Minister of Agriculture. In 1907 this Ministry had carried a measure of constitutional reform, embodying universal suffrage in regard to the Second Chamber and proportional representation in regard to both Chambers; and this measure, in accordance with statute, was confirmed by the Riksdag of 1909 after the election of members of the Second Chamber in the autumn of 1908. Owing to a divergence of opinion within the Ministry upon an important point bearing upon the extent of the Riksdag's powers, Trolle, Petersson and one other minister resigned in 1909. The new Foreign Minister was Count Arvid Taube, who had succeeded Trolle as representative of Sweden at Berlin. Some time afterwards Maj.-Gen. Tingsten also resigned. Moderate Conservatism was the note of this Ministry. The ministerialist party in the Riksdag had a majority in the First Chamber and a minority in the Second.

The National Defence Question.—At this period the problem of national defence was in the forefront of Swedish politics, inasmuch as the foreign affairs of the country were in a condition calculated to arouse anxiety. The union with Norway had been dissolved in 1905 and Sweden now stood alone in respect to foreign politics. Finland, which in 1809 had been taken from Sweden and united to Russia, had been having its autonomy more and more reduced, and Russia's foreign policy seemed to show a forward tendency westwards. A great variety of new military measures in Finland seemed to point to something more than a desire on the part of the Russian Government to prevent a German invasion of Southern Finland in the event of a Russo-German war. Right up to the north of the Gulf of Bothnia a network of railways was being spread out for military purposes, and new strategic lines were constructed of a kind necessitated neither for purposes of defence against Germany nor for purposes of trade. Barracks sprang up at the railway junctions. In Sweden Russian spies were ubiquitous, and a Russian military attaché had to be recalled on the ground of having pushed inquisitiveness beyond all limits. A handbook was produced for the use of the Russian military service containing information about the conditions of life in Sweden, and with Swedish maps in it, as well as a short vocabulary of military terms in Russian and Swedish. Swedes had an uncomfortable feeling that the attention of Russia was being directed altogether too closely upon their inadequately defended country.

A careful enquiry into the question of national defence had been undertaken in 1907. The Liberal members of the committee of investigation which was appointed were dissatisfied with its estimate of the defence expenditure required, and signified their attitude by withdrawing from it in 1910. This militated somewhat against the efforts of the committee, and it proved to be impossible, as had been intended, to submit a new scheme of national defences to the Riksdag of 1911. Instead of this, the Government brought forward a proposal for a new naval programme, and, in the face of opposition from the Liberals and Social Democrats, carried a bill, as a first step, for the construction of a powerful new battle cruiser.

Liberals in Office.—In Sept. 1911 the general election for the Second Chamber of the Riksdag, under the reformed methods which had almost doubled the electorate, resulted in increasing

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the strength of the parties of the Left. The Liberals elected numbered 101, the members of the Right numbering 65 and the Social Democrats 64. Admiral Lindman's Ministry resigned, and in Oct. the King entrusted Karl Staaff, who had been prime minister in 1905–6, with the task of forming a new Government. This Ministry remained in office until Feb. 1914. Count Albert Ehrensvard, previously Swedish minister at Washington, became Minister of Foreign Affairs, and both of the departments of national defence were placed under civilians, in accordance with the Liberal view that there should be greater civil control. Alfred Petersson, who had gone over to the Liberals, became once more Minister of Agriculture. The question of national defence again came up for treatment, but upon different lines and almost exclusively at the hands of the members of the Left. It had not been possible to proceed further with the projected new ironclad than the making out of the designs. The Government proposed to the Riksdag of 1912 that the project should be abandoned and the Riksdag agreed. This cancelling of a previous decision of the Riksdag, on account of the new elections having altered the composition of the Second Chamber, evoked strong dissatisfaction. Within a brief space of time a sum of 17,000,000 kr. was raised by voluntary subscription for the building of the ship, and since the Government was unable to decline to use this fund the keel was laid down on Dec. 1. The whole country was now stirred up, and further sums were subscribed in the same way to furnish machine-guns for the Landsturm and to provide aircraft. Towards the end of 1913 things had come to such a point that the prime minister was able in the course of a speech to advance arguments in favour of a forthcoming proposal for a winter training for the army, the establishment of reserve forces, the levying of a higher war-tax on the more well-to-do, the amelioration of the laws governing war, etc. But in view of the election promises to which the Liberal leaders had committed themselves during the contest of 1911 this programme was not to be submitted all at once; its most important item alone, that of the training of the infantry, would in the first place be submitted by itself on the occasion of the Second Chamber elections of 1914 before being proposed to the Riksdag. The public discussion of the matter became very lively, and although no thoroughgoing defence programme was in fact submitted to the Riksdag of 1914, violent feelings were aroused and expressed.

At last even the small farmers and peasantry, usually anything but enthusiasts for defence measures owing to the heavy personal taxation entailed, were drawn into the movement. On Feb. 6 1914 there was a great meeting in Stockholm of more than 30,000 representatives of this class from all parts of the country, assembled for the purpose of bringing home to King Gustav their anxiety at not seeing the question handled promptly and in its entirety. They were received by the King in the great courtyard of the Royal Palace, and their spokesman declared that the Swedish people were willing to bear the burden of whatever measures of defence were necessitated by the gravity of the time. The King answered that he, too, was of opinion that the problem called for treatment in its entirety and without delay.

This demonstration had important consequences at once. The Ministry had had no previous intimation of what the King was going to say, and matters were brought to a head by the resignation of Staaff and his colleagues. On Feb. 17 a new Ministry was formed, with Hjalmar Hammarskjiöld as its head.

Policy of Reform.—In connexion with foreign affairs during this period it may be added that, by arbitration at The Hague, the sea boundary between Sweden and Norway was fixed in accordance with Sweden's claim, and Sweden became a party to the North Sea and Baltic Agreement of 1908. By dint of close coöperation between the Government and the Riksdag a large number of important reforms were instituted. Among those carried through during Adml. Lindman's administration may be mentioned (in addition to the franchise measures above noted) the creation of a supreme administrative Court of Justice (*Regerings rätten*), together with a legal council, formed of some members of the Supreme Court, as advisers to the Government in legislative matters. Civil marriages were made permissible for all members of the State church. New laws were introduced as to farmers' tenancies and the leasing and letting of houses, flats, etc., and the speculative operations of the big companies dealing in land in Norrland were restricted and placed under control. A new company law was passed by the Riksdag and also a new banking law. A progressive income and property tax, based on the taxpayer's own statements as to both, was also introduced, together with a progressive inheritance tax. Custom-house duties were remodelled and the sugar-tax modified. An arrangement was come to with the Grängesberg Co. in regard to its iron-ore business in Lapland, by which the complicated question of proprietorial rights was so settled that the State joined in as part owner, receiving preference shares to the value of 40,000,000 kr., a specified royalty on the proceeds of the mining at Gellivara and Kirunavara and the right of redemption after a specified period. Large grants were made to the electric power stations at Trollhättan and Älvkarleby in central Sweden, as well as to that at Porjus in an uninhabited region of Lapland, and a widening of the Trollhätte canal was put in hand. A new law regarding insurance against illness was passed. Night work in certain occupations was forbidden for women. Improvements were made in higher technical education. In 1909 a sharp conflict arose between employers and workmen, and the latter organized a general strike in which nearly 300,000 took part. There were, however, no disturbances, thanks both to the discipline maintained and to the wise measures adopted by the Government. Social life was not brought to a standstill, as the workmen expected, and after a lapse of two months the conflict was brought to an end.

While the reforms introduced by Adml. Lindman's Ministry lay mainly in the sphere of economics and industry, the Staaff Ministry devoted its energies more especially towards social questions. A new social department was instituted, as a centre for the State's activities in this direction. The law bearing on the protection of workmen was extended, and various forms of workmen's unions were placed under control. A law was passed regulating the methods of dealing with alcoholists. The profits of the sale of spirits by the communes were allocated to the State, compensation being allowed therefor, the object of this being to free the communes from all economic interest in the liquor trade. After long preliminary planning, an illness and old-age pensions insurance law was passed, enacting obligatory insurance, with payments in three degrees, for all, except pensioners of the State, between the ages of 16 and 66, the pensions to be given in case of illness, or on the completion of the 67th year.

The War Years, 1914–8.—In the ministry which Herr Hammarskjiöld formed in Feb. 1914 Herr K. A. Wallenberg, the banker, was Minister of Foreign Affairs; Herr Dan Broström, shipowner, Minister for Naval Defence, and Herr Oscar von Sydow was Minister of the Interior. The Second Chamber was dissolved, and after a very sharp contest the advocates of active defence measures were returned in increased numbers, but without having secured a majority, polling 86 seats out of 230, while the Liberals numbered 71 and the Social Democrats 73.

The Riksdag met again in May, and the outbreak of the war brought with it a solution of difficulties, inasmuch as all parties recognized that there must be no disputing as to details of defence at a moment when the whole surrounding world was aflame. Universal military service had already been introduced, but now the training time for infantry was increased to 340 days, of which 250 were to be spent in recruit classes beginning in the autumn and continuing throughout the winter, followed by the usual training courses during three years. In order to secure non-commissioned officers of the right kind it was judged well to impose a longer training time, extending to 485 days, on students and other young men of similar standing, while for cavalry and artillery the period was fixed at 365 days. Large sums were allotted for the provision of war materials and for the strengthening of the coast defences. A programme was drawn up for adding new vessels to the fleet. Simultaneously with these steps towards increasing the defences of the country, measures were introduced for modernizing the existing code of punishments for military

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offences, this being accompanied by the creation of a special official, to be appointed by the Riksdag, whose duty it would be to inquire into all allegations regarding abuse of power or other derelictions on the part of superior officers in the army or navy—an appointment designed to act as a protection for soldiers and sailors against injustice.

An official declaration of neutrality was published without delay, and all the ministries holding office during the war, with the Riksdag's expressed approval, aimed at remaining absolutely neutral. Neutrality involved the duty of preventing any of the belligerent Powers from using Swedish territory as a basis for operations against enemies. Throughout the entire war the Swedish fleet remained on guard along the coasts of the country and on several occasions it had to take active measures. During the summer of 1916 there were many violations of neutrality in Swedish waters. In order to elude the observation of foreign battleships, trading vessels, flying the flags of belligerent countries, or carrying dangerous freights, sought to get through a channel called Kogrundsrännan within Swedish waters in Öresund, and apparently frequent attempts were to be expected on the side of belligerent countries at both ends of this channel to seize enemy vessels even at the risk of this occurring within Swedish waters. This channel was closed therefore against all but certain known Swedish vessels. The Allied Powers considered this action incorrect and protested, but the channel remained closed until Dec. 1918. A number of trading vessels belonging to the Allied Powers, which, owing to the closing of the channel, were confined in the Baltic, were, however, allowed egress on the condition that the Swedish population received a certain measure of necessary supplies from the west.

The stagnation produced by the outbreak of the war as regards foreign trade and shipping did not last long. Sweden became for a time, like Holland and Italy, an intermediary in the American trade with Germany, quite in accordance with international law as it stood before the war. When, however, the Allies proceeded to employ more and more stringently their weapon of blockade against the Central Powers this business as intermediary came quickly to a stop. The intensifying of the war at sea brought with it great obstacles in the way of neutral commerce. Its most painful feature was the sinking of neutral vessels by the German submarines, with its accompanying loss of lives. The mines which were spread about by other groups of belligerents also claimed many victims. The proceedings of the submarines called forth much indignation, and protests were made, but without much effect. The measures of the Allies were of a different order, but their control over shipping presently became so oppressive that protests against this also were made, the weightiest protest coming from the three northern kingdoms acting together. Sweden's geographical position and the commercial conditions which existed before the war necessitated the maintaining of relations with both sides. Trade transactions with Germany were in 1913 somewhat in excess of those with Great Britain, but Great Britain was the larger purchaser of Swedish products. During the war one great displacement in trade resulted from the diminution of Sweden's imports of coal from Great Britain and the consequent necessity of making good this diminution by imports from Germany.

Despite all the difficulties to be encountered it proved possible to maintain importation into Sweden from the west of raw materials, grain and other necessaries down to well on in 1916, but from this time onwards there was an increasing scarcity. When the Allies intensified their blockade, and Sweden could not break off trade relations with Germany, the blockade-line was drawn not between Sweden and the Central Powers but west of Sweden and the other Scandinavian countries. All goods which had to pass the blockade-line in the North Sea on the way to or from Sweden were subjected to sharp control. As regards goods from Sweden certificates of origin and ownership had to be furnished, to make sure that they were not in reality disguised exports from Germany, while in the case of goods for Sweden guarantees were required to the effect that they would not be forwarded to Germany. Suspected goods were unloaded in British seaports. Black lists caused serious losses to conscientious tradesmen as well as to others. Both groups of belligerents set on foot elaborate systems of trade espionage in neutral countries. In order to regulate the undertakings which the belligerents demanded from merchants, manufacturers and shipowners, the so-called War Trade Law was passed in 1916 to give legal value to officially recognized undertakings to foreign Powers, while at the same time it was laid down that undertakings not thus recognized lacked all legal value. A special trades commission was created to investigate all questions connected with this matter. The international goods exchange came to be worked like an enormous system of compensation, controlled by State officials by means of agreement. Every neutral country had to offer some equivalent in return for its imports. During the first years of the war it was to the interest of the Allied Powers that goods should go through Sweden to Russia. The great consignments caused inconvenience to the Swedish railways, but they made things easier for Sweden in the matter of imports.

Negotiations were set on foot for a commercial agreement between Sweden and Great Britain and her Allies, but they led to no result during the time of Herr Hammarskjiöld's Ministry, and this fact was turned to account against him in the political conflict which went on over the internal affairs of the country. After this Ministry resigned on Mar. 1 1917, and Herr Carl Swartz formed a new Government, the Foreign Minister, Adml. Lindman, brought about a temporary agreement by which the Swedish people were allowed the right to import nearly 92,000 tons of grain and about 40,000 tons of other goods, on the condition that certain vessels belonging to the Allies then confined in the Baltic should be allowed egress through the closed channel of Kogrund.

After Herr Eden's Ministry succeeded to that of Herr Swartz in the autumn new discussions were entered upon in regard to imports. In Feb. 1918 a so-called *modus vivendi* agreement was come to, enabling Sweden to import about 75,000 tons of maize, feeding-stuffs, raw phosphate, mineral oils and coffee, and in June a more comprehensive agreement was reached, in accordance with which it was possible to import larger quantities of grain, feeding-stuffs coal, oils, india-rubber, cotton, wool, hides, etc. In this connexion Sweden placed at the disposal of the Allies a portion of her commercial fleet. In addition, Sweden guaranteed to the Allies a certain share in her iron-ore exports, and also undertook to allow a certain amount of credit for goods bought in Sweden. In this way Sweden's most essential import was made sure of until the end of the war. In consequence of the universal scarcity the three Scandinavian countries came to an agreement as to the mutual exchange of commodities.

The hard conditions which prevailed during the war brought Sweden and Norway closer together again. After the severance between Sweden and Norway in 1905, and the election of a Danish prince as King of Norway, the relations between the Scandinavian countries had been somewhat cold. King Gustav, who at one time had been the Norwegian Crown Prince, himself took the initiative, and in Dec. 1914 invited the Norwegian and Danish monarchs to a meeting at Malmö, at which the affairs of the three countries as affected by the war came under discussion. Other such consultations followed, for instance at Christiania in Nov. 1917, and the prime ministers and foreign ministers of the three kingdoms also came together, while on some occasions of importance there were meetings at which special delegates were present.

In Jan. 1918 Sweden gave her recognition to the new Finnish State. When, shortly afterwards, the Red outbreak occurred in Finland, there was a strong movement in favour of Sweden's joining in on the side of the newly formed Finnish Government, but when the Russian troops began to take part in the struggle on the side of the Reds, Russia continuing to be a belligerent Power, the Government and the Riksdag agreed that it would not be wise to intervene. Swedish volunteers fought on the side of the Whites, and a couple of Swedish ambulances were sent over. Swedish refugees were brought back from Southern Finland. While the civil war in Finland was still in progress a petition came from the inhabitants of the Åland Is. for Swedish

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protection against aggression on the part of Russian troops which were stationed there. Troops were sent from Sweden to maintain order on the islands, and they achieved their purpose. When Germany, however, came to the support of the Whites and landed forces on the Åland Is., the Swedish troops were withdrawn.

Economic Measures.—At the very beginning of the war period the Swedish Government carried through several special administrative measures. The exportation of a number of commodities of great importance was prohibited, partly in order that they might be kept for home consumption, partly in order that they might control the exportation by export licences. This system was gradually developed until at last the export of *all* important goods was prohibited. An Industrial Commission and an Unemployment Commission were set up to decide on the measures which should be taken to maintain industrial work and to mitigate the serious condition of unemployment which threatened. A Food Commission was appointed to study the development of the market, and a National War Insurance Commission was charged with the task of dealing with insurances against loss of life and property through the war on the seas, as the private insurance companies were unable to undertake all the risks. The Riksdag's legislative powers were also called into play. A financial Moratorium was instituted at an early date. The Riksbank's obligation to meet its own notes with gold was suspended, and new laws were introduced giving the Government new powers, which were employed when necessary, to effect the compulsory purchase of goods from individuals and to fix maximum prices on commodities. Swedish vessels could not be sold to other countries without the Government's sanction, nor could they carry freight from one foreign country to another. All this accumulation of legal measures, which presently had added to it the law against unreasonable increases in rent, the law against " profiteering " and several others, did not come about at once but grew out of the needs which were created by the conditions of the war period. New organs for war-time administration were formed in the Trade Commission (June 1915) and the Food Control Commission (autumn 1916), the former of which had to apply the War Trade Laws and to supervise exports and imports, while the latter, as the successor of an earlier Food Commission, took in hand the food rationing of the country.

Rationing.—Before the war Sweden produced about four-sevenths of the cereals which she required; the rest had to be imported. On the other hand, she exported live cattle, pork and butter, the production of which was made possible by the importation of feeding-stuffs. The fodder harvest of 1914 was so scanty that it necessitated a reduction of live stock. The importation of cereals was undertaken by the State through the agency of the Food Commission. When there began to be a scarcity in some of the animal foods, and prices suddenly rose, recourse was had to the fixing of maximum prices for the first time in Nov. 1915. In the course of the year also the exportation of animal foods was restricted and producers were obliged, in return for the granting of export licences, to allot a certain proportion of their goods (" compensation goods " so-called) to the State for sale by the communal authorities at low prices to those who were less well-to-do. In the autumn of 1916 the scarcity of animal foods became so serious that rationing had to be decided on, and, even so, anxiety was occasionally felt lest the supplies should fail. The situation was aggravated later by the bad harvest of 1917. In Oct. 1916 it was decided that nobody should obtain sugar without presenting a sugar-card. These sugar-cards gave a person the right to purchase 13 kgm. of sugar a year, with an additional amount for preserving purposes to each family. In Jan. 1917 bread-cards were introduced. Farmers were allowed to retain a certain quantity of corn but had to sell all the surplus to the State. All such stores, whether bought by the State or imported, were rationed out to the rest of the population, who were given bread-cards providing at first allowances of 250 grammes a day to each person, later only 200 grammes, but again 250 in Nov. 1918. Persons engaged in particularly arduous work were allowed extra rations. The bread-cards were used also on journeys. The carrying out of this work of rationing needed very thorough supervision, and this evoked dissatisfaction and annoyance, especially among the farmers. The system was changed in the food control year of 1918–9, each farmer being called upon to supply a certain specified quantity of corn and being allowed to do more or less as he pleased with what he had left. Rationing ceased at the end of Aug. 1919.

The supply of bread was scantier than in normal times, and it had to be supplemented with other food-stuffs, especially potatoes. The consumption of all these rose enormously and a great scarcity began to be felt, most severely in the late winter and in the spring of the year 1917 and 1918. People had to have recourse to the eating of turnips. In the spring of 1917 there were food riots in various localities. In 1918 the danger of famine became worse, but calm prevailed. In the autumn of that year potatoes also had to be rationed, but this expedient did not work well. In densely inhabited localities milk was so rationed that the needs in the first place of small children, then of pauper children and the old and the sick were supplied. The exportation of meat, including bacon and pork, ceased altogether in the first half of 1917. The scarcity of fodder became at times so intense that moss and heather and even pine-needles had to be employed as substitutes in the cow-sheds. The selling of bacon and pork was placed under strict control, but only with the result that both disappeared almost altogether from the open market. The rationing of butchers' meat was considered, but it was not thought safe to take this step. Among other things rationed was coffee. The scarcity of food generally caused the Government to do what it could to intensify production by the putting of new land into cultivation, etc.

The Fuel Question.—The fuel question was beset with difficulties although Sweden is so rich in wood. Before the war about 5,000,000 tons of coal and coke were imported, for the most part from England. When, during the war, the importation from England ceased, and Germany was unable to supply as much as England used to do, the country was faced by a very serious scarcity of fuel. This was at the beginning of 1917. The regulation of the business of the wood supply was then entrusted to the Fuel Commission, which put wood-cutting operations in hand on an enormous scale. In Nov. 1917 56,000 workmen were in employment at wood-cutting. Down to May 1918, when the work ceased for the most part, 19,400,000 cub. metres of wood had been cut. Forest owners were allowed to make provision for their own needs. Other households had certain specified quantities allotted to them, according to the number of persons in each, special wood-cards being provided and the price of the wood being fixed at figures which did not quite cover the cost. Those persons who wished to buy more could do so but at higher figures. Factories and railways had to pay higher prices. The result was that fuel was always available in sufficient quantities, but that the wood supply involved a loss to the State of over 100,000,000 kronor.

Industry during the War.—The importation difficulties reacted also upon industries. There was a great scarcity of lubricants. This was partly met by the use of substitutes. The textiles, rubber and leather industries, as well as several branches of the chemical industry, suffered from the lack of raw materials. The scarcity of copper and certain other metals and metal alloys had injurious results on the working of electrical machinery and generally throughout the whole sphere of mechanical engineering, but, on the whole, Swedish industries were kept going under favourable conditions. To deal with the importation of raw materials, which was controlled by the Allies, import associations were formed by the manufacturers who needed the raw materials in question. These associations furnished the guarantees required by the Allies and imposed corresponding guarantees on the delivery of the small quantities thus dealt out. The associations were controlled by the Trade and Industry Commissions. In cases where the supply of certain goods was exceptionally small the State laid claim to the whole, and a system of rationing was sometimes carried out by Raw Material Associations, formed by the manufacturers and craftsmen who were in need of them. In 1916 steps had to be taken in regard to regulations for the sale of

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lubricants, iron pyrites, German iron, and hides, skins and printing paper. The first article to be appropriated by the State was linseed oil, next came hemp and india-rubber. In 1917 hides and skins were appropriated, as well as lubricants, leather shoe-soles, several metals, rails, paraffin, etc. Tickets for the purchasing of benzine for motor-cars and motor-boats were provided through the agency of the Industry Commission. All fat from the bones of mammals and all offal, etc., were turned to scientific or technical account. The use of carbide lamps increased swiftly, as carbide is a Swedish product. The Swedish iron-works and factories were constrained to supply iron goods at reduced prices to cultivators of the soil. In April 1918 rationing of wool began, as well as of cotton yarn, woollen or cotton stockings and woollen or cotton textiles and underclothing of these materials. Purchasing cards were supplied only where the need of them was genuine and "controlled." In Nov. 1918 the rationing ceased.

There was actually no very serious unemployment during the war. A great number of men who lost their work in the building and textile industries were employed in wood-cutting, clearance work in the forests, executing orders for supplies of stone for the communes, etc.

High Cost of Living.—High prices were the combined result of scarcity and the inflation of paper money. The prices of goods rose higher than in Great Britain, for example. Official investigations show that if a family which had an income of 2,000 kr. in 1914 sought to keep up the same kind of living its expenditure would have been increased to something over 3,000 kr. a year according to the prices which prevailed in May 1917, and to over 4,850 kr. according to those which prevailed in Oct. 1918. Wages had to be raised considerably. The State granted war bonuses which amounted in all to a sum total of 100,000,000 kr. a year. The State and the communes expended large sums also in subsidies. From Dec. 1916 down to the middle of 1920 the sum of 112,500,000 kr. was used for lowering the prices of food, clothes and fuel and, in some exceptional cases, rent, for the poorer classes. Of this amount the State provided 77,000,000 kr. During the first half of 1918 389,000 families, or 1,344,000 persons, benefited by purchasing goods at these lowered prices. The building industry was at a standstill almost entirely. The State took steps to help it but without much success.

Changes of Government.—At the beginning of the war all the burning questions of internal politics were put on one side, and all efforts were concentrated on solving the problems presented by the new condition of affairs. In the autumn of 1914 the new elections for the Second Chamber took place. The party of the Right remained unchanged in numbers, 86, the Liberals numbered 57 and the Social Democrats 87. Dissatisfaction with Herr Hammarskjiöld's Ministry increased gradually, the Government—as always happens—being held to blame for the hardships of the times. The Opposition contended that the ministers showed a lack of diplomacy in their negotiations with Great Britain and that they had not paid due regard to the opinions of the Riksdag—certainly the coöperation between the Government and the Riksdag was not what it might have been. In March 1917 the Ministry resigned. In an address with 600,000 signatures Herr Hammarskjiöld and his colleagues were urged to continue in office, but they persisted in their desire to withdraw. Herr Carl Swartz, who previously had been Financial Minister, formed the new Government, which was Moderate Conservative in character.

The Swartz Ministry, in which Adml. Arvid Lindman was again Foreign Minister, lasted only into the autumn. From the start it had borne the stamp of a stop-gap Ministry, inasmuch as the new elections were to be held in September. These went against the Right because, among other reasons, the prevailing hardships and the various measures of State interference were laid to their blame. The Right polled 59, the Liberals 62, the Social Democrats 86, while two new parties, the "Böndeförbund"—a league of farmers and countryfolk—and the Socialists of the Left came in with 12 and 11 respectively. The Ministry resigned and the King tried to arrange for a Coalition Government representing all parties. This effort proving unsuccessful, the Liberal leader, Prof. Nils Eden, undertook the task of forming a Liberal-Social-Democratic Government. The prime minister himself, the Foreign Secretary, Herr J. Hellner, and five other members of the Government were Liberals; Herr Hjalmar Branting, the leader of the Social-Democratic party, was for a short time Finance Minister; Baron Erik Palmstierna, a former naval officer and a Social-Democratic member of the Riksdag, was Minister of Marine; there were two other Social-Democratic members of the Government, which adopted a Liberal-Radical programme.

After the War.—The Riksdag of 1918 passed, among their legislation, a new Poor Law and a new Education Law, reflecting the increased influence of the wage-earners. The wind of reform blew more and more strongly in the autumn. An extraordinary meeting of the Riksdag was called and very noteworthy decisions were come to, which were ratified by the Riksdags of 1919 and 1921, involving (*see* under *Constitution*, above) an immense democratizing of the administration. The consequences for the First Chamber showed themselves at once, when the Government dissolved it in the autumn of 1919 and the new election took place. The chamber had been made up of 86 Conservatives, 43 Liberals, 19 Social Democrats and two Socialists of the Left. This was now altered to 38 Conservatives, 40 Liberals, 19 members of the "Böndeförbund," 49 Social Democrats and four Socialists of the Left. The greatest novelty lay in the women's vote and in their eligibility for both chambers of the Riksdag.

After the termination of the war in Nov. 1918 the emergency measures were almost entirely abandoned. The regulation of the bacon-and-pork-selling business ceased in Jan. 1919 and the rationing of potatoes in May. In Aug. bread-cards disappeared and the rationing of sugar also stopped on Aug. 1. Most of the industrial regulations came to an end during the first quarter of 1919. The Fuel Commission administration of the rationing of fuel terminated on March 1 of the same year. With the close of May the War Insurance Commission ceased its operation. The Riksdags of 1920 and 1921 renewed in modified form some of the emergency laws, but at the end of the first half of 1920 all that remained of the various Commissions were some small committees of liquidation.

When the League of Nations was still in process of formation the Governments of Sweden, Denmark and Norway appointed committees for the purpose of considering together their attitude towards it. The Swedish Government laid its proposal to join the League before the Riksdag of 1920. Opinions were divided: the decision was given in favour of accession by 86 votes against 47 in the First Chamber and by 152 against 67 in the Second. The Riksdag incorporated in this decision an expression of approval of the basic principles of the League, but formulated also its conviction that the Government should avail itself of every opportunity for urging that the States not invited at first to join the League should be incorporated in it as soon as possible; that a more satisfactory arrangement should be come to for the representation in it of the smaller States; that more definite rules should be framed for the meetings of delegates and for their methods of work; that the standing international tribunal should be constituted as soon as possible, and that its procedure in regard to mediation and arbitration should be more clearly defined and further elaborated; and also that efforts to bring about a universal and effective reduction of armaments should be set on foot without delay and vigorously pursued.

Sweden was represented at the International Labour Conference in Washington in 1919 and at that in Genoa in 1920, as well as at the League of Nations' first meeting at Geneva in 1920, when the Swedish delegates acted on the lines indicated in the Riksdag's utterance. In May 1921 the question between Sweden and Finland as to the sovereignty over the Åland Islands was settled by the League of Nations in favour of Finland (*see* Åland Islands).

Sweden did not formally recognize the Soviet Government in Russia, but at first a Russian representative was allowed to reside in Sweden to maintain the *de facto* relations between the two countries. In Jan. 1919 he was obliged to leave (but not until

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Swedish residents in Russia had been enabled to return home) because of oppressive conduct in Russia towards Swedes and in regard to Swedish property. All trade relations were for a time broken off, but to an enquiry from the Allied Powers as to whether Sweden would take part in a blockade of Russia a reply in the negative was given. In 1920 permission was accorded to a Russian trade delegation to visit Stockholm. From the Russian side large orders for railway engines were placed with Swedish manufacturers, and much Russian gold passed through Sweden, mostly destined for America.

The Eight-Hour Day.—Within the ranks of the Eden Ministry there was from the beginning a fundamental divergence of view between the Liberals and the Social Democrats, but for some time it was possible for them to work together. Moreover, this Ministry was the only one for a long time past which had a genuine majority, though a very heterogeneous one, in the Riksdag. The most important measure introduced in 1919 was for a legalized eight-hour day, but when first proposed it was rejected by the First Chamber. The Government dissolved the Chamber, and after the new elections an extraordinary autumn session was called at which the eight-hour day proposal was accepted. The Right had retained only 38 seats, the Böndeförbund coming back with 19, the Liberals with 41, the Social Democrats with 49, and the Socialists of the Left with three. According to this law, which was to hold good provisionally until the end of 1923, 48 hours in the week constitute work-time in industrial and other businesses in which at least four employees work at an employer's expense, agricultural work and forestry work excepted. As a general rule over-time must not be instituted to a greater degree than 150 hours in the year. A newly founded institution, the Labour Council, decides questions concerned with the carrying out of the law. A number of flaws were soon discernible in the law, and in the Riksdag of 1920 this Council applied to the Government to effect certain improvements. A proposal was laid before the Riksdag of 1921 and was in the main accepted. The modifications left the main principles of the law unchanged. Sweden subsequently declined to ratify the draft of the Washington Convention of the League of Nations on hours of labour, partly because it conflicted with the Swedish measure already passed, and partly because adhesion would be binding for 11 years, while the Swedish law held good provisionally for a shorter period.

The Social-Democratic Ministry.—It was over the communal taxation question that the Eden Ministry went to pieces. This question had for a long period been under discussion, and it was intended to submit some proposal in connexion with it to the Riksdag of 1920. The Social-Democratic members of the Government asked for a definite settlement, while the Liberals wanted only a provisional solution. The end was that the entire Ministry resigned, and that the King invited the Social-Democratic leader, Herr Branting, to form a new Government. In March 1920 he did so. Baron E. Palmstierna, formerly Minister of Marine, became Minister of Foreign Affairs. All the ministers were Social Democrats. The new Government could only count on minorities in both Chambers as a regular Ministerial party. The discussion of the communal taxation question ended in a victory for the Liberal standpoint, a provisional arrangement. In the meantime the Ministry awaited the result of the general elections to the Second Chamber in the autumn of 1920. A comprehensive programme was put forward by means of commissions of inquiry into projects of socialization, industrial democracy, and the control of trusts and other great combinations.

Change of Ministry.—Dissatisfaction with the eight-hour day and with the socialistic projects brought a good many electors over to the party of the Right. The strength of the Social-Democratic party in the Second Chamber went down from 86 to 75, and the number of the Liberals was reduced from 62 to 47, while that of the Right went up from 59 to 70 and of the Böndeförbund from 10 to 29. The Socialists of the Left were reduced from 11 to 7, a result of their sympathies with the Russian Communists. Two members of the Chamber were "independents." The more than usually complex party conditions led the King to invite Baron Louis de Geer to form a non-political Ministry. Count Herman Wrangel quitted the post of Swedish minister in London, in which he was succeeded by Baron Palmstierna, to become Minister of Foreign Affairs. The new Government began at once to occupy itself seriously with industrial, commercial and financial matters. Among other bills which it put before the Riksdag of 1921 was one for increasing the duty on coffee. On this being rejected Herr Tamm, the Finance Minister, resigned, and the prime minister, too, then resigned. He was succeeded by Herr Oscar von Sydow, former Minister of the Interior.

The Economic Crisis of 1920–1.—During the latter half of 1920 Sweden had entered on a grave economic crisis—her share of the general economic difficulties which prevailed after the war. The period from the dissolution of the union with Norway in 1905 down to 1914 has been characterized as one of great economic development. During and after the war cost of production rose swiftly, not least because the workmen, after the passing of the Eight-Hour Day Act, in most cases obtained higher rates of wages so that they could earn as much as when working longer hours. Compensation had already been allowed them for the increase in prices. As soon as importation possibilities became increased after the war, goods began to be imported to an extravagant degree, so that the country became flooded with them to the detriment of home industries. Finally the Swedish exchange, which stood somewhat higher outside than inside the country, facilitated importation but hindered exportation. When the international crisis came, with its swift fall in prices, it became necessary to lower wages again, but this brought the country up against great difficulties. In April 1921 about 60,000 industrial workmen were unemployed; in June about 90,000.

The Swedish Red Cross.—Some account of the activities of the Swedish Red Cross must have its place in an outline of Swedish history during and after the war. King Gustav's brother, Prince Carl, played a leading role in this connexion, and also the Crown Princess Margaret (daughter of the Duke of Connaught), whose death in 1920 was sincerely mourned. The work of the Swedish Red Cross was directed more particularly to relieving prisoners of war in the various countries, above all in Russia on the one side and Germany and Austria-Hungary on the other. During 1915–8 a great number of invalided prisoners, including 3,617 Germans, 22,123 Austro-Hungarians, 428 Turks and 37,295 Russians, were brought homeward through Sweden by means of the Swedish Red Cross, specially equipped trains travelling between the Swedish-Finnish frontier in the north and Trälleborg in the south. Across Sweden, moreover, there went a stream of parcels by post, in both directions, for prisoners. The Swedish postal service dealt with 12,700,000 parcels of this kind. The Crown Princess was specially interested in collecting books to despatch to the prisoners' camps. Important work was also done in the inspecting of the prisoners' camps in Russia, Germany and Austria-Hungary. Delegates distributed gifts from home among the prisoners: 1,016 railway waggons packed with such gifts passed through Petrograd *en route* eastwards, and from Russia 1,012 travelled into Germany and 304 into Austria-Hungary. The delegates drew attention to various shortcomings in the German camps and in most cases this resulted in improvements being effected. The conditions in Russia and Siberia were found to be much worse. Delegates' records of what they saw revealed a terrible condition of things in many camps. In some there were 30 deaths a day among the prisoners. Under the guidance of the Swedish delegates new hospitals were established in many places or old hospitals improved, kitchens and baking-rooms being constructed, drains put into order, and large stores of medicines and bandages, etc., being supplied. In Jekaterinburg, for instance, the authorities threw all care for the prisoners entirely on the Swedish delegates within a region of 1,200 sq. miles. Thirty-three hospital buildings were erected in this region, and at some periods a Swedish Red Cross Kitchen established there was able to distribute food to 1,200 men a day. This work was attended with risks. Two delegates were murdered and several died in hospitals for infectious cases. During the Finnish civil war two ambulances were sent to Finland in 1920, and one ambulance was sent to Poland to help in coping with the epidemic there.

The grave privations in many countries after the war due to the scarcity of food aroused deep sympathy in Sweden. Among other steps taken to afford help may be mentioned the welcoming of 20,000 children from Germany and Austria (and in some degree from the Baltic Provinces) to stay in Swedish homes with a view to their regaining health and strength. The homes of both the well-to-do and the poor were thrown open for this. The total amount of money devoted to such acts of helpfulness (including the cost of the children's visits) is estimated at more than 25,000,000 kr., of which the State was responsible for 1,500,000 and the rest was collected by private subscriptions. A detailed report was laid before the International Red Cross Conference in Geneva in 1921. (K. H.*)

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SWEET, HENRY (1845–1912), English philologist, was born in London Sept. 15 1845. Educated at King's College, London, Balliol College, Oxford, and Heidelberg University, he was a recognized authority on the subject of phonetics (*see* 21.460–61; 9.597), and a readership in phonetics was specially created for him in 1901 by the university of Oxford. His published works include an *Anglo-Saxon Reader;* a *Student's Dictionary of Anglo-Saxon;* an *English Grammar; The History of Language,* and many editions of Old and Middle English Texts. He died at Oxford April 30 1912.

SWETE, HENRY BARCLAY (1835–1917), English theologian, was born at Bristol March 14 1835. He was educated at King's College, London, and Caius College, Cambridge, and in 1858 was ordained. After some years of work in various country curacies and livings he became in 1869 theological lecturer and tutor at Caius College. In 1881 he became examining chaplain to the Bishop of St. Albans, and the following year was appointed professor of pastoral theology at King's College, London. In 1890 he succeeded Westcott as regius professor of divinity at Cambridge, and retained this position until 1915, when he retired with the title of emeritus professor. He was in 1911 appointed an hon. chaplain to the King. Swete's works on Biblical texts are of the highest importance. In 1887 he published the first volume of his edition of the Greek text of the Old Testament, completing the series in 1894 (3rd ed. 1901–7), while in 1898 appeared the Greek text of the Gospel of St. Mark, with notes and introduction (2nd ed. 1902) and in 1906 that of the Apocalypse of St. John (2nd ed. 1907). He was the editor of *Cambridge Theological Essays* (1905) and *Cambridge Biblical Essays* (1909), and was a contributor to Smith and Wace's *Dictionary of Christian Biography* (1882–87) and Hastings's *Dictionary of the Bible* (1899–1900). He also produced many historical and critical works, including *The Apostles' Creed in Relation to Primitive Christianity* (1894; 3rd ed. 1899); *Church Services and Service Books before the Reformation* (1896); *Patriotic Study* (1902); *The Appearances of Our Lord after the Passion* (1907; 2nd ed. 1908), and *The Last Discourse and Prayer of Our Lord* (1913). He died at Hitchin May 10 1917.

SWIMMING: *see* SPORTS AND GAMES.

SWINFEN, CHARLES SWINFEN EADY, 1ST BARON (1851–1919), English lawyer and master of the rolls, was born at Chertsey, Surrey, July 31 1851. He was educated privately, and in 1874 was admitted a solicitor, but in 1879 he was called to the bar, having been during his period as a student a pupil of Cozens-Hardy. In 1893 he became a Q.C., and in 1901 was raised to the bench of the Chancery division and knighted. In 1913 he became a lord justice of appeal, and in 1918 master of the rolls in succession to Lord Cozens-Hardy. He retired in 1919 and was raised to the peerage only a few weeks before he died in London Nov. 15 1919.

SWITZERLAND (*see* 26.238).—Before dealing with the affairs of Switzerland during 1909–21, a note may be made on a curious theory recently put forth, especially in Romance Switzerland, that the Swiss Confederation is "the oldest republic or democracy in the world." Now certainly a "king" has never ruled in Switzerland (save in the case of Neuchâtel before 1857), nor since 1648 has any emperor ever had any claim on the allegiance of the Swiss. But then we must recollect that till 1798 Switzerland never had a *single* head, whatever he might be entitled. If we take the term "republic" to mean a "democratic Government," it is quite true that there were (and are) "republics" of that kind in various regions of Switzerland (*e.g.* Schwyz), but what is true of a part is not true of the whole. Again, before 1798 there was no Central Government at all in Switzerland, while it was only in 1848 that it first possessed a "President" (with very limited powers). But there was a president already in 1787 in the United States of America, while the "free communities" or "republics" of Andorra (in the Pyrenees) and of San Marino (Italy) are far older than any such in Switzerland. Naturally the use of the word "*Republik*" by certain cantons before 1798 (*e.g.* the "*Stadt und Republik* Zürich") referred to the rural districts of each, and these by no means enjoyed "democratic government" at the hands of their respective towns. The fact that in 1848 the first "democratic Swiss Constitution" (still in force so far as regards the practical details relating to the Central Government) was avowedly based on that of the American republic is sufficient to disprove the quaint theory that Switzerland is the (in any sense) "oldest Republic in the world." The reverse is really more nearly the case. In neither of the two ordinary senses of "republic" is this theory even approximately accurate.

Population.—As regards resident population, the results of the last two Swiss censuses, Dec. 1 1910, and Dec. 1 1920 (only the provisional results, published in Feb. 1921), were as follows:—

	1910	1920
Total	3,753,293	3,861,508
Languages		
German	2,594,298	..[1]
French	793,264	..[1]
Italian	302,578	..[1]
Romansch	40,122	..[1]
Other languages	23,031	
Religions		
Protestants	2,107,814	2,218,589
Roman Catholics	1,593,538	1,586,826
Jews	18,463	20,955

[1] Figures not published up to Jan. 1 1922.

The decrease in the number of the Roman Catholics is mainly due to the fact that in 1910 the "Christian Catholics" (Old Catholics) were reckoned among them, whereas in 1920, for the first time, they were counted separately, the number given, however (56,250), being greatly exaggerated, since in Tessin (where there is none of this sect) many Roman Catholics described themselves as such under some error. It is noteworthy that the Jews were in 1850 only 3,145 in number, but in 1910 already 18,463, and in 1920 20,955.

In five cantons the population has diminished (Outer Rhodes of Appenzell, St. Gall, Tessin, Vaud and Neuchâtel). In recent years there has been much fear expressed in Switzerland that the non-Swiss were increasing too rapidly for the welfare of the land. This no doubt was due to the vast immigration of German, French, and Italian workmen, who asked lower wages than the Swiss, and, when settled down, became exempt from military service in their native land. During the World War many returned home, and so the figures are not so alarming as was feared at one time. Here is a complete list:—

1860	114,983,	of which 1,202 were British subjects;
1870	150,907	(British subjects 2,297)
1880	211,035	(British subjects 2,812)
1888	229,650	(British subjects 2,577)
1900	383,424	(British subjects 3,535)
1910	552,011	(British subjects 4,118)
1920	410,983	(British subjects, figures not available).

Thus the percentage rose from 57 per thousand in 1860 to 79 in 1888, and to 116 in 1910, the culminating point being reached in 1900 with 147, so that the 1920 figures of 106 show a distinct decrease, largely due, like the diminution of the Roman Catholics, to the greater number of French citizens who have gone from Geneva back to France. In 1920 the 12 most populous towns in Switzerland (number of residents) were: Zürich, 205,892 (190,733 in 1910); Geneva, 138,034 (123,153 in 1910); Basle, 135,134 (132,276 in 1910); Berne, 103,990 (90,937 in 1910); St. Gall, 69,651 (75,482 in 1910); Lausanne, 67,852 (64,446 in 1910); Lucerne, 43,696 (39,339 in 1910); La Chaux de Fonds, 37,591 (37,751 in 1910); Winterthur, enlarged, 49,491 (46,384 in 1910); Bienne, enlarged, 34,414 (32,401 in 1910); Neuchâtel, 22,951 (23,741 in 1910); and Fribourg, 20,468 (20,293 in 1910). No other Swiss town has a population attaining 20,000, though Schaffhausen is not far off with 19,930 (18,101 in 1910). There are also 14 Swiss towns with populations below 20,000, but over 10,000. The increase in the case of Berne is due to its absorption of the suburb Bümpliz, etc., and in the case of Bienne to increased prosperity, while the decrease in the cases of St. Gall, of La Chaux de Fonds and of Winterthur are to be accounted for by industrial depression, and the departure of many workmen.

As the "Conseil National" is elected in the ratio of one member for 20,000 of the total population or fraction surpassing 10,000, the new census will increase its members by eight, so that henceforth it will have 197 members.

Politics.—The members of the Swiss Federal Executive (*Bundesrat*) were almost all changed in the period 1910–20, so that in 1921 the seniors were G. Motta (first elected in 1911), and E. Schulthess (first elected in 1912). The five other actual members had all entered the Council since 1917—R. Haab in 1918, Karl Scheurer, E. Chuard, and J. Musy, all in 1919, and H. Häberlin in 1920. E. Chuard was the oldest in years (b. 1857), while J. Musy was born in 1876. Thus the Council had been

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greatly rejuvenated. Six members were Radicals, Signor Motta being the only Conservative and Roman Catholic.

The recent presidents of the Swiss Confederation (little more than the chairmen of the Federal Executive) have been A. Deucher (1909); R. Comtesse (1910); M. Ruchet (1911); L. Forrer (1912); E. Müller (1913); A. Hoffmann, (1914); G. Motta (1915); C. Decoppet (1916); E. Schulthess (1917); F. L. Calonder (1918); G. Ador (1919), and G. Motta (1920); while the president for 1921, E. Schulthess, would in 1922 be succeeded by the vice-president, R. Haab. Of late years the Political Department (*i.e.* the Ministry of Foreign Affairs) has become specially important. A resolution of the Federal Executive in 1917 decided that this important department should *ipso facto* be attributed to the president. But, as the president changes annually, this plan was soon found very inconvenient, and so in 1920 a return was made to the older system that each councillor should retain the department assigned to him. Hence G. Motta would be Foreign Minister till Jan. 1 1923, when the date of fresh election came round again.

The Swiss people adopted by a popular vote the principle of proportional representation for elections to the "Conseil National" in Oct. 1919. But though it was expected that the Socialists would win many more seats they only won much fewer. The Radical majority was reduced from 102 to 60, in the Assembly of 189 members, thus losing its absolute majority over all other parties combined, but remaining the strongest single group. Forty-one Socialists (in 1917 but 19) and as many Conservatives were elected, and the new "Citizens and Peasants" party (a split from the Radical party) obtained 28 seats.

Proportional representation was also winning its way in the cantons, Aargau and Fribourg adopting it in 1920, followed in 1921 by Berne and the Valais. Thus 18 of the 22 cantons approved it. Indeed in 1920 the canton of Fribourg, hitherto reckoned one of the most backward as to the recognition of popular institutions, made a great advance, accepting in one day the facultative referendum, the initiative, the election of the Executive by the people, and that of the Legislature by proportional representation. A number of Federal votes have been taken in recent years. The constitutional amendments related to infectious diseases (1913), the creation of an administrative court (1914), the levy of a war tax (1915), the imposal of a stamp tax on certain business papers (1917), regulations as to waterways (1918), a renewed war tax (1918), entry of Switzerland into the League of Nations (1920), and regulations as to hours of work (1920). A law (facultative referendum) as to sick insurance was also accepted in 1912. But of the "Initiatives" two were rejected (proportional representation in 1910—accepted, however, in 1918), and a Federal tax in 1918, but in 1919 the detailed regulations as to the working of proportional representation in the "Conseil National," and a law abolishing gaming houses were accepted. Of four later votes, all in 1921, those relating to popular approval of international treaties of a certain length, and new regulations as to motor-cars and to aviation were accepted, but a fourth relating to military courts of justice was rejected.

At the very beginning of the World War (Aug. 3 1914) the Federal Parliament handed over to the Federal Executive certain extraordinary (emergency) powers of acting, and these powers, excluding all obligatory popular votes were found to be very convenient by the Federal Executive.

The entry of Switzerland into the League of Nations was accepted by a popular vote on May 16 1920, the majority in favour (mainly from the French-speaking cantons) being 97,051 votes and by 11½ to 10½ cantons. But in Feb. 1921 the Federal Executive declined to allow the passage through Switzerland of troops, raised to act as police in the case of the Vilna plebiscite.

Some of the members of the former Austrian Empire have sought a nearer connexion with Switzerland. Liechtenstein was indeed admitted into the Swiss postal, telegraph, and telephone system. But the Vorarlberg (and for similar reasons the Tirol) had not up to Aug. 1921 succeeded in being admitted as Swiss cantons, there being great fear felt in Switzerland of increasing the German-speaking population, and particularly of augmenting the number of strict Roman Catholics.

Finance.—The finances of the Swiss Confederation were in 1921 (so said M. Musy, the Swiss Finance Minister) in a difficult position. Their backbone, in the matter of receipts, even in the pre-war period, was the amount of the customs' duties. But even at that period these produced less than heretofore. The last year when they showed an increase was in 1912 (£3,500,000). After that time the decline was pretty steady, and the deficits higher and higher. It has been estimated that, while in 1913 they sufficed to defray about 84% of the total expenses of the State, in 1919 the amount met only 28% of these expenses (in 1913 £3,360,000, and in 1919 only £2,520,000). And these expenses steadily increased after the outbreak of the war, though, of course, Switzerland was not one of the belligerent Powers. The deficits since 1914 are as follows:—1914, £901,000; 1915, £862,000; 1916, £665,000; 1917, £2,000,000; 1919, £2,475,000, and 1920, £3,980,000—in 1920 the receipts were £13,740,000, and the expenses £17,720,000. Despite the formal assurances of neutrality received from the principal combatants, the War Minister of Switzerland thought it essential to guard all its frontiers with a strong military force, and to erect costly new fortifications (as at Morat), so that at the end of 1920 the total "mobilization expenses" amounted to no less than £47,500,000, while the military expenses in the accounts for 1921 were £2,880,000, and that only an estimate far inferior to the demands of the military authorities. Large loans (nine in number, to the total amount of some £31,200,000) have been contracted, but on these heavy interest has to be paid. Exchequer bills for two to five years at 6% were also issued in order to assure the supply of necessaries of life. Special taxes were imposed, first a war tax (which produced £4,400,000), then a tax on war profits (which produced £11,120,000), next a "renewed" war tax (to last 16 years). The increased salaries and wages of the army of federal officials (including the railwaymen) were a further burden, and, naturally, as the cost of living increased, there came a fresh rise of salaries and wages to meet it—a vicious circle. Even the telegraph and telephone rates had to be raised, not to speak of the postal charges, so that while formerly a letter within Switzerland cost only 1d. it cost 2d. in 1921 and a post card 1d. in lieu of ½d. The charges on foreign correspondence have also been raised, so far as regards the transit from Switzerland to the outer world, for a letter from 2½d. to 4d., and for a post card from 1d. to 2½d. As Switzerland produces very little in the way of raw materials, such as coal, these had to be bought at high prices, a fact which further raised the cost of travelling, hotel prices, and of all articles of home consumption. The only persons who have not felt these raised prices are the self-sufficing (or nearly so) peasants, who, in some cases, have even made large profits by the sale of their milk, cheese, butter, etc. Naturally the towns felt this rise to an extraordinary extent, and great distress and lack of employment resulted. The only cheering symptom, from the Swiss point of view, was that the currency exchange was almost everywhere favourable to Switzerland, save as regards American money. An attempt has been made (Feb. 1921) to raise provisionally certain customs duties but at Protectionist rates, so that the interests of the consumers are being sacrificed to those of certain trades, as well as (also provisionally) to limit imports to a certain extent. In 1912 the customs duties amounted to 6% of the value of the goods imported, but in 1920 not even to 3 per cent.

Hence the deficit in the Federal budget for 1921 was put at five or six million pounds, a huge amount for a country with under four million inhabitants. If the Federal finances were in this state, the cantonal and communal finances were no better.

It must be borne in mind that the direct taxes are paid by a very small minority of Swiss. In the case of the direct taxes the total amount, from 1914 to 1920, was about £70,000,000, while the indirect taxes only brought in some £18,000,000.

Switzerland is still predominantly an agricultural country, so that the majority of voters are peasants, with very narrow views. The industrial population is very much weaker politically, and is regarded with great disfavour by the Agrarian party, which desires, for its own objects, to set up a "Chinese wall" round Switzerland. But the land must have other manufactures than chocolate, condensed milk, cheese, etc., and thus must import much which has to be paid naturally by its exports. Yet the narrow "Cantonal spirit" is still widely diffused in Switzerland.

The annual deficits on the Swiss State railways are especially great. It was officially reckoned that in 1918 the total Federal debt had attained a height of about £33 per head of the population, whereas in 1912 it had only been £17.

Army.—Formerly detailed annual accounts as to the Swiss army (a purely militia force) were published. But since the outbreak of the war these accounts have no longer been issued. But an indiscretion of the semi-official Bernese newspaper, the *Bund* of Berne (June 23 1920), tells us that in June 1920 the numbers were 337,282, of whom 71,993 formed the "second reserve," the rest falling into the "Auszug" or "Elite" and the "Landwehr." The "Elite" includes the younger men from 20 to 32, and the "Landwehr" or first reserve those between 33 and 40, while the "Landsturm" or reserve proper is composed of men between 41 and 48.

At the beginning of the war Col. Ulrich Wille was elected the "General," while Col. A. T. L. Sprecher von Bernegg became chief

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of the staff. It was thought necessary to guard all the Swiss frontiers, a policy which cost £47,500,000, and disorganized industry and agriculture to a very great extent. The German-speaking troops were sent, as far as possible to the Jura or the French-speaking or the Italian-speaking regions, while the French-speaking soldiers looked after the German-speaking districts. The object was to prevent any fraternization with the troops of the belligerents. Much inconvenience was caused by this mobilization. The military organization was tightened up on the lines of the German army, and this greatly bothered the free Swiss citizens.

Naturally the military budget increased greatly, amounting in 1921 to £3,000,000, though this represented a reduction of about £250,000 on the demands of the military authorities. This great increase is to be explained in part, at least, by the increased cost of material. In 1910 the annual cost amounted only to £1,680,000.

Agriculture, Commerce and Railways.—Censuses of cattle have been frequently made. In 1866 there were 553,205 cows, in 1886 663,102, in 1906 785,950, in 1911 796,909, in 1916 849,011, but in 1919 738,896 and in 1920 only 729,999. The great fall in the numbers is commonly attributed to the huge purchases of milch cows made during the war by Austrian and Hungarian cattle dealers, for export to Germany. Hence came a milk famine, and milk had to be "rationed." Potatoes and other such produce were also rationed and each householder had to plant them on his land, however unsuited for this kind of cultivation.

In 1920 foot-and-mouth disease raged furiously in all parts of Switzerland, and even intercourse between neighbouring valleys was forbidden in order to try to stop the spread of the infection.

During the war certain branches of Swiss commerce flourished much, for, against the wishes and instructions of the authorities, there was much smuggling of all kinds of goods over the frontier, especially towards Germany and France, which, naturally enough, are Switzerland's best customers. The imports were often less than the exports. But in 1915 they were nearly equal in money value, the imports being slightly more than the exports. However, in 1916, the reverse was the case, the exports being £99,000,000, and the imports £93,000,000, but in 1917 the imports had again the best of it. In 1918 the imports amounted to about £96,000,000, and the exports to about £78,000,000. (Great Britain ranked third in each case.) In 1919 the exports amounted to £136,000,000, the highest figure ever attained, and the imports to £143,000,000. But in 1920 the imports rose to the prodigious figure of £169,000,000, while the exports dropped to £131,000,000.

As coal is practically non-existent in Switzerland it must be imported, naturally at considerable cost. Hence the imported supply had to be strictly "rationed" during the war, and the price increased enormously, especially in the case of domestic consumption. Of course, the factories suffered much, and the railways even more. Hence the electrification of the latter was pushed on as quickly as possible. But it was not possible to do this all at once, and so one saw locomotives driven by means of logs of wood. The number of trains was reduced, at one time very much indeed, and the fares pushed up to a great degree, which much hindered communications, even within the country. The first electrically-driven train went through the St. Gotthard tunnel early in 1921. The Lötschberg railway was opened in 1914, just before the outbreak of the war, and thus its prosperity was greatly let and hindered, while on the Valais slope, above Brieg, the unstable nature of the ground has caused many landslips, and thus entailed many costly repairs. But the great scheme for connecting the two stations in Geneva has been indefinitely postponed, owing to its excessive cost.

Social.—In 1912 a vast scheme of insurance against sickness and accidents was accepted on a popular vote. But up to 1921 money was lacking to put it into operation, even though unsuccessful attempts had been made to "earmark" certain items of the revenue.

As everywhere else in Europe the unemployment problem was troublesome in Switzerland. The militia employed in the great mobilization came home, unused to work as before, while work was scarce owing to the lack of money, the higher cost of living, and the rise in the salaries and wages of nearly all classes. Naturally this want of employment was felt most in and near the great Swiss towns. And here came in a fresh complication—the lack of dwelling houses and flats. This was, in part, due to the rush from the country to the towns, and the crisis became very acute, so that in Berne, at least, all foreigners were ordered out of the town, so as to procure lodgings for Swiss workmen. In the rural districts neither unemployment nor lack of dwelling houses was felt to anything like the same degree, though, no doubt, they existed to a certain extent. But these rural regions are inhabited by peasants who do not easily move from their homes, and are occupied in the cultivation of their small bits of land. As in Switzerland there are few persons of means independent of a trade or a profession, the disturbance in social life was very great, while the high taxes and high wages limited the power of employing labour.

Ecclesiastical.—There were several welcome symptoms of the cessation of the "Kulturkampf," or religious strife following on the decrees of the Vatican Council. On Sept. 1 1920, a papal nuncio for Switzerland was named, for the first time since 1873, in the person of Monsignor Luigi Maglione, titular archbishop of Caesarea. He was already favourably known in Switzerland by reason of his love for that country, and his devotion in the case of prisoners of war and sick children. In Feb. 1921, the canton of Berne at last resumed its full legal responsibility for the reconstituted diocese of Basle, after holding aloof for many years, and thus recognized the bishop as spiritual head of the diocese, thus allowing him full liberty of exercising his functions within the canton for an unlimited period (and no longer for five or 10 years, as heretofore). Again, in the census of 1920 the "Christian Catholics" (the Swiss "Old Catholics," who previously had been included among the Roman Catholics) were numbered apart, though by reason of some error in the case of the canton of Tessin their number was put at 56,250; the real number is believed not to exceed 35,000 to 40,000.

On the other hand the Pope laid claim to the direct nomination of the bishop of Sion in the Valais.

The new census has put an end to the topsy-turvy fact that in the canton of Geneva the Roman Catholics outnumbered the Protestants—so many French Roman Catholics have returned to France that the balance has been reversed.

Mention may be made of the fact that, in 1910, in the canton of Basle, the separation of Church and State was carried out, while in the same year women obtained the right of voting in the disestablished Protestant church of Geneva.

In the summer of 1920 reunion conferences were held both at Beatenberg and in Geneva, but almost wholly between various Protestant denominations.

The World War Period.—During the fateful days immediately before the war broke out in 1914, the uncertainty whether there would really be war or whether commonsense would prevail kept the whole of Switzerland in a state of feverish anxiety, and when the loaded dice fell, very many persons in Switzerland were seized with panic. A wild assault was made on all provision establishments which supplied the necessaries of life, and these were bought in mad fashion and in quantities far above what was required. In many families stores of eatables were still found after the lapse of two years, and that quite apart from what had been spoilt. The banks and other establishments of a like kind had to withstand a regular siege, for everyone desired to get his property back. This haste had finally to be restrained by orders issued by the Government. As if by enchantment coins of small denominations disappeared from circulation. Not even at the post-offices was it possible to change Swiss banknotes for large sums. It was especially hard on the foreign tourists who were surprised by this sudden war. No one was any longer willing to change their foreign banknotes and cheques, formerly cashed so eagerly. Only the hotel keepers found themselves forced to receive cheques in payment for their accounts, and that despite the danger of incurring great losses by this act of friendship.

On the Swiss frontiers the blocking of all communications took strange forms. A typical case was that of Basle, close to the northern frontier. The tourists rushed in by thousands, and the railway trains were enormously delayed. With the keenest anxiety everyone sought for a carriage, a motor car, or some kind of cart so as to reach the frontier as easily and as quickly as possible. Many, whose cash had disappeared in consequence of the difficulties caused by the exchange, had to set out on foot, burdened with their luggage, to cover the great distance. These carts themselves were heavily laden with luggage, trunks and band boxes, while high up on these artificial mountains were perched travellers of every land, who to-day shared their common hard fate peaceably, but on the morrow were to oppose each other as enemies. Here was a German professor clothed in homespun, there an Englishman in tweeds, near by were some merry Belgian ladies with huge hats and elegant parasols, and, on top of all, countless schoolboys with caps of diverse colours. So was it all day long in the town. All this wild confusion was caused by the sudden interruption of international communications and the closing of the frontiers.

Thousands also were deprived at one fell stroke of their daily bread. Such were chiefly Italians, who desired to regain Italy over the St. Gotthard or the Simplon, often with only a little cash, sometimes quite penniless, and who were blockaded in Basle, and in incredible numbers, finally some 40,000 of them. All these unfortunates had to be cared for till it was possible for them to resume their journey. Quarters were found in private villas and other dwelling houses for the sick women and children. The Coöperative Society of Basle sent great carts filled with

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bread and milk, private benevolence made gifts of tea and other eatables. School houses and gymnasiums gave shelter to these unhappy, homeless Italians as far as quarters could be found anywhere, but a great number had to camp out in the open. Only when the great rush had somewhat abated was it possible to facilitate their return to their own country.

Side by side with these arrangements military preparations were carried out in Switzerland. On July 31 1914 the entire Swiss army was warned to be ready, and as early as Aug. 1 the order to mobilize was given. The first day for this was Aug. 3, and two days later the mobilization was quite complete. The troops were ordered to the frontiers which till now had been guarded in part by the second reserve (Landsturm), called out first of all. At the same time (Aug. 3) the Swiss Parliament gave the Swiss executive unlimited powers, even in financial matters. Col. Ulrich Wille was named as commander-in-chief, and Col. Sprecher von Bernegg as chief of the general staff. As it was hoped that the war would not last very long, the mobilized troops went off joyfully to the frontiers. The belligerent States solemnly assured Switzerland of their intention of observing its neutrality, a declaration which brought about a certain amount of relief. When finally the principal operations of war were seen to be taking place far from the Swiss frontiers, the Swiss people were able to think of recalling the troops, in order to simplify matters, from the service on the frontiers, though some were later summoned to relieve those actually serving there. But if in Switzerland a sigh of relief arose, the sad fate of Belgium was felt to be a stern warning, and greatly embarrassed the Swiss authorities, military and political, and it was felt to be quite impossible to strip the frontiers of all watching troops. The fact of this monotonous service, and the conviction that the war might possibly last a long time, brought about a certain disinclination for further service of this kind. Besides, such protection of the frontiers threatened to become costly to an appreciable degree. Therefore much criticism was exercised, chiefly by the Socialists, who especially blamed what, from their point of view, were the mainly needless fortifications around Morat, which were regarded as simply a piece of military display and lavishness, and were considered as a partial measure directed against one only of the belligerents. Thus the Swiss authorities had to order certain alleviations and simplifications in this frontier service. In order to satisfy the agricultural interest the peasant soldiers were called out at a period which caused least disturbance in the cultivation of the land, etc.

Among the military war measures must be counted the abolition, from the beginning, of telephonic communications between the different Swiss towns. This caused all the greater rush to the telegraph offices, and yet even these were under the censor, at least so far as regarded foreign countries.

The equipment of the Swiss army in new, field grey, uniforms was carried out in 1915–6. The expense of these new uniforms amounted to about £800,000.

Most unpleasant for Switzerland was the "Affair of the Two Colonels" (Jan. 15 1916), Egli and von Wattenwyl. This pair of Swiss officers were in regular communication with the German and the Austrian military attachés, ostensibly only for supplying such information as affected no Swiss military matters. All the same this "affair" caused great amazement, especially in French-speaking Switzerland, and in the breasts of the Socialists, who saw in this action of two officers of the Swiss general staff an unneutral and unfriendly act as regards the Entente. They were court-martialed, but were acquitted of the charge of infringement of their official duties, and were handed over to the Swiss executive for "disciplinary punishment" because of their conduct against Swiss neutrality. By this they were each sentenced to 20 days' strict arrest, and to suspension as leading officials in the Swiss general staff. Col. Egli demanded his dismissal at once. The Socialists and a delegation of the Government of canton Vaud required the summoning of the Swiss Parliament in order to discuss the "Affair of the Two Colonels."

About the same time the war control of the Swiss railways was abolished, while a census of Swiss who were not liable to do military service and of arms in private hands was decreed. A later appeal for well-qualified sharpshooters among Swiss citizens resulted in the volunteering of about 100,000 men, of whom, however, only a small percentage was accepted as being really fit for such military service.

Much bad blood was caused in the Socialist camp, and also among other citizens, by the Swiss Government's decision that punishments for certain purely military offences were to be purged in the penal establishments of Witzwil and of Orbe, while in the case of the officers confinement in the fortresses of St. Maurice and St. Gotthard alone was directed. Complaint was also made of the alleged rigorous treatment of ordinary soldiers, and of the far lighter treatment of officers charged with offences.

All this occasioned the promotion of an "Initiative" for the total abolition of courts of military justice. Enough signatures were obtained for this "Initiative," but it was later defeated on a popular vote.

It is easy to understand that Switzerland was the special rendezvous of foreign spies, especially the frontier towns and even the capital, Berne. In this respect all the belligerents did their very best. So even the former director of the Bernese tourist bureau, for taking part in an intelligence service in favour of a foreign Power, was condemned to five months' imprisonment and a fine of £8.

As early as Nov. 1916, the Swiss executive resolved to recruit 250 volunteers out of the army to serve as army police, and this for the entire duration of the war mobilization.

Certain troops, especially those from industrial regions, had to be pacified by the Swiss Parliament by increased pay. This scheme did not find support as late as the end of the year 1916, but was adopted in April 1918, and then it was not merely the pay which was increased, but also the amount of food rations carried in the knapsacks, and emergency support in case of need (this in the case of soldiers' families).

The fact, too, must not be overlooked that in cases of discontent with the military service many unfortunate events contributed to this dissatisfaction. One example was the accelerated mobilization of the 3rd Division (May 1917), and the following endurance marches in great heat, in consequence of which many soldiers were made ill, and fell exhausted on the roads. This brought about an exceedingly vehement movement against all military service, and was utilized to the utmost by the workmen.

In June 1917 the Swiss Government had raised the amounts of the emergency family grants in the big towns to about 2s. a head per day for grown-up persons, and to 8d. for children, while in the smaller towns the respective amounts were 1s. 6d. and 6d. In the same year the length of the relief services was fixed at 2½ months for the younger and active men (Auszug), and at six weeks for the older men of the first reserve or "Landwehr."

Considerable discontent prevailed in French-speaking Switzerland with the chiefs of the Swiss army, who seemed to it too "Germanophile." This went so far that, in course of the discussion by the Swiss Parliament of a report on Swiss neutrality (Aug. 1917), a formal vote of want of confidence was proposed, and the compulsory retirement of the general and of the chief-of-staff demanded. All such proposals, however, were rejected, but they threw a lurid light on the disagreement between French-Swiss and German-Swiss. In the Assembly, however, the assertion of the supremacy of the civil power over the military power was approved, as was also greater economy in the matter of constructing fortifications, etc.

In consequence of the prolongation of the war, and the frequent calling up as reliefs of soldiers without much means, great distress was inflicted on them and on their families, and many could not find work on being released from active service, as their situations had been filled by Swiss citizens exempt from military service and sometimes even by women. In order to alleviate this crying distress a department for the promotion of the welfare of the soldiers was founded by the Swiss executive which gave this department a first contribution of some £18,000 (Aug. 2 1917). Later on came the "National Collection" (a voluntary contribution made throughout Switzerland), which brought in millions

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of francs. To stimulate this collection specially large medals of copper, silver, and gold were struck, and also brooches made, all being sold to the people. The term and the institution "For the welfare of the Soldiers" must be understood to include also other benevolent institutes for the soldiers on active service, such as "Soldiers' Homes," some of which were splendid soldiers' institutes where refreshments were to be had cheaply, and which afforded opportunities for reading and for writing letters. We must not pass over the arrangements made for the washing of the soldiers' garments. Not merely was the soldiers' body-linen washed, but their clothes repaired, and in part replaced.

It would be most unjust to pass over the very prolonged occupation of the Swiss frontiers if we did not mention the exertions of the Swiss Red Cross Society. The Swiss Red Cross is managed usually by a board of directors. But at the very beginning of the mobilization (Aug. 2 1914) the Red Cross men were also called up, and a medical man placed at their head as chief. At that moment the Red Cross had at its disposal not quite £6,000. Hence it was resolved to organize a national collection, not merely for actual money, but also for gifts in kind (especially linen and woollen garments), and this idea was eagerly taken up. The money collected amounted to about £84,000, while the gifts in kind flowed in abundantly. As to the latter the Swiss women displayed great zeal. From all sides poured in shirts, socks, and other things, in huge quantities, including bed-linen and objects for use in hospitals. We must note the quaint fact that, over and above what is commonly used by soldiers on active service, many odd gifts were received, such as chemises for women, articles for female toilettes, and even children's toys.

If detailed figures were to be given for the useful objects collected from Aug. 1914 to June 1918 by the Swiss Red Cross Society, such as body-linen, shirts, sheets for beds, etc., the number would run up to several hundred thousands. The shirts, and the like, were specially welcomed by the poorer soldiers, who otherwise would have fallen victims to various diseases arising from the lack of such things, or in winter-time would have been frozen. For many, military service was thus rendered far more endurable.

One of the chief tasks which fell to the Swiss Red Cross was the creation of the so-called "Red Cross Squads." These were composed of men, exempt from military service, who placed themselves voluntarily at the disposition of the Red Cross, and were provided by it with uniforms and all things necessary for a regular "health service." The Red Cross Society itself has a great number of carriages at its disposal, and also sometimes commandeered motor-cars, and prepared them for the transport of the wounded. The troops on active service, like the Medical Corps, also used such vehicles in great numbers.

A further task of the Swiss Red Cross consisted in the training of well-qualified Red Cross women nurses (Red Cross sisters). Besides these there were other training establishments, either religious or lay (the latter are the mother houses which train nurses). At the very beginning of the war the Red Cross reckoned on the services of 960 sisters who could be employed in the care of sick soldiers. Many of these were employed in the huts for the wounded, set up at fixed distances behind the front, and in the military hospitals.

The Swiss army was severely tried by the influenza epidemic in the summer of 1918 and in the following winter, and that too during the general strike (*see* below). If the Swiss Red Cross had had many claims upon it previously, it was now scarcely able to meet the tremendous demands made upon it, first, by the army leaders, and later on (at first the plague was contemptuously termed "the Spanish grippe") when the epidemic spread to a totally unexpected extent among the non-military population, and the unceasing cries for help from this side resounded louder and louder. As the epidemic spread more and more widely, voluntary help had to be enlisted. Here stepped in the so-called "Samaritan Associations" (St. John's Ambulance), already closely connected with the Red Cross, and encouraged their members, with a certain amount of training obtained in voluntary sick-nursing courses, to place themselves at the disposition of the afflicted families. The chief work, however, fell upon the Red Cross and its professional trained nurses, and it is amazing how much the Red Cross achieved in this department. About 10% of the professional nurses (sisters) died of their exertions.

In another respect too the Red Cross rendered excellent service. As is well known, the American Red Cross Society gave some £20,000 to the Swiss military nursing department. This sum was employed in creating convalescent homes for the Swiss soldiers who had suffered from influenza. The Swiss executive put this task also in the hands of the Swiss Red Cross, which, however, later on had to make considerable additions to this amount of money.

In consequence of the spread of the influenza epidemic it became necessary either to suspend or to delay the holding of the training courses for recruits, the subsequent drill courses, and the education of the non-commissioned officers. The percentage of invalid soldiers was unexpectedly high, and as the epidemic was so rapid as to seem like an explosion, it could be combated only with very insufficient means. Hence very caustic criticisms were expressed without reserve. These demanded publicly the dismissal of the chief of the medical department of the Swiss army, who was said to be already overweighted with the care of the "interned" foreign soldiers, and so could pay too little attention to his own Swiss soldiers, and had ordered precautionary measures at too late a period. All kinds of military hospitals, if one can credit the accounts in newspapers of all shades of opinion, presented a very sorry appearance. The care of the foreign interned soldiers was taken away from this Swiss chief medical officer, and also, after an enquiry, he was acquitted of want of attention to his own Swiss soldiers.

After the Armistice (Nov. 1918) the Swiss army could gradually be almost wholly demobilized. The defence of the frontiers was entrusted to volunteer troops whose pay was fixed at from 8 to 10 francs (6 to 8 shillings) a day. This afforded a decent income at least to many who no longer earned anything, whether because of the direct effects of the war or of the prolonged military service in their own land. It was asserted that in consequence of the prolonged mobilization the Swiss soldiers had gained immensely in military efficiency. But it was a pity that such efficiency cost the little land of Switzerland between 40 to 50 million pounds, and this expense had to be met by raising the customs duties, taxes on excess profits, two sets of special "war taxes," etc., which, it was hoped, would bring in the necessary funds, if only after a lapse of many years.

Once again considerable bodies of troops had to be called up because of the general strike (Nov. 1918), which failed in a few days. And these extra troops were required also by reason of the break-up of the German and, especially, the Austrian armies, which flowed back like a flood, and threatened a regular invasion of Switzerland.

In Nov. 1918 Gen. Wille resigned his post, as he considered that his work was at an end. In the same month the military pensions were increased 10% and the export of arms and ammunition forbidden, while the bureau of the Swiss general staff was also dissolved.

To meet the emergency support of the families of poor soldiers during the four years of the mobilization period nearly £2,000,000 were expended. Both for the mobilized soldiers and for the volunteers the daily pay was raised to about 7s. Before the war ordinary soldiers received only 8d. a day. The old arrangements were put into force again in March 1920.

The defence of the northern frontier had to be strengthened again at the time of the signature of the Peace of Versailles (June 1919), for a huge immigration from Germany was feared. Later, the frontier police had also to be strengthened because of the great amount of smuggling and the enormous number of people who crossed the frontier because of the bad conditions of life in central Europe and the lack of employment, for Switzerland, as the sole non-enemy land open, was regarded as an El Dorado. On Aug. 28 1920 the watch on the frontiers was definitely abolished. The strict watch on the frontiers had greatly impeded all facilities for travelling, and the very severe regulations as to the visa of passports and payment of other dues were subsequently greatly lightened.

Economic Effects of the War.—After the first excitement had died down, there were, in the first months of the first year of the war, no notable advances in the prices of various articles in Switzerland. This took place gradually, as the difficulties of importing articles increased. As early as Nov. 1914, Italy announced that she would place no hindrances in the way of the export of articles of food and supplies of raw materials.

In the matter of corn Switzerland was not in a very favourable position at the beginning of the war, for the supplies existing there would have barely sufficed for a couple of months. One must not forget that the Swiss agriculturists devote their attention far more to milk and cheese than to corn. This latter, therefore, could be delivered more cheaply by foreign countries, and was a far less profitable occupation for the Swiss farmer than milk and its products. Hence Switzerland fell more and more into a state of dependence on foreign countries.

The Swiss authorities naturally first of all attacked this pressing problem, and tried to find a remedy. They acted very shrewdly in that they introduced, Jan. 9 1915, a provisional monopoly of corn, and issued a special decree relating to its export. Thus the country was to a certain degree provided with the raw materials for bread and, above all, a bar was placed on all speculation in this most necessary article. Hence it was possible in the following month of May to note that the regular supply of corn was proceeding quietly, and that Switzerland was better supplied with corn than at the beginning of the war.

In the case of various articles such as bread and milk, a prohibition to export them was issued at once. It may cause surprise

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at first to be told that milk was included in such a prohibition. But whoever is aware of the fact that nearly all the milk, so far as it is not consumed within Switzerland, was worked up into various shapes (*e.g.* cheese, butter, condensed milk) and then was exported in great quantities, will not find fault with this prohibition, when he learns that in Switzerland itself there were periodical milk famines for the native consumers. And it came to pass that milk itself was exported from Switzerland. For example, in the frontier city of Basle, the inhabitants at the beginning of the war were forced to exchange milk for vegetables grown in Alsace, because for ages the supply of fresh vegetables for Basle had been supplied by Alsace alone.

When the war had lasted about a year, and no end to it was visible, the necessaries of life in Switzerland began to be not only more expensive, but also scarcer. In June 1915 it was therefore forbidden to export any articles of this kind. This regulation was due to the act of profiteers, who bought these necessaries of life in huge quantities, and then accumulated them for export to central Europe. Switzerland now found itself in a rather awkward position. If she forbade the export of necessaries of life, central Europe menaced the stoppage on their side of the import into Switzerland of the various articles which she most needed, such as coal, raw materials, artificial manure, etc. On the other hand, the Entente threatened Switzerland with a rationing of the consignments of necessaries of life in case the export of such to Germany and Austria were not entirely stopped, for the Entente had soon discovered that for central Europe this matter was the sorest point in its war administration.

In the course of wearisome negotiations with both parties the Swiss tried to find a satisfactory arrangement. So first they tried to found with Germany some sort of organization for imports. Industrial firms founded private import trusts, *e.g.* in Geneva, under the name of *Société auxiliaire du Commerce et de l'Industrie*. A similar trust was created in St. Gall, and in Basle a so-called "Import Trust Company." It became harder and harder to assure sufficient supplies for the whole country. The imports of necessaries of life from the "Free Zones" to Geneva were subject to strict supervision by France. On the heels of the corn monopoly of 1915 there followed in 1916 a monopoly of the importation of rice. In order to ascertain the amount of existing stocks of provisions within Switzerland the Swiss executive ordered a return of the supplies of such wares as were found in the entire country. As the supplies of necessaries of life became scarcer, so did the prices rise steadily.

The "S.S.S." (*i.e. Société suisse de Surveillance économique*), with its headquarters in Berne, had itself entered on the commercial registry. Complaints were made by important members of the general public that by this action the exports and imports were placed practically under the control of the Entente. It was, however, too easily forgotten that naturally it was not the intention of the Entente to permit an uncontrolled import to Switzerland, and then an uncontrolled export to central Europe, and so supply its enemies with the things they lacked. But the Swiss rightly argued that it was absolutely essential for them to keep up a certain exchange of commodities with central Europe. For instance, cattle in great numbers were exported to Germany and Austria-Hungary, whence coals, iron, steel, manure, sugar and other needful articles were imported into Switzerland.

It would have been far easier to supply Switzerland with all these goods, had a larger number of railway goods trucks been available. But many were away in foreign parts in order to collect the accumulated goods in foreign harbours, because neither France, Germany, nor Italy had any trucks available for the through journey to Switzerland. Often the trucks were delayed for months on the way, or were utilized by the belligerents for their own needs, so that quite often Switzerland had to make protests, and to claim the return of its trucks. Even in 1921 France was still refusing to pay the sum agreed on for Swiss trucks held up and utilized by her. In consequence of this insufficient supply of goods trucks the import of corn to Switzerland was at one time quite blocked, and this caused no little anxiety in that country. As the feeding of the Germans began to be more and more difficult, and the prisoners and evacuated persons had to suffer thereby, many good persons in the Entente lands caused bread to be baked in Switzerland, and then, with other articles, to be sent to Germany for the use of the Entente subjects interned there. Switzerland had nothing to urge against this proceeding so long as there were sufficient supplies for its own people. But later on the supply of wheat for this purpose had to be specially delivered by the Entente. In the same year (1915) a prohibition to export cotton was issued, and from Nov. 25 onwards cheese could not be sent away in quantities of more than 1½ lb., and licences to export butter were no longer granted.

It was in 1916 that the profiteers were most numerous and most active in Switzerland. In April the Swiss executive had to make new and sharper laws against the speculators who chose the necessaries of life as their field of operation. In Geneva a great organization was discovered which busied itself with such speculations. By order of the cantonal executive considerable supplies of coffee, cocoa, and chocolate were seized, and a number of foreigners expelled. Great quantities of rice and fat were also confiscated in Basle and in Buchs, on the Austrian frontier. One must assume, of course, that the greater portion of these goods had been smuggled over the frontier. Soldiers, customs officers, frontier guards had their hands full with countering the tricks of smugglers, speculators and profiteers.

Henceforward the economic relations began to get sharper and sharper. After the inquiry as to the existing stocks of sugar came the sugar monopoly. This had become necessary because the wholesale firms were no longer willing to undertake the importation of sugar. (Before the war Switzerland imported annually sugar to the value of about £1,500,000.)

As the blockade of the Central Powers by the Entente became more and more strict, this had a reflex action on the economical situation of Switzerland. That little country found itself hard pressed from all sides. In June 1916 Germany threatened the stoppage of all exchange of goods if Switzerland would not deliver those which had been stored on German account in Switzerland, and the Entente as firmly refused to let this threat be carried out. In the same month a Swiss delegation journeyed to Paris in order to remove these difficulties. But at first no settlement could be reached, for the Allies and Germany both obstinately clung to their points of view. Finally in Sept., with great trouble, an arrangement was concluded with Germany. Hardly was this in force when France, England, and Italy required that Switzerland apply to them measures similar to those which Switzerland had accepted in the Germano-Swiss arrangement. How complicated this situation often was for Switzerland is shown best by the Note, according to which the Entente required from Switzerland a prohibition for the export of all those manufactures (machines and parts of machines), the making of which required oil for greasing them which came from the Entente states. The distrust of Switzerland became greater and greater. Germany complained that Switzerland had abandoned its neutrality, and was under the protection of the Entente. On the other hand, the Allies grumbled that the goods delivered by them were handed over by Switzerland to the Central Powers. What wonder then that the saying became prevalent in Switzerland—"A neutral Power is kicked from the left, and whipped from the right."

The following fact will show how much during the war Switzerland had to depend on a reasonable amount of imports. In 1916, despite all the efforts of the Swiss farmers, only two-thirds of the supply needed for the country could be produced. Besides wheat for bread, raw materials, artificial manure, cattle for slaughter, fat, and by far the greater amount of the potatoes used, had to be imported from foreign parts (Germany, Holland and Italy). In 1916 Germany exported to Switzerland 1,600 trucks filled with potatoes, both for consumption and for sowing.

For foreigners it was not easy to understand why Switzerland placed the seizure of the harvest and the fixing of maximum prices for the most important necessaries of life in the hands of the Military Department, for in Switzerland, as in other lands, so-called official Food Departments had been set up. It was easier to understand that the military authorities were empow-

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ered to issue orders that the supplies of hay and straw of each harvest should be commandeered. Inquirers were informed that the Military Department or the Chief War Commissariat office had, in the course of years, accumulated a great stock of corn, which was renewed every three years. When, at the very beginning of the war (Aug. 27 1914) the Swiss executive sanctioned the grinding of "full flour" and then, as is well known, ordered a corn monopoly for the Confederation (Jan. 9 1915), and also commandeered the entire corn harvest, the Chief War Commissariat office was the right authority to carry these orders out. But on Aug. 1 1917 a central bureau for the provision of bread was set up, and on Aug. 10 1917 this was followed by a Swiss bread bureau. On Sept. 13 1918 a Swiss Provision Department was resolved on, and the bread matter was entrusted to it.

The entry of Italy into the war (May 23 1915) was a hard blow to Switzerland, making it more anxious than ever, but still worse was the declaration made by Germany (Feb. 1917) to the Allies of the unrestricted submarine warfare. By this step Germany won no sympathy from the neutrals, although the Swiss executive refused the suggestion of the United States to break off all diplomatic relations with Germany. The Swiss held that this refusal was in accordance with their neutrality, as Germany was the sole land which supplied coal to Switzerland, for the Entente had now to send coal to Italy and could not supply it to Switzerland. At any rate Switzerland got coal from Germany, despite increased prices, cheaper than Italy did from its Allies.

The declaration of Germany (on Feb. 1 1917) that the port of Cette lay outside the blockade zone was only a poor comfort for Switzerland. It ought to have secured previously a reasonable amount of imports. France strained its resources to satisfy the demands of Switzerland as far as it could, and sanctioned important traffic alleviations for the transport of necessaries of life. But this did not hinder the needs of Switzerland from being increased. On Feb. 12 1917 two "meatless" days per week were ordered, and on other days only a single dish of meat was allowed for each meal.

One misfortune followed another. Soon the Argentine Republic announced (April 1917) that it had forbidden the export of wheat,—even the supplies already bought by Switzerland.

However, it must not be thought that during this critical period Switzerland had simply folded its hands on its breast. It tried as far as possible to make itself independent of foreign countries by directing additional planting of potatoes, vegetables and materials for bread. Flowers disappeared from all gardens. Everywhere their place was taken by potatoes and other vegetables. The pleasure parks and drill grounds in and around the towns were commandeered for the same purposes. In the evenings, when the day's work was done, the workingmen of the towns were seen, pick and hoe in hand, busy turning up the ground which previously had served all purposes except the planting of useful things. The State ordered each parish to put gratis at the disposal of the poorer classes land for cultivation, and even swampy spots had in all haste to be prepared for cultivation. It is easy to understand that sometimes practical impossibilities were demanded. "One lives and learns." Next, after the land had been prepared for cultivation, suitable kinds of manure were no longer to be had. Those who were not owners of cattle could produce none. Artificial manure of good quality proved too dear to be purchased by poorer people. These were obstacles that must not be underestimated, but absolute need and the horrible period of the war overcame them all. Frequently the results of this compulsory planting did not even approximately reward the pains and work which had been bestowed upon it, but people were too filled with joy to despise the little that was actually the result. Thousands and thousands of families who previously did not produce necessaries of life had themselves to plant the amount of potatoes and vegetables required for their own use, and so considerably relieved the crying need. In 1917 120,000 trucks of potatoes were produced (the normal production was about 100,000 trucks). But there was no abundance of this commodity, for in many poorer families potatoes had to replace macaroni, and such like wares which had become more expensive.

These measures on the part of the Swiss authorities were indeed very drastic, but they could not have acted otherwise. The townsman, like the country farmer, was affected by them. The latter indeed had to submit to regulations which meant a revolution in his ordinary business. He was ordered, without the slightest regard to the number of his cattle, to plant a fixed quantity of his land in corn, in such and such a manner. With far less help than heretofore (for the men of military age were generally absent), the peasant women and their half-grown children had alone to do all the work. Not infrequently even their horses were taken away for service on the frontier.

When the peasants had planted, as ordered, the fixed quantity of land in corn, and so helped in the supply of bread, it turned out that now they had too little hay for their cattle. Experience taught here, as elsewhere, that an existing state of things could not be simply changed by the alteration of a screw in a machine. The aforesaid regulations reminded men of the State right of tutelage in the matter of dealings with corn, as had been usual in Switzerland as late as the 18th century. Great quantities of corn were procured and stored in granaries, in order to secure cheaper bread to the people in general.

The more profitable pasture business (*e.g.* breeding of cattle and milk industry) had developed from agriculture. Before the war there were big farmers in Switzerland, who only grew potatoes and other vegetables enough for their own use. But the rest of the land was laid down in grass. So it is easy to understand that before the war Switzerland could export yearly huge amounts of cheese, butter, and condensed milk.

Against the introduction of "bread cards" Switzerland fought with tooth and nail. The workingmen in the towns were not willing to be deprived of their unrestricted amount of bread. A middle way was therefore tried in Switzerland—the grinding of the corn less finely, and the prohibition of the sale of fresh baked bread (Feb. 12 1917). Further, in May, a decree directed that bread should only be sold 36 hours after it was baked. But already in Oct. the final solution of this problem could no longer be deferred—the daily ration of 9 oz. a head.

Bread and meal were joined on the same card. The bread card was split up into such small rations that the traveller could obtain in the hotels and restaurants per portion only 1½ ounces. This regulation was followed in Feb. 1917 by the order to make macaroni, etc., only out of eggs, and then on March 1 1917 appeared the cards for rice and sugar. In the case of sugar about 2½ lb. extra were allowed per head for making jam.

Every month or two Switzerland had to start new negotiations with the belligerents, and to conclude new agreements. In May 1917, the negotiations about the management of the S.S.S. were brought to a conclusion, and an understanding was reached about the import of fodder and the export of live cattle. For the export of fodder from the Entente lands, Switzerland had had to export live cattle as "compensation." A new economic agreement between Germany and Switzerland was also concluded.

A special chapter in the provisioning of Switzerland was formed by the struggle about the price of milk. Here the consumers and the producers were often hotly opposed to each other. The workingmen in the towns reproached the peasants with illegal exploitation of the hard lot of the people, and that the latter often from time to time intentionally brought about a milk famine in order to drive prices still higher up. The "Town Associations" (a product of the war as against the country) took an active part, though not always with the same arguments, in this struggle against the peasants. These, on their side, refused absolutely, seeing that all kinds of fodder were always becoming dearer, and by reason of the general rise in prices, to supply their wares at the same fixed price. It was not always easy for the authorities in case of these quarrels to hit on a middle way which was good for all parties alike. One reason for the scarcity of milk was certainly that Switzerland temporarily exported many head of cattle, and this business wasted much milk. Then again, as butter and cheese rose in price, greater supplies of these articles were manufactured, as it was the more profitable business. All this took place, be it well understood, at the expense of the consumer, who had to suffer much thereby.

In order to assure nevertheless a sufficient supply of milk for the Swiss people in general, the Swiss executive empowered the Agricultural Department to fix the amount of the milk rations allowed to each parish, and sanctioned the delivery of milk at

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reduced prices to persons of small means. The maximum price for a litre (1¾ pt.) of milk was therefore fixed at 33 centimes (about 3½d.) in April 1917, but for people without means at 26 centimes (about 2½d.). The State and the parishes had between them to make up the deficiency. In order to create a closer organization and to render the commerce in milk somewhat the same for all 22 cantons, a central bureau for the supply of milk and its products in Switzerland was set up in Aug. 1917. It was empowered to issue decrees, and to subject the whole industry to Federal control. That was quite necessary, because it happened that the milk for the inhabitants of the towns was already rationed (so in Berne on Jan. 1 1918 the daily allowance a head was only three-fifths of a litre), while in the country free trade prevailed in this business. As the danger of a fresh rise in the price of milk became more and more imminent, the town workmen opposed it vigorously. They threatened a general strike if this most essential commodity should be again raised in price. In the Chamber of Deputies of the Swiss Parliament a compromise was made on this basis—the Swiss executive to grant one rappen (less than a farthing) per litre to the milk producers, and to pay the extra expenses of the transport—this was only to avoid a fresh rise in the price of milk (Oct. 1917). This was well meant, but it turned out later to have been a mistake, since from this time onwards rich and poor profited by this arrangement, and the Swiss authorities had to pay out a huge amount of money.

For the time certain kinds of cheese (cream cheeses, etc.) were not allowed to be sold, and the consumption of butter was restricted. Finally, it was arranged that each landowner was obliged to deliver a fixed quantity of milk from each cow for consumption. When later in 1918–9 the rationing was still more limited (Oct., half a litre, and in Nov. one-third litre per head) this evil was not so much due to any intentional over-production of milk products by the peasants, but, as pointed out above, because many peasants by reason of the compulsory planting of corn, and dearer hay, etc., and the consequent hay famine, could afford only to keep a far smaller number of cattle. This circumstance may have affected the production of milk more than was stated above. It must be added that children up to a fixed age and persons over 60 could claim an extra ration—so too sick persons, but for these a medical certificate was necessary.

At the beginning of the war people were much perturbed by the payment of 26 rappen (about ¼ of a franc) for a litre of milk, and yet in 1921 the price was 52 rappen (about ½ franc), or an increase of 100 per cent. After the conclusion of peace and on the return of more normal economic conditions it was hoped that a slight alleviation would ensue. But in 1919–20 the foot-and-mouth disease in Switzerland increased to such a degree that at the end of 1919 the daily ration of milk in the towns sank to below the average in the war-time—to one-third of a litre. The foot-and-mouth disease caused Switzerland a loss of about £5,500,000. Finally, in April 1920 this limitation was abolished. The milk famine was one of the greatest calamities that occurred in Switzerland during the entire war period.

It goes without saying that macaroni, groats and oatmeal, barley, cheese, butter, fat, and oils were all rationed, and even also, in part, potatoes and coals. The supervision took place by means of specially issued cards. The butt of the card had to be given up every month when new cards had to be procured. These bore every month differently coloured signs of authenticity. A regulation was also made that in each household even necessaries of life, which were *not* rationed, should not be kept in quantities exceeding the supply required for two weeks.

Some necessaries of life were meted out with a very sparing hand: thus only rather over 1 lb. of meal per head and per month was sanctioned, while, from Oct. 1917, white meal and groats were only allowed for hospitals and sick persons, and, even to procure these, corresponding bits of the bread and meal card had to be sacrificed. Other important necessaries of life were rationed as follows: maize about 14 oz., rice about 9 oz., and sugar about 20 oz.—in each case per head and per month. But even these rations were not fixed fast—on the contrary they were raised or lowered according to the existing supplies imported.

The restrictions that were most felt were those on butter and on fat for cooking. Foreign lard, even before the outbreak of the war, had been imported in great quantities. But afterwards the imports of this article fell off more and more—in July 1917 it had decreased by 90 per cent. Hence the supervision of all kinds of fat was placed under State control, and in Jan. 1918 a so-called "Central Bureau for Fat" was set up to ensure the provisioning of the country with fat and oil, both for eating. The fat and butter cards (fat for eating and oils) were brought in on March 1 1918. They allowed about 12 oz. of fat and about 5 oz. of butter per person each month. In June the ration of butter fell to about 3½ oz., and then rose again to about 9 oz. After the Swiss Government succeeded in buying in America (Jan. 1919) 15,000 tons of pigs' fat, it became possible to abolish the rationing of fat in July of the same year, but the butter cards remained in use for two months longer.

About the same time (July 1919) the rationing of macaroni, groats, oatmeal, and barley was abolished, and two months later (Sept.) the same was done with the bread and meal cards, and finally with the "meatless" days.

For the poorer classes so-called "Distress Relief" was organized, *i.e.* the Confederation, the cantons, and the parishes together paid over to these poorer people a portion of the price of certain necessaries of life. The principal objects of this charity were bread, milk, and potatoes. In the towns many classes of the population had to be supported in this manner—in the town of Berne alone about 27%. In the summer of 1918 the increase in the prices of necessaries of life rose to 120%, and in the autumn of the same year to 150%. Throughout the country the town workmen organized demonstrations against this increasing cost of necessaries, and these were combined with other matters of political discontent, these latter being stimulated by the events in Russia and in Germany and all leading up in Nov. to the general strike (*see* below).

Manufacturers in general accommodated themselves quickly to the state of things produced by the war. An exception was formed by the embroidery industry of eastern Switzerland, which was paralyzed through insufficient exportation and lack of foreign orders. On the other hand, the watch factories did very well, because they could manufacture parts of ammunition for the belligerents, which brought in much money, both to masters and men. The same thing happened with the great industrial magnates, who manufactured turning lathes, machines or parts of machines for the same object, and exported them. The delivery of completely manufactured ammunition was forbidden by the Swiss executive as being contrary to neutrality, but it was not difficult to get round this prohibition. Each of the belligerents sought to arrange matters to its advantage. Germany once claimed that every manufacturer of western Switzerland who delivered articles to the Entente should receive no more German coal for his factories. France, on the other hand, forbade the use of grease for machines and parts of machines which were to be exported to Germany. It was not always easy for Switzerland to steer the right course, without totally depriving its workmen of their wages.

The provisioning of Switzerland with coal proved often a very difficult and complicated matter. At the beginning of the war, and in part even up to the year 1916, it was not possible to complain in Switzerland of a coal famine, properly speaking, for the prices had risen by not quite a quarter per ton. Before the war one had to pay to the coal merchant (including his profits) about £2. 8s. per ton, and in 1916 some 7s. or 8s. more. But matters changed altogether in 1917, for not only did the price (including the profits of the coal merchant) rise to £5. 4s. but restrictive measures were taken. By a decree of the Swiss executive of March 7 1917, no one was allowed to procure a supply of provisions sufficient for over three months. In Basle the so-called "Central Bureau for Coal" was set up. Any person who required more than five tons of German coal had to take a share in the aforesaid company, or else to pay an extra £2 per ton. The object was to secure to Germany an adequate money advance, probably in order to compensate her for the loss on the exchange. Germany was required to provide solvent guarantors, so as to make sure that the money would be forthcoming. Later on, a local "Coal Supply Bureau" was set up in every town and every parish, which fixed the amount that any person could be allowed, and supervised the distribution. The prices for good coal (including merchants' profits) amounted to £10 per ton. New restrictions were often issued. The census of the amount of coal was soon followed by its rationing. It is well known that Switzerland, apart from peat and some slate coal, possesses no coal proper. That fact suffices to prove how dependent she is in this respect on foreign supplies. A "Swiss Coal Co." was formed, the object of which was to support financially efforts to find more coal in the country. Researches were carried on all over the land, and a certain amount of coal of poorish quality was found in the cantons of Berne and of the Valais. Peat too was cut, wherever there was a possibility of the smallest supply. But one cannot be surprised that, despite the high prices, the quantity of this coal fell far short of the amount required.

Soon after the scarcity of coal began, and particularly by reason of the rise in its price, the railways and the steamboats on the Swiss lakes were forced not only to raise their fares, but to take other restrictive measures. First of all the "excursion tickets" were suppressed, and then also the cheaper sorts of return tickets abolished (1917). The circulation of trains was reduced from March 1 1918 by a third. In Nov. 1918 the State railways raised their tariff for goods by about 80%, and in the same month experiments were made with supplying locomotives with wood instead of coal, and this, in consequence of the ever-increasing coal famine, even in the case of fast trains. The cantons were each bound to deliver a certain quantity of wood, according to their size and their supplies. Canton Berne, in particular, had to furnish very large quantities of beech wood. Previously, the whole supply of fuel had been seized by the State. All public bureaux and post-offices had to reduce the hours during which they were open, schools had to have holidays, etc. One restricted railway scheme appeared after another, and from Dec. 1 the circulation of travellers, on those bits of the railways which were still run by steam, was provisionally entirely suspended on Sundays and festivals. The only trains allowed on those days were those which carried milk. At the same time the distribution of letters on Sundays was discontinued.

In this time of need strenuous attempts were made by the Swiss authorities to electrify the railway lines, where this could be done

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most efficaciously. The private non-State railways were encouraged to do the same, and subsidies were promised to them for that purpose. Although, with certain exceptions, such as the St. Gotthard line and some smaller bits, this permission could not be utilized to the extent required, this is to be explained by the unheard-of prices asked for raw materials. The purchase of electrical machines alone absorbed such huge sums that the necessary capital could not be brought together.

In Oct. 1920 a fall in the price of coal took place, and the supply also gradually became better than heretofore, so that in the winter of 1920–1 the rationing of coal was abolished. The coal supply organization in Basle was wound up. But now another difficulty appeared. In consequence of the augmented supply the "Central Bureau for Coal" had acquired great quantities of coal at prices which were still high. Likewise the supply of peat had increased in amount. But as the coal prices sank the supply could not keep pace with the reduction in prices unless at a great loss. Business men complained that they could get coal direct from the pits at lower prices than those payable in Switzerland. The Swiss executive resolved to give financial aid for the distribution of the existing stocks in the country at cheaper prices. But it imposed on each ton of imported coal an extra customs duty, and this measure was to last until this advance was reimbursed.

Treaties.—In order to complete the picture of the economic difficulties which existed in Switzerland during the war we must here add a short account of the treaties which she was compelled to conclude with the belligerents.

The "S.S.S." (*Société suisse de Surveillance économique*), intended to regulate the circulation and employment of wares in the interest of the Entente, was founded on Oct. 11 1915. At the same time the "Treuhandstelle" for commerce with the Central Powers came into existence.

On Sept. 2 1916 the so-called Economic Agreement was concluded to facilitate the exchange of goods. Germany by this had to release per month 253,000 tons of coal, and the amount of iron and steel required by Switzerland. Switzerland, on the other hand, handed over products of milk, meat, etc. A Swiss export committee looked after the export of war supplies, produced with German raw materials (the so-called "Swiss Central Iron Bureau"). It was forbidden to use German iron or German coal for the production of war supplies destined for the Entente.

On Aug. 20 1917 a new arrangement was made. Germany was to grant permission to export 200,000 tons of coal at £3. 12s. a ton, and 19,000 tons of iron and steel, in both cases per month. On its side, Switzerland was to grant Germany a credit per month of £800,000 (foundation of the "Central Bureau for Coal").

On Sept. 29 1917 this arrangement was followed at once by a similar agreement with France. A group of Swiss banks granted to a group of French banks a credit per month of £500,000, this to last from October to December. In return Switzerland obtained from France certain economic reliefs. After two months this arrangement was renewed for 10 months, the credits allowed rising with certain improvements in the import of goods. On March 20 1918 a similar credit was granted to a group of English banks, the monthly maximum amount being fixed at £400,000.

On Aug. 30 1917 an agreement with France and Italy was concluded for the export of wood, to be worked up, from Switzerland. On Dec. 5 1917 the United States also made an agreement to supply 240,000 tons of bread-stuffs, till the next harvest. Other kinds of goods were "contingented." The lack of room on ships delayed, however, the delivery of these supplies very much. In place of the agreement with Germany (which had run out) a new treaty, much less favourable, was concluded (May 15 1918). Germany was bound to give leave for the export of 200,000 tons of coal, iron, and steel. The Swiss "Treuhandstelle" had to superintend the exchange of goods according to the S.S.S. system.

The Economic Agreement of May 5 1915 with Italy was still in existence. But on Nov. 1 1918 an economic and financial treaty was made with this country, as also with France and England. The credit to be allowed every month was fixed at a maximum of £200,000, but the amount of imports was limited.

In order to execute all these financial obligations of Switzerland the "Swiss Financial Association" was founded in Lucerne on Aug. 1 1918. To protect itself against the imminent danger of a maritime blockade, Switzerland agreed with Germany on April 24 1918 that free passage should be given for all cargoes destined for Switzerland.

In a fresh financial agreement with France (July 19 1919) Switzerland obtained a credit of about £1,250,000. The economic treaty with this country ran from March 25 1919 to the end of 1919. In Oct. and Nov. of that year the contingents of Switzerland for watches and embroideries were somewhat raised. In a fresh agreement of March 10 1920 a bargain was made with Switzerland for the delivery of 10,000 tons of coal (brown coal) from the pits on the left bank of the Rhine each month. Switzerland had to supply, among other things, electric power, but the promised amount of manure received by Switzerland was quite insufficient.

At the end of Nov. 1919 a new compensation treaty was made with Italy about the delivery of oil-cake and hay in exchange for cattle, for breeding and use.

The coal agreements came to an end in the beginning of 1919.

On Jan. 22 1919 an economic treaty was made with the United States; bigger contingents of goods were secured to Switzerland and a tonnage of 70,000 (soon raised to 100,000), England and France guaranteeing these amounts.

On March 25 1919 yet a new agreement was made with France about the supply of goods. France promised to deliver 60,000 tons of coal from Lorraine per month (at £4. 16s. a ton) and also manure and facilities for the transport of goods. On its side Switzerland engaged to deliver cattle for breeding and certain goods (chocolate, watches, embroideries, etc.) to the value of about £108,000 per month, and also a new credit not to exceed about £1,500,000 at the most.

The credit arrangement with England of March 20 1919 was not renewed. Later on, England too raised the contingents which could be imported, and sanctioned (March 1 1919) again the admittance of embroideries and silken goods. On April 28 1919 the "black lists" were abolished, and also the certificates of nationality and the contingents of imports permitted by the S.S.S.

Such were the economic agreements which Switzerland had to sign. Her economic dependence on foreign countries is thus abundantly clear, and yet it must be said that all the belligerents had taken much kindly notice of her position in this way or in another. It must be recognized that the Swiss authorities managed to get well through all their difficulties, and did not fail to take precautionary measures (sometimes very incisive) to provide the Swiss with all the necessaries of life. But, in consequence of the incredible rise in prices and the excessive prices of necessaries of life, even of those which are most indispensable, they were unable to bring it about that the distress of the people should not lead to dissatisfaction, complaints, and great discontent.

General Strike of Nov. 12 1918.—The Swiss Socialists (or Social Democratic party) were never stronger, and to a certain degree more feared, than towards the end of the fourth year of the war. The rise in prices of all commodities, and too the unforeseen and the previously unknown dearth of dwelling houses, were utilized very cleverly and ably for the purposes of propaganda, and brought great reinforcements to the Socialists. Protest meetings against too high prices were organized, and these were sometimes accompanied by political demands which caused serious restlessness. The revolution that had broken out in Russia in the preceding year and the break-up (Oct. 1918) of Germany, from the military point of view, and in part also from the political point of view, hurled their waves of revolt as far as Switzerland. Here the leaders of the workmen imagined that the moment was come for violent action. The crisis was the summoning of troops to Zürich, the Government of which on occasion of the memorial day (organized by the Socialists) of the Russian Revolution, feared serious riots. The calling of the troops to Zürich was considered by the workmen as a provocation, and the reply was a general strike for 24 hours, which very soon developed into an unrestricted general strike in the whole of Switzerland. The railways ceased to run, and in most Swiss towns the entire body of workmen took a holiday, though not in the rural districts or in western Switzerland where the strike was sometimes only a partial cessation of work, and ended in a speedy breakdown. In order to make this general strike more popular with the workmen the so-called "Olten Committtee of Action" put forth a social and political programme, which was submitted for speedy acceptance to the authorities, and included the following demands. The immediate transformation of the Government of the country so as to be in accordance with the will of the people. The new Government was to bind itself to the following programme at the very least; new election of the "Conseil National" according to the principles of proportional representation; voting rights of all kinds for women; introduction of the general obligation to work, and of the 48-hour week in all public offices and private businesses; the reorganization of the army so as to make it the army of the people; the securing of the supplies of necessaries of life, this provision to be carried out with the agreement of the rural producers; insurance for old and sick persons; State monopoly of imports and exports; and redemption of all State debts by the rich.

The Swiss executive refused to negotiate with the strikers, and the peasants made a show of cutting off the milk supplies of the towns. Another hope too of the strike leaders failed. They had expected that the soldiers, especially the members of the association of the "League of Soldiers" (thought to be imbued with revolutionary ideas and later forbidden by Gen. Wille), would

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naturally refuse military obedience. The military authorities, however, had taken the precaution to summon trusty troops from the rural and Alpine regions, and so the leaders of the strike saw their hopes falsified. When the news spread of the ultimatum issued by the Swiss executive to end the strike at once, otherwise the strike leaders would run the risk of being put into prison, the general strike came to a natural end. Such a strike has seldom broken down more wretchedly. The 48 signers of the "Olten Appeal" were accused of instigating the strikers to mutiny, and so were handed over to the military authorities for examination. By this accusation was meant any appeal which directly or indirectly was made to the soldiers, with the warning not to march against their own brothers, and not to turn their weapons against the workmen, but, in case such a command should be given, rather to refuse military obedience. By far the greater number of the 48 signers were acquitted. Only a few of the most prominent and the most compromised leaders were kept, and received punishments ranging up to six months' imprisonment. Here, as elsewhere, it became clear that the greater part of the Swiss workmen never would approve a united general strike with purely political aims.

Interned Prisoners.—As early as Oct. 1914, a beginning was made with the dispatch of the evacuated civilians home to France, Germany, and Austria, passing through Switzerland. And up to March 5 1916 some 60,000 persons were conveyed back to France alone by the same route.

On Feb. 21 1916 an arrangement was finally made about the exchange of the severely wounded German and French prisoners who were to pass through Switzerland. After the consent of the Swiss Red Cross had been previously obtained, this duty was confided to it by a decree of the Swiss executive. Now began the foreign action of that institute which lasted for five long years. Constance and Lyons were fixed on as the exchange centres; the trains were to pass through Switzerland at night, and the railway carriages required were to be furnished by the State railways.

Before the actual transport took place, "selection committees" visited the various prisoners' camps, in order to inspect the severely wounded men, and to settle which should be included in the exchange. The Swiss Red Cross agreed to defray all the expenses for the food, etc., of these poor men, and their nurses etc., but not the railway fares.

Besides the medical men, male Red Cross nurses accompanied the trains, sometimes also soldier nurses, while women nurses from nearly every Swiss nursing home looked after the invalids. The journeys took place at longer or shorter intervals, but often there were lengthy breaks, due to the state of the war, and to difficulties that arose between the hostile states.

The Swiss people took a great and a very sympathetic share in these transport trains. People flocked from long distances to the railway stations merely to see the trains rush past, and had the feeling that thereby they had showed their sympathy with the unfortunate victims of the war. At the places where the trains halted, the joy was enormous. At some spots the trains had to stop because the people would block them by standing on the rails, and a huge quantity of loving gifts, for which room was scarcely found, literally overflowed the Red Cross carriages.

The good example of France, Belgium, and Germany was followed in Nov. 1916 by Italy and Austria also. The exchange stations here were Como-Monza and Feldkirch-Dornbirn, and many trains came through with Austrians, Bulgarians, Turks, Serbs, English, and Italians. Later on, when Austria resolved to repatriate the numerous Italian consumptives, whose illness was still in the preliminary stages, special consumptive trains became also necessary. Imbecile soldiers were transported in great numbers. Twice trains, with many such, came through, and no one could determine their names or their homes.

A most pitiful and moving spectacle was the sight of the trains filled with evacuated civilian travellers. Old men with snow-white hair, women of all ages, and children, even unweaned infants, were seen in these trains. These unfortunate persons were warmly welcomed and well fed, in the most hospitable fashion. It is a gloomy chapter in the history of the war.

The interned soldiers were mostly housed in the Alpine regions. This took place for various reasons. First of all, the high air was looked upon as a great factor in their convalescence, and then again they were isolated from the temptations of bigger places and towns, and, finally, in the tourist centres many hotels stood empty, all ready to receive this new kind of guest, and well fitted to shelter great bodies of interned.

No Swiss industry was so hard hit by the war in its very existence as the Swiss tourist traffic, once so flourishing. According to the statisticians, milliards of francs were invested therein, and so, soon after the outbreak of the war, special measures of protection (such as exemption from bankruptcy suits) and also acts of charity had to be taken. What wonder then that the Swiss authorities, by this action in favour of the interned, hoped to kill two birds with one stone, and appropriate these small profits to the stricken *industrie des étrangers?*

The daily sum paid for accommodation, etc., per head was originally four francs, later five francs, and even in 1921 an extra amount of one franc daily per head for 1918 was the subject of negotiation. (These sums were paid by the respective states concerned.) But no state, save defeated Germany, had agreed up to June 1921 to this extra expense. The food was simple and nourishing, and in some places it was more than good.

At the beginning of the period of internment the interned were given free postage for all letters sent to their native countries. And nothing too was charged for parcels sent thence to foreign countries. This humane arrangement was afterwards first restricted, and later on quite suppressed, as the war seemed to be never ending, and the cost to the Swiss post-office ran up to £2,000,000, and even more.

A great difficulty arose as to the employment of the interned. In some places they took to an industry which promised them certain profits. Such were the beautiful, and even most artistic works of art which were produced by simple and untrained soldiers. They acted as joiners, mechanics, turners, wove baskets, made ropes, and nets, painted pictures, etc. In Thun, as early as 1916, a school of commerce was opened for the interned. The universities of Basle, Berne, Geneva, Lausanne, and Zürich allowed interned to matriculate as students. The Bernese University Committee provided in 42 prisoners' camps outside Switzerland both teachers and students with money, food of various kinds, clothing and books. The interned were permitted to hold exhibitions of their products, and special committees were founded to promote the sale of the fruits of their labour. Now and then they received visits from high-placed countrymen (such as Gen. Pau, etc.). They looked after their social amusements themselves. One English committee even got together money for the visits of English women to their husbands interned in Switzerland. The English interned enjoyed the special sympathy of the Swiss. The number of prisoners interned in Switzerland was already in Aug. 1916, 18,936—11,823 French, 4,322 Germans, 1,607 Belgians, 1,183 English, and one Austrian. These numbers later increased very much, and finally, when difficulties arose about food in Switzerland, it could not possibly receive an unrestricted number, and so after a certain time the interned were exchanged for others.

When the internment of wounded prisoners was resolved on in Switzerland this business was entrusted to the chief army medical officer, and the Swiss Red Cross. Practically, the Red Cross took charge only of the transport of the interned to and from Switzerland, everything else being supplied by the army authorities. The interned had fewer invalids than the exchanged prisoners, and so required only ordinary trains with occasional carriages in which to lie down; but many persons seriously ill were sent home, and the Swiss Red Cross looked after all such cases.

After the Armistice the principal transport of the prisoners belonging to the Entente took its start. The sick and invalids were partly sent for in special "sanitary" trains,—French, English, American, and Italian,—the nurses, etc., being supplied by the Swiss Red Cross. All these journeys passed off without any serious accidents, at least it never happened that any one was injured, though the trains went at express speed.

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The Swiss Red Cross spent (apart from the railway fares) some £13,000 in carrying out this transport. No fewer than 81,377 persons were conveyed by the Swiss Red Cross, and that without counting the numerous civilians interned and civilians evacuated, who had previously passed through Switzerland, the number of these amounting to several hundred thousands. All these persons travelled through Switzerland.

In April 1919 there were still 5,000 Germans interned in Switzerland. These could only be sent home later, shortly before the home-coming of the prisoners interned in France.

The international action of the Swiss Red Cross extended also to investigations as to prisoners and missing soldiers. From all parts enquiries arrived, relating to the whereabouts of various soldiers. This was a task which properly belonged to the International Committee at Geneva, specially created for this purpose. In many cases, however, the Swiss Red Cross, thanks to its fortunate and useful communications by reason of the exchange of the interned, could answer these enquiries. With this object a special office was set up in Berne for the interned prisoners of war in Switzerland, and to this all enquiries were to be addressed, whether for interned persons or missing persons.

International Red Cross at Geneva.—The following was the share of this well-known institution. When hatred and reprisals on both sides got the upper hand, it issued a series of appeals, first of all in favour of common action in carrying out the task of the Red Cross, next to the belligerents on behalf of the wounded and sick, of the nursing staff, of their supplying necessary wants in accordance with the Convention of Geneva, and of the Hague Convention. Next came protests against the torpedoing of hospital ships and against the bombardment of hospitals on the field, the protection of Red Cross unions, the recognition of the Red Crescent, as to the treatment of prisoners, and the distribution of money collected (about £13,000) to the Red Cross associations of the belligerents, as to the reception of Red Cross sisters in Switzerland for rest and refreshment, missions to visit camps of sick prisoners in Italy, Bulgaria, etc., and prisoners' camps in general, the facilitating of communications between the Red Cross associations of the several belligerents, in favour of the sending home certain categories of war prisoners, against the propaganda bureaux, and against the employment of poisonous gas, etc. That is only an imperfect list of the tasks which the International Red Cross undertook, and which it would take a book to describe in detail. Its influence was not less blessed than that of the Swiss Red Cross, and was of extreme importance for facilitating communications between the belligerents. It is worth mentioning that the French poet, Romain Rolland, gave half the proceeds of his Nobel prize to Gustave Ador, the president of the International Red Cross in Geneva, for the war prisoners.

Help Given to Other Nations.—As early as June 28 1915, Switzerland hearkened to the cry of distress from little Luxemburg, then occupied by the Germans, and sent flour to help its suffering population. On Oct. 6 of the same year the Luxemburg Minister of State, von Eyschen, came to Berne to arrange for the supply of the necessaries of life to his country through the Swiss "Import Trust." The principality of Liechtenstein was supplied also with food-stuffs; this led to its closer association with Switzerland, and in 1921 it had Swiss postage stamps and used francs as money. On Dec. 4 1918, shortly after the Armistice, Switzerland, in order to alleviate the hunger in the German districts of Austria, sent ten trucks, laden with flour, and nine with rice, to Innsbruck. These supplies were reimbursed by the Entente, as also were the 100 trucks of necessaries of life sent on the 27th of the same month. Switzerland was selected as being able to send supplies quickly. Later, she sent them from the stocks meant for her own consumption.

But this kind of help was not the only sign of sympathy shown by Switzerland. When the need increased it extended its charity to the reception of badly nourished children belonging to the belligerent states. In Sept. 1916, 760 Belgian children from the occupied territory were long in the canton of Fribourg. In other Swiss cantons such poor children were also received. In the year 1919 alone a total of 43,000 foreign children was received in order to recover from illness. It were principally Belgian, Austrian, and German children who benefited by this act of charity.

Obituary, 1910–21.—Death was especially busy with the great Swiss historians during the decade 1910–20. J. Dierauer (1842–1920); W. Oechsli (1851–1919); Karl Dändliker (1849–1910); B. van Muyden (1852–1912) passed away, as well as Jakob Heierli (1853–1912), the principal authority on prehistoric Switzerland; Adolf Wäber (1841–1913), the bibliographer of works of travel in Switzerland; Caspar Decurtins (1855–1916), the great authority on the Romansch dialect; Jean Grellet (1852–1918), the well-known writer on Swiss heraldry; Emilio Motta (1857–1920), the founder and also the editor (for 35 years) of the *Bollettino della Svizzera Italiana*, which rendered such great service for the history of Italian-speaking Switzerland; and Henri Fazy (1842–1920).

The fine arts also mourned the loss of Ferdinand Hodler (1853–1918), the merits of whose pictures were so hotly discussed during his lifetime; Max Buri (1868–1915), the delineator of Bernese peasant life; and Eugène Burnand (1850–1921). To these losses we must add Richard Kissling (1848–1919), the famous sculptor; and J. R. Rahn (1841–1912), the historian of Swiss art.

Other Swiss, each eminent in his own way were Theodor Kocher (1841–1917), the world-famous surgeon; F. Imhoof-Blumer (1838–1920), the celebrated numismatist; F. A. Forel (1841–1912), the physicist and monographer of the Lake of Geneva; Johannes Coaz (1822–1918), the great authority on Swiss forestry, and a mountain climber whose active career ended in 1850; J. H. Graf (1852–1918), the mathematician and leading authority on old Swiss cartography; and, last but not least, J. H. Dunant (1828–1910), the founder of the International Society of the Red Cross at Geneva.

We must not omit a group of men of letters of the "Suisse Romande"—Gaspard Vallette (1865–1911) and Philippe Monnier (1864–1911); and the novelist Edouard Rod (1859–1910).

Our list may be brought to a close with the names of the linguist, Ferdinand de Saussure (1857–1913); and of the Romance scholar, Heinrich Morf (1854–1921).

Miscellaneous.—Perhaps the most important event which happened in Switzerland in 1920 was the first meeting of the League of Nations in Geneva, a spot selected, it is said, by President Wilson. In Feb. 1921 Switzerland declined to allow the passage of police troops to guard the peace in the Vilna popular vote.

Switzerland has adopted officially the day of 24 hours, running from midnight to midnight.

Naturally, the possibility of winter sports in Switzerland was excluded (save for the natives) during the war, and they had not quite reached their former vogue even by 1921.

The long war had a most disastrous effect on the Swiss hotel industry. Previously to it far too many big hotels had been built, so that the whole industry was overcapitalized and in a state of great indebtedness to the banks. After the end of the war many hotels were pulled down or diverted to other uses, even in such frequented spots as Interlaken and Grindelwald. It has been stated by H. Gurtner that the total capital invested in the Swiss hotel business was in 1912 about £45,500,000, or about one-thirtieth of the total amount of the wealth of Switzerland. The same writer puts the total value of the hotels in the Bernese Oberland at about £6,000,000 just before the outbreak of the war.

On May 15 1914 a great national exhibition was opened at Berne. But the speedy outbreak of the war nearly ruined it.

The rate of exchange on London varied much during the war. After the first shock it rose to over 26 francs (par 25), but then sank, and attained its lowest point in June 1918, with 18·83½. It subsequently recovered somewhat, but in Aug. 1921 it stood only at 21·64. Of course this involved great losses for English residents and travellers, while the better value, obtained both in France and Italy, drew many to those lands.

BIBLIOGRAPHY, 1909–21.—In 1910 the 6th and final volume of the *Dictionnaire Géographique de la Suisse* (the first appeared in 1902) was issued at Neuchâtel, while in 1918 the same publishers began the publication of the *Dictionnaire Historique et Biographique de la Suisse*. (Both publications are issued in French and German.) H. Barth gave to the world in 1914–5 the three vols. (going down to the end of 1913) of his marvellous *Bibliographie der Schweizer Geschichte*. In the domain of constitutional history we have a new and revised edition (1914) of W. Burckhardt's *Kommentar der schweiz. Bundesverfassung von 1874;* A. Heusler, *Schweiz. Verfassungsgeschichte;* E. His, *Geschichte des neueren Schweiz, Staatsrechts 1798–1848* (vol. i. 1920); and W. Raustein, *Die schweiz. Halbkantone* (1912). For very early Swiss history we have A. Schenk, *La Suisse Préhistorique* (1912); P. E. Martin, *Études critiques sur la Suisse à l'Époque mérovingienne, 554–715* (1910); and Marius Besson (now the Bishop of Lausanne and Geneva), *L'Art barbare dans l'ancien diocèse de Lausanne* (1909).

The very best detailed history of the Swiss Confederation is that by J. Dierauer, entitled *Geschichte der Schweiz. Eidgenossenschaft*, now complete in five vols. and published at Gotha (vols. i and ii., 2nd ed., 1913; vol. iii., 1907; vol. iv., 1912; and vol. v., 1917) which brings the tale down to 1848;—a continuation is in preparation—there is also a French translation. E. Gagliardi, *Geschichte der Schweiz* (2 vols., 1920), is a new general Swiss history.

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An important episode in Swiss history is narrated by E. Gagliardi, *Der Anteil der Schweizer an den italienischen Kriegen, 1494–1516* (vol. i., 1494–1509, 1919). Marie Louise Herkin's life of *C. V. Bonstetten, 1745–1832* (1920) is a contribution to Swiss literary history of the 18th century. W. Oechsli's *Geschichte der Schweiz im 19ten Jahrhundert*, from 1798 (vol. ii. appeared at Leipzig in 1913, the work will be continued by E. Gagliardi), and J. Winiger's life of *Josef Zemp, 1834–1908* (1908), like E. Deriaz's *Un Homme d'État vaudois, Henri Druey, 1799–1855* (1920), and T. Weiss' life of *Jacob Stämpfli, 1820–1879* (1920), relate to modern Swiss history. In 1918 W. Oechsli published at Zürich a new edition of his *Quellenbuch zur Schweizergeschichte*.

In geology we have to note A. Heim, *Geologie der Schweiz* (appearing since 1919 in parts at Leipzig). In the domain of the fine arts vol. iii. of the *Schweiz. Künstler-Lexikon* appeared in 1913, as did an extensive supplement to the work. The special works by J. Scheuber, *Die mittelalterlichen Chorstühle in der Schweiz* (1910) and by E. A. Stuckelberg, *Cicerone im Tessin* (1918) are also very useful works in this department.

In ecclesiastical history we have the fine monograph, *Angelomontana* (1914), and vol. ii. (vol. i. appeared in 1907) of J. G. Mayer's *Geschichte des Bisthums Chur* (1914), and vol. v. (1917) of E. Doumergue's *Jean Calvin*.

Another subject of great importance to Switzerland is treated of in H. A. Gurtner's *Zur Verschuldung des schweiz. Hotelgewerbes* (1918), written by a Swiss hotel-keeper's son.

The following works refer to the Swiss Alps—Julien Gallet, *Dans l'Alpe Ignorée* (1910); E. J. P. de la Harpe, *Les Alpes Valaisannes* and *Les Alpes Bernoises* (1911 and 1915 respectively); and H. Dübi, *Die ersten 50 Jahre des Schweizer Alpenclub* (1913, also in French).

Turning now to the several cantons the following works deserve mention:—

BASLE: R., Wackernagel, *Geschichte der Stadt Basel* (vol. ii. 1916, vol. i. appeared in 1907); A. Heusler, *Geschichte der Stadt Basel* (vol. i., 1917).

GENEVA: L. Cramer, *La Seigneurie de Genève et la Maison de Savoie, de 1559 à 1605* (2 vols. 1912); H. Heyer, *L'Église de Genève. 1535–1909* (1909); L. Blondel, *Les Faubourgs de Genève* (1919; vol. iii. 1918) of the *Recueil Généalogique Suisse;* W. Oechsli, *Les Cantons Suisses et Genève 1477–1815* (1915); and E. Doumergue, *La Genève des Genevois* (1914).

TICINO: Karl Meyer, *Leventina und Blenio von Barbarossa bis Heinrich VII.* (1911).

VALAIS: D. Imesch, *Die Walliser Landrats-Abschiede seit 1500* (vol. i., 1500–19, 1916); and A. Büchi, *Korrespondenzen und Akten zur Geschichte des Kardinals Matth. Schiner* (vol. i., 1489–1515, 1920).

VAUD: B. van Muyden, *Pages d'Histoire Lausannoise* (1911), and *Recueil de Généalogies Vaudoises* (4 parts, 1912–20).

ZÜRICH: K. Dändliker, *Geschichte der Stadt und des Kantons Zürich* (3 vols., 1908–12). (W. A. B. C.)

SYDENHAM, GEORGE SYDENHAM CLARKE, 1ST BARON (1848–), British soldier and administrator, was born in Lincolnshire July 4 1848. He was educated at Haileybury and Wimbledon, and afterwards at the Royal Military Academy. In 1868 he entered the Royal Engineers, and in succeeding years served in various expeditions abroad, including the Sudan operations of 1885. The same year he returned to England, and was employed at the War Office until 1892, being at the same time secretary to the Colonial Defence Committee. He was also secretary to the Royal Commission on Navy and Army Administration. From 1894 to 1901 he was superintendent of the royal carriage factory at Woolwich. During all these years Sir George Clarke, who was created K.C.M.G. in 1893, had earned a great reputation, outside as well as inside his profession, as an authority on military questions, over and above his special subject of fortification. On his retirement from Woolwich, he was made a member of the important committee on War Office reorganization. In 1901 he was appointed governor of Victoria (Australia), and on his retirement in 1904 he became secretary to the Committee of Imperial Defence. From 1907 to 1913 he was governor of Bombay. He had been created G.C.M.G. in 1905, and in 1913 was raised to the peerage. He subsequently took a vigorous interest in many public questions, becoming chairman of the Royal Commission on Contagious Diseases (1913–5), chairman of the Central Appeal Tribunal (1915–6), and president of the National Council for Combating Venereal Diseases. In addition to his classic work on *Fortification* (1890; 2nd ed. 1907), his publications include *The Navy and the Nation* (1897) and *Imperial Defence* (1898), besides handbooks on military subjects.

SYKES, SIR MARK, 6TH BART. (1879–1919), English traveller and politician, was born March 16 1879, the only child of Sir Tatton Sykes, 5th Bart., of Sledmeer, Yorks. He was educated at the Roman Catholic public school of Beaumont College and afterwards at the École des Jesuites, Monaco, and Jesus College, Cambridge. He served in the South African War (1902), in 1904 became secretary to Mr. George Wyndham in Ireland, and in 1905 went to Constantinople as honorary attaché to the British embassy, remaining there until 1907. Before this, however, he had begun a series of travels and explorations, especially in Turkey and the Near East. He published several works dealing with his various expeditions, among them being *Through Five Turkish Provinces* (1900); *Dar-el-Islam* (1903); and *Five Mansions of the House of Othman* (1909). He also prepared maps of the north-western region of Mesopotamia and of the southern districts of Palestine, for which in 1906 he was thanked by the Army Council and Foreign Office. His knowledge of these regions proved invaluable during the World War. In 1911 he was elected to Parliament for Central Hull as a Unionist, and in 1913 he succeeded his father as 6th Baronet. On the outbreak of war in 1914, Sir Mark Sykes raised a battalion of the Yorkshire Regiment, but did not proceed with it to France. He was sent on important special missions to Russia, Mesopotamia and Syria, and published in 1915 *The Caliphs' Last Heritage*. He died suddenly in Paris Feb. 16 1919.

SYMPATHETIC NERVOUS SYSTEM, in physiology (*see* 26.287). On studying the effects of stimulation of the sympathetic nervous system it appears that they are directed towards activating the body for fight or flight. The dilatation of the pupil increases the perception of light; the acceleration and augmentation of the heart-beat increases the blood supply; the constriction of the blood vessels in the visceral area raises the blood pressure, driving the blood from the digestive area, whose functions are simultaneously inhibited, into the skeletal and cardiac muscles, the lungs and the brain. The sweat glands are stimulated to cool the blood heated by increased muscular effort and the hairs are erected in many animals to render them more alarming. The "goose skin" experienced by man under emotional stress is similarly produced, though not now advantageous. Some emotional responses, like some bodily structures, are vestigial remains. The other division of the autonomic system, to which the name of parasympathetic has been given, serves the purpose of building up reserves and of fortifying the body against times of need and stress. Thus by contracting the pupil it shields the retina from excessive light; by slowing the rate of the heart it gives it longer periods for recuperation; it excites appetite and by promoting the assimilation and digestion of food it stores up energy. The sacral division of the parasympathetic is a mechanism for emptying, thus leading to greater comfort. The sympathetic is, therefore, katabolic, converting potential energy into kinetic, and facilitating outward manifestations of that energy; while the parasympathetic is anabolic, directing energy inwards, where it is stored up. When these two are distributed to the same structure their action is always antagonistic.

In pain, fear, rage and any intense excitement, the sympathetic neurons are brought rapidly into play and the action of the cranial division of the parasympathetic is inhibited. Anabolism is in abeyance and katabolism goes on unchecked. This is comprehensible, since these katabolic activities are defensive in origin and aided the primitive animal in its struggle with or flight from its enemy.

Of late it has been realized that each of these divisions of the autonomic system coöperates with its appropriate group of endocrine glands. The sympathetic group consists of the adrenals, the thyroid and the pituitary—each of which are accelerators of metabolism. The intimate relationship embryologically, structurally and functionally between the nervous and glandular elements is best illustrated by the adrenals. The medulla of the adrenals and the sympathetic ganglia originated from similar cells, preganglionic fibres end round both, and adrenalin, the secretion of the medullary portion, produces the same effect on any part as stimulation of the postganglionic fibres; an interesting example of parallelism between a nervous and chemical mechanism. Just as the preganglionic fibre stimulates the secretion of adrenalin, so adrenalin increases the postganglionic responses.

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A similar reciprocity exists in the case of the thyroid; it is stimulated to secretion by the sympathetic and the secretion lowers the threshold to sympathetic stimulation. The existence of sympathetic secretory nerves to the pituitary has been shown, but there is no definite evidence of a reciprocal action of its secretion on the sympathetic.

The endocrine group which coöperates with the parasympathetic must be looked for chiefly in the glands of the alimentary tract and its annexes, since the building up of energy must ultimately be derived from the food. Gastric secretion is started by the appetite and the taste of food reflexly stimulating the organs, but it is continued by a hormone in the pyloric glands of the stomach which spur the fundus glands on to renewed effort. In its turn the acid gastric juice entering the duodenum acts on its mucosa to form secretion, which stimulates secretion of pancreatic juice. But the pancreas forms an internal secretion as well, which promotes the assimilation of sugar. Indeed, the metabolism of sugar gives a particularly good illustration of the general principle here laid down. Acting muscle requires three and a half times as much sugar as resting muscle, and the mobilization of sugar into the blood is a necessary preliminary to muscular effort. Accordingly sympathetic stimulation is found to produce this effect, through the adrenals, thyroid and pituitary, the secretion of each of which taken separately will lower carbohydrate tolerance and may excite glycosuria. On the other hand, the pancreas which is innervated by the parasympathetic has a precisely opposite effect, the antagonistic action of the glands being as definite as that of the associated nerves. Another example of this antagonism is seen in the continuous flow of pancreatic juice following removal of the adrenals, which can be temporarily inhibited by injection of suprarenal extract. Again, it is well known that adrenalin dilates the pupil of an excised eye but not of the intact eye of a normal individual. Therefore something inhibits the adrenalin effect. In depancreatised dogs adrenalin does dilate the pupil, and it has been found to do the same in patients suffering from pancreatic disease, since the normal antagonism of the pancreas to the adrenals is then lost. This pupillary response may also be present in hyperthyroidism, suggesting that the thyroid excess inhibits pancreatic activity, allowing adrenalin to show its dilator action unchecked.

The sympathetic nervous system, the endocrine glands and the gonads form a basic tripod entrusted with the duty both of the preservation of the individual and the continuity of the species. Their relationship is shown in disease as well as in health, and is reflected in many neuroses and psychoses. Disease is the resultant of some external action and of the reaction of the organism against it. It therefore draws on the defensive mechanisms and connotes a position of less stable equilibrium in which the body works with more friction. It may demand an increased supply of hormones to compensate for this, which may ultimately lead to exhaustion of the gland that provides it. In this way the balance between the endocrine glands is disturbed, either from overaction of a gland, or from its unopposed action through the loss of an antagonist.

The sympathetic-endocrine system is affected alike by toxic, nutritional or psychic factors, and is particularly likely to be injuriously influenced if more than one such factor is overtaxing it. As this system has to defend us against internal foes, such as bacterial infections, as well as external enemies, we find that it plays an important part in the regulation of the body temperature. Since it has been shown that the cerebral vessels are remarkably impermeable to drugs and toxins as long as they maintain their integrity, it has become impossible to explain febrile reaction to infection by a central mechanism. When the activity of the thyroid and anterior lobe of the pituitary is diminished, less heat is produced. When increased production is required, the thyroid and adrenals give histological evidence of increased secretion. Cramer has found this both in fevers and after exposure to cold. He has also experimentally produced such changes by the injection of a drug which causes fever. Infections such as gas gangrene which do not induce a febrile reaction do not produce these changes. He has traced the adrenalin into the blood vessels, whereby sympathetic nerve endings all over the body will be stimulated. At the same time more sugar is poured into the blood, largely through thyroid activity. The oxidation of this sugar increases heat production. It has long been known that the adrenals may show marked signs of exhaustion after a severe infection such as diphtheria, while the thyroid may suffer after typhoid fever. Such exhaustion appears to be an important factor in the psychoneuroses of convalescence.

The influence of nutritional factors on the apparatus is seen in the way in which (1) pregnancy enlarges the thyroid and pituitary; (2) vitamine defects cause enlargement of the adrenals and pituitary while causing some atrophy of other endocrine glands; (3) deficiency of assimilable protein in the food causes pellagra in which the adrenals suffer, while the sympathetic nervous system shows actual structural degeneration. While toxic and nutritional influences play chiefly on the glandular part of the apparatus, psychic factors naturally act primarily on the nervous part, though ultimately both parts will become affected, whichever is involved first. The sympathetic is the lowest level of the nervous system and retains several characteristically primitive features, such as peripheral ganglion cells, myenteric nerve nets, connector fibres lying outside the central nervous system, and urgent widespread responses, rather than accurately localized and discriminative ones. This is in accordance with the evolution of the nervous system for defense, and with the maintenance of this primitive function by the sympathetic. Pain has been shown by Trotter to be the specialization of the primitive sensation of lower animals, and fear might similarly be regarded as a specialization of a primitive emotion. It is to such sensation and emotion that the sympathetic nervous system preëminently responds. Both pain and fear are apt to become intense when the appropriate motor response is prevented, though they may not be appreciated when vigorous response is possible. Thus during the excitement of a fight neither fear nor pain may be experienced under conditions which would ordinarily induce them. In the civilized state the response appropriate to primitive man has often to be repressed. The effect of this repression may show itself either as an anxiety neurosis, at the psychic level, or at the sympathetic-endocrine level in certain affections of the associated glands, and in cardiac or digestive neuroses. Such repressions are particularly likely to be necessitated when the great instincts of self-preservation, reproduction and gregariousness, which relate respectively to the life of the individual, of the species and of the community, come into conflict with one another. The constant demand for adrenalin when sympathetic action is increased in fear and anxiety may lead to exhaustion of the gland. Addison's disease presents a clear-cut picture of adrenal deficiency in its symptoms of muscular weakness, low blood pressure, pigmentation and vomiting. Although this is due to organic changes, slighter degrees of a similar condition are now recognized and it has been suggested that this enters into many war neuroses and other functional states characterized by vasomotor instability, low blood pressure and myasthenia. Conversely, prolonged oversecretion by the adrenals must tend to raise blood pressure through the sympathetic, tending in turn to arteriosclerosis, with all its widespread effects. The well-known influence of anxiety in producing this condition can thus be explained.

There is a close association between the thyroid, the reproductive organs and the sympathetic. The thyroid tends to enlarge at puberty, marriage and in pregnancy, while myxoedema is most apt to occur after the climacteric. Amenorrhoea is common even in the minor degrees of hyperthyroidism. The effect of sympathetic irritation in producing thyroid enlargement and Graves' disease is now recognized. Cushing showed that if in cats he sutured the phrenic nerve to the cervical sympathetic so that every respiration stimulated the latter, he could produce the symptoms of Graves' disease. The influence of distressing emotions in producing hyperthyroidism was well shown during the air-raids on London during the World War. Epidemics of Graves' disease also followed the Kishinev massacres and the San Francisco earthquake. Again, if a distressing emotion has a matrimonial origin, it is particularly likely to induce Graves' disease, for here each limb of the basic tripod is involved. The disease has been compared with a state of continuous fear, a description which tallies with its general appearance.

The pituitary body also shows the two-fold association with the reproductive organs and the sympathetic nervous system. The anterior glandular part has an effect on temperature, the growth of bone and skeletal tissues and the reproductive organs. The intermediate lobe influences carbohydrate metabolism, while the secretion of the posterior lobe is mainly a stimulant to plain muscle and to the secretion of milk. The effect of the secretion of the posterior lobe on diuresis is still a matter of controversy, but it is clear that disease of the posterior lobe is often found in diabetes insipidus and that stimulation of the sympathetic nerves to the gland will cause polyuria. Probably hysterical polyuria is thus produced.

It is also clear that some cases of glycosuria are of sympathetic nervous origin; the physiological mechanism by which this can be brought about has already been explained. Diabetes is characterized, like sympathetic stimulation, by an exaggerated katabolism. This shows its effect first on the most abundant and most easily metabolised of the food-stuffs, the carbohydrates, which are also essential for muscular action, to which sympathetic stimulation should normally be a preliminary. Sympathetic stimulation induced by various disagreeable emotions will increase metabolism generally and specially lower carbohydrate tolerance. The influence of excitement and emotion in causing glycosuria is well recognized. It is commonest in Jews, a notoriously emotional race. When stocks go down in New York, says Crile, diabetes goes up. Temporary glycosuria occurred in a number of men who merely watched a football cup-tie without participating in it. Glycosuria has been, unfortunately, comparatively common in young officers entrusted with heavy responsibilities during the war. Singer and Clark have

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recorded two cases in which there was alternation between glycosuria and the exhibition of mental symptoms, as if the emotional discharge asserted itself either at the metabolic or the psychic level but not at both.

Finally, the inhibitory effect of the sympathetic on the digestive processes must be remembered. Fear checks the secretion of saliva, anger stops the secretion of gastric juice. Depressing emotions acting through the sympathetic check the peristalsis of the stomach while closing the pyloric sphincter, thus leading to a dilatation of the stomach. A similar inhibition of intestinal peristalsis may occur, leading to intestinal stasis. This in its turn will lead to a drag on the sympathetic nerves in the mesentery, increasing their inhibitory effect. Thus a vicious circle is established and the persistent intestinal toxaemia that results may produce organic changes in many structures, including the group of endocrine glands which coöperate with the sympathetic.

The consideration of diseases produced through the agency of the parasympathetic lies outside the present topic, except in so far as the vagus may overact from a loss of balance produced by diminished sympathetic action. Suffice it to say that laryngeal spasm, asthma, slow or irregular action of the heart, low blood pressure, hyperchlorhydria, spastic constipation and a liability to skin disturbances of the vasodilator type are among the symptoms evoked. Since febrile reaction to disease is a function of the sympathetic, which is antagonistic to the parasympathetic, we find that those subjects with an overacting vagus do not react well to infections and, indeed, show an abnormal sensitiveness to many foreign proteins. Their tendency to undue anabolism is sometimes indicated by their tendency to flabbiness of the tissues and overgrowth of lymphoid structures. A curious point is the occurrence of sweating, since the secretion of the sweat glands is under the control of the sympathetic. But a similar discrepancy is seen in the action of a vagotropic drug such as pilocarpin.

In assessing the effects of the sympathetic nervous system in disease, it must be borne in mind that we have very little knowledge of its morbid anatomy, though a beginning has been made in the study of pellagra. The evidence so far mainly relates to function and were our knowledge of its structural alterations at all comparable to what we know of organic changes in the spinal cord, we should be on firmer ground. But enough has been learned to show that the sympathetic plays a large part in the regulation of the internal viscera, and, through the endocrine glands, in general metabolism. The balance between these glands determines to a large extent both the racial and individual characteristics. Climatic influence has a profound effect through the skin on the sympathetic nerves and hence on the endocrine glands. The development of protective pigment is an important method by which the sympathetic-endocrine system can react to this, and the unadaptibility of albinos in this respect is well known. Thus physical environment can influence both temperament and structure, and the sympathetic-endocrine system must have played a large part in developing the variability of man into different races.

Evolved in a subconscious plane the sympathetic nervous system remains for ever beyond the control of the will. Timme quotes an instance which, while apparently contradicting this, proved on further inquiry to support it. This was the case of a man who could voluntarily dilate his pupils, who could cause the pilomotor muscles to raise the hairs on his arm, and who could at will produce the phenomenon of "goose-flesh" in various parts of his body. When closely questioned he admitted that the effects were produced not immediately by his will, but always by the intermediation of some association called into being by him. Thus when dilating his pupils he always imagined himself looking far into space, under which conditions the pupil does dilate. For the goose-flesh effect he would picture to himself his arm plunged into ice-cold water, and the goose-flesh appeared. Various associations produce autonomic effects without our will, and it is reasonable to infer that, if we can recall these associations through our will, the same autonomic effects will be produced.

The higher centres of the brain show their influence on the lower chiefly in the direction of inhibition. The highest organism is the most self-controlled, but the sympathetic cannot be thus controlled. The will can only help in so far as "it can make our voluntary activities harmonize with our environment." The emotional apparatus remains, as McDougall has pointed out, the most unchanging part of our nervous equipment, though the stimuli to which it responds may vary enormously in different individuals. But once the response occurs, it is extraordinarily true to type. This is comprehensible since the apparatus retains so many features of the primitive nervous system. (W. L. B.*)

SYNDICALISM.—"Syndicalism" is the name given to a form of socialist doctrine elaborated by, and born from the experience of, the members of the French *syndicats* or trade unions. On the one hand it is a body of social doctrine, or theory of social organization; on the other it is a plan of action for the realization of this ideal. Of all the social theories competing for existence it is the most purely proletarian in origin. One writer indeed has described it as "working-class Socialism" (*le socialisme ouvrier*) in contradistinction to the types of socialism originated and propagated by middle-class "intellectuals." Without unduly stressing the importance of this fact, it may be said that syndicalism is that form of socialist theory which regards the trade-union organizations, entirely proletarian in origin and direction, as at once the foundations of the new society and the instruments by which it is to be erected.

The syndicalist starts from the assumptions common to most schools of socialist thought. He affirms the inherent injustice of the wages system and the fundamental immorality of capitalist society, which is based, in his belief, on the exploitation of labour. He accepts and pushes to its logical conclusion the Marxian dogma of the class war; he therefore affirms that solidarity of interests does not, and cannot, exist as between employer and employed, between capitalist and wage-earner. From these premises he draws the usual socialist conclusion, namely, that individual ownership of the instruments of production must be abolished and communal ownership and control substituted for it. But at this point syndicalism and socialism (as usually understood) part company. Whereas the orthodox socialist demands control by the consumers acting through the State and its dependent organs the municipalities, the syndicalist demand, until very recently, was for producers' control, acting through the organizations of their own creation—the trade unions. This is the essential feature of syndicalist theory, that which differentiates it from other revolutionary schools of thought. The arguments usually employed by its advocates may be briefly set out.

State organization and control of industry are, in their view, incompatible with true working-class emancipation. The State is, and must be, an instrument of class domination; it is indeed "the executive committee of the capitalist class." It exists to defend the interests of that class, and is consequently as much the enemy of labour as capital itself. To extend its powers would be to twine the bonds of wage slavery ever more firmly about the workers' limbs. The State is, however, hopelessly wedded to an uncreative bureaucracy, incapable of initiative and ignorant of industrial technique. Its control, even if it were benevolent (which the syndicalist denies it could be), would necessarily be despotic and inefficient; the spirit of routine would combine with inexperience to crush out the possibility of economic progress. Here, as will be seen, the syndicalist endorses the ordinary individualistic criticism of State socialism. Producers' control, exercised through the *syndicats*, would, on the other hand, combine freedom with efficiency. Every worker would participate directly in the government of his industry; he would thus enjoy the substance of democracy instead of the shadow offered him by the *bourgeois* State. Moreover, the worker would be led to identify his personal interests with the successful conduct of the industry; he would have a pride in his work which would manifest itself in improved quality and greater output, thus producers' control would be justified both on human and economic grounds.

The form of social organization in which this ideal could be realized was, until recently, conceived somewhat as follows. The unit of organization would be the local *syndicat*. This would be brought into touch with the local groups by means of the *Bourse du Travail*, the present function of which is to act at once as an employment agency and a general centre for trade-union activities. When all the producers were thus linked together by the *bourse*, the administration of the latter would be able to estimate the economic capacities and necessities of the region, could coördinate production, and, being in touch through other *bourses* with the industrial system as a whole, could arrange for the necessary transfer of materials and commodities, inwards and outwards. A species of "economic federation" would thus replace the structure of capitalist industry, with which would necessarily disappear the political and administrative machinery of the State. Two features of this Utopia need to be emphasized: consumers as such were excluded from any share in industrial control, and a localized system of industry was envisaged.

This latter feature was a direct reflexion of French economic circumstances; both industry and trade-unionism were much

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more local in range than in other and more highly developed countries. But the movement towards large-scale organization which has so profoundly affected every aspect of economic life in recent years has produced a corresponding modification in syndicalist ideals. At the same time, it has begun to be recognized by the theorists of the movement that the consumers' point of view cannot wholly be disregarded. The experience of the World War has also had its effect. The Congress of Lyons, therefore, in 1919 was moving with the times when, in demanding the "industrialized nationalization of the great services of modern economy: land and water transport, mines, water-power, and credit organizations," it defined "nationalization" as "the confiding of national property to the interested parties, namely, the associated producers and consumers." This clearly envisages organization on a national scale and the participation of consumers' organizations in control.

Syndicalist theory starts, as has been said, from the idea of a class war which must be waged relentlessly till a complete social transformation has been accomplished. The essential weapon in this struggle is the power of the organized workers. As the cause of the conflict is economic it must necessarily be fought out in the economic sphere. Syndicalist congresses have persistently repudiated political action, and pinned their faith to a general strike as the grand instrument of social revolution. This reliance upon industrial or "direct" methods of action flows necessarily from the fundamental notions of syndicalism as to the nature of the State, and also from strictly practical considerations. Outside the mine or factory, workingmen hold divergent religious or political opinions which make effective mass action difficult, if not impossible. Inside, the nature of their employment gives them a sense of solidarity which overrides minor differences and bands them together in the *syndicat* for common defence; to persuade them to pass from the defensive to the offensive is the syndicalist's task, and in the accomplishment of this political labels and controversies would be a hindrance. Moreover, the political party is not, and cannot be, a class organization. The Socialist parties swarm with men of middle-class origin whose only bond with the workers is the slender one of opinion. In any event, the political party is an inefficient instrument for revolution; it can only operate effectively at electoral periods, and even then the mass of voters do nothing more than cast a ballot and return to their customary apathy for a term of years. Political action does nothing to rouse them from that apathy, to inspire them with revolutionary *élan*, to train them to initiative and independent thought. On the contrary, it asks for nothing better than docile followers of self-constituted leaders. The strike, therefore, is the characteristic syndicalist weapon. However limited in its scope and object, it is an educative experience; successful, it inspires the workers with a sense of power; unsuccessful, it impresses upon them the servility of their lot and the necessity for better organization and wider aims. Thus every strike is a preparation for the revolutionary "day," when the workers, or a fighting minority of them (for syndicalism repudiates as *bourgeois* the dogma of the sacredness of majority rule), shall seize the instruments of production by an "expropriatory" strike. In the meantime, they are working out from day to day, in the ordinary course of their employment, the ethics and the jurisprudence of the new social order.

The strike, of course, is not the only weapon in the syndicalist armoury. Various other means of waging the class war, known collectively as *sabotage*, are both preached and practised. These range from bad or slow work to the *grève perlée* (destruction of goods or machinery) and the *chasse aux renards* (assaults on "blacklegs" or *jaunes*). It is fair to say that many syndicalist leaders criticize these methods as destructive of the worker's *moral* and technical competence.

Syndicalism is essentially French in origin and reflects French working-class experience and conditions of life; nevertheless the history of Great Britain shows interesting foreshadowings of it. The idea of industrial self-government by the producers attracted for a time the mobile mind of Robert Owen; and the Grand National Consolidated Trades Union of 1834 was an attempt to realize it in practice. James Morrison, a young self-taught operative builder, seems to have originated the syndicalist conception of class antagonism on the part of the working-classes (see Max Beer, *History of British Socialism*). The Building Trades Union had developed the same notion in the previous year (S. and B. Webb, *History of Trade Unionism*). The plan of a general strike—originated by one Benbow—for a time, under the strange title of the "Sacred Month," made part of Chartist propaganda. There is no evidence, however, that these projects had any echo on the European continent. The syndicalist idea, as understood in France, may be said to have originated in the discussions of the International Working Men's Association. A French delegate to the Congress of Basle in 1869, for instance, prophesied that "the grouping of different trades in the city will form the commune of the future" when "government will be replaced by federated councils of *syndicats* and by a committee of their respective delegates regulating the relations of labour—this taking the place of politics" (Levine, *Syndicalism in France*). The collapse of trade-unionism in France after the sanguinary suppression of the Communalist insurrection in 1871 had as a necessary consequence the submergence of these ideals for a considerable period, and only a combination of favouring circumstances brought them once more to light. Among these the discontent of the organized workers with Socialist politics, and the anarchist propaganda of a general strike, may be particularly mentioned. These influences manifested themselves with increasing strength during the 'nineties in the two great labour organizations of the period—the General Confederation of Labour (or "C.G.T." under its French initials) and the Federation of *Bourses du Travail*. The secretary of this latter organization, Pelloutier, did more perhaps than any other individual to work out the characteristic doctrines of syndicalism and spread them among his fellow-workers. When these two bodies joined forces in 1902, trade-unionism in general and syndicalism in particular received an immense accession of strength, and the doctrine subsequently remained—in spite of the efforts of political socialists to capture the *syndicats* for their own purposes—the characteristic expression of French revolutionary idealism.

As such, it has inevitably received much attention from observers and writers drawn from other social classes. Of these the best known is Georges Sorel, but it is a complete error to suppose that he was the originator of syndicalism, or that he has had much influence on working-class opinion. The difficult form of his writings, with their frequent obscurity and lack of continuity, would alone have made this impossible. Sorel's adaptation of the Bergsonian doctrine of the "*élan vital*" to syndicalist purposes, and his theory of "social myths" (of which the general strike is one), have had considerable influence upon intellectual circles, but have affected no more than a fringe of working-class readers.

Syndicalist doctrine has had considerable influence outside France. In the United States, a movement of somewhat similar character arose with the organization of the Industrial Workers of the World. The Chicago Convention of the I.W.W. in 1905 drew up a declaration, the preamble of which affirmed the reality of the class struggle, embodied the theory of social organization which this involves and further made a plan for the realization of this ideal:—

"The unit of organization industrially is the workshop or Yard Committee, wherein the workers are organized as workers, irrespective of craft, grade, or sex. These Committees are coördinated by the formation of Works or Plant Committees, composed of delegates from each Workshop or Yard Committee. The Plant or Works Committees are coördinated by delegates from each of these Committees, in a village, town, city, or district, forming a Workers' Council, in which there are also delegates from the residential committees, these latter being the units of the social aspects of the organization."

The above scheme differs very little from the general theory of syndicalism in France, and presents a simple parallel to the shop-stewards' movement in Great Britain, which indeed was based upon it. The influence of the I.W.W., it may be noted, was largely confined to the alien immigrant workers: it never penetrated the American Federation of Labor to any serious degree.

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The influence of these ideas on the trade-union movement in Great Britain and Ireland has been very pronounced, though they have taken a different direction, modified by the traditional, conservative instinct of the British working-class. In Great Britain the real cause of the permeation of certain unions by syndicalist ideas was the absorption of trade-union leaders in administration or in politics, which caused them to lose touch with the rank and file. Especially is this the case with regard to the miners, the railwaymen's unions and the engineers.

Daniel de Leon was leader of the Socialist Labour party in the United States from 1880 onwards, and his writings influenced British socialist thought, particularly in the Clyde and in the mining valleys of S. Wales. Though not a syndicalist in the strict sense, he advocated organization by industry and the general strike. It is significant that 1903 saw in England the secession of the Socialist Labour party from the Social Democratic Federation. After that date, in addition to the growing educational influence of the Independent Labour party (though this was never syndicalist), was seen the promotion of the Workers' Socialist Federation, the British Socialist party (in the post-war period) and the Communist League, all of which advocated practically the same structure of organization and policy. They all agreed in a lack of faith in political action, though not always refusing to utilize it, but their real *politik* was industrial action. After the Russian Revolution of 1917, they secured greater prominence; they became the stormy petrels of the labour world in Great Britain, and their effect on the political action of the Labour party was seen in the Council of Action in Aug. 1920.

In England, between 1900 and 1910, there was a growing dissatisfaction among the rank and file with political action, despite the fact that the influence of the Labour party in the House of Commons secured the trade-union movement freedom of industrial and political action by the Trades Disputes Act of 1906 and the Trade Union Act of 1913 to a greater degree than ever before, it was felt by the far-sighted among the rank and file that a speeding up was necessary, and State collectivism as a way out towards industrial democracy was discredited. James Connolly, the Irish Labour leader who was executed after the Easter rising in Ireland in 1916, started a similar organization to that of Daniel de Leon on the Clyde in 1905. In his pamphlet *Socialism made Easy* he enunciated the syndicalist principles "that they who rule industrially will rule politically," and that "the functions of Industrial Unionism is to build up an industrial republic inside the shell of the political slate, in order that when the industrial republic is fully organized it may crack the shell of the political slate and step into its place in the scheme of the universe." Tom Mann, while in France and Australia, which had imported the ideas of the I.W.W. from America, was also powerfully influenced by the same theories, while on the Rand, in S. Africa, a small but very influential group of leaders was working out the structure, forms and policy of a movement similar in character. In 1910 Tom Mann preached the new faith in all the big industrial centres and rapidly won many followers. Workmen had refused to follow their orthodox leaders from about 1908, as they felt that the trade union of the old Liberal-Labour school was behind the times. The Plebs League was founded by a group of labour students in Ruskin College, Oxford, about the same time, and in 1909 these seceded from Ruskin College and founded first a labour college in Oxford and then moved to London as the Central Labour College, financed by the S. Wales miners and the railwaymen. This educational movement organized classes in every mining area in S. Wales, led by tutors from these two colleges, and influenced largely by the new ideas. A similar movement took place on the Clyde, in the great shipbuilding centres like Barrow, Birkenhead, and Pembroke Dock, and also in inland engineering centres like Coventry and Sheffield. Then followed the railway strike of 1911 and the great coal strike of 1912. It is quite clear that the National Union of Railwaymen and the Miners' Federation of Great Britain became organized as two of the most powerful unions in consequence of the new thought, *not* because their leaders had adopted syndicalism in the form taught by de Leon and the French group of thinkers, but because they adapted it in the peculiar British way; they made it practical and definite; they shaped it in alliance with the political and trade-union structure of Britain. They disagreed with the syndicalist view of the State, but they recognized the driving power of the theories that stated "that political power is a reflex of industrial power." The transport workers soon had a similar federation, and after the strikes of 1911 and 1912, and the Irish transport workers' strike of 1913, the Triple Alliance (of railwaymen, transport workers, and miners) was formed in 1915. The failure of this last to function during the miners' strike in the spring of 1921 discredited "direct action," and the British labour movement swung back towards constitutional and parliamentary methods.

See J. A. Estey, *Revolutionary Syndicalism* (1913); L. Levine, *Syndicalism in France* (2nd ed. 1914); G. D. H. Cole, *Self-Government in Industry* (3rd ed. 1918), *The World of Labour* (1919), *Labour in the Commonwealth* (1919), *Introduction to Trade Unionism* (1918); S. and B. Webb, *History of Trade Unionism* (1920); H. Lagardelle, *Le socialisme ouvrier* (1911); J. R. Macdonald, *Syndicalism* (1912); John Spargo, *Syndicalism, Industrial Unionism and Socialism* (1920); Bertrand Russell, *Principles of Social Reconstruction* (6th ed. 1920); Arthur Gleason, *What the Workers Want* (1920); *The Industrial Council for the Building Industry 1919* (Garton Foundation); G. D. H. Cole, *Guild Socialism Re-stated* (1920); J. Graham Brooke, *American Syndicalism* (1913); P. F. Brissenden, *The I. W. W.* (1919); James Connolly, *Socialism made Easy* (1905); N. Ablett, *The Miners' next Step* (1912); *A Plan for the Democratic Control of the Mining Industry* (South Wales Socialist Society, 1919); J. T. Murphy, *The Workers' Committee* (1918). (S. H.; J. M. R.)

SYNGE, JOHN MILLINGTON (1871–1909), Irish dramatic author, came of an Anglo-Irish family, which had contributed several bishops to the Irish church. He was born near Dublin April 16 1871. A delicate child, he was left much to himself, and as a youthful member of the Dublin Naturalists' Field Club took long rambles over the Dublin and Wicklow hills. At Trinity College, where he graduated in 1892, he obtained prizes in Irish and Hebrew, and he knew something of several modern languages. At this period his chief interest was in music and he gained a scholarship in counterpoint and harmony in the Royal Irish Academy of Music. A sonnet, moreover, contributed to *Kottabos*, shows not a little of the accomplishment of verse, as well as his innate passion for primitive things. During the next few years (1893–8), Synge travelled in Germany, Austria, Italy, finally making Paris his headquarters. He managed to spend a third of the year in Paris, a third in the W. of Ireland, and a third in London or Dublin. W. B. Yeats found him in Paris (1898) preoccupied with theories of language and literature, and advised him to return to Ireland. He went to the Aran Is., where he shared the life of the islanders, and he gave an account of it in a series of sketches afterwards collected in the volume, *The Aran Islands* (1907). In these and other sketches of the same period he had not quite shaken off the obsession of "stylism," and still had a wish "to do for the W. of Ireland what Pierre Loti had done for the Bretons." Gradually, however, Ireland got hold of him, and, turning to the dramatization of incidents in the life he now knew intimately, he began to elaborate, partly from his note-books and partly from the writings of Lady Gregory and Dr. Douglas Hyde, that richly imaginative though largely artificial dialect of Anglo-Irish which he carried to its furthest capacities. The Abbey theatre was opened towards the close of 1904, with Synge as one of the directors. He had already produced two one-act plays, *In the Shadow of the Glen* and *Riders to the Sea* (1903), of which the first had acquired some notoriety for the author as an affront to Irish morals; he had also written a farcical play, *The Tinker's Wedding*, which proved a failure when acted (1909) after his death. The beautiful three-act play, *The Well of the Saints*, produced before a few dozen people in the early months of the Abbey (1905), was regarded as a new affront; and in Jan. 1907, rumour having got about of its subject matter, the performance of *The Playboy of the Western World* was interrupted by an organized disturbance which continued night after night for a week. This affair, when the merits of the play came to be known, made the fame of the Abbey theatre. Synge's health was now shattered, and with

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death in prospect he worked at his fine play *Deirdre of the Sorrows*, all but completing it before the end came on March 24 1909. Just before he had collected his curious *Poems* (1909).

Synge appeared at a peculiar moment in the development of Irish literature, which had begun to address a largely increased public, blended of the two main elements of the population. By descent and culture he was of the Anglo-Irish stock, and he really saw the Irish subject matter in the detached spirit of an artist. It was probably something like this that part of his audience detected in the *Playboy*, and it caused his work for a while to be rejected in his own country. Time, however, has already proved the depth of Synge's insight into the soul of peasant Ireland. The *Playboy* is by general consent his masterpiece. In this play, the fantastically rich imagery of his dialogue, which elsewhere has often a somewhat monotonous effect, has full dramatic justification; the play has even, like *Hamlet*, the supreme mark of vitality, that it conveys the suggestion of a permanent human enigma. There are good critics, however, who assign the highest place among his works to *Deirdre*.

A collected edition of Synge's works, in four volumes, was published in 1910. In *John Millington Synge and the Irish Theatre* (1913), M. Maurice Bourgeois has given, in great detail, an account of his life and writings; and there is a critical study of him by P. P. Howe (1912). (W. K. M.)

SYRIA (*see* 26.305).—The greater part of the decade 1911–21 was a period of depression and distress in Syria, which, in common with the rest of the Ottoman Empire of which it then formed part, suffered from the interruption of commerce and the war-time exactions consequent upon the Italo-Turkish, the Balkan and the World Wars in an almost unbroken succession from 1911 until 1918. Although only for a brief time an actual theatre of hostilities, Syria, which had escaped with a slight bombardment of Beirut in Feb. 1912 during which a Turkish gun-boat was sunk in the harbour by an Italian squadron, was particularly exposed to military requisitions and exactions.

Even before the entry of Turkey into the World War involved the Levant ports in a fresh blockade (Nov. 1914) the coastal population had begun to migrate inland from fear of enemy landings, and the whole country was disorganized by the pressure of refugees on the one hand and of the military preparations for an invasion of Egypt on the other, while the civil population was much excited by the shameless propaganda conducted by German agents who sought to inflame Moslem prejudice against Christians all over the country. The Minister of Marine, Ahmad Jemal Pasha, who was also in command of the IV. Army and governor-general, conducted the government of the province in such a way as to give rise during a long period to the suspicion that he aimed at imitating Mehemet Ali in founding for himself a semi-independent viceroyalty; and his autocratic exactions and high-handed measures did much to pave the way for the final revolt against Turkish authority, which caused its collapse when the battles in Palestine in Sept. 1918 had broken the front.

In the subsequent operations Syria was overrun rather than conquered. Damascus fell to the British and Arabs on Oct. 1, Tyre was taken by the British on Oct. 4, Beirut was seized by a French squadron on Oct. 5 and occupied on Oct. 7 by British troops, which took Homs on Oct. 16, Tripoli (Tarabulus) on Oct. 18, Hama on Oct. 21, while the Arabs took Aleppo on Oct. 25 and the French occupied Alexandretta on Nov. 10.

Immediately after the liberation of Syria Gen. Allenby set up an administration of Occupied Enemy Territory in accordance with "the Laws and Usages of War" laid down by international agreements embodied in the Hague Convention. In order to comply as far as possible with the divergent policies to which the British Government had committed itself he confided those areas which had been liberated chiefly by Arab troops to "O.E. T.A. East," with Arab administrators under a chief administrator at Damascus—'Ali Riza Pasha er Rikabi, while the Lebanon, the littoral N. of the Ladder of Tyre, and as far as Bab Yunis N. of Alexandretta, was under Col. P. de Piépape as chief administrator O.E.T.A. North in Beirut with French officers. Later, when Cilicia was occupied in conformity with the Armistice which came into effect on Nov. 1 O.E.T.A. in Beirut became O.E.T.A. West and Cilicia was controlled by a new O.E.T.A. North under the French Col. Brémond.

From the very first the French had considerable difficulties to face, as Arab Nationalism and the idea of Syrian independence based upon the doctrine of self-determination both greatly influenced the civil population, which was, moreover, puzzled in that French officers were engaged in administering the country on French lines and conducting a French propaganda, when it was notorious that British troops had liberated the country and were still occupying a great part of it, and that the Arab administration in Damascus was anxious to lean on the British alliance and to ignore as far as possible the existence of the Sykes-Picot Agreement which had divided the country into arbitrarily defined spheres of influence regardless of the claims of the Arabs. Colonel de Piépape was, moreover, much hampered by the limited selection of French officers from whom he had to pick his administrators. Furthermore, Syria being a comparatively rich and civilized part of the Ottoman Empire and inhabited almost entirely by non-Turks had been particularly exposed to the exactions of the Turkish army and Government, and her population had been greatly exhausted by military conscription, political deportations, voluntary flight of refugees and by the ravages of locusts, starvation and disease. Yet Syria was unable to benefit to any great degree from the presence of the British army, as had Palestine; few military roads were made—except the remarkable rock-cut carriage-way across the face of the Ladder of Tyre (Ras en Naqura) which was made by Sir Valentine Fane's 7th Indian Div.—little local labour was employed, and charitable contributions for the help of the civil population of Syria were the less readily forthcoming as it had none of the religious and sentimental glamour attaching to the Holy Land.

With the withdrawal of the British Army of Occupation from O.E.T.A. North and West which began on Nov. 4 1919 and ended on Jan. 19 1920 the difficulties of the French were greatly enhanced, as their own troops were hardly numerous enough to cope with the forces of disorder which began to raise their heads almost immediately. Attempts to enforce French authority were met with armed resistance. Certain of their agents played them false, and both in Cilicia and Syria Gen. Gouraud, who had become High Commissioner in Beirut in Oct. 1919, had to cope at once with Turkish Nationalist plots directed from Angora, panislamic agitation, anti-Armenian traditional hatred and Syrian and Arab Nationalism. Active troubles soon began, the Damascus administration, now controlled by the Emir Faisal, had little real authority over the semi-independent tribes which were plentifully supplied with rifles, either issued to them for war against the Turks, or captured weapons, and it was itself harassed by the conflicting policies of the Syrian extremists who resented the presence of the Arab "Patriarchalists" from the desert, and of the Hejaz Arabs who maintained that Syria was but a province conquered by them in war and lawfully at their disposal. The Emir had, moreover, to keep the peace with his French and British allies in the face of a growing anti-European spirit which was hostile to the French schemes for controlling Syria and indignant at the British attitude towards the Jews, while Syrian Nationalists resented the partition of the country between two foreign Powers and inclined towards anybody—even the once hated Turks—who offered hopes of driving the Europeans into the sea.

Baalbek was the scene of the first fighting between the French and Arabs—at Christmas 1919. In Jan. 1920 the French were attacked near Quneitera and in the Merj Iyun. Later in the month their troops were engaged in the Latakia (Ladigiye) district, and while they were able to recover Baalbek before the end of Jan. their garrison at Alexandretta was attacked in Feb. On March 1 the Jewish colony at Tell Hai, near Metulla, in what was then the French sector of Upper Galilee, was raided by Arabs. On March 8 the Syrian National Congress, sitting in Damascus, under the influence of impatient extremists, proclaimed the Emir Faisal as King of Syria, and placed him in an extremely difficult diplomatic position. In the face of the extremists he

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was unable to hold back, and he organized a Syrian Cabinet under Riza Pasha and did his best to enforce discipline throughout his dominions where compulsory military service had been reintroduced on Dec. 21 1919. The authority of Damascus was, however, unable to restrain the outbreak of Arab Nationalist enthusiasm which the formation of the kingdom of Syria aroused. Antioch was taken from its small French garrison on March 20, there was anti-European trouble from the Amanus to Jerusalem (*see* PALESTINE), and Arab officers entered into renewed relations with the Nationalist Turks of Angora. As early as Dec. 11 1919 Ramadhan ibn Shalash, the Arab governor of Raqqa, instigated by Angora, had made common cause with a Kurdish freebooter, Ibrahim Pasha Milli, and had attacked Deir ez Zor, from which, although in the French sphere of influence, the British had not yet withdrawn. The Emir Faisal immediately dismissed Ramadhan, but he became contumacious, declined any longer to recognize the authority of Damascus and openly adhered to the Nationalist Turks. His Arab successor in Raqqa, Maulud Pasha, was equally disloyal, and throughout the summer disturbances in both French and British areas were actively fomented by him and other disobedient adherents of the Damascus Government.

More vigorous steps were taken by the Nationalist Turks of Angora. Not content with conducting a campaign of extermination against the Armenians in Cilicia where the French were not strong enough militarily to occupy the whole province in the face of the formidable Turkish forces operating against them and the Armenians, the Government of Angora invaded northern Syria itself. Aintab was attacked in strength on April 1 1920. It was relieved by a French column with some difficulty on April 15–16, but, when the relieving troops were withdrawn on April 28, the siege was resumed on April 30. It was relieved a second time on May 22, and an armistice was concluded on May 29 by which the French evacuated the citadel and established themselves in a fresh position. They were again attacked by the Turks and relieved for a third time on Aug. 11. This time the French were strong enough to attack in their turn, although unable entirely to invest the Turks, who had occupied the citadel as part of their position. After long-drawn operations, during which the Turkish mines in one of the piers of the great bridge of the Bagdad railway over the Euphrates at Jerablus were exploded by lightning and two spans of the bridge wrecked, the French were successful, and Aintab was once more made safe on Feb. 10 1921. During this period its pop. is supposed to have decreased by some two-thirds to 25,000. Nor were the disturbances in the N. confined to the Aintab area, apart from the campaign in Cilicia. Nationalist Turks and Syrians at the beginning of Dec. raided as far S. as Jebele on the coast 14 m. S. of Latakia, and farther E. a force of Nationalist Turks established themselves near the newly fixed boundary between Syria and Mesopotamia and tried to stir up unrest among the desert tribes.

In the S. the existence of an independent state at Damascus with Nationalist aspirations to absorb all Syria and the Lebanon, and unwilling to admit French influence or recognize any French mandate, was likely to prove an uneasy neighbour—the more so as the Emir Faisal had declined on two occasions (March 27 and May 8) to repair to Paris at the invitation of the Allies to explain the situation. The Emir maintained that it was only by remaining at Damascus that he could hope to restrain the more extreme Nationalists from launching a wholesale attack upon French territory. As soon, therefore, as Gen. Gouraud had an adequate force at his command with which to enforce the authority given to France as Mandatory for Syria on behalf of the League of Nations, he made ready to impose it upon Damascus, when in June 1920 the Emir Faisal was beset by difficulties. Himself one of the Ashraf, a son of the King of the Hejaz, he found it increasingly difficult to restrain the Nationalist Syrians, the pro-Turk panislamists and the Patriarchalist tribesmen who were traditionally hostile to any authority which sought to stand between them and their prey in the cultivated lands. In June the Cabinet of Riza Pasha fell, largely on the question of the relations between Syria and the Europeans—particularly the French, and Hashim Bey Attassi took office. At that time in the discussions of the budget in the French Chamber it appeared that France, while proposing to allot some £3,700,000 for the expenses of the High Commissionership of Syria and some £440,000 for propaganda to be directed against the extremist doctrines of those opposed to her rule, was ready to grant a subvention of £800,000 to the Emir Faisal provided that he co-operated whole-heartedly in the execution of the Mandate. The Emir was, however, in no position to do so, owing to the intractability of the Nationalist leaders who threatened to depose or murder him if he ventured to abate in any way from the extreme of their ambitions, wholly incompatible with any foreign Mandate. At the same time the economic situation of Syria was bad, and the taxes were extremely high—for example, the camel tax in Syria was £E3 (£3 1s. 6d.) per beast as against 1 rupee (1s. 4d.) per beast in Mesopotamia, and the sheep tax was 36 P.T. (7s.) against 8 annas (8d.)—and were, moreover, farmed, owing to the absence of the necessary fiscal machinery for ensuring official collection. Thus the Emir's Government was regarded with suspicion by the Nationalists and those who were opposed to any accommodation with France, or indeed any European Power.

On July 14 1920 Gen. Gouraud informed the Emir that French authority was to be enforced and that he would assume control of the Syrian railways—hitherto run by the Arab administration, parts of which had not been working since January. This intimation was none too soon, as it was known that the Arab general, Rushdi Bey, in command of the 3rd Arab Div. and governor of Aleppo, who had formerly been in the Ottoman service, was in active communication with the Nationalist Turks of Angora for the purpose of arranging joint operations against the French. Almost at the same time Gen. Gouraud found it necessary to arrest nine members of the Administrative Council of the Lebanon, apparently for conspiring with Syrian Nationalists to make it impossible for France to exercise her Mandate.

The Emir Faisal was willing to comply with Gen. Gouraud's wishes, but the Syrian Nationalists, miscalculating their strength, opposed the advance of Gen. Goybet's column which was sent to occupy Damascus. They even attacked the Emir Faisal, delayed the final message of submission sent by the Emir and his Cabinet to Gen. Goybet, and by ill-judged hostilities compelled the French to defeat them smartly at Khan Meiselun on the road through the mountains N.W. of Damascus on July 24, and to enter that city next day as conquerors rather than as protecting allies, thus bringing about the downfall of the Emir, whom the French held responsible for the resistance of the Nationalists although it had been offered in defiance of his authority and policy. The Emir's last Cabinet fell with him, and the French, who inflicted a fine of £S500,000 (10,000,000 frs.) upon the country, caused a new administration to be formed under 'Ala ed Din er Rubi, while the Emir Faisal and his family withdrew from Damascus on July 28, going to Haifa, where he remained until Aug. 4, when he left for Europe.

The suppression of the Nationalists at Damascus did not immediately bring peace to the country, as the French were unable adequately to control the Hauran, and on Aug. 20 Bedouin raiders stopped a train at Khirbet el Ghazali on the Hejaz railway and murdered the Syrian prime minister 'Ala ed Din er Rubi, Ata el Ayyubi, the Minister of the Interior, and 'Abdurrahman Yusuf, President of the Council of State; for some time afterwards railway communication was hazardous in that area, and trains were generally protected by a guard of soldiers in armoured trucks at either end.

On Sept. 1 1920 Beirut became an autonomous district of the Greater Lebanon (*Grand Liban*), which was enlarged from its former extent under the Turks so as to embrace all Biqa' or the Coelesyria composed of the Turkish kazas of Hasbeya Rasheya, Biqa' and Baalbek (which, originally allotted to "O.E.T.A. West," were left to the administration of O.E.T.A. East by Gen. Allenby as having been largely liberated by Arab troops), and the coast territories between Palestine and the Nahr 'Akkar; and next day the former Turkish sanjak of Latakia and the northern parts of that of Tripoli were formed into a new administrative area of Alawiya (*Territoire des Alaouites*). In the N. the Turkish

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sanjaks of Alexandretta, Deir ez Zor and Aleppo, were united (Sept. 1 1920) to form the "Government of Aleppo," which thus extended to the Khabur, beyond which the country was under the administration of the French officer commanding in the *Confins Militaires;* and by the end of the year the caravan route over the Beilan Pass above Alexandretta was so far cleared of Turkish raiders and Arab marauders that civilian traffic began to be resumed. In the S. however the Hauran was still disturbed, and in March 1921 a party of Arab raiders blew up bridges on the Hejaz railway over the Yarmuk and to the N. of Dera, while the Syrian Nationalists were reported to be active in that sector of the British sphere beyond the Jordan which still formed part of the Emir Faisal's dominions but was not in any way subject to British authority. In April however this danger was abated, as the Emir's elder brother, the Emir 'Abdalla, arrived in 'Amman and restored order throughout the area of the ancient kingdom of Kerak in coöperation with the British.

Frontiers.—On Dec. 23 1920 the frontiers towards Mesopotamia and Palestine were fixed in such a way as to retain the whole of the Litani-Leontes watershed with Quneitera in French mandated territory, and providing for the joint Anglo-French use of the railway between Semakh and Nasib, although the line itself remains in French territory. On the side of Arabia the frontier runs from Nasib to Imtar and thence in a straight line to Abu Kemal on the Euphrates.

In March 1921 Gen. Gouraud, when in London for the Near Eastern Conference, took advantage of the presence of the representative of the Nationalist Turkish administration at Angora, Bekir Sami Bey, to conclude an agreement, in virtue of which the French withdrew from the whole of Cilicia, and adopted as the northern frontier of their Syrian mandated territory a line running from Payas on the coast N. of Alexandretta to Choban Beg (Bey) on the Bagdad railway, and thence along the railway to Nisibin, whence it runs to the Tigris and down that river as far as the frontier of Mesopotamia near Jeziret ibn 'Omar, thus restoring Killiz, Aintab and Urfa (Edessa) with an area of 22,500 sq. km. and an estimated pop. of some 640,000, to the Turks.

On March 4 1921 the formation of an autonomous Druse (Druz) State, comprising the Jebel ed Druz in the Hauran, to be under French supervision but independent of Damascus, was announced.

Area and Population.—Thus the area comprised in Syria as defined by the boundary agreements of Dec. 1920 and March 1921 is divided into the Greater Lebanon (*Grand Liban*), Damascus, Jebel ed Druz, Alawiya, Aleppo and the military territory.

Although no exact census had been taken in Syria the following figures are supplied by the French administration:—

I.	Greater Lebanon (*Grand Liban*):			
	Sanjak	Capital	Area sq. km.	Pop.
(*a*)	South Lebanon	Sidon (Saida)	2,172	132,000
(*b*)	Biqa'	Zahle	3,600	110,000
(*c*)	Mount Lebanon	Ba'abda	3,000	180,000
(*d*)	North Lebanon	Shtora	2,065	164,000
(*e*)	City of Tripoli			
(*f*)	City of Beirut		18	140,000
	Total		10,855	726,000

II. Alawiya (*Territoire des Alaouites*):

(*a*) Sanjak of Latakia—composed of the kazas of Jebele, Sahyun, Baniyas (Valenia), Omranie or Masyaf and the municipal area of Latakia.

(*b*) Sanjak of Tartus—composed of the kazas of Tartus (Tortosa) Safita, Qal 'at el Husn.

Total area 6,200 sq. km. with a pop. of perhaps 400,000.

III. Government of Aleppo:

(*a*) Sanjak of Alexandretta, area 5,000 sq. km. divided into the kazas of Alexandretta pop. 26,000, Beilan pop. 26,200, Antioch pop. 126,900, and Harim pop. 36,700, or 209,800 inhabitants for the sanjak.

(*b*) Sanjak of Deir ez Zor, area 30,000 sq. km. and a pop. of 174,000.

(*c*) Sanjak of Aleppo:	Area sq. km.	Pop.
City of Aleppo	—	144,006
Kaza of Jebel Sima'an	4,694	25,130
El Bab	2,437	27,752
'Azaz	2,200	9,957
Membij	3,867	5,030
Ma'aret en Nu'man	3,450	21,629
Idlib	1,860	53,598
Raqqa	7,200	9,865
Jisr esh Shughr	1,125	36,018
	26,773	332,985
Total for the whole Government	61,773	716,785

IV. Government of Damascus:		
(*a*) Sanjak of Damascus:	Area sq. km.	Pop.
Kaza of Damascus	600	238,504
Wadi el 'Ajam	800	16,732
Duma	841	37,937
Zebdani	180	14,155
Quneitera	2,000	43,183
Jerude	12,000	29,431
Nebk		22,221
	16,421	402,163
(*b*) Sanjak of Hauran:		
Kaza of Hauran	3,500	29,760
'Ezra	1,318	30,018
Musmiye	3,972	14,718
Bosra Shams	970	26,436
	9,760	100,932
(*c*) Sanjak of Homs:		
Kaza of Homs	4,000	88,214
Qaryatein	4,000	6,945
Job Jerra	2,000	4,159
Palmyra (*Tadmur*)	10,000	5,340
	20,000	104,658
(*d*) Sanjak of Hama:		
Kaza of Hama	1,900	77,205
Selemiye	2,500	20,864
Hamra	815	—
	5,215	98,069
Total for whole Government	51,396	705,822
Thus the whole of Syria contains:—		
Greater Lebanon	10,855	726,000
Alawiya	6,200	400,000
Aleppo	61,773	716,785
Damascus	51,396	705,822
Jebel ed Druz		
Military Territories	25,700	154,500
	155,924	2,703,107

The precise boundaries of the state of the Jebel ed Druz had not yet been settled in 1921, but it was to be detached from the sanjak of the Hauran then in the Government of Damascus.

Administrative Divisions—Of these various administrative areas the Greater Lebanon is under a French Governor who appoints Lebanese officials to take charge of the seven departments of Interior, with *Gendarmerie* and Police; Finance; Justice and Pious Foundations; Public Works, Posts and Telegraphs; Education and Fine Arts; Agriculture, Trade and Industry; and Public Health. Each of these officials is assisted by a French adviser. The sanjaks are administered by Lebanese *mutesarrifs* with French advisers, assisted by local administrative commission. Pending a census of the population and a subsequent election a provisional administrative commission of 15 Lebanese members had been nominated. Its functions and powers are analogous to those of the old Administrative Council under the Organic statute of the Lebanon in 1864.

In Damascus the administration is directed by a Council of State composed of Ministers each assisted by a French adviser.

In Aleppo there is an Arab Governor who appoints native officials to take charge of the departments of Finance; Justice and Pious Foundations; Public Works, Posts and Telegraphs; Economic Services; and *Gendarmerie* and Militia. The Governor is assisted by a council and an administrative commission. The former is composed of the heads of the five departments, of heads of religious communities, of two members from each of the three sanjaks, and of the mayors of Aleppo, Antioch and Alexandretta. The administration is supervised by a French Resident appointed by the High Commissioner, and French advisers assist the heads of departments and the *mutesarrifs* of sanjaks.

In Alawiya a French Administrator with French heads of the four departments of Finance; Public Works, Posts and Telegraphs; Public Health; and Justice and Pious Foundations, controls the administration. There is an administrative commission composed of seven Alawiye (or Nuseiriye), two Christians, two Sunni Moslems and one Isma 'iliye ("Assassin"). Each sanjak has a French Deputy Administrator with a native *mutesarrif* as his subordinate.

In virtue of the treaty of March 4 1921 between Gen. Gouraud and the religious and political chiefs of the Druses the State of the Jebel ed Druz in the Hauran is administered by a Druse governor elected by the population for four years, subject to the confirmation of the French High Commissioner. He is assisted by a council, elected for three years, which has one session every year during which the budget is voted, and by a permanent Administrative Commission. French advisers assist the higher Druse officials. The local *gendarmerie* and police are recruited by voluntary enlistment.

All these administrations, which are autonomous *inter se*, are subject to the general control of the French High Commissioner of Syria who

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resides at Beirut, going into summer quarters at Aley in the Lebanon.

Currency.—On May 1 1920 the standard currency of the pound Syrian (£S) was introduced to supersede the pound Egyptian (£E), which had been the official currency under the British occupation, and the now obsolete pound Turkish (£T). The £S is equivalent to the French *louis* of 20 frs., formerly well known in Syria, and is divided into 100 piastres of 20 French centimes each.

Railways.—During the decade 1910-20 the railway construction in Syria was chiefly directed towards improving and linking up the lines serving the trade routes across, and little attention was paid to the development of a purely Syrian system for the development of the country. The only line which can be classed in this category is that between Tripoli and Homs, which was opened in June 1911, and even this was chiefly useful for importing the heavier material required for the construction of the Bagdad railway which was being built across the country in the north. During the World War it was taken up and its rails used in the extension of the Bagdad railway towards Nisibin, but after the French administration had been established the line was relaid and the railway was again opened for traffic in July 1921. In the same way the French Hauran railway between Damascus and Mezeirib was taken up and used in Palestine.

Of the Bagdad railway, destined to link the Syrian system with Haidar Pasha, and perhaps with Europe and Mesopotamia, the Adana Osmanie (92 km.) and Dorak-Yenije (23 km.) sectors in Cilicia were opened on April 27 1911, the sector Bulgurlu-Ulu Kyshla (38 km.) in the Taurus was opened on July 7 1911, and that from Ulu Kyshla to Kara Punar (52 km.) in Dec. 1912. At the same time the Aleppo-Moslemiye (Muslimie) (15 km.), Moslemiye-Raju (77 km.), and Moslemiye-Jerablus (103 km.) fork was opened, and the branch from Toprak Kale (on the Osmanie branch) to Alexandretta (60 km.) at the foot of the Beilan Pass was opened in Nov. 1913. This branch was cut in several places by H. M. S. "Doris" in Dec. 1914, but was reopened for traffic in 1921. During the war every effort was made to complete the great tunnels in the sectors Kara Punar-Dorak and Osmanie-Raju, and, after being used for narrow gauge traffic for some months they were opened for standard gauge use just before the Armistice, and the first through train from Haidar Pasha reached Aleppo in Oct. 1918. Further E. the line was pushed forward to Nisibin:—Jerablus-Tell el Abyadh (95 km.), Tell el Abyadh-Ras el 'Ain (87 km.), Ras el 'Ain-Nisibin (120 km.).

In Dec. 1913 in return for a French loan the Porte gave a concession for the extension of the French standard gauge railway then working between Aleppo and Rayak down through the Biqua' and Galilee to Ludd in Palestine, but nothing came of it, and no steps were taken to start the harbour works at Jaffa, Haifa, Tripoli and Alexandretta for which permission was granted at the same time.

During the war the railways of Syria were greatly strained to meet military requirements, damaged by hostile action, and inadequately kept up, rolling stock became worn out and many engines built for coal consumption were forced to use wood. As a result when the French took over the control of the Syrian railways in July 1920 they found them in need of wholesale reconstruction.

Agriculture.—The chief Syrian industry is agriculture, and it is estimated by the French authorities that of 11,000,000 ac. available for cultivation in Aleppo, W. of the Euphrates, only about 1,500,000 were in 1921 under the plough. A still larger and even less developed area is known to be available for agriculture E. of the river. In the sanjaks of Hama and Homs and in the Biqua' the cultivable area is estimated at over 1,000,000 ac., while the Damascus oasis contains 1,500,000 ac. of good land.

The corn lands of the Hauran are reported to have produced 230,000 tons of wheat in 1919–20, of which 115,000 was exported to neighbouring districts. During the war the Haurani cultivators were generally able to sell their wheat to the Turks for gold, and it is estimated that they obtained £E2,000,000 in this way. Payments for animals and labour however were only in depreciated paper.

The tobacco district of Latakia in Alawiya used to produce some 1,000 tons of tobacco annually.

The production of silk in Syria, which fell during the war to less than one-tenth of its former volume, began to revive in 1920, and the export from Beirut nearly doubled on the 118 tons of silk and 82 tons of cocoons and allied materials exported in 1919.

Before the war it was estimated that there were some 5,000,000 sheep, 1,000,000 goats, 500,000 kine and 250,000 camels in Syria, but during the war it appears that the sheep and goats were reduced by at least 50%, the kine suffered more severely, and the camels, which were very wastefully used by the Turks for military purposes, were still further reduced in numbers, at least 40,000 having been lost in the Jordan valley alone in 1916–7.

Commerce.—The trade of the port of Beirut since 1910, the last complete year of peace, may be summarized as follows:—

	Imports Tons	Exports Tons
1910	233,297	50,934
1911	216,162	48,078
1912	145,054	53,072
1913	193,844	49,248
1914	118,917	30,588
1919	64,547	18,547

Exports of Syrian produce from Beirut in 1911, the last normal year of peace, and in 1919, the first complete year since the Armistice, were as follows:—

	1911 Tons	1919 Tons
Wool	5,500	1,521
Hides	400	122
Olive Oil	233	90
Apricots	4,468	1,436
Wine	161	7
Gums	40	34

During the first quarter of 1920 466 tons of wool were exported from Beirut and 248 tons from Alexandretta, which had just been reopened for commercial traffic. In that period 67 tons of hides were exported from Beirut. For 1919 the value of imports was declared at the Customs as follows:—

	£E
Jan.	59,597
Feb.	223,111
March	629,614
April	376,117
May	551,737
June	900,370
July	1,213,974
Aug.	534,332
Sept.	848,570
Oct.	781,366
Nov.	1,031,477
Dec.	895,248
	£E8,045,513

It must, however, be remembered that goods have to be declared at their local value, on which an 11% *ad valorem* duty is collected. During 1909 prices for imported goods were unreasonably high.

Archaeology.—Before the war extensive excavations had been started on the site of the ancient Carchemish, near Jerablus, under the direction of D. G. Hogarth, with the aid of T. E. Lawrence and C. L. Woolley. These operations, which had yielded highly satisfactory results after the interruption due to the war, during which these three archaeologists all distinguished themselves by their widely different services against the Turks, were resumed in Jan. 1920 under Mr. Woolley, and pursued in spite of the prevalent unrest and the actual hostilities which went on in the immediate neighbourhood. (H. P.-G.)

SZÉLL, KOLOMAN (1845–1915), Hungarian statesman, was born on June 8 1845. He studied at Pest and Vienna, and in 1867 became deputy for the district of St. Gotthard. He very quickly won the reputation of being remarkably well informed on economic and financial questions. Széll was one of Deák's intimates, whose ward, the daughter of the Hungarian poet Vörösmarty, he had married. In 1875 he was Finance Minister in the Cabinet of Koloman Tisza, and as such imposed on himself the task of restoring the shattered credit of Hungary. In 1878 he concluded with Austria the first economic *Ausgleich*. At that time the single Austrian bank was changed, in conformity with this arrangement, into the dualistic Austro–Hungarian bank, and Széll consolidated the Hungarian Rentes, and nearly succeeded in balancing the State finances. As he feared that this balance would again be upset by the occupation of Bosnia and Herzegovina, he resigned from the Cabinet, incurring thereby the displeasure of the Crown. He still kept his seat in Parliament, and as deputy constantly criticized the financial policy of the Tisza Cabinet. At the beginning of the eighties Széll founded the Hungarian Mortgage Credit Bank, of which he was governor until the end of his life. He opened entirely new sources of credit for Hungarian agriculture. He declined repeated offers of the portfolio of Finance. When the Banffy Ministry suffered a serious crisis at the end of 1898 and was compelled to resign in Feb. 1899, Széll was entrusted with the formation of a new Cabinet. By means of the Pact of Feb. 23 1899 he restored parliamentary peace. On the basis of the so-called Széll formula the new *Ausgleich* with Austria until the year 1907 was concluded after long negotiations. The most important result of this was that Hungary attained the status of an independent customs area, but, under the arrangement for reciprocity, still maintained intact the existing conditions of the Customs Union with Austria. In 1901, under Széll's Ministry, the new elections resulted in a Liberal victory. A year later began the struggle for the reform of the national defence, and Széll introduced in 1902 the law for increasing the number of recruits, in exchange for which the Independent party wanted concessions to the principle

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of nationality. The obstruction against the provision for defence lasted from the end of Jan. to April 4 1903, and resulted in the suspension of the constitution ("*Ex lex*" condition). Széll sought to wear down the opposition by delay. As part of the majority would not agree to this, he resigned on June 16 1903. When his successor, Count Stephen Tisza, on Nov. 18 1904 brought about a split in the Liberal party by forcing through Parliament new rules of procedure, Széll joined Count Andrassy in the secession from the party. Under the Coalition Cabinet of Wekerle, Széll was chosen president of the Constitutional party. He tried continually, but in vain, to bridge the opposition between Tisza and Andrassy. He died on Aug. 16 1915. (E. v. W.)

SZILAGYI, DESIDER (1840–1901), Hungarian statesman and jurist, was born at Nagyvarad (Grosswardein) on April 1 1840. He studied law at Budapest, Vienna, and in Germany, and early attracted attention by his articles on law and politics. As head of a section in the Hungarian Ministry of Justice he travelled on a commission from the Government to England to study there the conditions of the administration of justice, of which he had a knowledge then equalled by few. Brought up wholly in Liberal ideas, Szilagyi took a conspicuous part in the codification work of the Ministry of Justice. Deputy in 1871, professor of public law and politics at Budapest University in 1874, he was in 1877 one of the leaders of the Opposition, which, however, he left in 1886. In 1887 he was returned to Parliament by Pozsony (Pressburg) as an independent member. He became Minister of Justice in 1889. From this time to 1894 he directed his efforts principally towards a radical reform of the whole administration of the courts. In 1894 he took a conspicuous part in ecclesiastical legislation, with which his name is permanently connected. Article XXXI. of the Law of Civil Marriage, and articles XXXII. and XXXIII. on the religion of the children and on State registration, were the result of his active coöperation. After the appointment of Baron Banffy, the former president of the Hungarian House of Deputies, as prime minister, Szilagyi was elected president of the House on Jan. 21 1895, which office he retained until 1899. A man of extensive knowledge, spotless character and wide vision, and a brilliant orator, he was one of the most considerable of the Hungarian statesmen of his day. He died on July 3 1901.

See *Szilagyi's Speeches* (4 vols., in Hungarian, Ed. Fayer).

(E. v. W.)

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TACNA-ARICA QUESTION.—Among long-standing disputes between states, the question of Tacna-Arica, between Chile and Peru, still remained unsolved in 1921. Its history can be summarized as follows.

The Treaty of Ancon, which, ratified on March 28 1884, put an end to the war of 1879 between Chile and Peru, was carried out in its entirety with the single exception of Clause 3, dealing with the fate of the provinces of Tacna and Arica. In 1881, when Peru first sued for peace, Chile, with an eye to the future safety of her frontiers, demanded the cession of three Peruvian provinces: Tarapacá, Tacna and Arica. The Peruvian Government made no difficulty about the first-named, which passed definitely into Chile's possession; but they refused to consider the cession of the relatively valueless provinces of Tacna and Arica, on the ground that public opinion in Peru would never suffer it. To smooth the way for them Chile offered to purchase the territory in question for the sum, or equivalent, of ten million Peruvian *soles*, but the offer was rejected. The war therefore continued until 1882, when Chile succeeded in occupying the Peruvian capital. Chile again made the cession of Tacna and Arica a *sine qua non* for the signing of the peace treaty. The Peruvian Government's chief concern was to find a way of acceding without grievously wounding the national sentiment. Examples were not lacking in recent European diplomacy of a means of effecting this; France, especially, had had recourse to an expedient wherewith to save appearances and mask important transfers of territory, namely, Nice and Savoy in 1860 (Treaty of Turin), and the island of St. Barthélemy in 1877 (Treaty of Paris). That expedient consisted in inserting in the treaties whereby the territory was ceded a soothing stipulation for a plebiscite, which should decide, at some future date, its definite ownership. Comparison shows that the negotiators of the Treaty of Ancon, in drafting the clause concerning Tacna and Arica, followed closely enough the formulas provided by the Treaties of Turin and Paris. The clause runs as follows:—

Art. 3. The territory of the provinces of Tacna and Arica, bounded . . . etc., shall continue in the possession of Chile and subject to Chilean legislation and Chilean authorities for the term of ten years, reckoned from the ratification of the present Treaty of Peace. This term having expired a plebiscite shall decide by popular vote whether the territory of the said provinces is to remain definitely under the domain and sovereignty of Chile or continue to form part of Peru's territory. The country in whose favour the provinces of Tacna and Arica shall be annexed shall pay to the other ten million *pesos* in Chilean silver money or in Peruvian *soles* of equal fineness and weight.

A special protocol, which shall be considered an integral part of the present treaty, shall establish the form in which the plebiscite is to take place and the terms and periods in which the ten millions are to be paid by the country which shall remain owner of the provinces of Tacna and Arica.

Chile's contention subsequently was that this clause was inserted solely in order to allay Peruvian national resentment and so to make possible the conclusion of peace; that the plebiscite to which it refers was to be carried out under such conditions as to render inevitable the definite annexation of Tacna and Arica, upon which Chile had insisted from the first; that the sole purpose of the stipulated lapse of 10 years before the plebiscite should be held was to give the Peruvian people time to accustom themselves to Chilean rule, and that the sum of 10 million *soles* which would be paid by Chile was meant as compensation for the cession. Peru, on the other hand, maintained that the plebiscite clauses introduced into such treaties as those of Turin and Paris had not the disguised intention that Chile claimed, and that, even supposing they had, the plebiscite called for in the Treaty of Ancon was of a very different nature.

The period of 10 years had not expired before Peru took steps to secure the holding of the plebiscite, proposing conditions, which, as they included the restriction of the vote to the Peruvians born in the two provinces, proved unacceptable to Chile. Several years of fruitless negotiation ensued, and in 1901 Peru severed diplomatic relations. Four years later she accepted Chile's invitation to renew their intercourse, and to seek with her neighbour an agreement based upon the interests and convenience of the two republics; but the Peruvian plenipotentiary, on his arrival at Santiago, made it clear that his Government desired no other agreement than such as would forward the carrying-out of the plebiscite under the same conditions proposed previously, and diplomatic relations were again broken off.

Notwithstanding her contentions as to the purely accommodatory nature of the clause in dispute, Chile always declared her willingness that the plebiscite should be held, provided the suffrage were not limited to Peruvians but extended to all the adult inhabitants of the provinces, including foreigners resident therein since a certain date, who could read and write; and that a representative of Chile, as the nation exercising sovereignty over the territory, should preside over the commission controlling the proceedings. For her part, Peru insisted that the 10 years stipulated for the holding of the plebiscite was a *maximum* period, and that since its expiry in 1894 Chile no longer exercised such sovereignty *de jure*, and could not therefore justly claim to preside. Chile, on the contrary, held that the term was intended as a *minimum* period.

Diplomatic intercourse having been resumed, Chile, in 1910, made definite proposals for the holding of the plebiscite in accordance with her contentions. Peru refused, and once more broke off relations.

In 1920 Peru made formal request for the revision of the Treaty of Ancon by the 1921 Assembly of the League of Nations, but later withdrew her demand, reserving the right to renew it at a future Assembly. The problem of Tacna and Arica stood in 1921 therefore in much the same position as at any time subsequent to the Treaty of Ancon, though towards the end of the year suggestions for arbitration were again under discussion. The area of the territory in dispute was only 23,306 sq. km., and only 18,000 ac. were in 1921 under cultivation. The pop. numbered no more than 37,000, and the trade and industry were almost negligible. Nor were any ethnical, linguistic or religious considerations involved, the inhabitants, whether Chilean or Peruvian, being of the same race, speaking the same language and professing the same faith.

TACTICS[1] (*see* 26.347*).—While personal reminiscences of the Great War had up to 1921 appeared in plenty, and in many languages, it is remarkable that so far no comprehensive and scientific study of its abiding tactical lessons had been published. Diarists and biographers there had been; also not a few training-manuals and text-books; but the world was still awaiting the Clausewitz or Henderson who would show it how military science developed from 1914 to 1918 in the minds of great leaders, how the world struggle differed from anything and everything that preceded it, and how it was finally lost and won. This is the task which will eventually confront the true biographer of Marshal Foch, the greatest soldier figure of the war, when it becomes possible to follow his innermost thoughts during the progress of the conflict. The future historian will have to show how principles and theories which had been developed during a lifetime of profound study were abandoned, modified or confirmed as the result of experience of modern war, contact with the military chiefs of Allied nations and bitter contest with the best military brains Germany and Austria could produce. When some skilled military writer shall have interpreted Marshal Foch as G. F. R. Henderson interpreted Lee and Stonewall Jackson, it may be possible not only to understand the Allied victory but perhaps even to penetrate into the future and to realize some of the simpler problems which war on the great scale has in store. That is the best the military historian can hope to do—so to present the picture of the past as to throw

[1] This article may be considered also as supplementing, for the World War, the article STRATEGY (25.986).

** These figures indicate the volume and page number of the previous article.*

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some light upon the obscurity of the future. Always we are left groping our way through what is at the best semi-darkness, but any ray of light is helpful. It is in this spirit and with full consciousness of the difficulties and dangers which lie ahead that the present writer attempts here the task of reviewing the practical developments of the decade 1910–20 and of presenting them in a form which in 1921–2 might already be out of date.

1.—Tactics in the World War

Tactics and Strategy.—First it may be as well to inquire exactly what is meant by tactics, and whether the division between strategy and tactics is left as clear as it was before the World War introduced the new feature of continuous lines offering no flanks for attack, and ceaseless fighting which, from day to day and month to month, varied only in intensity.

Let us ask two questions: (*a*) Can grand or combined tactics still be defined as the sphere of the higher commander on the day of battle? and (*b*) if so, can we accept the corollary that all the fighting on the western front from 1915 until 1918 was tactical and outside the sphere of strategy? All days were battle days; but does this mean that the problems which the commanders of the British, French and Italian armies in the field were called upon to solve were essentially tactical in their nature? The definition may require some modification, but to the second question the answer is distinctly "Yes." They were vast problems involving all sorts of considerations, but they were essentially *tactical*. Questions of strategy, so far as Britain was concerned, were dealt with in London, or in conference with her Allies in Paris, Rome or elsewhere. It was in these places and not in the field that great decisions were formed as to the despatch of troops to the various theatres of war, the formation of new forces, and the wisdom, or the reverse, of embarking upon fresh undertakings. Behind them all were the equally anxious problems of finance and allotment of man-power. In modern wars, Army, Navy (in which is included the Merchant Marine) and Munitions are only three departments of the nation; each puts forward its rival claims, which can only be judged by the Government in consultation with the technical advisers. And so it is that, as war absorbs into itself more and more of a nation's energies and resources, the Government with the prime minister at its head must accept responsibility for *strategy* in the highest possible sense of the word. In no sense, however, can the Government be held to be responsible for *tactics*, which are the exclusive sphere of the military commanders. The Government, in consultation with their technical advisers, allot troops; soldiers alone command them. Whether that command, in its turn, gives scope for *strategy*, as in Palestine, or only for *grand tactics*, as on the western front, depends upon the number of men available in proportion to the size of the theatre of war, upon the railway and road development of the theatre of operations, and upon many other considerations.

Strategy, now as always, is the art of bringing the enemy to battle on terms which are disadvantageous to him; *grand tactics* are the methods employed for his destruction by a force of all arms. Before the war, when aviation was still in its infancy, the term "all arms" included as a rule no more than infantry, artillery and cavalry. Even the engineers were rarely considered as having any direct influence upon the result of a battle. All this is changed, and to the four arms there must now be added, without any doubt, aeroplanes and tanks, and it is a matter for the gravest consideration whether in future wars the chemist will not occupy as important a position as he now does in peace. Machine-guns are purposely excluded here, not because their importance is underrated, but merely in the hope of avoiding unnecessary complication and because they may be included in the wide term of infantry, which also covers such accessories as bombs and rifle grenades.

The sphere of the higher commander in battle is therefore by so much enlarged in that he must know how to utilize and combine far more weapons than were at his disposal in earlier wars, and the demands made upon him are in the same degree heavier and more complex. And so through all the long chain of command, from "the Chief" at G.H.Q. to the platoon commander in the foremost trench. It has been amply proved that, more than ever, no arm of the service is complete in itself; each requires in a greater or less degree the assistance of others in order to win even a small success. The smallest raid into a German trench needed hours, almost days, of careful preparation: night patrols and aeroplane photographs for reconnaissance; artillery and trench mortars to destroy the enemy's wire; if the ground won is to be held engineers must help to make it good, and even if it is not to be held the engineers must be called upon to destroy with explosives enemy machine-gun emplacements or other defences. Then, according to the object of the raid and the intentions of the commander, arrangements must be made for the withdrawal or reinforcement of the raiding party, all of which require most thorough and careful forethought. Much of the detailed preparation for a minor operation of this kind will fall upon company and platoon commanders; and when it is remembered that in war platoons may be, and often are, commanded by junior non-commissioned officers, it is seen that, just as responsibility for the success of higher strategy must depend upon the wisdom of the prime minister and the Government, so responsibility for tactical success extends to the last link in the chain of military command.

War has become national in a sense in which it never was before, and it is a sad reflection that, after twenty centuries of Christianity, its study is more important than ever. Owing to the insular position of Great Britain, its dense population and consequent dependence upon overseas trade, it, more than any other country, is dependent upon success in war. No country in the world could so ill support defeat; yet in no country is the study of war so much neglected. There has recently been a most praiseworthy effort to train the British soldier in the arts of peace; it might be well if similar efforts could be made to fit the civil population in all classes of society for the vital responsibilities of war. The response to Lord Kitchener's appeal in 1914–5 proved beyond doubt the essential soundness of the national spirit; but the story of a hundred battles proves that spirit without professional knowledge and skill is desperately expensive in life.

Hence it is that, just as our conception of war has become national and the need of study more general and less strictly professional, so our definition must be less restricted. We prefer to regard tactics, even "combined tactics," simply as the art of commanding troops in action, without any limitation as to the number of troops employed or the status of the commander. Indeed, it is perhaps easier, in considering the fighting in France and Belgium, to exclude the rôle of the commander-in-chief than that of many of his junior subordinates. Nevertheless, for the purpose of this article, we shall be concerned entirely with the sphere of the larger formations, with organization and equipment, with the effect of inventions upon attack and defence, and with the changes and developments in tactics since Russia and Japan fought themselves to a standstill in the plains and highlands of Manchuria.

Communications.—Now, these changes have been brought about by exactly the causes which have produced the whole evolution of tactics during the last two thousand years, namely, improvement in weapons and communications—that is, in conveying ever more men to the field of battle and in furnishing them with ever more efficient means of killing when they get there. For, after all, the object of tactics is to kill; if possible without being killed, but in any case to kill. For the first time in history these developments enabled armies during the World War to be placed and maintained in positions which offered no flanks for attack and therefore afforded no scope for strategy or for manœuvre. Increase of population was a contributory cause, but primarily the "continuous lines" extending from sea to sea were rendered possible only by the development of railway and road communications, and by firearms of marvellous range, rapidity and precision. It was these features, existing so far only in Europe, and attaining their fullest influence only in western Europe, which differentiated the World War from everything

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which preceded it. Something of the same kind was seen during the Russo-Japanese War, when great mountain ranges made movement far from the railway extremely difficult, with the result that, broadly speaking, neither Oyama nor Kuropatkin had room for manœuvre, and tactically the war resolved itself into a series of frontal assaults on a defended defile. So it was that, from 1914 to 1918, commanders on the western European front had no opportunity for crushing strokes and striking victories like Austerlitz, Rossbach or Salamanca. Their genius had to show itself rather in the skill and ingenuity with which they made use of the resources placed at their disposal by modern science, than in rapidity of movement and dashing leadership. More than ever war has become "an art served by many sciences," but in so doing it has lost much of its romance. It was only as they moved eastward out of Europe to Palestine and Mesopotamia, where restricted railway communications and scanty populations made it necessary to operate with comparatively small forces in big countries, that the British commanders found themselves working under conditions which previous experience had made familiar to them. Before 1914 instances of the tactical use of railways could be numbered on the fingers of one hand; the arrival of the ever-famous Stonewall brigade on the battlefield of Bull Run, the dramatic appearance of Lambton's naval brigade at Ladysmith on the morning of Oct. 30 1899 at a critical moment in the action of Lombard's Kop, and one or two other examples complete the tale of occasions when railways can fairly be said to have had a direct influence upon a tactical decision.

All this is now changed. Broad-gauge and light-gauge lines are now a necessary and ever-increasing part of the mysterious machinery of battle; and it is they, together with the complementary service of road transport, that have made it possible to mobilize the entire manhood—almost the whole adult population —of a nation, and to maintain in the field armies numbering several millions of men. These armies in their turn claim the services of every industry and every factory to such an extent that in time of war the term "civilian population" is merely misleading, and undefended towns and ordinary merchant vessels become legitimate objects of attack. Thus it is that the new feature of "continuous lines" has been introduced into civilized war, and frontal attacks have become inevitable.

Obstacles: Wire.—Here, however, we must stop to consider another new factor which has resulted directly from the extended use of railway communications and the "nationalization" of war. This is the use of obstacles, more particularly of wire. For several years before 1914 it had been amply evident to every student of the great military problem of Europe that, so soon as the German armies were mobilized and received the order to march, every road between the Dutch frontier and the mountains of Switzerland would be filled to overflowing with advancing troops. There was, be it noted, no doubt whatever among competent soldiers that Germany would not hesitate to violate the neutrality of Belgium; indeed, the very size of her armies, as well as her declared principle of envelopment, made it certain that she would do so, even had the fortifications of the eastern frontier of France not barred the way from Alsace and Lorraine to Paris. To this extent, therefore, "continuous lines" had been foreseen, but it was generally considered that they would exist only during the opening phase.

The present writer can recall very clearly an interesting argument between a very distinguished senior officer and two of his subordinates which took place early in 1914. The senior officer maintained that he found it impossible to visualize a collision along a front of something like 140 miles. The two subordinates maintained that this gigantic battle must be the result of the numbers which would certainly be mobilized; clearly it could not last very long before it broke up into groups of armies operating semi-independently, but, taking Mukden as something of a guide, they expected to see the first, and perhaps the decisive, battle rage from Belfort to the neighbourhood of Namur for perhaps three weeks. "Well," was the senior officer's final remark, "I'll give you three weeks, but not a day longer," and with that the juniors departed content. Some things, it will be seen, turned out as anticipated; but many, especially the rapidity of the Allied retreat, turned out very differently. On the one hand, the German movement through Belgium was too quick and too successful to allow the Allied armies to make the expected stand; on the other hand, the continuous lines were never broken, and after three months of moving warfare the *siege of Germany* began. Once started, it lasted, not for three weeks, but for four whole years—a phenomenon which was due to field fortifications and, more than anything else, to wire.

It is a remarkable fact that in all the tactical exercises, staff rides and other instructional devices in which soldiers were accustomed to indulge before the war, the problem of field fortification was but lightly considered. This is true of all countries, and it is quite wrong to believe that Germany, as has been held in too many quarters, showed any greater prescience than her enemies. The reasons are simple: first, it was not possible to test the efficacy of trenches, dug-outs, barbed-wire entanglements or "pill-boxes" under manœuvre conditions, when time was short and compensation a grave consideration; secondly, it was generally agreed that fortified positions limited the offensive power of the defending garrison and could themselves be easily avoided or turned. This was the teaching of the South African and all previous campaigns, and even Manchuria gave but little indication of what war was to be like in the highly industrialized areas of western Europe. Thus it was that, at the end of the first battle of Ypres, in the middle of November 1914, the British, French and German armies found themselves confronted with entirely novel tactical conditions which demanded entirely new tactical treatment; and to-day new tactics involve not only the training of troops but also the application of mechanical device. In 1914 the new conditions were those of "continuous lines," for which the solution was eventually found, but only through a weary process of "trial and error," in the course of which the ultimate victors came perilously near to exhaustion.

It is not proposed here to discuss the various methods which were adopted with a view to avoiding the central problem and seeking a decision in other theatres of war, for they have nothing to do with tactics. It is, however, permissible to refer to the effect of operations in different theatres of war upon the tactical evolution in the armies of the Allies and of the Central Powers.

Interior Lines.—Put quite briefly, it would appear to be this —that, as a result of their central position and possession of *interior lines* facilitating the rapid transfer of troops from one theatre of operations to another, the German commanders were not so free to concentrate their attention upon the demands of local conditions as were the French and especially the British. The theatres of Mesopotamia, Gallipoli and later of Salonika and Palestine were so remote from France and from each other that it was less difficult to allot to each the necessary proportion of the different arms, and to give to each the distinct training and equipment essential for its efficiency, than it was for Germany, whose troops and commanders were constantly on the move from one theatre to another. Hence it was that, while Germany was inclined, or compelled, to compromise, the Allies opposed to her were able to specialize, with the result that, with one notable exception, in every theatre the initiative and the lead in tactical development were with them. That notable exception was the not very noble or praiseworthy one of the use of gas. In the true realm of tactics it may fairly be said that, from the end of 1914 until March 1918, when Ludendorff had for the first time been able to devote his individual attention to the problems of the western front, the lead in tactical evolution was always with the Entente armies.

Changes in Organisation.—To return to the deadlock in the West, it became clear towards the end of 1914 and beginning of 1915 that the problem of field fortification could not be solved by the methods of 1870, S. Africa or Manchuria. It was not that principles were changed and theories at fault. The power of modern rifle fire had been amply demonstrated, especially by the British Expeditionary Force, whose trust in their weapons had been more than justified; the French seventy-

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five, the British long-range field gun (for as such the 60-pounder must be regarded), and indeed the German heavy howitzers had done all that had been expected of them, but one and all failed to compete successfully with the new factor. Infantry, even with the best available artillery support, could not be expected to assault with success the hostile lines, which were daily becoming stronger; and cavalry, which had been invaluable during the retreat of Aug. and the early days of Sept. 1914, as well as in the subsequent advance, could find no scope when Nov. and Dec. came. No vulnerable flank was offered, nor was there the slightest opportunity for those daring raids against the hostile communications which have sometimes offered such dangerous attraction to the cavalry leader. The conditions were indeed the exact opposite of those in S. Africa during 1899–1902. Similarly, the German army had been able to prove that the theory of tactical envelopment was the inevitable corollary of machine-guns and quick-firing artillery, for frontal attack was far too costly, and Joffre and French and their lieutenants had once more proved to the world that counter-attack was the soul of successful defence. It was not that the principles or theories were wrong; so far as they went they were correct enough, but the trouble was that they did not carry sufficiently far. Their basis was manœuvre, and suddenly it was found that manœuvre was no longer possible, but that it had been displaced by the tedious processes of siege warfare. Infantry was still the conquering arm, but was now less dependent upon cavalry and even more dependent upon engineers and artillery; while the Air Force was rapidly acquiring an importance which, though foreseen, had in peace always been put aside by considerations of expense. It was at this stage, too, that the bomb first made its reappearance as an infantry weapon, and its use increased to such an extent that, towards the end of the battle of the Somme, in the autumn of 1916, it threatened to supersede the rifle. Many new auxiliary services grew up, many new weapons were invented, and leading men in every branch of science devoted their great talents to the destructive art of war.

Yet amidst so much which was new the great central problem of war remained unchanged, for it was, as it always has been, the destruction of the enemy's field army. In the new conditions which had arisen this meant great innovations in army organization. The cry was for more technical troops of all kinds. A third field company (engineers) and a pioneer battalion were added to each British division; the signal service was greatly extended, and, above all, the demand for more and heavier artillery was urgent. Every month, almost every week, new needs were discovered and fresh demands from the armies in the field were reaching the British authorities at home, who were already more than fully employed in equipping Territorial divisions and in raising new armies. Put quite broadly, however, the problem of the capture of the German fortified lines, which could not be turned, was one of improved material and improved coöperation between artillery and infantry, each with the attendant services necessary to efficiency. That is the main thesis to which it will be necessary to return again and again.

Artillery and Infantry Coöperation.—At this point it will be as well to look backward and to trace very briefly the history of the evolution of artillery and infantry coöperation for the previous twenty years or so. It is the story of the contest between artillery and field fortification, which in some respects resembles that between the gun and armour at sea, or between ships and forts. It is, in fact, the old contest between attack and defence. For many years before the S. African War it was an accepted axiom of combined tactics that any attack by infantry must be preceded by an artillery bombardment, of which the principal purpose was partly to overcome the enemy's artillery and partly to shake the *moral* of his infantry. Accustomed as we have become during the last few years to think of guns at least in hundreds, it seems strange to turn to the official account of the battle of Magersfontein (1899) and to read that at 4.30 P.M., on the day preceding the attack which was to take place at dawn, the British force opened fire with one 4·7 gun, one battery of howitzers and three of field artillery, which "shelled Magersfontein Hill for two hours. . . . Though his guns had provoked no reply from the Boer, Lord Methuen felt confident that they had not only inflicted loss, but had produced considerable moral effect upon the Boer commander. This, however, was not the case. The fire had but one important result, that of warning the enemy that an attack was imminent." The fact was that in those days military science overestimated the powers of a few guns and underestimated those of hastily constructed entrenchments, which were then in their infancy and almost an unconsidered feature of war. Again and again the same thing occurred, but so difficult is it to learn from any experience but one's own that we find the Japanese army making exactly the same mistake some four years later. Then, at the action of Ta-shih-chiao, the Japanese, with a vastly stronger artillery than the British had possessed at Magersfontein, bombarded the Russian right for several hours. So heavy was the fire on this occasion that General Stakelberg declined to occupy his trenches, and reported to his senior officer that, should he be forced to do so in order to repel an infantry attack, he would certainly suffer very heavy loss. But no infantry attack developed, Stakelberg's troops remained under cover, and the losses inflicted by the bombardment were almost negligible. From these and many similar experiences the theory was deduced that, in order to get results from the fire of the guns, the artillery bombardment must be accompanied by an infantry attack. To coöperate successfully, the action of the two arms must be simultaneous instead of successive, for only in this way could the enemy be compelled to man his defences, to show himself above his parapets, and to expose himself to shrapnel fire. In the words of the French regulations of 1913: "Artillery no longer *prepares* the infantry attack, but *supports* it." The old term, "artillery preparation," belonged to a dead language.

Such, in a few words, was the generally accepted theory of infantry and artillery coöperation at the beginning of the World War, and during the earlier stages it proved to be remarkably correct. It was not until the field armies found themselves brought up short by deep trenches protected by wire entanglements, furnished with strong revetment, and strengthened by dug-outs, that the experts discovered that, curiously enough, new conditions must be met by old methods, and the discarded, not to say discredited, "artillery preparation" was revived.

Up to this point, too, it may be fairly claimed that the actual artillery material with which the various armies took the field in the autumn of 1914 had stood the test well, although naturally subjected to the restrictions on ground of expense which are inevitable in times of peace. Each artillery, English, French and German, had, however, developed on somewhat different lines, corresponding to the mentality of the different nations, their theories of battle fighting and the amount of money available for each experiment. Each of the three armies had a mobile field gun, England the 18-pounder, France her famous 75-millimetre and Germany the 77. France, thinking always of rapid movement either in retreat or advance, and always refusing to consider the possibility of standing on the defensive, had concentrated on the light, rapid-firing and very accurate field gun, with an organization on a divisional basis. England also believed in the divisional organization, but in addition to the 18-pdr. she had the 4·5-in. howitzer for high-angle fire, which had been found so necessary in S. Africa, and the 60-pdr., whose long range, commanding the roads and often forcing premature deployment of the German infantry, was invaluable during the retreat. The German army alone possessed heavy howitzers and high explosive, no doubt because the general staff always considered the possibility of being forced to engage permanent fortifications on the French and Belgian frontiers, but it was weak exactly in those points upon which the French and English had specialized. The 77-mm. was inferior as a field gun both to the 75-mm. and to the 18-pdr.; it possessed nothing corresponding to the 4·5-in. howitzer; and its heavy artillery, while possessing great shell power, was lacking in range. Thus it came about that, when expense was no longer a ruling factor, each army began to borrow ideas from the other and to adopt material

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suitable to the wearisome ordeal of trench warfare. Thus, too, Europe stumbled into that war of material, of ever stronger material of defence and ever stronger material of attack, which was to last until the autumn of 1918. It was under these conditions that the German army, which was to have been back in its own homes "by the fall of the leaf," found itself pinned to French and Belgian soil, and that the war, which at the outset, as was believed by most of the leading authorities in England, political, military and financial, could not last more than six months, dragged out its devastating existence for more than four long years. One man among them alone ventured at that early stage to lay his plans for a long war, Lord Kitchener.

Offensive or Defensive?—It was a depressing situation for the professional soldier of England, France or Germany to find himself in. No matter to which of the three armies he happened to belong, he had been trained from youth in a war of movement, of stroke and counter-stroke, and of rapid decision. The more he knew of the history of his profession, the more deeply he had studied the campaigns of the great captains, the firmer was his belief in the power of the offensive and the "will to conquer." There was much searching of heart, especially among those who had seen the German masses beaten back time after time by the attenuated lines of the British Expeditionary Force in the first battle of Ypres. If the rifle alone could do so much, how was it possible to overcome strong defences heavily protected with barbed wire and bristling with machine-guns? Had modern developments changed not only the methods of warfare but the very basic principles themselves? Had, in fact, the defence become stronger than the attack?

There were those who thought that a decision, since there must be one somehow, must be sought elsewhere than in France or Flanders, and there arose the controversy between "Easterners" and "Westerners," which lasted as long as the war itself. But that great question carries us into the region of strategy. Clearly no commander could be content to sit still and avoid a decision on his own front, at least without direct orders from the supreme authorities. Nevertheless, the same causes which gave birth to the desire to "find a flank" elsewhere than in France produced even on the western front two schools of thought, which were christened by the French, with their wonderful gift for discovering appropriate labels, the "usuristes" and the "trouistes." The former, as their name implies, held that nothing could be gained by hurling infantry, however well supported, against the German lines. In support of this view they were able to point to the desperate losses which were incurred in the fruitless fighting of the early part of 1915, and to the opinion of a captured German officer who, when asked when and how he thought the war would end, was said to have replied: "In about six months' time, and about fifty metres from where we now are." A war of attrition, and victory through exhaustion, or by somebody else's efforts in some other field, were the tenets of the "usuristes." These theories found no appreciable support in the British army, nor in the British troops from overseas or in the Dominions whence they came. The war of attrition was rightly regarded by them as a dangerous "will-o'-the-wisp" which was bound to lead to disaster, for it meant the abandonment of that "will to conquer" which has always been the greatest asset of victorious leaders, and depended for success upon the collapse of the enemy's *moral* rather than upon the triumph of their own. The arguments of the "usuristes" could not be disproved. They could be met by faith alone; but faith was not lacking, and the names which will always be held in the highest honour in every country are those of leaders, whether political or military, who never lost their belief in the power of the offensive and refused to be tempted into the broad and easy path of the "usuristes."

The "trouistes" had their way, and in the end they compelled victory. The principal article of their belief was a firm conviction that morally the defensive is the weaker role, and that the path to victory must always lie through a wisely and resolutely conducted offensive. Put shortly, and in axiomatic form, "there is no defence which cannot be broken." The formula was simple, but the proof was only found after three more years of trial and error.

Since the very earliest days of the war the cry in every army had been for more and heavier artillery, with more and heavier shells, and the fighting of the earlier part of 1915 merely emphasized the same need. By Sept. 1915 the French and British armies, no less than the German, had been provided upon a scale never before dreamt of, but yet far below that which was to be reached before the war was over. Side by side with this vast expansion went the increase of the signal corps, for without coöperation between the arms it was clearly useless to expect the full value from either. Before the war, both in France and England, this subject of coöperation had received great attention. It formed the subject of countless essays, lectures and articles in technical magazines. All that was lacking was practical application and testing under service conditions. Probably the Signal Service which took the field with the British Expeditionary Force excelled both the French and the German, but it depended largely upon despatch-riders, admirable in a war of movement but of less use on a modern battle field. In the words of a French writer: "Il eût mieux valu quelques harangues de moins sur la liaison, sur l'union des coeurs d'artilleurs et de fantassins, et quelques kilomètres de plus de fil téléphonique." But telephone wire costs money, and its absence is just one of those difficulties with which every army must expect to be faced at the beginning of a great war. By Sept. 1915, however, the Signal Service, the link between infantry and artillery, was well equipped; but, in the absence of practical experience, its possibilities and limitations were not yet realized. In this direction, as in many others, much was still to be learnt.

First Great French Attack.—Material equipment was provided lavishly and the first of the great attempts to burst through the enemy's lines was eventually fixed for Sept. 25 1915. At that date much of the British army was still new and inexperienced, so the main attack was delivered entirely by the French in the Champagne country. Farther to the north subsidiary attacks were launched both by the French and the British, but with them we are not concerned. Already the old formula: "The artillery does not prepare the attack, but supports it," had been so far abandoned that three days were devoted to the destruction of enemy's defences by guns of every calibre, and these had themselves been preceded by several days of counter-battery work; thus was seen the revival of the old discredited "artillery duel," which cannot fail to interest the eventual historian of tactical evolution.

It is clear that an attack which is thus prepared has one grave weakness. The exact time, and even the day, of the infantry assault may be concealed from the enemy unless he is sufficiently fortunate to capture a prisoner who knows and can be persuaded to part with the secret, but there is nothing of the rapid march followed by the speedy onslaught and crushing blow of a Lee or a Stonewall Jackson. On the contrary, the attack is not only faced by astonishingly strong defences but is at the same time deprived of what is perhaps its principal weapon—surprise. Some efforts were, of course, made to conceal the exact area selected for the main attack by carrying out similar bombardments on other parts of the front, but the vast amount of ammunition necessary for a real destruction of wire defences and dug-outs rendered it impossible to carry out a thorough preparation at more than one or two points. Thus it came about that the element of surprise was lacking, and the attack was to this extent weakened. Nevertheless in the initial stages it was almost completely successful. The hostile front was broken on a front of 15 miles, and some 20,000 prisoners were taken, together with about 100 guns.

Great hopes were raised momentarily, not only on the fighting front but in London and in Paris. But these hopes were sadly dashed, for it was quickly discovered that, after all, the real difficulty for the assaulting troops was not the capture of the enemy's organized first-line defences, formidable and almost impregnable though they had hitherto appeared to be, but the exploitation of success. So soon as the great attack had been

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launched there was no longer any doubt as to the exact point or points at which the German reserves were required, and as the attack began to lose its energy and vigour the defence grew stronger. The assaulting infantry found itself in a comparatively narrow salient, exposed to a cross fire of artillery from both flanks, and checked in front by machine-guns which could not be hastily located. It was just at this moment that the infantry found that its own artillery support was weakened, for guns were trying to move forward to new positions and were at the same time struggling against perhaps their greatest difficulty, namely, ignorance as to the exact position of their own infantry. As the days passed the defence steadily grew stronger, until at last the attack withered away and finally ceased altogether towards the end of the first week in October. When the time came to reckon up gains and losses it was found that against a gain of some 40 square kilometres of ground, 30,000 prisoners and more than 100 guns, the French army had put a loss of 120,000 killed or missing and 260,000 wounded. The German loss was probably not much less.

The stories of the various subsidiary attacks were not very different from that of the principal French effort. There had been no break-through, but much had been learnt. In the first place it had been proved that the attack was still stronger than the defence, for the leading infantry had passed through the German lines with surprising ease, and there was a general feeling that at several points, notably at Loos, the Allies might well have won greater success than that which actually came to them. There was, therefore, reasonable ground for the feeling that, notwithstanding bitter disappointment, the advocates of the "break-through" had been justified, and that, with the experience that had been gained, success would certainly be achieved "next time."

New Tactical Lessons.—The causes of failure may be summed up thus: (*a*) the attacks were made on too narrow fronts; (*b*) there was no surprise; (*c*) communication between infantry and artillery was not satisfactory. So far as the first of these causes of failure was concerned, it was evident that it could be remedied by allotting more men to the attack, and that in turn developed itself into the more or less mechanical question of the provision of more guns and ammunition. The second cause was more difficult, since, as has already been seen, surprise and prolonged bombardment cannot well be reconciled. One or the other must be sacrificed. The third cause of failure led to a very definite step in infantry and artillery tactics, and to the evolution of ideas which were put into practice for the first time in the fighting on the Somme in 1916.

As has been seen, it had already been found necessary to abandon the idea, formed in S. Africa, that "artillery does not prepare the infantry attack," and it had been realized that an adequate artillery would have had no difficulty in dealing with the Boer defences. The fault, after all, had not been in the older theories of attack, but in the British army having tried to carry them into effect with insufficient material. Had, for instance, Lord Roberts's army in Feb. 1900 been provided with heavy and light guns on the 1915 scale, Cronje's defence at Paardeberg could not have lasted six hours, and the costly infantry attacks would have been entirely superfluous. Clearly the fault had not been in the theory of an artillery preparation, which had now been proved to be so completely indispensable that it was necessary not only against the first system of defences but also against the less elaborate lines in rear. How to secure this coöperation against the second and third lines of defence was in Sept. 1915 the latest of tactical problems. The solution then adopted was that the guns must lengthen range or attack new targets *at the request of the infantry*. Such was the training and instruction of 1915, and it was only when put to the test of actual fighting that it was discovered that no system of communication which the wit of man had yet devised was sufficiently good and sufficiently reliable to keep artillery fully informed of the requirements of the infantry; nor was the artillery always able, for various reasons, to do exactly what the infantry wanted, even when fully informed. It was out of the confusion and disappointments of Champagne and Loos that the theory of *methodical progress with limited objectives* was eventually evolved and put into practice in the Somme fighting of 1916.

The experience of the first two years, or, more accurately, twenty-two months of the war was brilliantly summarized in a memorandum on the attack, dated June 20 1916,[1] over the signature of Marshal Foch, then general commanding the northern group of the French armies. Later experience, no doubt, caused further modification of views, but this document is invaluable as showing the stage which had been reached by the best military thought of the day; for it is in every way worthy of the great reputation which the author had already won for himself as a writer and as a student of war no less than as a great commander in the field. No excuse is needed for quoting some of the more important passages.

In the first place it is assumed as a reasonable basis for consideration that the German defensive organization will consist in a series of prepared positions, of which two will be complete, while the others will be more or less skeleton, but sufficiently advanced to be quickly made tenable.

"Against such defensive organizations and against an adversary who is perfectly protected, infantry is incapable of preparing an attack with rifles and machine guns, just as fire power prohibits all action by 'cold steel.' For these reasons infantry has lost its offensive power in the actual battle. Guns alone can destroy the enemy's defences, upset his organization, kill or annihilate the defenders and master his artillery.

"In consequence, the rôle of the infantry is limited to seizing and occupying the ground over which the artillery has wrought effective and complete destruction."

In another part of the same paper the marshal says:—

"In such conditions the attack of every position entails two phases: (1) the destruction of the defences, or the artillery preparation; (2) effective occupation by the infantry (*de vive force*). Experience has shown that when the destruction by the artillery has been effective the advance of the infantry is easy and cheap in human life. When the destruction has been but partial or not thorough, infantry is completely checked" . . .

"Artillery preparation is clearly the measure of infantry possibility. It must be resumed the moment the advance is checked. The *depth of ground shelled by the artillery decides the area which can be allotted for conquest by the infantry. It is not great—two, three or four kilometres.*"[2]

From these hypotheses it follows logically that each successive position requires fresh reconnaissance, fresh bombardment and a fresh infantry assault. Infantry, however, by virtue of its own fire-power, is more than ever able to resist counter-attack.

These new theories may be summed up in the words of another high authority: "Artillery conquers defences, infantry occupies them." What a complete change two years of war had brought about from that other phrase: "The artillery does not prepare the infantry attack, but supports it"! Yet be it noted that the latter was also the direct result of war experience.

A further example of the leading position which artillery had by this time attained is seen in the rapid elaboration of the "creeping barrage." It will be remembered that during the Champagne fighting, artillery altered range or changed its targets "at the request of the infantry." This system had proved unworkable in actual practice, and for it was gradually substituted a new plan by which infantry and artillery worked together in accordance with a carefully prepared time-table. It is only necessary here to record the fact that for the first time infantry movements conformed to artillery fire, although it is also true to say that the artillery "lifts" were based upon the speed at which it was calculated that infantry could move. It is also noteworthy that, as the idea of moving close up to the wall of bursting shell, whether shrapnel or high-explosive, became more familiar to the infantry, the artillery "lifts" were reduced and the rate of progress became slower. Such tactics required no mean degree of confidence in the infantry and a high standard of accuracy in guns and ammunition as well as of training in gun-crews. Some casualties from the barrage fire

[1] It will be noted that this memorandum was issued only a few days before the opening of the Somme offensive.

[2] The italics are ours.

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were unavoidable, but it was found far safer for infantry to run the risk of an occasional short burst than to let the barrage run away from them, leaving them exposed to enemy machine-guns.

Two other points in connexion with the Somme battle are especially worth noting. First, several attempts were made to operate on a really large scale by night, and on one occasion at least considerable success was won. Secondly, tanks made their first appearance, an event of real historic importance.

Nevertheless it must be admitted that 1916 brought the Allies little if any nearer to the longed-for "break-through" than had 1915, and largely for the same reasons. Again it was evident that prolonged bombardment was the enemy of surprise. Again it had been found that the first system of defence was far less difficult to deal with than were the less well-organized and comparatively ill-defined lines in rear. In addition it was discovered that the shell-torn ground opposed a formidable obstacle to the movements of the attacking infantry, while every hole was a ready-made emplacement for a German machine gun.[1] Great things had indeed been achieved both by the British and the French armies but the enemy was not crushed, and after months of fighting on an unprecedented scale he still preserved an unbroken front from the English Channel to the Swiss mountains. This time the explanation was held to be that, after all, the system of limited objectives was wrong, for the delay necessitated by the methodic preparation for each successive attack merely permitted the enemy to recover from the previous reverse, to bring up reserves of infantry and artillery, and to organize a fresh defence. Thus at each stage of the battle the defence grew stronger, and the attack weakened until it at last died from exhaustion. From this premise it followed that if real success was to be won the artillery preparation must be heavier than ever but in greater depth, and the infantry must pass through all the successive lines of defence in one irresistible rush. Such was the teaching of the French official instructions of Dec. 1916 which prepared the ground for Gen. Nivelle's disastrous attack in April 1917.

Lessons of 1917.—Unlike its predecessors, the campaign of 1917 was singularly unfruitful in tactical ideas. Partly owing to insufficient preparation, partly to over-confidence and partly to want of secrecy—for it was commonly reported that every flower-seller in Paris knew exactly what was intended—the great French offensive by the IV., V. and VI. Armies met with a severe reverse. The subsidiary attack by the British I., III. and V. Armies was more successful, but again resistance was found more difficult to overcome as the attack progressed, and the operations were finally abandoned when it became evident that the main attack, from which so much had been hoped and expected, could not attain its object.

The principal scene of operations then became the Ypres area. First the capture of the Messines ridge, and then the prolonged attack, in appalling weather and on a narrow front, against the Passchendaele ridge. As had happened on every previous occasion, the first system of enemy defences fell easily enough,[2] but difficulties increased just when, theoretically, they should have been most easy to overcome. The artillery "preparation," on a scale far greater even than in the Arras battle of April, did its work only too well, for, coupled with the heavy rains, it converted a naturally swampy country into a pock-marked morass, intensifying in a high degree the troubles of the infantry, and greatly curtailing the usefulness of the tanks, which were by this time an important new arm of offense. During this period, too, the use of gas, especially the newly discovered "mustard" variety, became more persistent and more general than ever before. Masks were worn for hours on end, and so impregnated did the soil become that many men suffered merely from sitting or lying down to rest. Never has any army fought under greater disadvantages than did the British during the autumn of 1917, yet, even if it did not do what was hoped from it, it is only necessary to read Ludendorff's account to realize how heavy was the strain upon the German resources. Moreover, under the leadership of Hindenburg and Ludendorff, the defensive strategy and tactics of the German army had been radically overhauled during the winter of 1916–7, and the *morale* of the troops had been wonderfully improved. Indeed, the army which held the French on the Aisne, the British at Arras and the combined Allies round Ypres was altogether different in spirit from that which had been hunted back to the Hindenburg line during the previous winter. Even the air service responded to the new spirit, and the Entente troops no longer enjoyed the immunity from bomb attacks which had been theirs throughout 1916; far from it. Such was the effect of the masterful and trusted leadership which now had control of the German army.

Tactically, the principal change brought about by the new régime was a greater elasticity in defence, which aimed at affording as ill-defined a target as possible to the attacking artillery and the vaguest possible objective to the assaulting waves of infantry. In reserve were held certain battalions whose duty it was to advance to the counter-attack as soon as it was known that an attack had been launched, and thus it came about that more than once infantry which was in process of organization and consolidation after a successful attack found itself thrown upon the defensive and perhaps forced back from a position which had been dearly won. Special aeroplanes were detailed to look out for these counter-movements, and special batteries to deal with them, sometimes by putting down a defensive barrage of gas, and from these small beginnings grew up that war of movement which gradually reasserted itself and increased in intensity until at last the war was lost and won. More and more as the great attacks, whether French, British or combined, failed to win a decisive result, it was realized that in some way or another the element of surprise must be reintroduced, for without it the offensive was deprived of almost half its power. But the question was, How could the enemy defences be overcome without the preliminary bombardment which inevitably "gave away" the assailant's intended plans? The solution of the problem was at last found in the use of tanks, and at the battle of Cambrai tanks came into their own.[3] Massed secretly by night conveniently near the objective, and advancing when the time came under cover of an artillery barrage, but over ground which had not been rendered impassable by tons of heavy shell, the tanks effected a complete surprise, passed line upon line of defences, and enabled supporting infantry to occupy an important area of ground with but little loss. So severe had been the drain upon the German reserves during the Ypres fighting that for some twenty-four hours the British troops were within an ace of really effecting a break-through, and Ludendorff has himself said that if they had been able to push on a little farther they might have broken in upon his communications and so have scored a considerable strategical success. But the drain upon the British reserves had been no less heavy than upon the German, and the necessary weight to turn a tactical victory into a strategical success was just lacking. In the end Ludendorff was able to mass troops for a counter-attack, and some of the ground which had been lost was re-won; but for the Allies by far the most important result of the Cambrai fighting was that the "trouistes" had been able to justify the faith which was in them and to show that there was a way leading to decisive victory—namely the proper coöperation of infantry, tanks and guns. The seed sown at Cambrai bore rich fruit in the campaign of 1918, but before it could do so Ludendorff was to show that, even without tanks, a break-through was not impossible.

The "Break-through" in 1918.—In discussing the first great French effort to break through the German defensive lines, that

[1] In addition the British armies in particular had to overcome almost incredible difficulties in keeping up the requisite supplies of ammunition and food over a country which was almost devoid of roads. It was indeed found necessary to institute a regular road department of the transportation directorate.

[2] It should also be noted that the perfection (coupled with ample supply) of instantaneous fuze now made the destruction of wire defences a far simpler affair than it had been before.

[3] It should be noted that the earliest embryo of the tanks made its appearance against Bullecourt in May 1917; but the number of these new engines was then insufficient and their tactics were not well understood. The attack failed, but the date is important historically.

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of 1915 in Champagne, it was shown that there were three important causes of non-success—namely, absence of the element of surprise, unsatisfactory coöperation between infantry and artillery, and the fact that the whole enterprise was on too small a scale. In a brief review of later offensives it has been possible to show how these defects were gradually overcome, how artillery gradually dominated the tactical theories of the day, but at the same time rendered surprise an impossibility, until at Cambrai it seemed that the solution had at last been found. But Cambrai was itself something of an experiment, and on too small a scale to have a really decisive result. As is always the case in war, the armies of the Central Powers had been passing all the time through the same evolutionary stages as those of the Entente. The minds of Hindenburg and Ludendorff were busy with exactly the same tactical problems as those which daily occupied the thoughts of British, French and Italian commanders. After the great failure in front of Verdun in the early part of 1916 there was no German offensive on the Franco-British front until March 1918, but much experience had been gained in the East and in Italy; moreover, there can be no doubt that Ludendorff's penetrating mind had grasped the reasons for the failure of successive attacks by the Entente armies, as well as the real meaning and significance of Cambrai. Profiting by the experience of others—always a most difficult thing to do, but perhaps particularly so in war—he had refrained from himself taking the initiative until the Russian *débâcle* had put him in a position to do so on a really grand scale. By March 1918 he was able to mass some 80 well-trained divisions for offensive operations in the West, and this in turn enabled him to attack the British III. and V. Armies on a front of 80 kilometres.

The mere fact of being able to stage an attack on this scale gave the German armies a great prospect of success, and eliminated the third of the causes of failure enumerated above. The other two were more difficult to deal with, but in order to secure surprise Hindenburg and Ludendorff decided to dispense with that counter-battery work and artillery preparation which on the Somme, at Arras and round Ypres, no less than in Champagne, had disclosed the Allies' intentions while at the same time rendering the ground difficult, and sometimes impossible, to the attacking infantry. Five hours only were allotted to the artillery bombardment, and in this time wire was to be cut and the enemy guns to be mastered at least sufficiently to allow the infantry to advance. Such was the solution of the second problem—the introduction of surprise—and the decision to attempt so much in so short a time was perhaps the bolder since the German army must accomplish without tanks and on a much larger scale what the British had accomplished with them at their last attempt.[1] The third difficulty—that of coöperation—was overcome by the provision of large numbers of light trench mortars,[2] which, as well as a proportion of field guns, accompanied the infantry advance, as well as by an elaborate system of light signals by which the infantry might indicate their position and wishes to the artillery.

Thus each of the difficulties of 1915 found an appropriate solution in 1918. The attack was on a sufficiently large scale to allow considerable room for manœuvre within the salient which was inevitably formed; the infantry received adequate support from the artillery, at least for several days, and until it was itself exhausted by appalling loss and by the breakdown of supplies (for which the efficiency of the British air service was largely responsible) on congested roads; lastly, a tactical surprise had been effected, with the result that the troops which bore the brunt of the first onslaught were without reinforcements for several days; and this was principally due to the fact that there was no preliminary bombardment to indicate definitely the portion of the front which had been selected for attack.

[1] The facts that the German design had been foreseen at Versailles and that the evidence of prisoners confirmed the British forecast in no way detract from the tactical skill with which Ludendorff's plans were prepared and executed, or from the value of the lesson.

[2] It has been said that the Germans possessed 15,000 of these weapons in 1918.

Nevertheless, notwithstanding the admitted skill and care with which the German commanders had prepared their plans and the colossal scale upon which they carried them out, they, no less than the Entente, failed to reach decisive results. What they did was to show what it was possible to achieve with the materials which science and industry had by this time placed in the hands of the commanders in the field. They had shattered many of the shibboleths of trench warfare and shown that infantry was still the conquering arm. In doing so, they not only exhausted their own man-power, but set loose a new set of tactical ideas which were seized by the genius of Marshal Foch and eventually assisted in their own destruction; for, just as Germany had learnt from the Allied successes and failures of 1915, 1916 and 1917, so the Allies in their turn learned from the German success and failure of 1918.

Foch in Command.—It is not necessary here to trace the steps which led to the appointment of Marshal Foch to the Supreme Command in March 1918. All that remains to be done is to follow the effect of that appointment upon the tactical history of the war on the western front. Even after the first great German drive had been checked in front of Amiens, the initiative remained with the Germans for more than three months while the great soldier who was now in command of the Allied armies was reorganizing his forces and making his own plans. During this period the German attack tactics were unaltered, but each successive effort was a little weaker than that which preceded it, and the only new development was the skill with which one French commander evaded the enemy's blow, surrendered his forward posts and crushed the assaulting lines as they approached his real fighting positions. Such tactics were only possible at a specially favoured portion of the front, but that they were brought into play at the right place and at the right time was another sign that trench warfare was becoming a thing of the past. Meanwhile Foch was maturing his plans, and when historians of the future, with full documentary evidence at their disposal, examine the record of these days it may be found that the marshal's greatest claim to fame is that he, the student of the past, still retained his belief in the war of movement and in the counter-stroke as the strongest weapon of defence.

Twice in the earlier stages of the war great counter-strokes had been delivered with marked success, but for two years they had not been repeated, and the side which had attacked had been met only with passive defence. In 1914 the German sweep towards Paris had been outflanked by Manoury and thrust back to the line of the Aisne, and nearly two years later the costly attempt to capture Verdun had been checkmated by the opening of the first battle of the Somme, though not until it had been in progress for several months. Since that date there had been the two great Entente attacks of April and July 1917 and the German attack of March 1918. In 1918 troops for the attack were provided by withdrawal from Russia, where they were no longer required; but in 1917 it had been necessary to denude important parts of the front in order to release the number of divisions necessary for offensive action, and to trust for defence to a highly developed trench system which could be held by comparatively few troops, so that there was a considerable risk of counter-attack. It is remarkable that, against an enemy trained in the German traditions, the assailant was always able to impose his will, and the defence became largely a question of railways and transportation. The relief of troops on a fighting front, their replacement by others, and their transport to a quiet part of the line became a regular tactical system to which the French gave the name of *roulement*. It was a new feature of war, completely contrary to the peace teaching of every country, but one which was the logical result of the elaborate preparations which were then considered necessary before it was possible to burst through a modern system of field fortification. It was not until Marshal Foch assumed command that the grand tactics of defence underwent any real change, and perhaps he was fortunate in that Cambrai and the March offensive had shown what was possible, and that, as the result of the movement which had taken place, the positions held by the opposing forces

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were not so formidable as they had hitherto been. Be that as it may, it is none the less the fact that Marshal Foch had the courage and resolution to make his defence active, and to base it upon the counter-attack—to return, that is, to the practice of former wars, and to the theories which he had himself so often preached in peace.

In this connexion two points of particular interest should be noted. First, it was not until the middle of July in 1918 that Foch was ready to pass from the defensive to the offensive, and by that time the Germans were perilously near Paris. There must, therefore, have been a grievous temptation to stand purely on the defensive, as Ludendorff had so often done with success, and it was a bold decision which rejected what to a lesser man might have appeared the easier and the safer course. Secondly, there was the peculiar configuration of the German front, which, after running almost due south from the English Channel to Soissons and Château-Thierry, turned sharply westward to Verdun. The German forces within this right-angled salient were lapped round and enveloped, with the result that in whatever direction they attacked they must expose a flank to an active and vigorous opponent. If Ludendorff should attack southward, Foch would counter eastward from the west face of the salient; similarly, if Ludendorff attacked westward, the counter-movement would come from the south. In either case vital German communications provided a strategical objective within possible striking distance. It was indeed a weak tactical situation, in which a series of great and costly but only half-successful assaults had landed the German army, and of which the commander of the Entente armies intended to take full advantage.

His opportunity came in the middle of July. On the morning of the 15th the Germans attacked on both sides of Reims. For three days the battle continued with varying fortunes, until at daylight on the 18th Foch launched his carefully prepared counter-stroke on a front of 35 miles against the right flank of von Boehm's army. There was no artillery preparation, but the French advance was covered, on the Cambrai principle, by a swarm of tanks. The surprise was complete, and by nightfall the German flank was crushed and von Boehm's principal line of communication was in Mangin's hands. But more than this had happened, for at one blow Foch had passed from the defensive to the offensive, and had seized the initiative, on a more comprehensive scale, but in the form made classic by the great commanders of history. The initiative, once chosen, was never relinquished, but was followed by a series of rapid and vigorous blows, beginning with the brilliant attack by the British IV. Army south of the Somme on Aug. 8. From that moment until 11 A.M. on Nov. 11 the German army knew no rest, but was pushed from one strong position to another by victorious forces of many nationalities, into all of which Foch had been able to instil something of his own personality and surprising vigour. The time as well as the direction of the counter-stroke had been truly chosen, for, after acting on the offensive through four strenuous months, the German infantry had exhausted its strength, and moral defection and despondency had spread from the homeland to the armies in the field. It is Foch's eternal glory that he had had the moral daring to wait until this moment had come. So the great counter-stroke of 1918 had in it all the elements which had gone to make the success of exactly similar, if smaller, efforts in former campaigns. It was carefully prepared as an integral part of a general plan of campaign; it was directed against an adequate strategic objective; it came as a surprise; and it was correctly timed. Perfect in conception and execution, it met with its reward, but the curious thing is that it contained nothing new. What the world really saw on that July morning of 1918 was the touch of the artist who knew how to express old ideas in modern terms of war—for Foch was bigger than the tools he handled. Perhaps Ludendorff was not—but it is easy to criticize the commander who fails.

Attack Tactics.—At this point it may be as well to leave the subject of the counter-attack and to return to the study of infantry and artillery coöperation as exemplified in the latest phase of the operations. Once more we may turn with advantage to a French memorandum on attack tactics. This time it is one dated July 12 1918, only six days before Mangin's counter-attack. In it, as in all the more recent documents, stress was laid upon surprise, and it was expressly laid down that attacks must be launched either without artillery preparation, or, if that was not possible, then the bombardment must be as short and as violent as possible. Then followed the important words:—

"Finally, the infantry must realize that it possesses an armament which is strong enough to enable it to exploit its first success, and to continue its progress, while overcoming local resistance with its own resources and without artillery action."

The same spirit inspires the IV. Army instructions for Aug. 8 when the tactics of Cambrai were more or less closely followed. What a change from the memorandum of June 1916 when the system of methodical advance from position to position, with artillery preparation preceding each stage of the infantry movement, is insisted upon. Surely tactical opinion has again come round full circle, and at the end of four years' war we are not very far from the position at which we started: "Artillery does not prepare the infantry attack, but supports it." Yet both the tactical memoranda from which we have quoted have the same high authority, that of Marshal Foch himself, and both are wise, for the conditions of 1918 differed widely from those of two years earlier. In 1916 the initial attack was against positions upon which months of labour had been spent, and held by an infantry confident in their leaders and in themselves, and quite sure of ultimate victory. Against such defences and with the material at the disposal of the Allied commanders, prolonged bombardment offered the only possible prospect of success; but it equally increased the difficulty of subsequent movement across heavily shelled country and left the enemy in no uncertainty as to ultimate intentions. In minor operations, notably round Thiépval and Beaumont Hamel, real tactical surprise was frequently attempted with success, but only in comparatively minor operations undertaken with important but limited objectives when the defence had been already disorganized.

In 1918, on the other hand, German infantry had been wearied by incessant travelling from front to front in its efforts to burst through the network of opposing armies, with which Entente strategy had encircled it. Two years of effort, which history will certainly look upon as prodigious, had culminated in the great offensive which, begun on March 21 and ended on July 18, had exhausted the physical energy of the troops and produced a corresponding deterioration of *moral*. At the same time two years of under-nourishment and nervous strain had undermined the spirit of the civil population to an extent which was necessarily reflected in the army. The defences, again, were but improvised trench systems, hastily adapted to the requirements of the moment and in no way comparable to those of 1916. Against them the British and French armies could bring a more numerous and more powerful artillery than at any previous period of the war; a better and more numerous air service; a more formidable infantry equipment, thanks to the now universal light mortars; and, finally, an ample provision of tanks—those new engines of war which were certainly the best means of overcoming the German machine-gun defence and, by their moral as well as their physical effect, were to play so great a part in the final phase of the war. With such changed conditions it would indeed have been strange and wrong if corresponding changes had not been introduced into tactics. Changes in tactics are brought about by scientific discovery and consequent improvements in the means of killing. At no time in history have men of science devoted themselves so universally and so whole-heartedly to war requirements—that is to say, to the art of killing their fellow-creatures—as they did from 1914 to 1918. Gas, bombs, smoke screens, wireless telegraphy in the field, are but a few of the means by which scientists had a direct influence upon tactics and by which the research student in the laboratory was directly connected with the platoon commander in the field.

It was, therefore, by the united efforts of all classes in a truly national war that trench warfare came to an end in Aug.

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1918; but that which followed was not the open warfare of Frederick the Great, Napoleon or Wellington. Even to the very end, in Nov., the opposing lines were continuous for 300 miles, and no open flank afforded opportunity for crushing defeat. Local flank attacks there were in plenty, and some on quite a big scale, but there was no Waterloo or Sedan. It had been a national war, and the German nation had suffered a crushing national defeat; but even when the Emperor had deserted and fled ignominiously to Holland the beaten army was still able to withdraw across the Rhine in some semblance of order.

Palestine.—Different in almost every respect, and therefore also in the tactics employed, were the campaigns conducted in parts of the world outside Europe. This was especially so in Palestine, and for that reason will it be well to devote some space to the special conditions of that theatre of war and upon the resulting conduct of operations. In the first place the theatre of war was practically a neutral country. Nominally a part of the Turkish Empire, Palestine was in actual fact extra-national, or extra-imperial, with a population by no means united or enthusiastic in support of the Turkish power. The Russo-Japanese War offers another, and even more remarkable, instance of a quarrel between two nations being settled on the territory of a third. In such conditions the war can have none of those national characteristics which formed such a dominating and distinctive feature of the war in the west of Europe. This was the fundamental difference between the main campaign and the subsidiaries, from which it came about that the defeat of Turkey was less national and far more military than was the defeat of Germany. A second important feature of difference is to be seen in the railway development of the theatre of war. It is only through a complete network of railways, supplemented by road transport, that a nation is able to concentrate the whole efforts not only of its manhood, but of its entire population upon the one purpose of winning a war, just as in peace the whole efforts of a population are concentrated upon various forms of industry. When the necessary conditions are lacking, the resultant warfare must inevitably be, if not exactly more primitive in form than in a highly developed country, at least nearer to that waged by the professional armies of the past.

The preparatory stages of this campaign, including the Turkish raids against the Suez Canal and the subsequent advance to El Arish and the neighbourhood of Gaza, need not detain us beyond noting the construction of the broad-gauge railway from Kantara across the Sinai desert. It was wise strategical and tactical foresight which had led Allenby's predecessor, Sir A. Murray, to insist upon a broad-gauge line and so be prepared for operations on a large scale instead of yielding to the temptation to content himself with a narrow-gauge line, which could have been more easily and rapidly constructed and would have sufficed for his own immediate requirements. A false, or at least a different, decision on his part in the spring of 1916 would have had a most hampering effect upon subsequent operations, of which it was at that time only possible to foresee the most shadowy possibility.

For the purely tactical study, we may pass at once to the period of Lord Allenby's command and the advance in Palestine. This period may itself be divided into two phases: first, that campaign which began with the capture of Beersheba on Aug. 31 1917 and culminated in the entry into Jerusalem on Dec. 11 of the same year; secondly, the dramatic series of operations which, between Sept. 19 and Oct. 26 1918, resulted in the destruction of the IV., VII. and VIII. Turkish Armies.

Allenby's strength in mounted men was significant of the possibilities of the theatre in which he was to operate. In discussing the development of the tactics on the western front no mention has been made of the mounted arm, simply because after the first weeks of the war it had no scope for acting in its peculiar sphere; there was no scope for mobility and the mounted man never really found his opportunity. It was exactly the reverse with the Palestine campaign. So we find that in all these operations the infantry gets from the cavalry or other mounted troops far more of the support which it always requires and from the artillery far less. There are no long preliminary bombardments, for as a rule there are neither guns nor targets, but in the very first operation undertaken, the capture of Beersheba, "a mounted attack by Australian Light Horse, who rode straight at the town from the east, proved completely successful. They galloped over two deep trenches held by the enemy just outside the town, and entered the town about 7 P.M., capturing numerous prisoners."[1] In passing, it is worth noting that the operation against Beersheba was undertaken expressly because "when it was in our hands we should have an open flank against which to operate, and I could make full use of our superiority in mounted troops"; and again, when the city had been taken, with 2,000 prisoners and thirteen guns: "This success laid open the left flank of the main Turkish position for a decisive blow." Surprise and movement had taken the place of costly infantry assaults, simply because local conditions had made them possible.

Exactly the same experience was repeated in the second stage of this campaign, which began in Sept. 1918 and ended when the armistice came into force on Oct. 31. At the commencement of these operations the Egyptian Expeditionary Force was holding a line from the river Jordan on the right to a point where the left rested on the Mediterranean coast, 10 miles north of Jaffa. The total fighting strength of the force was 12,000 mounted men, 57,000 infantry and 540 guns. Opposing them, the Turkish IV. Army watched Lord Allenby's right on the Jordan, in the centre was the VII. Army on a front of some 20 miles, while on the right was the VIII. Army holding a similar length of front. Including reserves, but excluding certain posts on the Hejaz railway which were more than fully occupied defending themselves against the Arabs, the Turkish commander-in-chief had at his disposal some 4,000 mounted men, 26,000 infantry, with 400 guns, by no means a strong force with which to stand on the defensive on a front of over 50 miles against an active and resolute enemy.

Allenby's numerical superiority, it will be noted, was especially in mounted men, and this he decided to turn to full advantage when he resolved to make Nazareth, a good 40 miles to the north, the objective of his next advance; but to set his cavalry free it was first necessary for the infantry and artillery to force an opening through the Turkish front. By using every device to deceive the enemy as to his intentions, Allenby was able to concentrate 35,000 rifles and 383 guns on his left, where they were opposed by no more than 8,000 rifles and 130 guns, while two cavalry divisions and one Australian mounted division were immediately available.[2] The infantry attack was launched at 4:45 A.M. on Sept. 19 after an artillery bombardment lasting no more than fifteen minutes, the exact object of which is not clearly evident. The attack was completely successful, and the cavalry, dashing through the opening afforded to them, seized the communications and closed all lines of retreat to the north. Nazareth was entered on the second day of the operations, and four days later "the last remnant of the Turkish VII. and VIII. Armies had been collected." The IV. Army met the same fate only a few days later, and on Oct. 1 the Arab army and Allenby's Mounted Corps entered Damascus, which lies nearly 100 miles in a straight line to the north-east of Nazareth. Still pressing northward, and completing as they went the unutterable destruction of the Turkish armies, the mounted troops, with a few armoured cars, entered Aleppo, more than 200 miles north of Damascus, on Oct. 26, and when the armistice was signed on the 31st were within striking distance of Alexandretta.

II.—Tactics after the World War

An effort has been made so far to give in outline some idea of the tactical conditions on the western front and in Palestine,

[1] From Lord Allenby's despatch, dated 16.12.1917:—"What would not the British or French cavalry on the western front have given for such an opportunity! But wire, mud, shell holes, and especially German machine guns, effectually prevented any such possibility."

[2] Lord Allenby's despatch, dated 31.10.18.

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the methods resulting from these conditions, and the results achieved. Utterly dissimilar as were these two theatres of war, the underlying principles of victory are found, as always, to be the same. A firm faith in the offensive, concentration at the right time and against a suitable objective, surprise, and coöperation. The welding of all the forces, moral and physical, by the genius of the commander into one homogeneous whole, with one common inspiration, and directed to a common objective, namely victory. So far the two campaigns selected for illustration are in agreement with one another and with all the campaigns of the past; in every other respect the contrast is complete. On the one hand, in France and Flanders we find whole nations in arms, troops numbered by hundreds of thousands, and, as a necessary corollary, continuous lines, heavily fortified and without flanks to be turned, almost (one might say) without any vital line of communications, so complete were the railway and road systems available. As the result—long periods of stagnation, infantry deriving no assistance from the mounted troops (except indeed when acting dismounted), and dependent in the first place upon artillery and latterly upon tanks as well. Movement, when at last it comes, is by slow stages, until when victory is won it is by the crushing of a nation rather than of the armies in the field alone; for this was national war. On the other hand, in Palestine we find armies operating in a neutral arena, small in numbers with open flanks to the east, and each dependent upon a single line of railway; scope and objective not only for trained and disciplined mounted troops, making full use of their mobility, but also for light rapid-moving Arab levies harrying the Turkish communications, and achieving great strategical and tactical results, with but little loss to themselves, entirely by the power of movement. Artillery here plays but a secondary or even lesser rôle, for instead of congestion there is space—space in plenty, and when that element is present light troops come into their own; activity takes the place of force, and victory is over the field armies rather than over the civil population.

Between the two extremes of the western European front and Palestine lay such other campaigns as Mesopotamia and Macedonia; but these, though interesting enough in themselves, add nothing to our present purpose and seem only to emphasize the same theory in less convincing form—namely that each theatre of war, by its own distinctive physical features and climate, influences, if it does not actually dictate, the tactics by which battles and campaigns are won. Otherwise war might become an exact science instead of the most difficult of the arts.

This war of 1914–8, then, by its very size and variety, has solved no tactical problem, has answered none of the questions left by S. Africa in 1899–1902, or Manchuria in 1904–5, but, like all its predecessors, has raised many new ones. Strategy is still the art of bringing the enemy to battle on terms which are disadvantageous to him; tactics are still the methods employed for his destruction. In former wars this most desirable object was accomplished by a judicious combination of artillery, cavalry and infantry. To-day the object is the same, but the means have been complicated to a degree which in 1910 was altogether beyond human imagination. Railways have completed the work of Carnot and the French revolutionary generals, and made national war a complete reality; but through the perfections of the internal-combustion engine war itself has taken on a third dimension. If a great master was formerly required properly to handle and combine the comparatively primitive means at his disposal, how much greater should the artist now be who is to use, and not to waste, the much more complicated tools which science has now placed in his hands. As science advances the art becomes more complex, things tend to become greater than men, and use more difficult than invention. Always change has followed along the same line, but so rapid have been the latest steps that the armies of 1921 were further from those of 1821 than Napoleon's armies were from those of Hannibal; yet the human imagination and capacity remain as they were two thousand years ago.

All through the ages changes in tactics have been brought about by improvements in the means of killing. Latterly science has advanced with giant strides, yet the mechanism of slaughter appears to be only in its infancy. How difficult, therefore, to foresee even with what weapons later wars may be fought, and what may be the next steps in tactical evolution. It is easy, indeed, to let the imagination run riot, and to picture whole populations destroyed by infernal machines easily and efficiently controlled by wireless waves. The pebble is to be thrown in at Berlin, Stockholm, Moscow or anywhere else you will, and the influence carried to the uttermost parts of the earth. Equally easy it is to persuade oneself that there will be no change, and the next war will begin exactly where the last left off. History teaches us, unfortunately, that neither of these views is likely to be exactly fulfilled. Possibly they serve as useful correctives one to the other; but the difficulty is to strike the happy medium. When so many new questions have been raised and so few old ones have been answered, only one definite new principle seems to have been established. It is that, more than ever before, tactical methods must vary in accordance with the theatre of operations, and that methods suitable to one country are unsuitable to another. Indeed even this is hardly new, since it is clear that methods which sufficed to overthrow the Mahdi at Omdurman would have been quite unsuitable against the Boers in S. Africa. A short time ago we were satisfied with two classes—"normal warfare" and "savage warfare"; that is to say, war against highly trained, well-equipped professional armies or against primitive races, of which every able-bodied man was an ill-equipped untrained soldier. Those distinctions no longer suffice. Here there is an initial difficulty, for in trying to imagine the tactics of the future we must first imagine the conditions under which war will be fought. Will they resemble the conditions of France and Flanders, of Macedonia, Mesopotamia or Palestine?

Conditions for Future Wars.—One thing is certain, that the wit of man cannot devise a system which will be equally suitable for all. Principles there are, but nothing more. This is especially a British difficulty, for no army of the world is called upon to fight under such varying conditions as is the British; moreover, the British army of modern history has never fought in its own country. It is only necessary to reflect upon the history of the World War of 1914–8 to realize that, while Germans fought almost entirely on their own frontiers, if not in Germany, Frenchmen in France, Italians in Italy, Turks and Bulgarians in Turkey and Bulgaria, the British army and troops from the British Dominions and India fought all over the world. French troops, it is true, fought in many distant campaigns, but except at Salonika the oversea campaigns were preponderatingly British, and cannot be considered apart from the British Dominions and India. The only other countries at all in like position are America and Japan, with few extra-territorial commitments.

As a further branch of this same problem we must for a moment consider the troubles of organization and equipment which are inseparable from those of tactics. The French army exists for the defence of France, the Italian army for the defence of Italy. Defence, no doubt, includes offensive action, especially in the case of Germany, but how simple these tasks seem compared with that imposed upon Great Britain with all her world-wide interests. It is easy to see with what confidence the general staffs of continental European nations can address themselves to their well-defined problems, and how much more complex are the manifold problems of the British general staff. Others can fortify their frontiers. Not so Great Britain or her Dominions, who must always be prepared to fight oversea in some theatre of war which cannot be foreseen with any degree of confidence or certainty. That is one fundamental and special complication, as the result of which tactics, organization and even equipment must always, from a British point of view, be something of a compromise, ready and able to be adapted to special conditions on the actual outbreak of war.

Let us consider for a moment what is to be the future of trench warfare. Will future wars reproduce the conditions of 1914 which led up to it? Will it be the normal warfare of the future, or was it no more than a passing phenomenon? Is it

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desirable or not to organize, train and equip modern armies with a view to it?

The only possible answer to these questions is that nobody knows. Similar conditions would no doubt produce similar results, but are we likely to find them? What we know beyond the possibility of doubt is that in 1914–8 highly developed industrial countries with dense populations were fighting on or near their own borders. It was these conditions which made possible a war on a front of hundreds of miles; and we may well ask if they can be found again, and, if so, where? Probably the answer would be that only nations possessing the greatest possible resources could support a war of this kind, and that those nations are extremely limited in number, even more limited in 1921 than they were in 1914. Trench warfare in its extreme form is the direct outcome of the industrial revolution of the nineteenth century, and is not possible between such nations, for instance, as Russia and Poland.

But there is more than this. It must also be remembered that trench warfare came in 1914–5 as a surprise, and that all armies dropped into it quite unconsciously. It began with a few strands of ordinary wire laid out in front of simple old-fashioned fire trenches. It was indeed a strange phenomenon. In place of the rapid decision for which everyone had looked, the largest armies the world had ever seen were peering at one another through their screens of metal. That was late in 1914, just at the moment when all the belligerents had practically run out of gun ammunition, when there was no means of dealing with such an unexpected obstacle, and neither side could get at the other. Nothing like this had ever been seen in war. As we now know, it took four years to find the way out of the impasse, but the important point to note is that after the war every nation possessed the antidote. With masses of artillery, instantaneous fuzes and tanks, is trench warfare of this type in any circumstances conceivable? One thing at least seems to be certain, and that is that, having learnt their lesson, the armies of all nations will strain every nerve to render it impossible, and to avoid a repetition of the wearisome experience of 1914–8.

If this means anything at all it is that future wars between civilized nations will be opened with a suddenness and violence far in advance of 1914. In past wars there have always been a few days of grace between the declaration of war and the first serious collisions. In 1914 Germany issued orders for her general mobilization on Aug. 1, France declared war on the 3rd, the Belgian frontier was crossed by Germans on the 4th and by France on the 6th; Liége was entered on the 7th, and the last forts were captured on the 15th; finally the field armies came into collision on the 17th and 18th. Meanwhile on the southern front the French occupied Mülhausen on the 8th with covering troops, but failed to hold it, and it was not until the 14th that their I. and II. Armies and the Alsace group were mobilized and ready to advance into Alsace and Lorraine.

Now, in considering the strategy or the tactics of the opening phases of any future campaign, it was very difficult in 1921 to divest the mind of the picture of 1914, and to remember that there no longer existed in Europe two great military nations with armies magnificently led, fully organized and separated only by an almost imaginary line called a frontier. Something of the sort, it is true, may be found in the borders of France and Italy, but a formidable mountain range only to be traversed by troops at certain well-defined points introduces an important factor which was absent in 1914. Other open frontiers also remained in 1921, notably between Germany and Poland, between Poland and Russia, and still between France and Germany; but, for the time at all events, organized well-equipped armies no longer existed as we knew them in 1914, except in the cases of France and Italy. Nevertheless it is necessary to look forward. Germany, no doubt, had been forbidden by the Peace Treaty to maintain an army of more than 100,000 men, but it was by no means impossible that before many years had passed several of the more backward nations of Europe would become rich and prosperous, with great industries and extensive railway systems, and would be unable to deny themselves the luxury of great standing armies and all the paraphernalia of war. History, at least, is not encouraging in this respect, and it would certainly be most unwise to assume that, because the necessary conditions of a first-class war were no longer visible in Europe in 1921, they would remain so for ever, or even for a very long time; moreover, it cannot be forgotten that the opening years of the twentieth century saw a first-class war far outside the confines of the European continent.

No excuse is, therefore, necessary for the assumption, in 1921, that coming generations would know war even as the present generation has known it, and that its opening phases would not be so very unlike those of 1914, always with such difference as is brought about by the scientific development of engines of destruction. If this assumption is justified—and it is absolutely necessary to make some assumptions—the prospect is that either there will be no declarations of war, or that by various means the period of mobilization will be very much shortened and the great collisions will take place much more rapidly than before. And this with two objects, partly to avoid trench warfare and to reach a rapid decision, partly to ensure that fighting shall take place on enemy territory and not in the homeland. These objects are in their essence strategical, but will naturally find themselves reflected in the tactical sphere. In the first place, with a view to protecting themselves from a sudden inrush, nations may have to spend vast sums upon the fortification of their frontiers, as France did after 1870, and as Germany did for ten years prior to 1914. The influence of these great fortifications and their ultimate fate are not, however, very encouraging, and it is more probable that money may be spent upon the equipment of field armies, and that very special attention may be paid to the success of the first inroad into enemy territory, to seizing the initiative, upsetting the enemy's plans and insuring that at least the opening battles are fought upon his soil.

Tanks and Aeroplanes.—For these purposes great use will presumably be made of aeroplanes, and rapid-moving tanks acting in company with cavalry and horse artillery, and here we are at once upon highly speculative ground — since the tactical value of these new services is still uncertain. There is a fascination in dreaming of possibilities, but experience shows that tactical development has always proceeded by the slow processes of evolution rather than by revolution, and notwithstanding the great successes achieved by tanks towards the end of the World War, it is difficult to believe that they will be able to act alone for any great length of time. In this connexion it must always be remembered that at the end of 1918 tanks had the enormous advantage of still being something of a surprise. They were constantly improving in efficiency and numbers, and through bitter experience correct tactical methods were gradually evolved. More important than all, even up to the end of the war anti-tank defence was ineffective, an advantage which the new arm cannot expect to enjoy even at the beginning of future campaigns. Even with this great advantage in their favour tanks were vulnerable, and at Hooge and even at Cambrai it was seen that boldly handled artillery could, on occasion, inflict great damage. Increased speed and improved mechanism will render tanks less vulnerable, but against them must be set such possible defence as light easily hidden artillery and anti-tank guns. Indeed, there is just a possibility that future years may see a competition, not unlike that at sea, between gunnery in its various branches on the one hand and speed coupled with armour on the other. The tank will endeavour to combine mobility for offensive action with its own protection, while the gunner and rifleman will try to force the tank to carry armour so heavy as to destroy its mobility. Something of this kind was actually seen in the case of the German tanks, which, in the effort to afford security to their crews, had been so solidly constructed as to be almost useless. Another difficulty from which tanks may suffer is inability to carry out their own reconnaissance in moving warfare. Tanks would also appear to be almost as defenceless at night as is artillery; they are indeed entirely an offensive weapon except for the actual protection which their armour affords to the crews. For these reasons tanks would

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appear to be dependent upon other arms, and incapable of entirely independent action at all stages—for reconnaissance, for overcoming anti-tank defence and for security. At the same time there is no doubt whatever about the immense reinforcement of offensive power which they have brought to the other arms. In themselves they combine mobility, fire and protection, each in a certain degree; moreover, they may solve many difficulties with regard to supply of ammunition, especially to cavalry. It has been amply proved that the great enemy to cavalry, and to infantry as well, is the machine-gun, and it is exactly against this weapon that tanks have proved themselves to be most efficient. Once a machine-gun is located in the open, *i.e.* almost anywhere except behind concrete defence, the tank can deal with it quickly and effectively, while guns heavy enough to destroy the tanks themselves should in their turn be dealt with by horse artillery. In this way each of the three arms will derive support and protection from the other, and all will derive information and active assistance from the air.

Aeroplanes will carry out both strategical and tactical reconnaissance, will locate the enemy's forces, and, so long as light lasts (an important reservation), will watch and report his movements. In action they will watch the progress of their own forces, look out for counter-movements, indicate in every possible way the nature of the enemy defences, and intervene in the fight, whenever possible, with bombs and rifle-fire. If any such coöperation is to be possible, the various arms must not only understand one another thoroughly, have been trained together and have established a mutual confidence, but they must have ample and efficient means of intercommunication, which can only be by wireless telegraphy or telephony.

The same principles must apply to the employment of tanks with infantry and field (including heavy) artillery. Of all the difficulties which infantry has to overcome the two most dreaded are wire and machine-guns. In discussing the action of tanks with cavalry, rapid movement over comparatively open country has been assumed, but it is unlikely that this can be more than a preliminary phase of a few days' duration in a campaign where the belligerents are on even terms in matters of equipment. Heavy slow-moving troops will be rushed by rail to the frontier and will come into action within a few miles of railhead. Then will come the great struggle for the initiative, the result of which may well decide the whole war, and ruthless vigour will be demanded from troops and leaders. At this stage there will be great battles in which, as in August 1914, neither side will be completely on the defensive or completely on the offensive; but both, in their determination to reach rapid decision, will think chiefly of attack, and there will be comparatively few highly organized defences, other than those which may have been prepared in peace-time. Hastily prepared defences may be extremely effective against infantry, especially if well concealed. It is then that tanks, moving easily across country, crashing through hedges, crossing hollow roads, climbing embankments and making paths, easily and quickly, through hastily constructed wire entanglements, will be of the utmost assistance to their accompanying infantry. In the stage of the campaign we have tried to imagine there will hardly have been time to construct land mines, the tank's greatest enemy, but the opposing infantry will be provided with heavier anti-tank rifles and more light field guns than are possible with cavalry. Possibly the tanks themselves may be more heavily armoured than those with the cavalry, where rapid movement is the ruling factor, but they cannot be entirely proof. They, like the cavalry tanks, will be dependent upon the air for information and upon artillery for support. Hence smoke screens, concealing the moving target from the defending guns, may be invaluable, as well as the moving barrage and the fire of guns told off to deal with special obstructions, batteries of emplacements which have been reported by aeroplanes or detected from air photographs. But since both sides will possess tanks, presumably approximately equal in numbers and efficiency, and since the tank is essentially an offensive weapon, it is probable that a new feature may be introduced into tactics, namely tank counter-strokes and tank engagements, for on each side these machines will attempt to get at the enemy's infantry and protect its own. But with all their power for offensive action the tank still has grave limitations, for there are still obstacles to movement, such as the muddy banks of a sluggish stream, which they cannot overcome; mud, as the armies knew it in Flanders, is to the tank what uncut wire is to the infantry, and without power to move the tank is highly vulnerable. Valuable as they doubtless are, it is, therefore, easy to fall into the error of overestimating their possibilities, and it is important to bear in mind that they will not always have the moral effect upon infantry that they had when they were terrible and unfamiliar objects on the battle-field. They cannot turn hostile infantry out of even hastily prepared entrenchments; the most they can do is to make it comparatively easy for their own infantry to get in, and even to do so much they are themselves dependent upon the help of supporting artillery, while all arms are almost blind without the help of aeroplanes.

So far it may perhaps be possible to penetrate into the future, and to anticipate that the opening stages of the next great war between highly developed nations possessing contiguous frontiers will not be very unlike those of 1914 except that they will be fought out with more complicated machinery and with even greater vigour. He would, however, have to be very bold who would venture to prophesy whether, with all the new inventions we now possess, or indeed with others of which we as yet know nothing, wars will really be short and decisions quick or whether prolonged passive resistance is still a possibility. Have the aeroplane and the tank, heavy artillery and the instantaneous fuze so strengthened the offence that it will be able to overcome any defence which human ingenuity can devise, and that there will be a return to the Napoleonic era, or will the defence again be able to assert its superiority as it did from the winter of 1914 to the summer of 1918? Is it again possible that aeroplanes, aided conceivably by artillery firing at extreme range, may wage war against the civil population with asphyxiating gases and heavy bombs, and render war so terrible and so destructive to life and property that field armies may cease to have their purpose? The answer would appear to be that one lesson which emerges from the late war is that there is no limit either to human ingenuity or to human endurance, and for that reason, if for no other, it is only prudent to assume that the balance between offence and defence will be as finely adjusted as ever in the past, and results will depend not upon engines but upon the brains and courage of those who use them.

Minor Wars.—If we leave for a time the consideration of what may be termed first-class campaigns and turn to those of the second or third class, it would certainly seem as though science had rendered the advantage of civilized nations over uncivilized greater than ever before in both the strategical and tactical spheres. As has been shown, one great feature of differentiating first- from second-class campaigns is that of space and freedom of movement. Movement means power to concentrate with rapidity and secrecy and so to effect surprise. Now, it so happens that while campaigns of the first class have in the past been confined almost entirely to Europe, those against uncivilized or undeveloped races are conducted under the burning skies of Africa or Asia. Frequently the climate has been a more formidable foe than the enemy, and the tribesmen or local levies have had far greater mobility than highly trained European infantry. Any device, therefore, which can add to mobility is enormously in favour of the civilized man, the product of industrial conditions. The campaign in Palestine gives the best possible example of tactical success directed against a suitable strategical objective. Victory when it came was absolute and complete, but it was over an enemy whose *moral* had been shaken through acting purely, or almost purely, on the defensive through four years of war. Against that enemy the British forces had won a series of tactical successes, but it was not until cavalry had secured full liberty of movement that tactical success was crowned by strategical victory. Against an enemy ill provided with special means of defence and with inferior

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artillery equipment, fast-moving tanks should give to cavalry or mounted infantry an invaluable reinforcement in fire power. It is the weakness of mounted troops that whenever they are called upon to use fire one-fourth of the personnel is out of action, merely taking care of their horses; and this at the critical moment of action. No such disability handicaps the tanks, whose fire power is great in proportion to the personnel employed. They will, therefore, supply exactly the factor in which mounted troops are necessarily weak, while their own peculiar drawback, vulnerability to fire from artillery or specially constructed rifles, will be of little account. Mechanical difficulties, from heat and other causes (for the strain upon the crew in a closely confined space is always great), they will certainly have, but these should not be insuperable and may be disregarded. A mixed force of tanks and mounted troops should therefore have just that combination of mobility and fire power which is necessary to allow civilized troops to make free use of space—that is, to manœuvre freely and confidently—against an uncivilized or ill-equipped enemy before his *moral* has been shaken.

Exactly the same arguments apply to tanks acting with infantry and artillery in a formal attack against an uncivilized enemy in position. The mere fact that such an enemy does not himself possess tanks will add enormously to the moral effect of their appearance, and should go far toward rendering an artillery preparation or bombardment of any kind unnecessary. If this is so, surprise becomes much more simple; and surprise is, as always, the strongest weapon of the attack. It is evident, therefore, that at every stage the older arms will be wonderfully strengthened by new inventions, yet it cannot be claimed that even in second- or third-class warfare science has yet succeeded in producing anything entirely to take the place of the man and the horse; for the man and the horse are, after all, the only pieces of mechanism which are adaptable to varying circumstances, yet perfect in themselves and directed by an individual intelligence. Science then does not as yet supersede the most primitive factors in war, but where one side has the monopoly of its products (or even only of some of them) there should be economy of effort, and consequently of life, which should enable the civilized army to be always on the offensive and to force a favourable decision with great rapidity.

Lessons of 1914–8.—To sum up, then, the experiences of the past war and the effects of the latest discoveries, it would seem that at first the defensive proved to be a far stronger form of warfare than had been anticipated, because, owing to dense populations and good communications, armies could hold continuous lines, with no open flanks. Frontal attacks of the most pronounced kind became unavoidable, and months and even years passed before the attack regained its ascendency. In these conditions there was no scope for the mounted arm, and even the infantry returned to the most primitive form of warfare. Rifle-fire was useless, for it could not kill, and fire which does not kill is wasted. It was then that the infantry had recourse to the bayonet and the bomb, and the long-range fighting of S. Africa ceased to be. Instead, for three whole years infantry tactics were on a lower and less scientific plane than in the Manchurian War, which, in the opinion of many soldiers, was fought out on altogether a lower plane than the S. African War which preceded it. Meanwhile ever-growing demands were made upon the artillery, not only for increased weight of projectile and volume of fire, but for a degree of accuracy which had never before been considered necessary or even possible. So far did the dependence of the infantryman upon artillery support extend that there were some who advocated the abolition of the rifle altogether, since it could no longer kill. Then came two vitally important inventions—first, the instantaneous fuze, which deprived wire of much of its terror, and then tanks, with their combination of mobility and fire. With tanks and artillery, infantry recovered its power of movement, and with movement the rifle recovered its position, for trenches had lost their protective value and once more it could kill in the open. In less civilized warfare we can see that on a narrow space like the Gallipoli peninsula continuous lines were possible, but elsewhere space gave freedom for movement, fire was supreme, and the victor imposed his will by crushing the enemy's field armies. In both forms of warfare it was proved once more that in the end infantry is still the queen of battle, but requires ever more assistance from the other arms and from science.

Now, in this very question of the influence of scientific discovery upon tactics, the World War has taught us much. But need the experience have been quite so bitter? No doubt it is easy to be wise after the event, but we should learn little if we allowed ourselves to be convinced that we were perfectly wise before it. To take only one instance, the enormous expenditure of gun ammunition during the opening weeks of the war had the effect of entirely using up all reserves within a very short time after the opening of hostilities. It is now no secret that by the end of the first battle of Ypres the British artillery was practically without ammunition; guns were rare enough, but even the few there were had nothing to fire. And this was true of all armies. It was not only the weather which stopped the fighting in the middle of Nov.; it was, as well, largely the fact that infantry was almost deprived of artillery support. Moreover, it was just this period of respite which enabled the armies to dig themselves in, and to organize those systems of field fortification which for so long defied assault. Now, this deficiency was due to two causes. In the first place to a short-sighted economy, always in favour of running a risk in order to avoid unpleasant parliamentary criticism—and this tendency exists in all countries; in the second place, it was due to a tendency, which is also universal, to devote too much attention to the past and too little to the future. It is so easy to follow Napoleon's advice, to read and reread the campaigns of the great commanders; it is so easy to store the mind with facts and figures; but it is so difficult to apply the knowledge acquired to the requirements of the future and to breathe life into Dryasdust. This is, perhaps, the most difficult task of the general staffs, which all nations had by 1921 established more or less upon the Moltke model. Every great army has its inventions board, whose duty it is to sift the corn from a vast quantity of useless chaff; but the real trouble is to foresee what the tactical effect of any new discovery may be and how to turn it to advantage upon the field of battle. It is easy to learn by experience, but wonderfully difficult to prophesy. Some instances there have been, notably Wellington's confidence that, with the weapons he had, he could dare to go into battle in new formations giving him unprecedented fire power. By his penetrating insight he gained a very definite advantage over men whose experience in European warfare was infinitely greater than his own, and, by breaking away from the stereotyped lines rendered classic by Frederick the Great and even by Napoleon, British infantry gained a tactical advantage which they retained until Waterloo. It was exactly the same firm and traditional belief in the efficacy of rifle-fire which won the first battle of Ypres, for at least in this respect nothing approaching the training of the British Expeditionary Force had ever been seen in European armies. Similarly, it was Moltke's realization of the power of improved weapons and other developments of science that was the origin of his idea of envelopment, whereby he revolutionized German tactics and crushed the armies of Austria and France. Both commanders took risks which are now difficult to realize, but both were justified, not only by their own victories, but by subsequent history. Wellington and Moltke both had their critics, but there is no one who now doubts the wisdom of linear formations or enveloping tactics.

It is unfortunately impossible to produce a Wellington or a Moltke at will, but the application of the lessons of history to the requirements of the future is at least as important and needs at least as much study as the facts themselves. With each step forward and as science renders more and more services to the great art of war the future becomes more difficult to forecast. In the first place it is evident that, as war becomes more complex, peace manœuvres must become less and less realistic. It is related that Frederick the Great regularly rehearsed the movements with which he intended to beat the Austrians. We are also told that the comment of the victorious Prussian soldiers

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after Königgrätz was that the battle had been "exactly like the last manœuvres." Something of the same kind might conceivably have been said of Mons or Le Cateau, but certainly not of the Marne or of the first battle of Ypres; still less of the Somme, the German offensive of 1918 or of Aug. 8. For many reasons manœuvres can only last for a strictly limited time, whereas modern battles are almost unlimited in length; for the same reasons troops can be employed only in limited, instead of unlimited, numbers; while for other reasons the convenience of the civil population outweighs the demand for military instruction. To such an extent did civil requirements outweigh military that up to the outbreak of war British troops were not allowed to sleep even in barns or outhouses, although billeting is a most necessary, and by no means easy, military exercise, ignorance and inexperience of which subsequently caused the British army much suffering and fatigue. How infinitely more difficult will it now be to produce anything which shall in any way represent the conditions of a modern battle-field, with trenches, wire entanglements, smoke screens, gas attacks, barrages, aeroplanes and tanks! The thing simply cannot be done. Manœuvres will still be a valuable means of training up to a certain stage; but that stage will be far short of the reality, and must be supplemented in the general staffs by imaginative thought.

That is the first difficulty to be overcome. In the second place invention, which has received so great a stimulus since 1914, will not now stand still. The vital importance of the general staff keeping in close touch with the best and most progressive scientific thought of the day, either through the inventions board, or through any other form of "liaison," can, therefore, require no emphasis. If anything is clear as to the course of future wars between civilized countries it is that success at the outset is half way to ultimate victory. If through more rapid mobilization, a better strategical plan, or both, one side can seize the initiative and drive it home by early tactical success it will be in a winning position from the start. It cannot be denied that, owing to the foundations laid by Moltke, the superstructure built by Schlieffen, and the attention which had for years been paid to the possibilities of machine-gun fire, Germany held an advantage in 1914 which was only wrested from her by "the miracle of the Marne" and by the fact that her ammunition supplies failed her just as did those of England and France. Had German leadership, equipment and tactics in 1914 been equal to those of 1918 it is difficult to believe that Paris would not have fallen in spite of the genius of French and British commanders. And so it seems probable that the next war will open with even greater suddenness and greater violence than the last, with more efficient engines of destruction and more rapid movement. The country that would have its tactical development keep pace with science must, therefore, be prepared to spend money upon experiment; its general staff should have its research department; tactical training and scientific research should together form the latest new Model Army. Indeed, just as during the war every army commander had on his staff his meteorological expert and his chemical adviser, so surely the general staff in peace should have its chemical department, for it is not impossible that the chemist may become as important in war as in every great industrial enterprise.

But there is yet a third reason why future wars will certainly produce unpleasant surprises which may even be revolutionary in their nature. By the Treaty of Versailles the German army was reduced to 100,000 men, but it could not alter the fact that Germany's central position in Europe placed her in a situation in which she believed that she must trust to arms for her existence or go under in the struggle. She has also been trained in the belief that offence is the surest defence. Except that Poland had taken the place of Russia on Germany's eastern frontier, and that the Austrian Empire had disappeared, the military problems of Central Europe remained in 1921 much what they were before 1914. Germany was still an ambitious, industrious nation, with 60,000,000 well-educated and intelligent citizens. On the one frontier lies France, and on the other Poland, both with large armies, and neither of them particularly friendly to Germany. In these circumstances it was only reasonable to assume that her policy would be to avoid war, at least for many years to come. At the same time it was clearly evident that her military problems must give rise to very anxious thought. This spectacle of a rich, densely populated country with an army regulated by treaty is, it is true, not entirely new. The same thing happened after Jena, but with the difference that Germany was not then either rich or densely populated. Nevertheless an answer was found to the restrictions imposed by Napoleon. It need not be the same answer this time, precautions against that having been taken, but there is the alternative that Germany's effort may be to compensate for the numerical weakness imposed upon her by scientific equipment and by bringing new forces into play. The World War showed beyond doubt that, given good leaders, a mass of untrained human beings could quickly be converted into an efficient fighting force. Germany's military aim will, therefore, naturally be to train the 100,000 men she keeps in peace-time to become highly efficient leaders in war. Her war budget will be high per man, for the army must be recruited on a voluntary basis; yet the total sum will not be great compared to that of other countries, and money will be available exactly for those purposes of research and experiment which are seen to be so highly important. Many years must elapse before Europe can have recovered sufficiently from the results of the World War to reproduce the conditions of 1914; and perhaps by that time her peoples may have realized the futility of war as a solution for differences of opinion or interest; but in this respect history is far from encouraging, and all the time there will be in the centre of Europe a nation whose soldiers are thinking out war problems on lines which must inevitably be quite different from those followed by their neighbours. Hitherto all the military nations have thought along similar lines. Sometimes one and sometimes another has thrown up a great genius, the product of whose mind had placed his own country at an advantage; but here we have an entirely new set of problems, the solution of which may lead to new and startling results.

In 1921 there were thus three important factors rendering it more than ordinarily difficult to penetrate the obscurity of the future. First, the impossibility of reproducing in peace-time the conditions of the battle-field as we actually know them; secondly, the effect of scientific research upon tactical evolution; thirdly, the peculiar position of Germany and its repercussion upon military thought. Other factors doubtless exist, for the opening stages of every war bring their own peculiar surprises. All that can be done is so to arrange plans that they may not be too rigid, and may if necessary be adapted to meet the unexpected, just as Joffre in 1914, surprised by the extent and weight of the German turning movement through Belgium, switched his own reserves to his extreme left and produced the counter-stroke of the Marne and the Ourcq. This is merely an example culled rather from strategy than tactics, but it serves to illustrate the fact that, in war, the great contest between brain and brain, it is the unforeseen which happens. The real difficulty is to anticipate the problem rather than to solve it. Never in the history of the world have tactical problems received such close attention and study as during the years just prior to 1914. With one great war just finished and the shadow of another hanging heavily over Europe, discussions on strategy and tactics filled the columns of newspapers and magazines not only of the professional but also of the general press. The general staffs of all nations worked out theories and doctrines of war, and the official handbooks gave the armies the considered opinions of the best military brains in each country. The conflicting systems of envelopment and penetration were weighed and considered, with the result that military training could be classified in two clearly defined systems, sometimes called for convenience the French and the German. The real value and capabilities of quick-firing artillery and the necessary infantry formations with which to meet it were thrashed out in theory, and so far as possible by experiment, for, although the French "75" was already an old gun, its effects had never really been tested on the

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battle-field. Meanwhile Germany introduced her heavy field howitzer and England her long-range field gun. The probable effect of these new factors in war were weighed, discussed and fairly accurately foreseen. But surprise came elsewhere, for the factor which was neglected was the power of the railways to maintain in the field such armies as the world had never beheld, with what we can now see was only the natural corollary—field fortifications impregnable to the material which armies then possessed, and by their strength and extent rendering impossible both envelopment and penetration. The truth is that it is less difficult to find the correct answer to the questions which are asked by history, experience and such foresight as we possess, than to foretell and ask the really vital questions.

III.—The Art of Leadership

So far we have dealt almost entirely with the mechanism of war, the tactics of 1914–8, and possible future developments. There remains the all-important subject of command, and the qualities which go to make a great commander—the human element—for without true leadership arms and equipment and even training will achieve but little. "With a great general no action is executed which is the fruit of chance or fortune; everything is the result of combination and talent" (Napoleon's War Maxims, No. 82). Such was the considered opinion of the great master of war, and it can be confidently asserted that nothing has happened since he fought his last, and perhaps his most wonderful, campaign in 1815 to shake it. Surely no commander ever took greater risks than did Napoleon in the series of operations which ended at Waterloo, but they were the result of careful study and calculation and they came near to victory over almost double his numbers. Even now who can say what might have happened but for failure of his physical power and energy at the most critical moments, for surely England and Europe were never in greater danger than during the forty-eight hours after the Prussians had been beaten on the field of Ligny. How curious to reflect that a little more than a hundred years later the descendants of those who stood at Waterloo should have fought out another campaign on a vastly greater scale but on very similar lines and on ground not very far distant. The combatants were differently grouped, it is true, but the German blow in March 1918 was directed at the junction of the Allied armies, this time the British and the French, just as in 1815 the French blow was struck at the junction between Wellington and Blücher. Once again the British army was based on northern ports, while her ally was based on inland territory; once more the allies were for a time in danger of retiring along divergent lines and perhaps of defeat in detail. Numbers and weapons were different from those of 1815, but the main features of the campaign and the principles upon which it was fought out were the same. So true it is that the principles of war are simple and eternal, but the application of them varies in each particular case. Never yet has there been a great commander who has not read and thought deeply about his art in order that, by training his instinct on the right lines, he may decide correctly when the supreme hour arrives. It is not in order that we may master the principles of war that Napoleon has advised us to "read and reread the campaigns of Alexander, Hannibal, Gustavus, Turenne, Eugène and Frederick," but in order that we may "obtain the secrets of the art of war," and those secrets lie in application.

How strange, too, that of the great names which will go down to history in connexion with the campaign of 1918 two at least are those of men who had seen little or nothing of war before 1914—Foch and Ludendorff. For more than forty years Foch had no experience of anything but peace soldiering; Ludendorff heard an enemy's rifles and saw his own men drop for the first time in his life near Visé on Aug. 4 1914. Both had mastered every detail of their art, not in the open field but in the solitude of the study. Each in his own way was an artist, but of the two it was Foch who had the inspiration, "the fire in his belly," which is the sign of the true master. Yet it is not enough to follow the movements even of these two, for all wars will not be fought either with the numbers or the weapons of 1918 any more than with the weapons and over the extent of ground of 1815. Something between the two may be found to be nearer to the normal, but when due allowance is made for later invention, surely no campaign is better worth studying than this of 1815. Fought out between two great captains in the space of a few days and over a few miles of country, it forms a very epitome of war in all its branches. The doubt up to the last moment as to Napoleon's intentions; the strategical surprise; a concentrated force with one line of communication operating between two forces with divergent lines; the handling of D'Erlon's force and the attempt to effect a concentration on the battle-field at Ligny; the British and Belgian rearguard action at Quatre Bras and the retreat to Waterloo; Wellington's masterly disposition of troops as contrasted with Blücher's two days earlier; his telling use of advance posts, Hougoumont and La Haye Sainte, breaking up Napoleon's massed attacks; the concentration of forces on the field and the great counter-stroke against Napoleon's right and rear, so largely the result of Blücher's loyalty and force of character; finally the stupendous defeat, the inevitable result of this most difficult manœuvre when successfully accomplished, as it was here, at Königgrätz and on one or two other occasions in history; and the relentless pursuit. They were indeed crowded days of glory. And then Wellington's characteristic comment: "A damned serious business. Blücher and I have lost 30,000 men. It has been a damned nice thing, the nearest run thing you ever saw in your life. . . . By God! I don't think it would have done if I had not been there."[1]

Since those days Moltke has perfected the art of marching to the battle-field, of concentration by many different roads upon a single objective, and we have seen the same manœuvre developed under more difficult circumstances at Liao-yang. Arising from Moltke's tactics, so closely followed by Oyama in Manchuria, there have been many fierce disputes upon the comparative virtues of envelopment and penetration on the battle-field. Yet all these theories, these varying systems and bitter discussions, are based upon one solid foundation, the development of fire; for from the days of the long-bow to those of the modern tank it is to the development of fire that all changes in tactics are directly due. To-day, more than ever before, the power of developing fire is in the hands of the commander who seizes and retains the initiative. This he may do either through superior readiness for war and quicker mobilization, through a better strategical plan, or through superior numbers. In any case he will require superiority in the air, and better, more numerous or more skilfully handled covering troops, cavalry and rapid tanks. Decisive battle will be the object, and the experience of the World War would appear to prove that quick decision can only be obtained through envelopment. Converging lines of communication drawn from widely separated bases may then be a positive advantage, especially since the rapid means of communication now available have overcome much of their danger. Moreover, so devastating is the effect of converging or enfilade fire from modern weapons that the troops exposed to it are in deadly danger. An attacking force, it is true, may conceal an exposed flank by the skilful use of smoke, but not so the defending force, and the increased range and rapidity of modern arms are on the side of the attack rather than of the defence. Each commander will, therefore, strive with all his energy and will power to secure the initiative at the outset of a campaign; every artifice will be used and every engine will be employed. Sooner or later, however, one or other of the combatants will be forced to the defensive, but, if he is master of his art he will not resign himself to his fate any more than did Wellington and Blücher in 1815 or Joffre in 1914. He will devote all his skill and resource to recovering his freedom of action and to assuming that domination over events which will enable him, in his turn, to impose his will upon his adversary.

This change of fortune can only be brought about by a tactical counter-stroke, exactly as was done by the Entente armies in

[1] *The Creevy Papers*, vol. i., chap. x.

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1914 and again in 1918. On each occasion they aimed at the envelopment of the enemy forces, for the very successes which had brought the Germans so close to Paris afforded to a commander, sufficiently skilful to seize it, the opportunity to deliver an enveloping counter-attack—the very opening he needed. Thus it is clear that even to-day, provided the opposing armies are well led, neither can have the monopoly of enveloping movement or fire development, but that, as has always been the case in war, "everything must be the result of combination and talent." So it is that so soon as a great commander finds that, for one reason or another, the initiative has passed from him he will think only of the counter-offensive whereby he is to regain it. He cannot wait, like Wellington at Salamanca, or Napoleon at Austerlitz, and watch his enemy commit a fatal error, for modern battle-fields are too vast, and mistakes are committed too far from the field of action. His aeroplanes will no doubt bring him much useful information, but before he can turn it to advantage the whole situation may have altered.[1] He cannot, therefore, so plan his battle as to make the action of his reserve, or striking force, dependent upon some chance or fleeting opportunity. Instead he must form some new plan, some new combination of his own, and carry it through with undiminished audacity and resolution. It is, perhaps, this blindness of the commander which has brought about the greatest change of all in modern grand tactics, for he cannot now survey the whole even of his own force, and much more than formerly he is dependent upon his subordinates, who must, in Napoleon's phrase, "understand his system" if he is to be well served.

But there is another aspect of the matter. With weapons of still longer range and greater accuracy than our modern artillery, with small-bore weapons of still greater rapidity of fire than the Maxim or the Lewis gun, fronts will become more and more extended, and the establishment of continuous lines will be possible even to comparatively small armies. It will be easier to use natural obstacles for the protection of flanks, which will become more difficult to find and to turn. In this respect the defence would appear to have gained a distinct advantage over the attack, in that frontal assaults are likely to become more inevitable. The indirect result of the increased volume of fire seems, therefore, to be more important than the direct effect. Against this it is possible to put forward the suggestion that frontal attacks are actually less to be feared than they were. Formerly they had two disadvantages—first, that they were desperately costly in life; secondly, that at the best they resulted merely in the tactical retirement of the enemy, not to his destruction or to any great and decisive strategical result. Now, however, owing to the same increase of fire power which has strengthened the defence, it is possible for the assailant to make all his dispositions for attack out of sight of and unperceived by any enemy who elects to stand purely on the defensive. Little more than a hundred years ago Napoleon drew up his army in front of La Belle Alliance in full view of Wellington on the slopes of Waterloo; a few years earlier Marmont had manœuvred in front of Wellington at Salamanca and met his doom exactly as had Kutusov, for exactly the same reason, at Austerlitz. All this is now changed, and in 1918 Ludendorff showed how, even without command of or even superiority in the air, it is possible for the assailant to make his arrangements for attack without being detected; and this instance is the more remarkable since his intention had been foreseen and his troop movements were at least suspected. It is this power of massing unseen against the portion of the front selected for attack that gives the assailant his principal chance of success, even should the attack not come as a complete surprise. Moreover, the very extension of the front which, by our hypothesis, has rendered the frontal attack inevitable, makes it extremely difficult for the defender to ensure that his reserves are best placed for resistance. Even with superiority in the air and good intelligence, a commander who has lost the initiative and has been forced to stand on the defensive cannot be absolutely certain when the blow will fall. With his widely extended lines, it is more than probable that he has several delicate points to guard, failure at any one of which would give the enemy some considerable strategical advantage. Hence the disposal of the reserves intended to be used for defence becomes a matter of extreme difficulty, and unless the assailant's intention is exactly anticipated, as is not very probable, much priceless time must be lost in moving them to the point of danger, and meanwhile the assailant may have secured an initial advantage of which it will be extremely difficult to deprive him.

This brings us to the second weakness of frontal attacks—the difficulty of winning any real strategical result. That weakness was very real so long as the only result of defeat was to compel an army, as in the Russo-Japanese War, to retire along its line of communications to a fresh position somewhat nearer to its base. But with modern lines, extended even more widely than in Manchuria, a new tactical idea has been evolved. Partly owing to our enlarged ideas on the massing and use of artillery, partly owing to the improved engines of destruction which brought a great accession of strength to the attack, and partly owing to the tactical use of aeroplanes, there grew up that idea of a "break-through" which was completely realized in the World War only in Palestine, but which came near to accomplishment in France in March 1918. But perhaps the factor which contributes most to the chance of a successful "break-through" is that very difficulty in the disposal and handling of reserves to which reference has just been made. In this connexion it must be remembered that tanks have given the attacking force an altogether new power of pushing home an initial success with rapidity and vigour. In place of the slow-moving infantry which laboured painfully through the shell-torn swamps of the Somme or the Passchendaele ridges, we may well see a strong force of tanks, able to move at a steady pace for several hours on end, turning defeat into rout, disorganizing communications and spreading panic before reserves can be brought from distant parts of a widely extended battle-line. Hence it would seem that just those developments which give to the defender the power to defend his flanks and to guard against envelopment have at the same time given to the frontal attack a greater chance of success than it ever had.

In this case it may be asked, How should the commander who has lost the initiative and been compelled to stand on the defensive attempt to recover control of his campaign? The answer is, by exactly the same methods as those by which Foch recovered it in July 1918—that is to say, by counter-attack. There is no other means. And this is true whether the attack be enveloping, or frontal, and it is if possible more essentially true than ever before, since, owing to the distance to be covered, reserves which are held for purely defensive action are in great danger of being too late. Not only can they not win a battle; they may well be too late to save it. Thus even the briefest consideration of defence brings us to the old conclusion *that attack must be met by counter-attack, that offence is still the soul of defence, and that the true rôle of the reserves in a defensive action is to convert it into an offensive one.* These are but the oldest principles of battle, fighting, true from the days of Alexander the Great until to-day, but always put into practice by new means and new methods. This is the essence of Marshal Foch's own appreciation of Napoleon (London *Times*, May 5 1921):—

> "Often during the darkest days of the war we used to ask ourselves what Napoleon would do with the armies of to-day. . . . This is what he would have said: 'You have millions of men; I never had them. You have railways, telegraphs, wireless, aircraft, long-range artillery, poison gases; I had none of them. Yet you make nothing of them. Stand aside while I show you how to use them.' In a month, or perhaps two, he would have changed everything, reorganized everything, employed everything in some new way, and crushed the bewildered enemy."

There in a few words we have the marshal's views on his great predecessor. It is not that he would have discovered some spectacular and dramatic way of winning the war, but merely that he would have bent scientific discovery to his own ends and put each new invention to its proper tactical use. Thus he would have won battles, and when he had finished his

[1] Moreover, so many movements will be carried out at night that even the aeroplanes will miss a great deal.

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work all would have appeared obvious and simple. That is the way of the artist; and the great tactician is a supreme artist.

(N. M.*)

TAFT, LORADO (1860–), American sculptor (*see* 26.354), was elected to the National Academy in 1911. He was director of the American Federation of Arts from 1914 to 1917 and in the latter year was appointed a member of the board of art advisers for the state of Illinois. He received a silver medal at the Panama-Pacific Exposition, San Francisco, 1915. His recent works include: "Black Hawk" (1912, figure of an American Indian, at Oregon, Ill.); Thatcher Memorial Fountain (1918, at Denver, Colo.); and "The Fountain of Time" (1920, at Chicago). In 1921 he published *Recent Tendencies in Sculpture.*

TAFT, WILLIAM HOWARD (1857–), 27th President of the United States (*see* 26.354), antagonized a considerable branch of his own party in 1911 by his endeavour, which proved unsuccessful, to secure a reciprocity agreement with Canada. Meanwhile wide public interest had been awakened in the conservation of national resources and the President's attitude was attacked by the conservationists. In 1909 Gifford Pinchot, chief forester, charged Richard A. Ballinger, Secretary of the Interior, with being opposed to conservation. A Congressional committee, after investigation, exonerated the Secretary, but he later resigned. The attack upon Ballinger was denounced by the President, who continued to be criticized in connexion with the sale of public lands, and who dismissed Pinchot from office. The President lost ground also as a result of a breach of friendship between himself and Theodore Roosevelt, who supported Pinchot. In 1912 the President signed the Panama Tolls bill, exempting American coastwise shipping from tolls; he affirmed that it did not violate the Hay-Pauncefote Treaty, and believed also that the United States had the right to fortify the canal. At the same time he expressed a readiness to arbitrate the question with Great Britain, who had protested. Cleavage within his party was crystallized at the Republican National Convention in 1912. In the pre-convention campaign Roosevelt came forward as leader of the progressive wing against Taft as leader of the conservative or "stand-pat" wing, and the mutual recriminations were bitter. At the convention, however, the conservatives controlled the party machine, and the committee on credentials by arbitrary decisions excluded most of Roosevelt's contesting delegates. Taft was renominated on the first ballot, receiving 561 votes, 21 more than the required majority. Roosevelt denounced the action of the convention and later was nominated by the newly-formed National Progressive party. In the ensuing election Woodrow Wilson, the Democratic nominee, won an overwhelming victory, securing 435 electoral votes to 88 for Roosevelt and 8 for Taft. President Taft carried only two states, Utah and Vermont, and those only by small pluralities. The general feeling throughout the country was that President Taft had shown a deplorable lack of administrative firmness, his good nature having caused him to vacillate. On retiring from the presidency in 1913 he became Kent professor of law at Yale, but devoted much time to lecture engagements. In 1913 he was elected president of the American Bar Association, and in 1914 first president of the American Institute of Jurisprudence, organized to improve law and its administration. After the outbreak of the World War in 1914 he supported President Wilson's strong stand for neutrality. In 1915 he approved the Army League's campaign for preparedness. He was an active promoter of the League to Enforce Peace, but after America's entrance into the war he argued that victory was necessary for attaining lasting peace. In 1918 he was appointed by the President a member of the National War Labor Board for arbitrating labour disputes during the war. In 1919 he endorsed the Peace Treaty of Versailles, regarding its most important part to be the Covenant of the League of Nations. He spoke throughout the country in behalf of the League. After the Senate's rejection of the Peace Treaty he urged reservations if these would secure ratification. In July 1920 he was appointed to represent the Grand Trunk railway on the board of arbitration for determining the sum to be paid by the Dominion of Canada when the road was to be made a part of the national system. He supported Warren G. Harding, the Republican candidate for president in 1920. On June 30 1921 he was appointed by President Harding Chief Justice of the Supreme Court to succeed Edward Douglas White, deceased.

He was the author of *Popular Government; its Essence, its Performance, and its Perils* (1913); *The Anti-Trust Act and the Supreme Court* (1914); *The United States and Peace* (1914); *Ethics in Service* (1915, Yale lectures); *Our Chief Magistrate and his Powers* (1916, Columbia lectures) and *The Presidency: its Duties, its Powers, its Opportunities and its Limitations* (1916, lectures at the university of Virginia).

TAGORE, RABINDRANATH (1861–), Indian poet and author, was a member of a well-known Bengali family noted for its activities in literature, art and religious reform as well as for its public benefactions. In 1921 the head of the orthodox Hindu branch was Maharaja Bahadur Sir Prodyot Coomar Tagore (b. 1873), a great-nephew of Prosunno Coomar, who was the first Indian to be nominated to the Viceroy's Legislative Council and founded the Tagore law professorship in the university of Calcutta. The grandfather of Rabindranath was Dwarkanath, "merchant, philanthropist and reformer," who was known to his contemporaries as "Prince Tagore." He visited England in 1842 and again in 1845, sat to D'Orsay for his portrait, and, dying of fever in London in 1846, was buried at Kensal Green. In conjunction with Raja Rammohan Roy he initiated the movement of religious reform which took shape as the Adi Brahmo Somaj. This work was continued by his son, Maharshi Devendranath, of whose seven sons, Dwijendranath, the eldest, devoted himself to the study of philosophy; Satyendranath, the second, was the first Indian to enter the covenanted civil service and served for 35 years in the Bombay Presidency; and Jyotirendranath, the third, was an accomplished musician. Their cousins, Abanindranath (b. 1871), Gogonendranath and Narendranath, became distinguished artists. Rabindranath, the youngest son, was sent to England to study law, but soon returned. In 1901 he established the famous Shantiniketan, or abode of peace, at Bolpur, a village 93 m. from Calcutta. Originally organized as an *asram*, or retreat, by the Maharshi, it was developed by Rabindranath into a school conducted on unconventional lines, and he aimed at enlarging it into an international university which should comprehend the whole range of eastern culture. His outlook upon the west was thus summarized by him in a letter published in the Indian press at the close of 1919: "The bulk of English people can never be in a normal state of mind with regard to us, our situation being unnatural, and I am impelled to think that it is best for us to do our own work quietly in our own surroundings." Gandhi's policy of non-coöperation was, however, severely condemned by him as perverted nationalism, "which was making of India a prison," in a letter addressed to the principal of his school at Bolpur in June 1921. He paid frequent visits to Europe, Japan and the United States (where his son Rathindranath became a student in the university of California), and carried through several lecturing tours. His reputation as a writer among his own countrymen was early assured, and the 30 poetical and 28 prose works composed by him in Bengali are now regarded as classics. The English public first became interested in his works in 1912, and his fame rapidly spread. In 1913 he was awarded the Nobel Prize for literature and utilized the whole amount, £8,000, for the upkeep of the school at Bolpur. He was given the degree of Doctor of Letters in the university of Calcutta and accepted a knighthood in 1915, but addressed a letter to the Viceroy in 1919, resigning the title as a protest against the methods adopted for the repression of disturbances in the Punjab.

His more important books, of which English translations have been published, are the poems *Gitanjali* (Song Offerings) (1913), *The Crescent Moon* (1913), *The Gardener* (1913), *Songs of Kabir* (1915), *Fruit Gathering* (1916), *Stray Birds* (1917), *The Lover's Gift and the Crossing* (1918); the plays *Chitra* (1914), *The King of the Dark Chamber* (1914), *The Post Office* (1914), *The Cycle of Spring* (1917), *Sacrifice* (1917), and other plays; the novels, *The Home and the World* (1919), *The Wreck* (1921); as well as a volume of letters, *Glimpses of Bengal* (1921), and the short stories *Hungry Stones*

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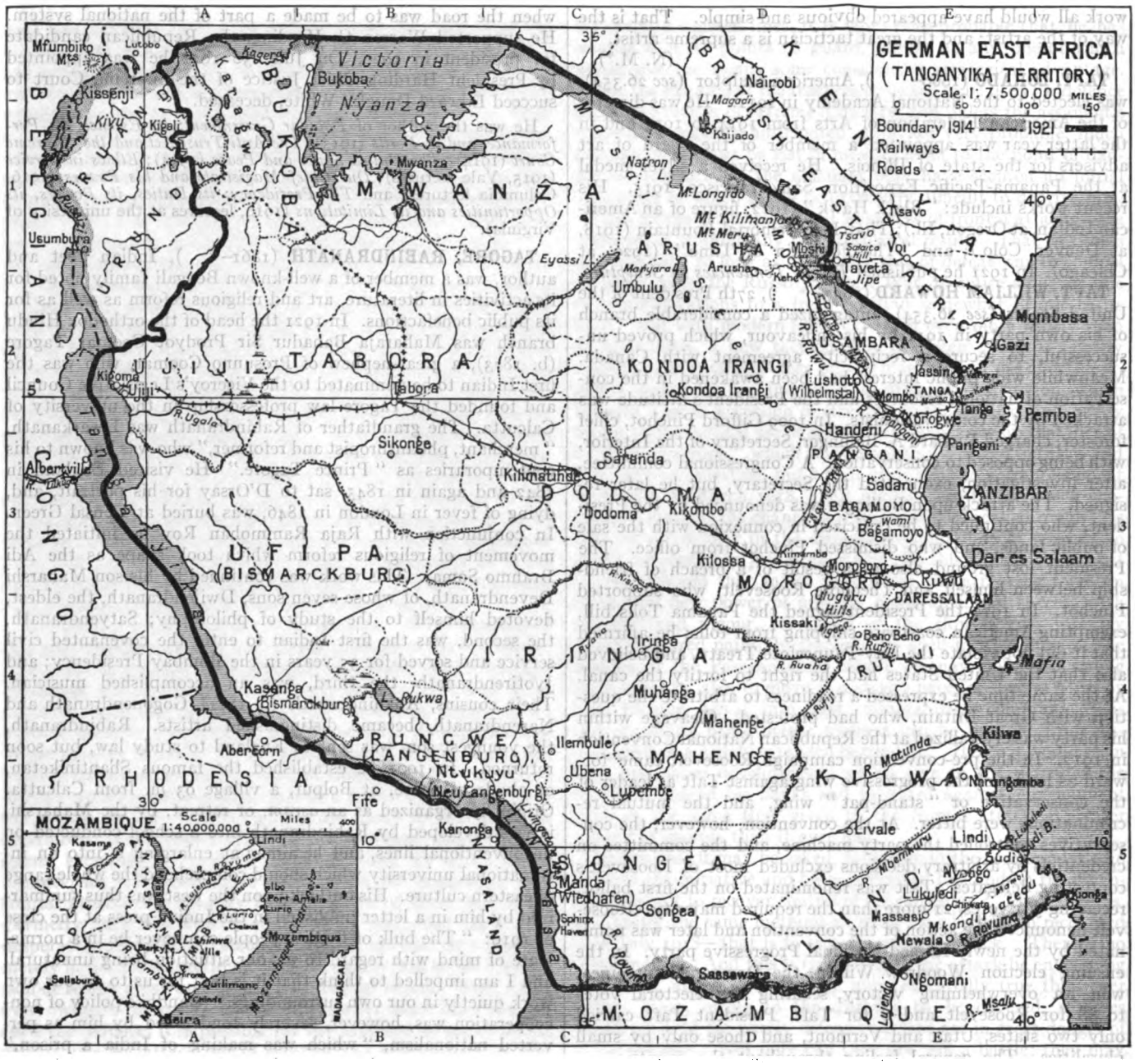

(1916) and *Mashi* (1918); and republished lectures, *Sadhana, or the Realization of Life* (1913), *Nationalism* (1917), *Personality* (1917). He also published his *Reminiscences* (1917).

See W. W. Pearson, *Shantiniketan* (1917); article in *Hindusthanee Student* (March 14 1921). (H. E. A. C.)

TANGANYIKA TERRITORY, the name officially given in Jan. 1920 to that part of ex-German East Africa administered by Great Britain. It has an area of some 365,000 sq. m., compared with the 385,000 sq. m. of the former German protectorate, the rest of the region having been added to Belgian Congo except the small Kionga district at the mouth of the Rovuma, which was incorporated in Portuguese East Africa. Urundi and Ruanda, the provinces acquired by Belgium, were the most populous parts of German East Africa, and whereas the population of the German protectorate in 1916 was estimated at some 8,000,000 that of Tanganyika Territory in 1921 was under 5,000,000. Europeans in 1920 numbered about 2,200, of whom 1,400 were British and 300 Greek. The largest towns were Dar es Salaam (20,000 inhabitants) and Tanga (16,400) on the coast, and Tabora (25,000) inland.

With the conquest of the country in 1916–7 civil administrators were appointed by the British and Belgians in the areas they occupied, Mr. (afterwards Sir) H. A. Byatt being chosen by the British. His headquarters were at Dar es Salaam. Iringa, Mahenge and other regions were, until March 1918, administered by Gen. Northey's chief political officer, Mr. (afterwards Sir) H. L. Duff. At first the Belgians, with Col. Malfeyt as Royal Commissioner, administered, from Tabora, the western area from Victoria Nyanza to near the southern end of Tanganyika. In March 1918 the Tabora region was taken over by the British. By decision of the Supreme Council in May 1919 the mandate for German East Africa was assigned, without qualification, to Great Britain, but Belgium advanced claims to retain not only Urundi and Ruanda but a much larger area, including the province of Ujiji, with the lake terminus of the railway from Dar es Salaam. The matter was settled by an Anglo-Belgian agreement signed in Sept. 1919. By this agreement Ujiji province went to Great Britain, and also such parts of Urundi and Ruanda as were needed to allow the projected railway from Tabora to Western Uganda—a link in the Cape to Cairo scheme—to remain in British administered territory. By another convention signed in March 1921 Belgium obtained the right of transit of goods free of all custom duties over the railway from Kigoma (the lake terminus of the line) to Dar es Salaam, and in general by any other route adapted for transit,

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together with areas (on payment of nominal rent) at both ports for wharfs, bonded warehouses, etc. The districts which Belgium had temporarily administered but which fell within the British mandatory area were formally transferred to the British administration on March 22 1921.

Orders in Council for the government of Tanganyika Territory were made in July 1920. The next month the administrator, Sir Horace Byatt, was gazetted governor and Sir William M. Carter appointed Chief Justice. The terms of the mandate, as proposed by Britain, were made public in March 1921.

In accordance with the terms of the Covenant of the League of Nations the mandatory was bound to allow equality to nationals of all members of the League in matters of residence, trade and commerce. This condition had an important bearing on the position of British Indians in the territory. It prevented any discrimination being made against them, as had been done in the neighbouring colony of Kenya. A proposal had been made during the World War that the territory should become, in effect, a reserve for India. This proposal could not be adopted, but in Aug. 1919 the Colonial Office consulted the Indian Government as to the desirability of setting aside special areas for colonization by Indians. Investigations were made in the territory by Sir Benjamin Robertson, with the result that the Government of India in a despatch dated Feb. 10 1921 stated that it was improbable that Indian farmers would be attracted to Tanganyika, where only large estates seemed likely to succeed.

The Indian Government moreover drew attention to the rights Indians possessed under the mandate and urged that Indians should also be granted perfect political equality with other settlers, of whatever nationality. Indians in Tanganyika numbered in 1921 some 15,000. They had penetrated to every part of the territory, and save for the competition of Greeks in certain areas practically monopolized the retail trade.

The transition period—1918–21—proved difficult, and there was much delay in setting up the new machinery of government. This was in part inevitable, as until the Treaty of Versailles came into force, an event delayed until Jan. 20 1920, the country was still legally German territory. The whole of the German settlers were repatriated and their estates sold during 1921. Until this process was completed no new land grants were made, and agriculture was practically at a standstill. A Land and Mines Department was, however, formed towards the close of 1920, and mining regulations were promulgated early in 1921. The only mineral worked on a considerable scale was mica, the chief deposits being in the Uluguru mountains. Between 1917 and 1920 mica valued at £40,000 was exported for the British Ministry of Munitions. In March 1920 the mines were closed. The alleged indifference of the administration to the needs of the commercial and planting community evoked strong protests, and further difficulties were caused by the change from the German currency in rupees at 15 to the £ to the florin at 10 to the £, preliminary to the substitution of the shilling for the rupee, as in Kenya (*see* KENYA COLONY). The exports and imports for 1917–20, taking the rupee at 15 to the £, were:—

	Imports	Domestic Exports	Re-exports
1917–8	£1,109,000	£591,000	£36,200
1918–9	£1,007,000	£674,000	£26,200
1919–20	£1,158,000	£1,330,000	£96,300

These figures did not include sisal and cotton to the value of £284,000 exported by the custodian of enemy property nor the mica exported for the Ministry of Munitions. The principal exports were sisal, cotton, hides, skins, copra, coffee and ghee. Up to 1920 the exports were mainly accumulated stocks. The chief imports were cotton piece goods, rice and other foodstuffs. The re-exports represented transit trade with the Belgian Congo. Trade was mainly with Zanzibar, Kenya and India. For the year ending March 31 1920 the net tonnage of the ships cleared was 193,000 (154,000 British).

Sir Horace Byatt and his staff had a difficult task in building up a new administration on the ruins of the German system. In native affairs they sought to reëstablish the old tribal organization, almost destroyed under German rule, and steps were taken to abolish slavery. During 1918 and 1919 the Government had to feed large numbers of the people, who, as a result of continued drought, suffered severely from famine. The Indian penal codes were introduced, but it was not until 1921 that civil courts having jurisdiction over non-natives were established. The absence of such courts was not an unmixed evil in this period of transition, though traders, who could not sue for debts, were loud in complaints. But the tendency to wild speculation and to charge high rates of interest was checked. Customs laws—with a general *ad valorem* duty of 10% on imports—similar to those in force in Kenya were introduced before the World War ended, and, in 1921, British weights and measures. Revenue was derived chiefly from the customs dues, trade taxes and licences, and hut and poll taxes, each able-bodied male native paying not fewer than three florins a year. While revenue naturally rose as the area under civil administration increased, so likewise did expenditure. Up to March 31 1920 the total revenue received was £1,596,000, and the total expenditure £1,365,000. It then became necessary to spend much larger sums to put the country into working order, and for the year ending March 31 1921 the Imperial exchequer made a grant of £330,000. For the next financial year the Imperial exchequer made a grant of £914,000—the Colonial Office had asked for £1,500,000. Heavy expense was incurred in making good the damage done during the World War to railways, roads and harbours. The garrison maintained three battalions of the King's African Rifles; cost about £250,000 yearly.

Under British administration the German names given to certain districts and towns were replaced by native names. The following changes were made: Wilhelmstal district became Usambara district and Wilhelmstal (town) Lushoto. Bismarckburg district became Ufipa and Bismarckburg (town) Kasanga. Langenburg district became Rungwe and Neu Langenburg (town) Ntukuyu. Wiedhafen, on Lake Nyasa, became Manda. In 1917 Oldoinyo Lengai (God's mountain) at the S. end of Lake Natron was in frequent eruption; it is the only known active volcano in the territory. In May and June 1919 very severe earthquakes occurred in the S.W. part of the territory. By the fall of the side of a mountain near the N.E. end of Lake Nyasa some 5,000,000 tons of earth and rocks were displaced: the falls in the Livingstone mountains altered considerably the face of the country.

See *Report on Tanganyika Territory* (1921), a valuable official monograph covering the period to the end of 1920; the *Colonial Office List* for parliamentary papers; A. S. and G. G. Brown, *The South and East African Year Book and Guide* (London, annually); Hans Meyer, *Ostafrika* (1914); F. S. Joelson, *The Tanganyika Territory* (1921), and the authorities cited under GERMAN EAST AFRICA.

(F. R. C.)

TANKS.—The name "Tank," applied during the World War to a bullet-proof, armed, track-driven, climbing, automobile, machine-gun destroyer, was first given to an engine of war in Dec. 1915, as a blind to conceal the true nature of the experimental fighting machine then being secretly constructed in England. After the first appearance of the machine in the field in Sept. 1916, the word was universally adopted. It is here used to describe all armed and armoured automobiles of a fighting type propelled on the caterpillar system. To the British is due the credit of first conceiving and introducing this weapon, which was destined to exert a decisive influence on the course of the war on land.

The conditions responsible for the birth of the tank were not in principle new. They were the same as have always existed in war, but intensified by the application of modern methods to the situation unexpectedly created by the course of the land campaign on the western front. Neither the strategic development nor the outcome of its full tactical exploitation had been foreseen. It was owing to this that so vital a factor as the tank proved to be should have had to be improvised during the course of hostilities as the solution of an age-old problem. The problem was that of giving effective assistance, in the shape of direct protection, to infantry advancing under fire.

Apart from coöperation elsewhere, assistance can be given in two ways. It can be effected either by artillery, which with its power of long range action can support advancing infantrymen whilst in motion, and therefore unable to make full use of their rifles, by shooting over their heads, or more directly by the provision of some form of physical protection against blows or missiles. The attempt to provide protection whilst retaining the power of movement both for hand-to-hand fighting and also against missiles, as opposed to that afforded by fortification to troops when stationary, has recurred throughout the history of warfare. The best known examples of it are the shield and body armour carried or worn by the man. Though the need for these did not then cease, their practicability was terminated by the introduction of firearms, since no weight of material that the human being or the horse could carry was of avail against missiles propelled by the force of powder. There was

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also the idea of giving wheel-borne collective protection to several men at a time, and devices for doing this have been numerous, and have varied according to the progress of mechanical knowledge and the resources available at the moment.

The Assyrians made use of war chariots, or mobile fortresses, which were adopted from them by the Egyptians and Israelites.[1] Chariots were also employed by the Chinese in 1200 B.C. Then, for siege warfare, there were the Roman *Testudo*, or "Tortoise," and the mediæval *Beaufroi*, or "Belfry," which was usually assisted by the "Cat" or "Sow," an engine of a more mobile type. About 1400 A.D. Conrad Kyeser wrote on this subject, and some 20 years later Fontana and Archinger designed cars, the latter a large machine to carry 100 men. In the middle of the 15th century appeared the "Scottish War Carts," known also as "Tudor War Carts." In 1472 one Valturio designed a machine to be propelled by wind sails. In 1482 Leonardo da Vinci wrote to Ludivico Sforza describing a machine which, except in motive power, was in essentials the counterpart of the tank. A battle car was designed for the Emperor Maximilian I., and in 1558 Holzschuher described one for use with infantry and cavalry. Eleven years later two land battleships are stated to have been built by Simon Stevin for the Prince of Orange. Except those propelled by the wind, all the above were moved by the muscular power of men or horses. In 1634 David Ramsey took out an English patent for a self-moving car, and Caspar Schott designed one for use against the Turks. In 1769 Cugnot, a Frenchman, actually constructed a steam-driven road car which could be used in war; and later Napoleon wrote a paper on the subject of the automobile in war. In 1855 James Cowan, in England took out provisional protection for a "locomotive battery fitted with scythes to mow down infantry," and endeavoured to persuade Lord Palmerston to take up this adaptation of the chariot. Capt. Nadar put forward a similar suggestion in 1870; and in 1900 John Fowler, of Leeds, produced armoured steam traction engines for S. Africa.

The introduction of rifled breech-loading firearms did not force into use any system of man-borne or horse-borne protection, notwithstanding that the range, volume and accuracy of all kinds of fire was immensely increased and its effect rendered correspondingly more deadly. For, it was less possible than it had been to produce shields or body armour which were capable of resisting the greater penetration of the rifle bullet and yet light enough to be carried; whilst no practical method of mechanical propulsion across country of the heavy weights involved in collective protection had been discovered. And yet, as time passed, the need for some more intimate form of help for the infantry soldier than that afforded by artillery grew more insistent. It was accentuated by the invention of the machine-gun and of the magazine and the automatic rifle, and by every successive improvement in small arms or artillery. In point of fact, however, the mechanical difficulties had been overcome some years before 1914. The "caterpillar," or "track," or "endless band" system of propulsion, by which weight is distributed by the increase of the surface bearing on the earth, instead of being concentrated, as with a wheel, and a better tractive effect obtained, which had been known, and in the United States largely employed, for some years, had furnished the key to cross-country mobility; and the perfecting of the internal combustion engine had subsequently given to the world compact power with light weight.

The principle of the "footed wheel," "caterpillar," or "track" system of propulsion appears to have originated in the patent of Richard Lovell Edgeworth in 1770 for a device whereby a portable railway could be attached to a wheeled carriage.[2] This employed the basic principle of all subsequent track-driven machines. Then followed patents for tracks of different natures, by Thomas German in 1801, William Palmer in 1812, John Richard Barry in 1821. In 1846 there was the Boydell engine, with footed wheels, improved upon by Andrew Dunlop in 1861; whilst in 1882 Guillaume Fender and John Newburn designed modifications of tracks. In the following year the actual use of tank-like engines for war was predicted by M. Albert Robeida in *La Caricature*.[3] In 1886 there came the Applegarth tractor, and the Batter tractor was patented in the United States two years later. The latter anticipated the tank in many details. All the above machines were steam propelled. In America steam locomotives with caterpillar tracks, some furnished with sleds or runners, had for years before the war been applied to haulage in lumber camps. After the appearance of the petrol engine Frank Bramond patented in 1900 a special form of track for pneumatic tired wheels. In 1907 a Rochet-Schneider car fitted with a chain track was tried for military traction purposes, and in 1908 a 70 H.P. Hornsby-Ackroyd chain track tractor took part in a review at Aldershot, and Hornsby also demonstrated a 75 H.P. Mercèdes motor car fitted with tracks, a speed of 20 m. an hour being attained on sand. Another British tractor, of the footed wheel type, was the Diplock Pedrail. In America petrol-driven caterpillar tractors had before the war become quite common for agricultural purposes, amongst them being the Bullock, Killen Strait and Holt tractors.

While experiments in petrol-driven caterpillar-track tractors for military use had been carried out by the British authorities before the war, there had been no serious investigation or proposal by any nation to develop the caterpillar principle for fighting as opposed to transport purposes. In 1903 Mr. H. G. Wells had in fiction anticipated the intervention in battle of fighting machines which amounted to large-size tanks. Five years later Capt. T. G. Tulloch had suggested a scheme for a steam-driven pedrail armed and armoured trench-crossing machine, and in 1911 had put forward a proposal to use armed and armoured linked Hornsby-Ackroyd tractors with a crew of a hundred men. And in 1912 Mr. L. E. de Mole, an Australian, actually placed before the War Office a design, followed in 1916 by a model, for a climbing, fighting track-driven machine. This was the real prototype of the tank; and in some particulars, especially its pivoted ends and flexible chain tracks for steering a curved course, it seems to have been superior to the machine actually produced. Unfortunately, whatever may have been official opinions or intentions in regard to this scheme, no action was taken.[4] In Dec. 1915 a caterpillar-track wire-cutter, invented by M. J. L. Breton, the French deputy, and called the *Tracteur-porte-cisaille*, or *Tracteur Breton*, was tried, and orders were given for a few, which, however, were not constructed. The *Boirault* cross-country motor, which consisted of an articulated polygon, was also tried, but was found impracticable owing to lack of steering power.

In the years preceding 1914, military opinion generally inclined to the belief that in any future struggle open warfare, or a "war of movement," alone was probable; that in such a campaign mobility was the essential; and that there would not be many occasions when a sheer unassisted frontal attack would have to be pressed to the end against carefully prepared positions held by unshaken defenders. It was appreciated that such operations if attempted would be costly to the infantry, though how costly was not realized. And it was thought that they could usually be avoided by manœuvre, or, if they had to be carried out, would be assisted by envelopment or flank action which would relieve the task of the infantry by weakening the power or determination of the defence to fight to the end, or by operating at night or by surprise. The other, local, measures for assisting the infantry consisted of the bombardment and supporting fire of the attacking artillery up to the moment of actual assault, and the covering rifle fire from stationary infantry to cover those who could not use their rifles whilst actually moving forward, both of which were intended to keep down the defenders' fire. Great and, as it proved, undue reliance was placed on this concentration of the fire-power of the attack both from artillery and from small arms. It was hoped that by the continual cumulative reinforcement of the firing line until it had arrived at assaulting distance, and possibly dug itself in, a superiority of fire over the defenders would be gained sufficient to permit of the delivery—helped by artillery till the last moment—of the final assault with the bayonet. To enable the firing line to improvise some sort of protection when it could no longer move forward and was "frozen" to the ground, the infantry of all armies were equipped with a portable entrenching tool. The blade of this instrument, it was thought, also, might in some cases serve as a species of shield. Except by the Ger-

[1] The greater part of this historical summary is taken from *Tanks in the Great War* by Brvt.-Col. J. F. C. Fuller, and *The Forerunner of the Tank* by H. M. Manchester, *The American Mechanist*, Vol. xlix. No. 15.

[2] *The Engineer*, Aug. 10 1917 and following issues.

[3] *Strand Magazine*, June 1917.

[4] Mr. de Mole's ideas had no influence on the evolution of the tank, for the originators of the latter were ignorant of his project, which only became generally known after the war, in Oct. 1919, some four years after the Mark I. tank was designed, when the subject came up before the Royal Commission on Awards to Inventors.

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mans, wide extension of the attacking infantry was relied on to reduce the casualties. The Germans favoured mass tactics, trusting to break through by weight of numbers in spite of loss.

Up to the outbreak of the war, therefore, partly owing to a wrong estimate of possibilities; to a non-appreciation of the progress of science in its application to warfare; to fallacious reasoning based thereon; to the necessity for economy in military matters; and to the mechanical difficulties which had so long stood in the way and which were still thought to stand in the way, not only had no solution of the problem of providing mobile protection been arrived at, but no serious effort to reach a solution had for a long period been attempted. It followed that when hostilities opened in 1914, save for the development of artillery tactics and *matériel*, not one of the combatants was really in possession of better means of rendering possible the advance of infantry under fire than those which had been at the disposal of the opposing forces in the Russo-Japanese War of 1904–5. Indeed, in face of the actual growth in strength of the tactical defensive all armies were in this direction relatively weaker than in previous wars of modern days. And the weakness seems to have caused no anxiety. The prevailing complacency, however, was soon to receive a rude awakening.

It might be imagined, since the Germans first assumed the offensive on the western front, that they would have been the first to become aware of this deficiency and to feel the need for mobile protection. This was not so. Though they carried out a succession of attacks during the first month of the war they were not held up, except for a short time before the fortresses Liége, Namur, Maubeuge, and Antwerp, which they reduced by gun-fire, and were able until they reached the Marne to continue their onward rush and to maintain their pressure. These attacks, with the exception of the abortive assault on Liége, were not executed against carefully prepared positions such as developed later, and were not usually of a purely frontal nature unassisted by tactical or threatened strategic flank operations or envelopment. Nevertheless, the German losses were extremely heavy, probably more severe than had been expected, but were thought to be the price of the apparent general success of their strategy at the time. They would have been truly justified had the German plan of campaign in fact succeeded. During this period such losses as they suffered were caused mostly by the quick-firing field artillery of the French on the one hand, and on the other by the musketry of the highly trained long-service British infantry hastily entrenched in improvised positions. This, it is stated, was so intense as to lead to the erroneous conclusion that the British Expeditionary Force had been secretly and lavishly equipped with machine-guns. And it was not owing to the strength of the resistance of the British or French field armies on the defensive that the progress of the Germans was finally brought to a standstill at the Marne.

It was only when the rôles of the two sides were reversed and the Allies assumed the offensive that the factors first came into play that eventually forced on them a fresh effort to solve the ancient problem. It was then, so far as the British were concerned, that it became apparent that, notwithstanding the weakness shown by permanent forts which had quickly succumbed to the power of specially designed ordnance, not only had the capacity for passive resistance of field defences been much increased, but the active power of the defensive had been very greatly enhanced by the application of modern methods and the scientific employment of modern arms.

More than a hint of this was given first by the nature of the resistance made by the German rear-guards during the battle of the Marne, notably at the crossing of that river at La Ferté-sous-Jouarre on Sept. 9, where the British 4th Div. was held up almost entirely by machine-gun fire in its endeavour to force the passage. It has since become known that the Germans had concentrated at this spot some 42 machine-guns, equivalent to the number of these weapons with 21 British battalions.[1] Later, during the fighting on the Aisne, greatly as the British were harassed by the German weight of artillery, it was mostly by machine-guns that their efforts to advance were checked, in some instances by the combined action of these guns and obstacles, such as abattis and wire entanglements, which though improvised, were found to be very effective, especially in view of the British weakness in artillery. Even at this early stage so strong were the German defences that the nature of the operations began to approximate to that of siege warfare. Later, at the beginning of Oct., in the more open action when the British endeavoured to outflank the German right to the north of Lille it was the same story. Their progress was in every direction opposed by machine-guns, sometimes in the open, sometimes in defended villages or houses, and often protected by improvised entanglements. Almost invariably the presence of German advance troops even in small bodies implied the presence of machine-guns which were handled with the greatest skill. The static warfare which then ensued on the western front during the winter of 1914–5 after the failure of the German offensive and the efforts of both sides to outflank each other on the coast, only accentuated the tendencies already noted. Its effect was to convert the struggle into a species of "field siege" warfare from which all possibility of manœuvre was excluded and in which all efforts at the offensive had perforce to be attempts to break through, entailing frontal attacks. Nevertheless, though this development had been expected by the Germans no more than by the Allies, and their immense preparations had been based on their original plan of an overwhelming and short offensive campaign on this front, they were in many ways well equipped for it. They were for a long time in possession of an immensely preponderating artillery—an advantage in attack or defence; whilst in defence the nature of the fighting gave full scope to their untiring industry backed up by their genius for field fortification. They also had a great proportion of technical troops and an armament of machine-guns far superior to that of the Allies. Though the relative conditions between the sides in these particulars changed, in the struggle which lasted for nearly four years the defensive was for a long time to prove stronger than the offensive, all attempts at which had to be carried out without finesse, by the method of brute force with its prodigal loss of life. It was during this period more especially that the machine-gun was to exert its influence and to reveal to the full its true power in the prepared defensive.

The machine-gun was no new invention, but its possibilities when cleverly used in numbers, though shown to some extent in the Russo-Japanese War of 1904–5, had not been proved. The British and German were equipped with almost identical types of the same gun differing only in detail, both being the outcome of the genius of the late Sir Hiram Maxim.[2] Previous to the Russo-Japanese War the weapon had never been held in great esteem by the British military authorities, except by a few enthusiasts; but the lessons of that campaign had led to an effort to increase the proportion of these guns in the equipment of the army beyond that which existed at the time of the S. African War. But this was not done owing to mistaken ideas of economy. It was also held that superior musketry fire discipline would make up for any deficiency in this respect, and great pains were taken to train the infantry to attain a rate of fire which in fact did exceed that of any other troops. On the other hand the machine-gun had become the weapon *par excellence* of the Germans. They perhaps of all nations had most correctly gauged its worth, the fact that it combined the maximum of killing power with the minimum of vulnerability, and the economy in a military sense of its adoption on a large scale. And after the Russo-Japanese War they had made a specialty of it. Without ostentatiously increasing the proportion of machine-guns with their infantry formations they had armed special units with them and accumulated a large stock in reserve. They had also trained a body of picked officers and men in their technical and tactical use. Their army, therefore, entered the war in this particular better equipped than any other. The first sign of this fact was given by the bold method in which they employed machine-guns in their onrush in the west. The next, as has been said, was the skilful way in which they used them in defence, at first in rear-guard operations, and then in the prepared defensive. In these tactics they excelled, and specialized in combining the intense fire power of the machine-gun with the obstacle—usually barbed wire entanglements—in a way which had never before been done. So far from the weapon being looked upon as a rare article impossible of replacement to be cherished and kept out of danger, it was not considered a disgrace for a gun to be lost once it had earned its value in killing the enemy. This apparent prodigality was a measure of the

[1] "*Die deutsche Kavallerie in Belgien und Frankreich*," Von Poseck, p. 102.

[2] The British were equipped with the Vickers, the French with the Hotchkiss, and the Germans with the Vickers-Maxim.

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reserve of weapons available and the chief source of the great increase revealed in the strength of the defensive. The pre-war policy of the Germans was justified in the event. It was the combination of this weapon with barbed wire as initiated by them that suggested the need for the tank. And it was its intensive application and elaboration after the opposing armies had crystallized in two continuous closely opposing lines of carefully entrenched positions extending from the sea to Switzerland, that eventually brought the tank into being.

British Tanks

Early in Oct. 1914, it was borne in on the mind of a British officer who had special opportunities for ascertaining what was actually occurring, that the frontal assault of prepared positions, especially when adequate artillery coöperation was not available, had become impossible unless some more effective assistance could be rendered to the infantry than that previously contemplated and accepted as adequate; that this assistance in the absence of gun power and ammunition sufficient to blast a way through the whole enemy system of defences—trenches, obstacles and machine-guns—should consist of some protected power-driven machine which could force itself through barbed wire, climb across trenches and destroy by gunfire or crush by its weight the machine-guns of the defence. Knowing of the existence and cross-country capabilities of the American Holt caterpillar tractor, it occurred to him that a specially designed machine developed on similar lines would be the solution of the problem. This officer, Lt.-Col. (later Maj.-Gen.) E. D. Swinton, R.E., at that time acting as official military correspondent ("Eye-witness") with the British Expeditionary Force, was the first officially to put forward a scheme for a caterpillar machine-gun destroyer, in a communication to the Secretary of the Committee of Imperial Defence in London on Oct. 20 1914.[1] Though the machine then contemplated and finally evolved was for the purpose of giving infantry protection when advancing, it was expressly designed to do this indirectly, by its own offensive and destructive action. It was definitely intended, and designed, for the express purpose of forcing its way through wire and crossing trenches and hunting for machine-guns in order to destroy them by shell fire or to crush them by passing over them. The only "protection"—using the word in its limited, and more usually accepted sense—afforded by it was that of its bullet-proof sides to its own fighting crew. This point is accentuated because of the misconceptions which have existed as to the rôle of the tank, chiefly as to its being an armoured vehicle for transporting men, or a mobile shield to give cover to those moving up behind it. It did in fact perform this latter service, but only incidentally, in its quest for machine-guns. Machines for carrying up bodies of infantry and stores were not actually developed until three years later as an extension of the principle. As will be seen, the necessity for finding some mechanical method of carrying troops under cover across country had already occurred independently to a French officer. And in England similar suggestions were put forward, also independently, by Lt. R. F. Macfie, in Aug., and Lt. B. J. F. Bentley in Oct. 1914.

The history of the tank from Oct. 1914, until it took the field 23 months later, and even afterwards, is a record of progress made often in the face of apathy, scepticism and even opposition. This is typical of the history of the evolution of most inventions or new ideas, but is somewhat remarkable in this instance because the subject was one of vital urgency immediately concerning the lives of the British troops in the field. It is also remarkable for another reason. The idea of this land weapon not only received its first help toward realization from the minister responsible for the navy, but its realization was, indeed, only rendered possible by the financial support given by him from naval funds. The gist of the suggestion made to the Secretary of the Committee of Imperial Defence in Oct. 1914 was put forward by him in a memorandum and reached the First Lord of the Admiralty, Mr. Winston Churchill, who was predisposed towards experiments in the direction of some mechanical armoured device for carrying troops across country, to take the place of the armoured motor car which could only operate on roads. A certain number of these cars, belonging to the armoured car section of the Royal Naval Air Service, organized by the Admiralty, had been operating in France and Belgium, and their utility had become seriously curtailed by the destruction of the roads and the state of trench warfare which had arisen. In Jan. 1915, the First Lord, to whom the employment of mobile bullet-proof shields had already been suggested, took up the question of the urgent need for methods of meeting the deadlock reached on land, and his views were officially brought to the notice of the army authorities. He did not, however, only place the matter before the military. He caused researches to be made in the direction of crossing trenches by means of tractors carrying portable bridges, and in Feb. summoned a special Admiralty expert committee under the chairmanship of Mr. (later Sir) E. H. Tennyson d'Eyncourt, the Director of Naval Construction, to explore further the subject of mechanical cross-country transport generally. This committee at once started work and continued its labour for some time, experimenting chiefly in the direction of "landships" with large wheels, coupled steam rollers, pedrail and caterpillar tractors, single and articulated, for which suggestions had been put forward by different individuals. The underlying idea of all these investigations was the production of a machine for the conveyance of troops, not a machine-gun destroyer.

Previous to the receipt of the First Lord's views, the need of a specific machine-gun destroyer had been urged on the War Office directly by Col. Swinton early in Jan. 1915, followed by representations fron Capt. Tulloch. The War Office took the matter up, but did not associate itself with outside technical experts to investigate possibilities, as had been recommended. After the trial and failure in Feb. of a Holt caterpillar tractor to cross obstacles which it was not designed to negotiate, and that of a wheeled tractor with the naval trench bridging device in May, it dropped the whole idea as impracticable. Meanwhile the Admiralty committee had continued its experiments, though without knowledge of the conditions of the military problems it was required to solve. In June, the War Office, then aware of the Admiralty's activities, became desirous of collaborating in them, and a joint naval and military committee was formed. The efforts of the Admiralty thus obtained the first official recognition of the service for whose benefit it was really working. At the end of the month the committee was furnished by the War Office with a detailed specification of the requirements of the destroyer as prepared by Col. Swinton and forwarded by the Commander-in-Chief in France, and the Admiralty designers were for the first time in a position to apply their inventive faculties to fulfilling certain definite conditions. The result of their efforts was the production in Jan. 1916 of an experimental machine paid for entirely from naval funds and produced almost entirely by naval agency, which was the prototype of all British machines. The chief point of its design, and on which it differed from other caterpillar machines, was its rhomboidal shape and all-round track, which were the invention of Lt. (later Lt.-Col.) W. G. Wilson, of the Admiralty landships committee, working in conjunction with Mr. (later Sir) W. Tritton. This machine, afterwards known as the Mark I. Tank, successfully underwent its official trials on Feb. 2.[2]

As has been said, at the beginning of the war the solution of the problem of enabling a frontal attack on trenches to be carried out had been thought to lie very largely in bombardment by artillery. But the futility of the limited bombardment by field guns with shrapnel shell, which was all that was possible for some months even against such comparatively weak defences as the Germans at first held, became apparent. Then, in reply to

[1] For the origin of the tank see the Minutes of the Proceedings before the Royal Commission on Awards to Inventors, Oct. 1919.

[2] For purposes of secrecy the name "Tank" had been applied in Dec. 1915 to the experimental machine under construction, then known as a "landship," in a report by a sub-committee of the committee of Imperial Defence. It was suggested by two officers connected with that committee. The experimental machine was afterwards known as Big Willie, and, though a male, as "Mother."

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the insistent demand from the front the national energies had been turned to the making of guns and ammunition of all types, and prodigious quantities had been produced. But after the battle of Loos it began to be realized that even a great concentration of artillery and the expenditure of an immense amount of ammunition in a prolonged bombardment from guns of all calibres was not necessarily effective against such defences as the Germans had created, and could not insure that the assaulting infantry would not be held up by uncut wire and suffer terrible loss from concealed and protected machine-guns. Some other means of dealing with the numbers of these weapons which would survive a bombardment even of the heaviest nature was necessary. As a result of the performance of the experimental tank in Feb. 1915, G.H.Q. France came to the

FIG. 1.—Mark I. Tank.

conclusion that such machines might be of some assistance, and made a demand for 40.[1] This number was increased by the British War Office to 100, and supply was undertaken by the Tank Supply Committee of the Ministry of Munitions, composed of members representing interests directly concerned, under the chairmanship of Maj. (later Sir) Albert Stern. Orders were placed on Feb. 12, and production was commenced at once with the utmost secrecy, under great difficulties of labour and material owing to the great national effort then in full swing to produce munitions of all sorts.

During this initial period of manufacture various minor improvements of the original design were incorporated. The sample machine, in accordance with the original specification for a machine-gun destroyer, was armed with two 6-pdr. guns and three Hotchkiss machine-guns. It was soon realized that, though effective for its purpose, this armament was deficient in man-killing fire-power for self-defence in the event of attack by large numbers of men, and it was decided to arm a certain proportion of tanks with four Vickers machine-guns instead of two 6-pounders. They were known as "females," the gunned machines being known as "males." The total number under construction was 150, half males and half females.

The Mark I. Tank (*see* figs. 1 and 2).—Details of this machine are given in the table on p. 697, but since all the succeeding machines were a development of it, some further description is given. Its main characteristic was the all-round track, which gave it its climbing power. This was perpetuated in all the British heavy tanks, though in the medium, or "Whippet," tanks evolved later, the same result was obtained by the projection of the tracks which were not under the machine. The essential value of both forms of construction was that whatever the fore and aft angle of the machine with the horizontal a gripping surface was presented. This was achieved by the high, curved bows, rendered possible by combining the body and the chassis of the machine and using the sides of the body to support the tracks. The length was 32 ft. 6 in., over all, and 21 ft. 5 in. without the tail. The width was 13 ft. 9 in.; the height 8 ft. ½ inch. Power was given by a six-cylinder sleeve valve Daimler engine of 105 H.P.; transmission consisted of a cone clutch, primary (two speed) gear box (controlled by the driver) differential secondary (two speed) gears, actuated by hand levers, one to each track, and chain drives to the driving sprockets at the rear of each track. There were thus four speeds ahead. This system necessitated a "gearsman" at each side, and was inconvenient and clumsy. The petrol feed was by gravity. There was no silencer. The armour plate varied from 12 mm. thickness in front to 6 mm. at the top and on the belly, the only part proof against the German "K" (armour-piercing) bullet being that 12 mm. thick. The armament of the male tank comprised two 6-pdr. guns, one on each side and four Hotchkiss machine-guns, and that of the female tank two Vickers machine-guns on each side and three Hotchkiss machine-guns. Owing to the pressure of time certain details in the design and equipment of the machine were adopted in order to employ material which was in production and quickly obtainable without waiting for special manufacture. The power unit, including the engine, with gear-box and differential was adopted because it was the standard power unit of an existing tractor and already in production. The 6-pdr. gun was adopted not because it was considered the best for dealing with machine-guns (the 2-pdr. automatic gun was originally specified), but because the Admiralty had a large number of these guns in hand and promised to supply the requisite number to the army. The 6-pdr. proved, however, to be a very good weapon for its purpose. The male tank carried 324 rounds of 6-pdr. common shell for the 6-pdr. gun and 6,272 rounds of S. A. A.; the female carried 31,232 rounds of S.A.A.[2] The crew consisted of one officer and seven other ranks. The driver sat with the officer in the conning tower in front. The total weight of the male tank when loaded was 28 tons; of the female 27 tons. The average speed across country was 2 m. per hour, and the radius of action, nominally 23 m., averaged 12 m. over rough ground. The

[1] The first order placed by the French army headquarters, without awaiting the construction of an experimental machine was for 400 machines, and this was increased to 800.

[2] It was originally proposed to carry a certain proportion of case shot. This was not done, but it was found necessary later to do this.

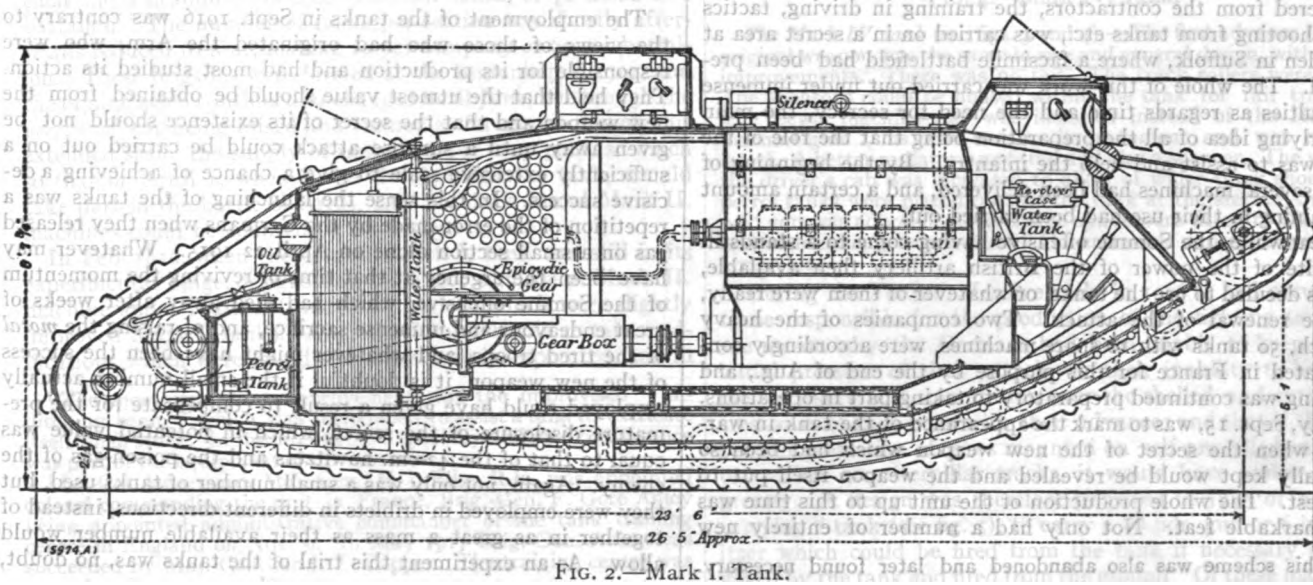

FIG. 2.—Mark I. Tank.

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tank could cross trenches up to 11 ft. 6 in. in width and could climb a vertical height up to 5 feet. Six of the first establishments of tanks were equipped with a wireless set capable of sending and also to some degree of receiving.[1]

Two features of the Mark I. tank were not perpetuated in later patterns, except in the first gun-carrier machines. One was the tail. This consisted of a pair of wheels carried by a frame pivoted at the stern of the machine which for ordinary steering could be actuated by the driver by means of wire cables. For sharp turns, which were effected by driving on one track alone, they could be raised off the surface of the ground by a hydraulic ram at the back of the tank. The weight of this tail attachment also served to ease the rate of descent of the tank after crossing a summit, and the extra length it gave to the whole machine increased the width of the gap which could be crossed. It was found in actual practice that the complication and liability to damage the tail was not compensated for by its advantages, and its use was abandoned after the first actions. In both the male and female Mark I. machines the 6-pdr. and Vickers machine-guns were mounted in sponsons to give as far as possible arcs of fire up to direct ahead and astern. In order to reduce the width so that the tanks could be carried by rail these sponsons were removable and could be unshipped for travelling, when they were carried on small wheeled trollies. The inconvenience of this system caused it to be abandoned, and in later patterns of tank the sponsons were so designed that when travelling they could be swung inwards and housed in the width of the tank, or could be unbolted and slid in.

In March 1916, measures were taken to provide the *personnel* to handle the new weapon, and an establishment was framed for a unit. For secrecy this unit, under the command of Col. Swinton, was raised and formed, as a portion of an existing service, under the name of the "Heavy Section," subsequently changed to "Heavy Branch," of the Machine-Gun Corps. This was to provide the *personnel* for the 150 tanks then under construction, without any reserve of machines or man-power. At first the organization was for three battalions of 50 tanks each, but this was altered to six companies of 25 tanks each, each company consisting of four sections of six tanks and one spare tank. Each section was formed of three male and three female machines, and was subdivided into three sub-sections of one male and one female tank. A specially constructed and equipped mobile field workshop was allotted to each two companies. To assist in the formation of this unit a nucleus of officers and men were transferred from the existing Motor Machine-Gun Corps; officers also being obtained from the cadet battalions, and from France, and other ranks being enlisted from the motor trade. Technical *personnel* of all ranks was supplied by the Mechanical Transport Branch of the Royal Army Service Corps.

The first headquarters of the Heavy Branch were at Bisley, where, since there were no machines, the training was of a preliminary nature confined to discipline and gunnery and the use of the Vickers and Hotchkiss machine-guns. Training in gunnery was carried out by means of borrowed guns, and entailed the sending of the men to Salisbury Plain and to the Naval School of Gunnery at Whale Island. So soon as the tanks began to be delivered from the contractors, the training in driving, tactics and shooting from tanks etc., was carried on in a secret area at Elveden in Suffolk, where a facsimile battlefield had been prepared. The whole of this work was carried out under immense difficulties as regards time and the need for secrecy, the main underlying idea of all the preparation being that the rôle of the unit was to assist and help the infantry. By the beginning of Aug. several machines had been delivered, and a certain amount of training in their use had been carried out.

Meanwhile, the Somme offensive having come to a standstill in spite of the power of the British artillery then available, it was decided to use the tanks, or whatever of them were ready, in the renewal of the attack. Two companies of the heavy branch, 50 tanks with 10 spare machines, were accordingly concentrated in France for this purpose by the end of Aug., and training was continued preparatory to taking part in operations. Friday, Sept. 15, was to mark the appearance of the tank in warfare, when the secret of the new weapon which had been so carefully kept would be revealed and the weapon itself put to the test. The whole production of the unit up to this time was a remarkable feat. Not only had a number of entirely new machines been manufactured sufficient for 60 to take the field within six months of the order for them having been placed at a time of great industrial stress, but the secret of their creation, which was known to thousands, had been so well kept that they did actually come as a surprise to the enemy.

It was to assist in the further advance of the British right flank, which had begun so successfully at the opening of the battle 10 weeks before, between the Somme and the Ancre that the tanks were to be thrown into the fight. The IV. Army was to break through the enemy's front between the Combles ravine and Martinpuich and seize Morval, Les Boeufs, Gueudecourt and Flers. On its left the Reserve V. Army was to attack and gain Martinpuich and Courcelette while the French were to press on its right. The cavalry were to follow up through the gap which it was hoped would be created and seize the high ground about Rocquigny–Villers au Flos–Riencourt-lez–Bapaume. Two companies of the tanks were engaged, the bulk with the IV. Army, the rest with the Reserve Army. The general idea of their tactics was that they should start so as to reach their objectives five minutes before the infantry. They were to act in small detachments of two or three machines against the strong points in the enemy's defensive system, lanes being left for their advance in the artillery barrage commencing at zero hour.

The tanks advanced at dawn in a slight mist and came as a complete surprise to the enemy. The operations of those with the XV. Corps of the IV. Army were the most successful; but for various reasons the results of the employment of tanks was somewhat disappointing. Of the 49 machines taking part 32 alone reached their starting points, 9 pushed ahead with the infantry and caused considerable loss to the enemy and 9 others, which did not catch up the infantry, did good work in dispersing of the enemy still holding out at isolated spots; of the balance of 14, 9 broke down and 5 became "ditched." (Ditching was usually caused either by a tank getting into such a position in a deep and wide crater or trench that its engine power was not sufficient to pull it out, though the tracks gripped, or by weight of the machine being taken by its belly on hard ground, in which case the tracks revolved without biting.) One tank gave remarkable help to the infantry held up in front of Flers by wire and machine-gun fire, when by its action it caused the surrender of 300 Germans and enabled the infantry to move on. Another destroyed a field gun. On Sept. 25 and 26, 13 machines acted with the IV. and Reserve Armies. Of these nine were ditched in shell craters, two reached the village of Thiepval and stuck there. But again, as a set-off to mishaps, one single tank on the 26th performed a remarkable feat which demonstrated the potentialities of the machine. Within one hour, and at the expense of five British casualties, it made possible the capture of a strongly held, well wired, trench (the Gird trench) some 1,500 yd. long and strengthened by numerous strong points, which had held up a whole brigade of infantry since the previous evening. The Germans suffered heavy loss, and 8 officers and 362, other ranks, surrendered. On Nov. 13, at the battle of the Ancre after heavy rain, of five tanks that went into action, all became ditched, two machines doing very valuable work before this happened. Next day, in an attack on a field work south of Beaumont Hamel, one machine out of three employed was put out of action by shell fire, and two became ditched. The latter, however, were able to bring so effective a fire on the strong point that it surrendered and 400 prisoners were collected by the tank crews. But, whatever their defects, the tanks had passed with ease through all entanglements and had destroyed many machine-guns, which weapons, indeed, were practically powerless against it.

The employment of the tanks in Sept. 1916 was contrary to the views of those who had originated the Arm, who were responsible for its production and had most studied its action. They held that the utmost value should be obtained from the new weapon and that the secret of its existence should not be given away until a surprise attack could be carried out on a sufficiently extensive scale to give a chance of achieving a decisive success. In this sense the launching of the tanks was a repetition of the error made by the Germans when they released gas on a small section alone on April 22 1915. Whatever may have been the urgency at that time of reviving the momentum of the Somme offensive, which had died away after weeks of great endeavour and immense sacrifice, and of raising the *moral* of the tired troops, and whatever might have been the success of the new weapon, it is doubtful if the small number actually employed could have given a result to compensate for the premature disclosure of the secret, which in potential value was equal to that of the 42-cm. howitzers and the poison-gas of the enemy. Again, not only was a small number of tanks used, but they were employed in driblets in different directions, instead of together in as great a mass as their available number would allow. As an experiment this trial of the tanks was, no doubt,

[1] This scheme was also abandoned and later found necessary.

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productive of valuable lessons, but they were obtained at the cost of discounting the future. It was in the face of a considerable amount of scepticism that the machines took their place in the battle-line, and those who did not believe in them, without looking beyond the lack of any startling success achieved on a great scale, were not slow in their condemnation. But one thing the tank had definitely proved: *The machine-gun and the barbed wire entanglement no longer ruled the infantry battle.* In the tank, still experimental and imperfect as it was, they had found their master. At last attacking infantry could meet the defence on more than equal terms.

On the part of the tanks themselves there was mechanical failure of machines, which were the first of their kind, tried under more difficult conditions than those which they had been designed to meet. The specification in which they had been constructed had been based on the requirements of the spring of 1915 at a time when the prolonged shelling, such as in 1916 and later rendered whole tracts almost impassable even by infantry, was undreamt of. At the Somme the tanks had to cross a dry "crumped" area, and at the Ancre a combination of "crumped" area and morass. There were, in addition, breakdowns due to faulty design and to the unexpected wear and tear of certain parts of the machinery, which only experience could have shown should have been of special material and which were, moreover, practically worn out by practice and demonstrations before the action. Failures were also due to the lack of time for the complete training and practice of the crews; to insufficient preparation in the way of reconnaissance and supply services, which for such complicated machines necessitated very complete organization. On the other hand, many of the commanders at whose disposal tanks were placed had no idea of their capabilities, weaknesses or limitations. Nevertheless, the outstanding brilliant exploits of single machines which did not break down, the great saving of life for which the tanks as a whole were responsible, and the demoralizing effect of their appearance on the enemy and the great encouragement afforded to the British infantry, clearly showed that the machines were sound in principle, only needing improvement in detail, and that those handling them required more experience in this new form of warfare.

As a result of its trial it was decided that the new Arm should not only continue, but should be expanded to a force of 1,000 tanks. After the fighting on the Ancre the unit did not again go into action till April of the following year, which allowed of a period for expansion, reorganization and training, and the incorporation of improvements to machines.[1] The expansion of the Heavy Branch of the Machine-Gun Corps was to be on the following lines: there was to be a fighting headquarters in France and an administrative headquarters in England.[2] The six original companies were to be expanded to four battalions in France and the two companies at home to five battalions, or nine battalions in all. The unit therefore reverted to its original battalion organization. It was eventually to comprise three brigades, each of three battalions, each battalion of three companies and a workshop, each company consisting of four fighting sections of five tanks each and a headquarters section of four tanks, or 72 tanks to a battalion. The number of tanks per section was shortly afterwards reduced to four, making 20 per company or 60 per battalion. These brigades were formed at the beginning of 1917, and the organization continued unchanged until June, but though the *personnel* was being raised and trained as far as possible on this extended scale, the supply of tanks did not keep pace, so much so that on April 1, when it was decided that the tanks should take part in the battle of Arras, only 60 Mark I. and Mark II. machines could be counted on for action.

In Feb. 1916, when the original Mark I. tank was still in its experimental stage, designs had been got out for a Mark II. machine and a Mark III. machine, both of which were slightly improved Mark I. tanks. After the Somme battle certain modifications which were found necessary were incorporated, and in Oct., in order to keep up continuity of supply, orders were given for 50 machines of each type (making 250 tanks ordered in all) pending the decision on the design for the 1,000 asked for by the army, in Sept. The chief improvements consisted of the abandonment of the tail, as already mentioned; the addition of "spuds," or fins, to the track plates, to give a better grip; and the provision of improved rollers. The Mark III. machines were also intended to have thicker armour to resist the "K" bullet. In regard to the 1,000 new tanks preliminary orders to collect material were given to the manufacturers in Sept. At the end of the month when it was learnt that these machines could not be ready by March 1 (partly owing to the manufacture of spare parts necessary for the existing tanks), the demand was cancelled, but was renewed two weeks later. This is mentioned to show that military opinion as to the advisability of proceeding with the new weapon was not unanimously favourable. The 1,000 machines were to be of the type known as the Mark IV., which was a much improved Mark I. tank. It was then anticipated that this number could be delivered by the end of June. Owing to various difficulties this estimate was not fulfilled, but sufficient machines reached France in time to equip two battalions for the attack on Messines in May; and it was the standard British tank during 1917 and 1918.

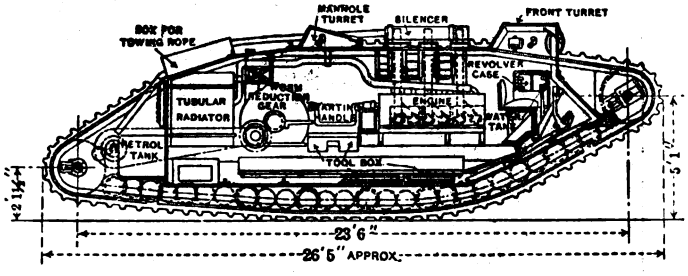

FIG. 3.—Mark IV. Tank.

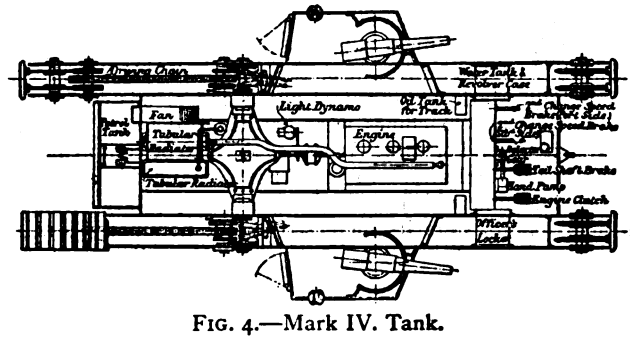

FIG. 4.—Mark IV. Tank.

The Mark IV. tank (see figs. 3 and 4).—The first advance from the original weapon was the same in size and general design, with certain improvements. There was no tail. The track rollers were better. The sponsons could be housed within the tank for rail transport. The Lewis machine-gun was installed instead of the Hotchkiss machine-gun (this was not an improvement and was reversed later). A better radiator was fitted and also a silencer. The width of the driver's cab was increased to allow of wider track shoes. The petrol tanks were placed outside the tank at the stern. A short 6-pdr. gun was adopted. Detachable spuds were fitted to the tracks, and unditching gear provided. The entrances and exits were more accessible.

During the Verdun offensive early in 1916 it had occurred to those responsible for the production of the fighting tank that one reason why the Germans had been unable to keep up the initial pressure of their attack was their inability to bring up their artillery and ammunition over the shelled and entrenched area so as to keep pace with their advance; and that if they had been in possession of guns mounted on self-propelled carriages, or carriers on caterpillar tracks, it would have assisted them greatly. A design was therefore prepared in July of a "gun-carrying" tank (see fig. 5), to carry a 60-pdr. gun or 6-in. howitzer which could be fired from the tank if necessary or conveyed by the tank and fired from the ground. Of these machines,

[1] The most important improvement was the improvised "unditching beam" which was introduced to assist a tank to extricate itself when stuck. In the later types a specially designed contrivance was part of the equipment of the machine.

[2] Lt.-Col. (afterwards Maj.-Gen.) H. J. Elles, R.E., was appointed colonel commanding the unit in France, Brig.-Gen. F. Gore Anley being appointed administrative commander of the tank training centre in England on Nov. 9. In May 1917 Brig.-Gen. Anley was succeeded by Maj.-Gen. Sir J. E. Capper. The training centre was moved to Bovington in Dorset.

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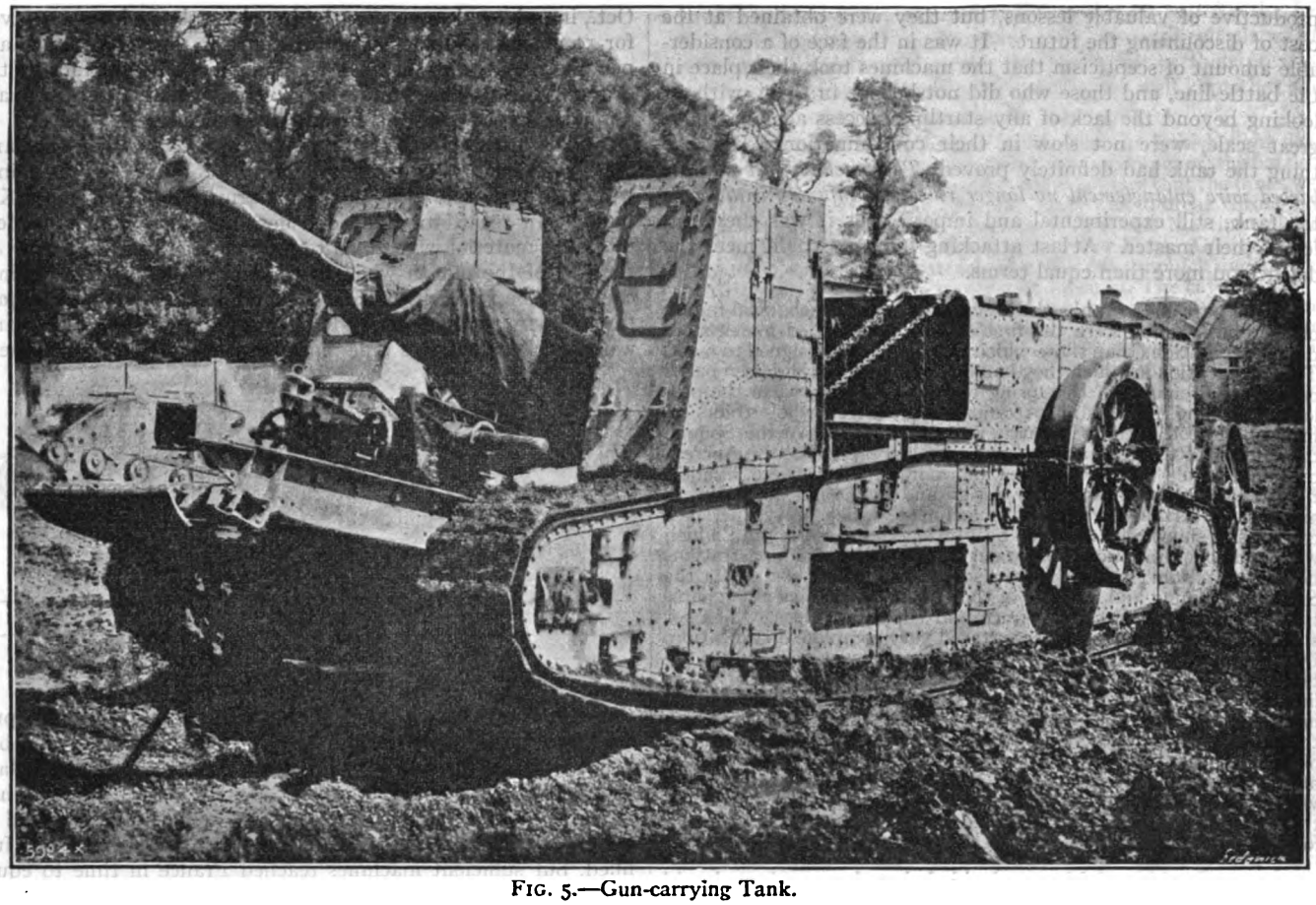

FIG. 5.—Gun-carrying Tank.

48 were made, delivery in France commencing in July 1917. They appear to have been employed as much for the conveyance of ammunition and stores as for the purpose for which they were designed. In Dec. 1916, also, the design of the "Whippet," the Medium Mark A. tank, (see figs. 6 and 7) was commenced. Of this type 200 machines were produced, delivery in France starting at the end of 1917. It was evolved to be complementary to the heavy tanks and to meet the demand for a speedier, handier machine which could be produced in large numbers. Its main points were its increased speed, nominally 8 m. per hour on the flat, and an average across-country of 5 m. per hour, and its lightness, one-half that of the Mark I. machine. It was also easier to transport by rail. Each track was driven independently by a four-cylinder 45 H.P. Tylor engine. Transmission was by cone clutches to gear boxes of the constant mesh type, giving four speeds forward and one reverse. The design was largely due to Sir W. Tritton. Thus, at the end of 1916, in addition to the first type of heavy tank in the field, measures were in hand to supply a much improved pattern of that machine (Mark IV.) and also a lighter type—the "Whippet."

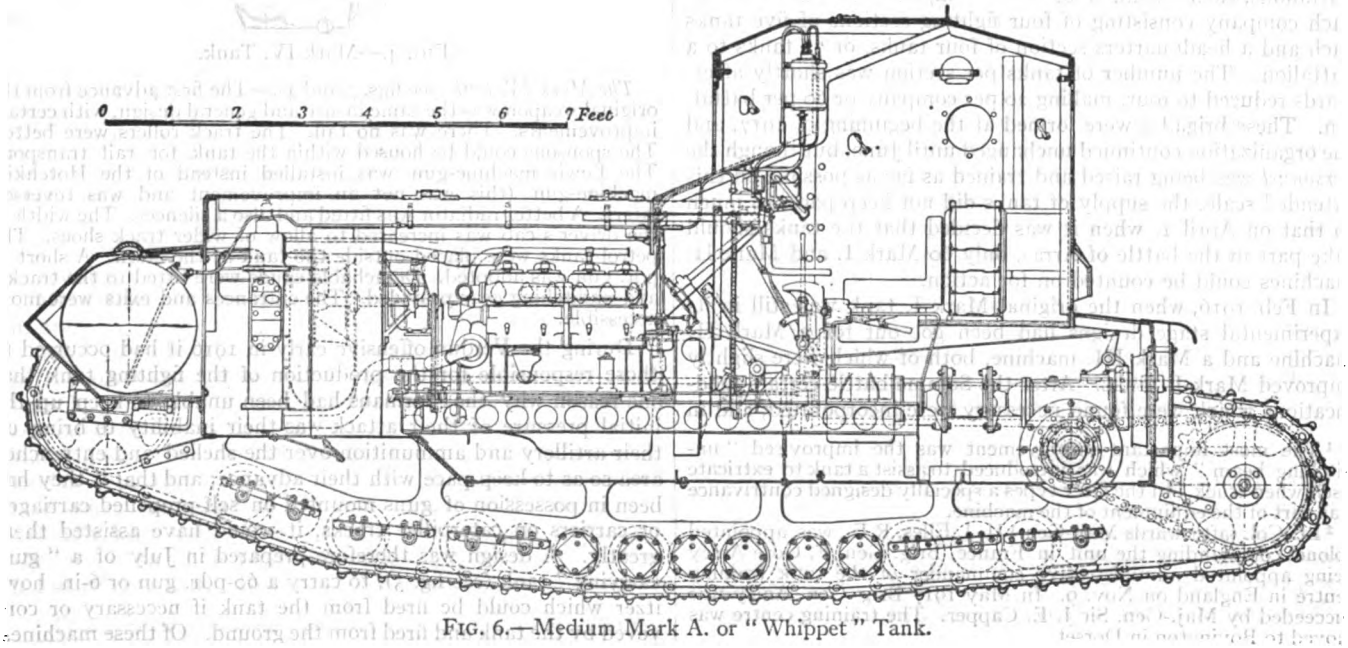

FIG. 6.—Medium Mark A. or "Whippet" Tank.

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In the field, though there was still considerable doubt as to the value of tanks, the next six months, from Oct. 1916, were, as had been said, a period of expansion, organization and training, and preparation for the operations of 1917. The training was always handicapped by the paucity of machines; and it was found necessary not only to educate the members of the new arm itself but also other arms and the staff. Headquarters, schools and rest camps and the usual organization of a large unit were established. The next action in which the tanks took part was the battle of Arras on April 9, when an attack was carried out by the I., III. and V. Armies in order to penetrate the German line by a sudden blow and allow of an army corps and two divisions of cavalry to break through. From the point of view of tanks it does not require much comment. Only 60 machines were available, and they were again not employed in

FIG. 7.—Medium Mark A. or "Whippet" Tank.

a mass for a quick penetration but for "mopping up" operations along the whole front.[1] More complete preparations were made for their coöperation than at the Somme. The battle was prepared by a prolonged bombardment, and was also preceded by heavy rain at the last moment, which combined to produce a sea of mud pitted with craters. The Vimy Ridge was captured by a rush of the Canadians which rendered tanks unnecessary, and on other parts of the front they had varying success, but gave valuable assistance. Against Bullecourt on the 11th, where they attacked without artillery preparation in the snow, the attack was a failure, though two tanks penetrated five miles behind the German front line, when they were captured. Fighting continued till the 22nd. The cavalry were prevented from breaking through by the usual obstacles—barbed wire and machine-guns. It was on the first day of the fight that the first German "tank trap" was discovered consisting of a deep covered-in pit. Again the main lesson learned was that tanks should be used in mass and not dispersed. After this battle an expansion of the Heavy Branch, Machine-Gun Corps, from 9 to 18 battalions (nine of heavy tanks and nine of medium machines) was decided on. But at the end of June this expansion was suspended owing to shortage of man-power, as it was apparently not yet realized to what extent the tanks reduced casualties. Before the next action, the battle of Messines, a certain number of the new Mark IV. tanks had been received and several of the old Mark I. and Mark II. machines had been converted into supply tanks for carrying tank stores to the fighting machines, a very great advantage the want of which had previously been much felt. In the attack on the Messines–Wytschaete Ridge, which started on June 7, 76 Mark IV. and 12 supply tanks took part. The operations in this case approximated to the "assault" in the old form of siege warfare and depended mostly on an intense bombardment, lasting from May 28 to June 7, and the explosion of 20 large mines. During the infantry advance on Wytschaete the creeping barrage proved so effective that tanks were only necessary at different spots to overcome individual machine-guns. They advanced in two lines, the first of 40 machines, going forward at zero (dawn), and the second, of 34 machines, at 3 P.M. to the Oosttaverne line, where their help was very valuable. Apart from the debated point whether the third battle of Ypres should ever have been fought or not, the work of the tanks in it needs still less comment than at Arras or Messines. In spite of remarkable feats accomplished by them, especially the capture of the Cockcroft, a nest of strong points, on Aug. 19 with a loss of 15 infantry, it was, on the whole so far as they were concerned, a failure, and a failure which was inevitable and to be expected under the conditions which existed. They had to act in a low-lying area which had been converted into a potential swamp through the destruction of the drainage system by the artillery of both sides, rendered still worse by the churning up of the surface into a wilderness of craters, which were filled by heavy rain just before the battle. The only means of approach across this morass were the causeways, which were naturally kept continuously under fire by the enemy. Preceded by many days of intense bombardment the attack commenced on July 31, and as it continued the rain made matters worse. That tanks should have been expected to function under such conditions, when, independently of the enemy's action, even the infantry were unable to move forward, is astonishing. It shows that those responsible for the decision to employ them were ignorant either of the situation or the limitations of the machines, or both.

It was not till Nov. 20, when the tanks had been in France over a year, that they were given an opportunity of showing of what they were capable when employed on a large scale, in a manner calculated to exploit their peculiar attributes, and under favourable conditions. As this was a turning-point in the history of the new weapon it is of importance that it be described in detail.

During 1916 and the greater part of 1917 the tanks had been thrown into the fight in dispersed detachments to assist in overcoming certain points of resistance, and somewhat casually as an aid to the attacking infantry. The conditions, also, had usually been such as to render success doubtful, sometimes impossible, and in any case of a minor nature. In several instances they had succeeded in achieving their immediate object and had undoubtedly saved many lives. In others they had failed. As a consequence it was seriously discussed whether tanks should not be abandoned as useless.

But those responsible for the Tank Corps (the name of the unit had been changed to "Tank Corps" at the end of June) had been concerned in thinking out an operation which would not only be strategically valuable, but would enable the corps definitely to prove its worth and establish a confidence in itself, which, never very marked on the part of General Headquarters, had recently been much shaken. Broadly, the scheme consisted in launching without any preliminary bombardment a surprise attack on a large scale with as many tanks as possible over ground suitable for their action, *i.e.* reasonably hard soil which had not been shelled to pieces. The area chosen was that near Cambrai, in the re-entrant of the Canal d'Escaut between Ribecourt, Crèvecoeur, and Banteux, which consisted of almost unshelled rolling downs of chalk. The attack was originally intended to be of the nature of a "raid" (this was not adhered to in its execution) carried out by an advance at dawn of three lines of tanks, the first of which would make straight for the enemy's guns, previously bombed from the air, to be followed up by the second and third; artillery coöperation to be confined to counter-battery work and the destruction of communications and depots, etc., behind the German front line. The essential points of the plan were surprise and speed. The project was put forward and approved, and the result was the battle of Cambrai, which took place on Nov. 20.[2]

[1] "Mopping up" consisted of disposing of small bodies of the enemy, especially such as had escaped the bombardment and allowed the first line of the assault to pass them.

[2] The action as fought was in almost every detail the execution of the plan put forward officially for the employment of the tanks by Col. Swinton in Feb. 1916, 22 months previously.

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Further details of the plan were that the artillery barrage of shrapnel and H.E. shell should open on the enemy's outpost at zero hour (6:20 A.M.) and be advanced by stages of 250 yd. just ahead of the tanks and concentrated on special points. The tanks were to go forward at zero hour in sections of three machines, sections being allotted to different objectives according to the strength of the latter. Each section was composed of one vanguard tank and two main body tanks. The former was to lead and protect the advance of the two other machines, behind which followed the infantry in parties of varying size, marching in sections in single file. As the Hindenburg trenches, some 12 ft. wide, would have to be crossed each tank was to carry a specially made fascine 10 ft. long and 4½ ft. in diameter to drop into the trenches to assist in the crossing. Special machines were fitted with drag grapnels in order to drag aside the wire entanglements which were known to be exceptionally thick and strong, for the passage of the cavalry. Great precautions were taken to maintain secrecy, upon which so much depended, and extremely careful preparations were made in the way of reconnaissance, the training of the infantry to act with the tanks, the movement of machines, and the formation of dumps of the necessary stores. For instance the preliminary movement of the tanks necessitated 36 special trains, and the material collected in dumps included 165,000 gal. of petrol, 55,000 lb. of grease, 5,000,000 rounds of S.A.A. and 54,000 of 6-pdr. ammunition. Three brigades (nine battalions) of tanks took part in the attack, with two army corps of three divisions of the III. Army, a cavalry corps and 1,000 guns. In all there were 378 (Mark IV.) fighting tanks and 98 administrative machines.

Fog on the morning of Nov. 20 assisted the attack, which was carried out as arranged, the tanks following the barrage and the infantry the tanks. The operation was an amazing success and came as an absolute surprise to the enemy, most of whose infantry were panic stricken and bolted or surrendered, the garrisons of certain strong points alone offering a determined resistance. Assisted by the tanks, the infantry by evening had occupied Marcoing,[1] Bois des Neuf, Premy Chapel, Havrincourt, Graincourt, Aneux, Noyelles. Next day, and on the 23rd, 25th and 27th, further progress was made, but the tank units which had been fighting continuously were disorganized and the crews physically exhausted; and the mistake had been made of not keeping a small proportion of tanks in reserve. On the 27th the impetus of the attack died out with practically no more ground gained than had been won on the first day, where the tanks, starting from a base of 13,000 yd. length, had in 12 hr., and at a cost of some 4,000 casualties, enabled the enemy's zone to be penetrated to a depth of 12,000 yd. (at the third battle of Ypres an equal extent of penetration had taken three months), and 8,000 prisoners and 100 guns to be captured. And their action had obviated the necessity for a preliminary bombardment (which would have cut up the ground and rendered any rapid advance of infantry impossible, and brought a concentration of enemy's reserves), and also the usual wire cutting artillery fire, which together would have cost many millions of pounds. (An estimate places the cost of the preliminary bombardment at the third battle of Ypres at approximately £22,000,000. A similar bombardment at Cambrai would possibly have cost more, as the German wire was on the reverse slopes of the rising ground.)

In numbers the *personnel* of the tank corps employed in the fight amounted to a little over 4,000 of all ranks, or the strength of strong infantry brigade. The fact that there were no larger bodies of infantry ready to reinforce the tired troops and press the advantage gained, and that the cavalry did not break through to Cambrai as was intended, was not owing to any failure on the part of the tanks, which achieved more than had been promised. The absence of any large force to take advantage of the opening made by them tends to show that it was not believed that they could do what they actually did accomplish, and that their complete and extraordinarily speedy success was as much of a surprise to British Headquarters as it was to the Germans. For nearly three years efforts had been made by both sides to force a way through the enemy's position quickly. At Cambrai a door was suddenly flung open and there was no force to press through. The success achieved by the surprise counter-attack by the Germans on the 30th also had nothing to do with the previous action of the tanks, but its effect was to discount the whole British victory including their performance. Against the southern portion of this German counter-attack a brigade of tanks which were hurriedly collected proved their worth in a defensive rôle, and gave invaluable assistance in stopping the onrush of the enemy.

The success of the tanks at Cambrai on Nov. 20, and all that it implied, gave as much food for thought as had the first use of gas by the Germans in 1915, unattended, however, by the horror of the means employed on the first occasion when a surprise penetration was effected by either side. It has been described as the "Valmy of a new epoch in War, the epoch of the mechanical engineer."[2] But it is doubtful if the truth of this statement has been fully appreciated even three years after the war. Even so, the effect of this action on the Allies, and also on the Germans, was immediate and far-reaching. It almost established the fact, for which the protagonists of the tank had been endeavouring to gain acceptance for many months, that the new Arm, used properly, was a serious factor in warfare which could not be put aside and ignored. And yet, though opinion in regard to the tanks had changed, even at that period when the immense losses suffered in the attempted offensives of the previous eighteen months had rendered the problem of man-power so acute, the crucial point was still not realized that an actual saving in life and economy in man-power would be gained by the development and whole-hearted employment on a very large scale of the mechanical Arm. And steps were not at once taken for a great expansion. The increase of the Tank Corps previously deferred was agreed to; but a proposed further expansion, based directly on the experiences of Cambrai, was not approved. And later, in April 1918, even the agreed increased establishment was again temporarily suspended after the German offensive in order to meet the demands for infantry reinforcements, and was not completed until after the striking successes gained by the tanks in July and Aug. 1918.

After Cambrai all ideas of attempting to prosecute the offensive were abandoned, and there ensued a period of preparation for resistance against the attack which was expected as the result of the reinforcement of the German strength on the west, rendered possible by the defection of Russia. To assist in meeting this, the Tank Corps, now of five brigades, or thirteen battalions, with 320 Mark IV. and 50 Medium A machines fit for action, was in Feb. 1918 distributed in detachments over some 60 m. of front.

During the second battle of the Somme, from March 21 to the end of the month, the part played by it was to coöperate in various local counter-attacks, its action being generally useful in assisting to delay the enemy's advance, as the German infantry would not as a rule face tanks until their guns were brought up. But out of the total, some 170 machines alone went into action usually and inevitably in hasty, improvised operations carried out during the general retrograde movement. Many machines were lost and their crews employed on foot as Lewis Gun sections. It was during this period that the new "Whippet" machines made their début with great effect. Generally speaking, the tanks were too scattered for full value to be obtained from their action. The corps also took its share in repelling the second German thrust against the British, which started in the Lys area on April 9, during which three battalions fought, some of the *personnel* of the lost tanks fighting on foot as a Lewis Gun brigade. It was in this quarter, near Villers Bretonneaux, that the first duel between tanks—possibly a presage of future warfare—took place.

The lack of decisive results obtained by the small detachments of tanks acting in improvised counter-attacks in the general defensive seems to have revived the lingering prejudices of those who were hostile to the arm, and who maintained that the mass action of Cambrai could never be repeated. However, in spite of this, progress was made in May and June in preparing for the future offensive, the chief point of note being that the new Mark V. (heavy) tanks, which were a great improvement on previous models, being much handier and also more mobile, were arriving at the rate of 60 machines per week. On July 4 occurred the action which probably finally dispelled the doubts of the most conservative and reactionary. This was the surprise attack of Hamel, a deliberate offensive and not a defensive counter-attack, in which recently received Mark V. machines coöperated with the Australians. This fight was an example of a perfectly organized action and of the advantage of previous careful training to act together of tanks and infantry, and was a speedy and complete success, achieved at the low cost of some 700 casualties. One feature was the special power possessed by the new and speedier tank of destroying machine-guns, many of which were rolled over and crushed.

The logic of facts was irresistible, and after this action the coöperation of the tanks was thenceforward accepted, not only as a useful adjunct but as an absolute necessity, for all offensive operations. On July 17, at the battle of Moreuil, one battalion of tanks coöperated with three French divisions in a most suc-

[1] The information of the capture of this village was sent back by a wireless signal tank, and was received at Albert 10 min. after the troops entered Marcoing.

[2] *Tanks in the Great War*, Col. J. F. C. Fuller, p. 153.

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cessful attack on a similar plan launched after one hour's preliminary bombardment.

July 18, the date of the great French victory of Soissons, marked the turning point of the war. It depended on tanks, and was rendered possible by their proper employment in mass and as a surprise. In fact, as the recent British offensive on a smaller scale had been, it was based on the battle of Cambrai. It was followed by a similar operation, the battle of Amiens on Aug. 8 which opened the British strategic offensive.

This battle was also based on the power of the tank arm, and was designed and organized to derive the utmost value from it and to give it every chance to perform its proper, logical function in a general operation. The tactics to be employed by the tanks were an elaboration of those employed at Cambrai modified by recent experience and adapted to the improved machines available. The attack was carried out by three army corps, with three divisions in reserve, a cavalry corps and 11 tank battalions. In regard to the tank battalions they were now better equipped than they had been. Nine were equipped with the new Mark V. machines (36 each), and two with the "Whippets" (48 each), or in all 420 fighting machines. There were also 42 tanks in reserve, 36 supply tanks, and 22 gun-carriers, or 580 machines in all. The "Whippet" tanks were to act with the cavalry. There was no artillery bombardment, and the tanks advanced with the barrage at "zero" hour. The heavy guns were used for counter-battery work and the field artillery moved forward in close support of the infantry. Noise barrages (made by low lying aeroplanes) were used to drown the sound of the tanks' approach. On the first day the maximum advance of the tanks was 7½ m., and they continued in action for four days till the 11th.

The battle of Amiens was a tremendous blow, both material and moral, to the Germans, who, besides casualties, lost 22,000 prisoners and 400 guns; and the victory was admittedly very largely due to the tanks. Amongst other lessons learned it was again found that these machines, like other arms, required a reserve to keep up the pressure after the first day of action, and that the limit of endurance of the heavy machines before overhaul was three days; that they were suited for trench warfare, the medium machines for open warfare; that the heavy supply tanks should be replaced by a light cross-country tractor; that wireless and aeroplane communication, as then developed, was not so certain as that by galloper; that it was a mistake to tie up tanks to cavalry, for, during the approach they could not keep up, and during the fight were kept back by the cavalry, which under hostile machine gun-fire had to retire or move to a flank until the tanks disposed of the machine-guns; and that machines of greater speed and greater radius of action were necessary. According to one authority,[1] if machines capable of moving at 10 m. an hour with an endurance of some 100 m. had been available, the German forces south of the Amiens–Roye–Noyon road might have been cut off and the end of the war greatly accelerated.

July 18 and Aug. 8 were not only victories for the French and British over the Germans, they were victories over their opponents for the tank arm in each army. In regard to the British it is sufficient to say that up to Nov. 5, their last fight, no attack took place without tanks. They coöperated in every offensive including such important operations as the battle of Bapaume, and the second battle of Arras, the battles of Epehy, Cambrai-St. Quentin (when the Hindenburg line was broken), the Selle and Maubeuge. Latterly, indeed, during the "war of movement" which set in after the Hindenburg line had been passed, advancing infantry when faced by the German rear-guard machine-gun posts almost invariably halted for tanks to come up and dispose of them before they moved forward.

So far as statistics can show what a part they played, the following facts speak for themselves: By the time of the battle of Amiens much of the *personnel* of the Tank Corps had been in action 15 or 16 times, and during the 95 days from that time to the Armistice tanks (to the number of 1,993) were engaged in fighting on 39 days. The casualties, killed, wounded and missing were 598 officers and 2,826 other ranks. These, though heavy in relation to the strength of the unit, which was under that of an infantry division, were not heavy for 39 days hard fighting if it be borne in mind that in pre-tank days it was not unusual for an attacking division to suffer 4,000 casualties in one day often without reaching the objective.

The final despatch of the Commander-in-Chief of the British armies contained the following words:—"... Since the opening of our offensive on August 8th, tanks have been employed on every battlefield, and the importance of the part played by them in breaking up the resistance of the German infantry can scarcely be exaggerated. The whole scheme of the attack of August 8 was dependent upon tanks, and ever since that date on numberless occasions the success of our infantry has been powerfully assisted by their timely arrival. . . ." It would not be too much to say, that in spite of any artillery assistance, the series of overwhelming, immediate and economical (both in life and treasure) victories won at Amiens and afterwards would have been absolutely impossible without tanks, as would the whole scheme of the strategic offensive which depended for its execution and cohesion on the prompt and certain success of these attacks. And this statement, which is tantamount to an expression of opinion that human bodies cannot vie with armoured machines against wire and machine-guns, is no disparagement of the British infantry. It is one which would be borne out by the survivors of Neuve Chapelle, Loos and the Somme.

After the action of the Somme a few tanks were at the end of 1916 despatched to coöperate against the Turks in Palestine, where the situation was somewhat similar to that which had arisen on the western front. It was doubtful, at first, whether the machines, some parts of which wore out very quickly, would operate in the sandy desert; but it was found that the dry sand was less harmful than the mud of Flanders, and the tanks in fact stood the test well, and covered a surprising number of miles, though they happened to be machines already partly worn out in training. Only eight tanks were sent out, which was far too small a number to enable any very important result to be obtained in a field where the bold use of tanks in force might have had a decisive effect. The terrain favoured their action, and the strength of the defence, doubtless owing to German influence, lay largely in machine-guns. Their entry into action was not a surprise, for the enemy were aware of their arrival in the country; and they were used on two occasions only, at the second and third battles of Gaza, on April 17 and Nov. 1 1917, all the machines taking part.

Though the tasks set before them at both battles would have been more suitable to a force of machines five times their number, they rendered in each case great assistance and saved much loss of life. As a result of their help, which was greatly appreciated by the infantry, who were, of course, chiefly affected, an effort was made early in 1918 to obtain a number of "Whippet" machines for action against the Turkish rear-guard during the further advance. But this demand synchronized with the German offensive on March 21, and no machines could be spared for a theatre peculiarly suited to them.

So far an outline has been given of the main tank operations, and the development and expansion of the unit. The former showed a gradual increase of the scale on which recourse was had to the machines, and an elaboration in the preparations made and the tactics applied. From the 49 fighting tanks which were allotted to the attack at Cambrai, the number rose to 580 of all types at Amiens nearly two years later, the latter being the greatest British tank action fought. And, according to the preparations which were being made at the time of the Armistice, any great offensive in 1919 would have been conducted with thousands of British tanks alone, leaving out of consideration the equally large numbers of French and German machines that would have been engaged.

By Aug. and Sept. 1918 the type of heavy fighting machine had been improved in design, reliability and speed, and a faster medium tank had been introduced. Measures had also been taken to equip, for cross country work, all the battle services for the tanks. There were fighting tanks; supply tanks, to carry up ammunition, drinking water and stores; gun-carrier tanks, used for the same purpose, as well as for conveying artillery and trench mortars, both sometimes dragging sledges similarly loaded; wireless signal tanks; salvage tanks; all working on a coördinated system toward the maintenance or pressure on the enemy with the maximum of efficiency. And to assist in doing this there was a complete repair organization, the central workshops, with its advanced stores and salvage companies. For a major operation, the system of attacking with a small number of machines divided up into separate detachments had been abandoned and the proper tactics of mass attack in as large force as possible in definite formations to meet different conditions, with reserves to keep up the advance, had been adopted. Signal

[1] *Tanks in the Great War*, Col. J. F. C. Fuller.

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units had been formed. The elementary system of signalling with flags and with daylight lamps to aeroplanes had been elaborated, pigeons were used, and wireless signalling had been reintroduced, and wireless telephony with aeroplanes had been tried, but not with much success. Intimate coöperation with low-flying aeroplanes had been organized, especially in the direction of noise barrages, machine-gunning and bombing the enemy, chiefly of the hostile guns, and dropping information, as also observation for counter-battery work, and smoke-screens were employed. In short the battle was organized to include and harmonize with the new instrument.

In regard to the future of the tanks, had the war not ended in 1918, certain proposals for expansion for the 1919 campaign, made at the Inter-Allied Tank Committee in Jan. 1918, were again brought up in July, and new establishments for the increase of the Tank Corps to a strength of 34 battalions were sanctioned in Oct. This strength, together with the number of some 6,000 machines which it was hoped to produce for 1919, is in itself evidence of the importance attached to the tank arm at the close of the war. Its strength in the field in Oct. 1918 amounted to 12,355 of all ranks, whilst many thousands more were under training at home.

The work of designing and producing the different types of machines which took the field, or were almost ready to do so, necessitated a very large organization. In addition to the Medium Mark A. (Whippet) machines, of which, as has been stated, delivery began in France at the end of 1917, the following types were evolved.

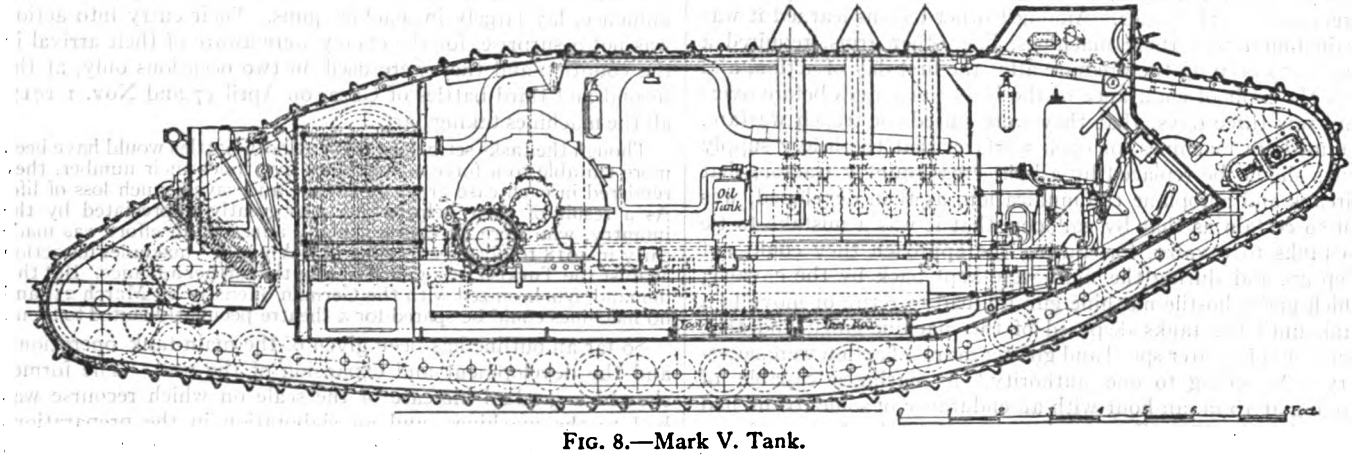

FIG. 8.—Mark V. Tank.

The Mark V. tank (see fig. 8 and table A). This was in design and size the same as Mark IV., but it was superior to it in the following particulars:—The engine, a 6-cylinder Ricardo engine of 150 H.P., was more powerful and was expressly designed for the tank. The manœuvring powers were improved by one-man control and an epicyclic gear. The means of observation were improved. The unditching gear could be worked from inside the machine. Better means of clearing the tracks of mud were provided. The design for this was begun in Oct. 1917 after the experiences of Messines and the third battle of Ypres, and was to meet the requirements as then known. Some of these machines reached France in time for the attack on Hamel on July 4 1918, and this tank was the principal machine of all the subsequent fighting. In all, 403 were made.

The Mark V. Star tank was the same as a Mark V. machine, with 6 ft. added to the middle of its length. It could cross wider trenches (14 ft.) than the Mark V. machine, and could carry about 20 men in addition to the crew. The design was not started till Feb. 1918, 32 machines being made, of which some were delivered in time for the battle of Amiens. The tank was too long to be very handy.

The Mark V. Two-Star tank was the same as the Mark V. Star, but with a 225-H.P. Ricardo engine. Design was started in May 1918, one being made but not delivered before the Armistice.

The Mark VI. tank was intended to be the same size as the Mark IV. with an improved transmission (the Williams-Janny variable speed gear), but did not get beyond the design stage.

The Mark VII. tank. This was 3 ft. 6 in. longer than the Mark IV. and Mark V. It had a 150-H.P. Ricardo engine and a variable speed gear. Seven were made, but none was used in the field.

The Mark VIII. tank. The design for this machine was commenced in Dec. 1917; seven machines were made, but none was employed in the field. It was larger (34 ft. 2½ in.) than any other tank, and was designed so as to be made up of parts manufactured in England and the United States, and was to be engined either with the American 300-H.P. Liberty, or the British 300-H.P. Rolls-Royce, engine. The engine-room was separated from the fighting-chamber by a bulkhead and the ventilation was improved.

The Mark IX. tank (Infantry tank). The design for this was begun in Sept. 1917. Thirty-five machines were made, but none was actually used. It was a long machine with space in the centre to carry 50 infantry or 10 tons of stores.

The Medium B (Whippet) tank. The design of this, which differed from that of the Medium A, was commenced in June 1917. The shape was more like that of the heavy tanks. It had a four-cylinder 150-H.P. Ricardo engine. Forty-five machines were made, but none used. In all, 2,636 British tanks were constructed.

The production of the tanks on the first order for 150 which, were in action in 1916, six months after the order had been placed, was, as has been said, a remarkable achievement. After that time supply was carrried out by the Mechanical Warfare Supply Department of the Ministry of Munitions, working in conjunction with the War Office and G.H.Q. in France. The subject was handled by a succession of committees, composed of those concerned, which endeavoured to obtain coöperation and the allocation of responsibility as between the army, which demanded machines and changes of design, etc., and those who had to meet these demands. In Aug. 1918, control was taken over by a Tank Board, to coördinate all sides of the question of supply. There were naturally considerable difficulties in administration of the production side of this weapon improvised during hostilities, at a time when the manufacturing resources of the country were already deeply committed in satisfying the urgent demand for munitions of other kinds. The lack of continuity in the demands, also, which fluctuated as the value of the tank varied in the opinion of the army in the field according to its success in action, made continuity of work and accurate forecasts of output almost impossible. There were also questions of obtaining the necessary labour, manufacturing facilities, raw materials, and that of priority amongst so many competing requirements for carrying on the war. The problem was complicated by the multiplicity of special component parts and fittings required, the great wastage of machines from action in the field, and the quite unexpected wastage by wear and tear of certain parts, some of which, as the design of the machines developed, became obsolete before they could be used; and there were the technical difficulties of ensuring efficiency in details, of which the only test could be use in the field.

A great expansion in the sources of supply became necessary as the programmes of construction increased in size, and many engineering firms were engaged in the manufacture of the tanks in addition to the comparatively small number concerned in 1916 and 1917. Before the Armistice the supply of tanks was considered so important that men were relieved from the army to carry on production. The programme for 1919, including Inter-Allied production, which covered over 6,000 machines, required 193,000 tons of steel, 10,000 6-pdr. guns and 30,000 machine-guns, and an expenditure of £80,000,000. By the end

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of the war, tanks were accepted as being the best and most economical means of arriving at a decision in the field, as the ratio of results obtained to material and man-power absorbed was greater than from any other means. In England development in design has since continued in the direction of the evolution of tanks possessing greater speed and a greater radius of action than that of the more or less embryonic machines which were evolved during the war, and also in the production of machines which can function either on land or on water. Success in these directions will endow the machine, originally improvised with the limited object of assisting the infantry to break through an entrenched line, with far greater powers.

French Tanks

It is not remarkable that allies fighting a common enemy, side by side in the same theatre of war and subjected to similar conditions, should have evolved a similar means of meeting them. And it would have been natural had they done this simultaneously, in a common effort, or at least with mutual knowledge from the beginning on the part of each of what the other was doing. Curiously enough, this was not the case with the British and French, the two nations concerned in the creation of the tank. Forced into being by the same causes, a remedy for the same disease, even suggested in form by the same mechanical prototype, the British tank and the French *Char d'Assaut* were conceived separately, and for many months developed on independent lines, the British ignorant of French intentions and the French ignorant of what the British were doing. In the case of the latter, as of the former, it was the difficulty experienced in carrying out the pre-war theories of infantry attack against a prepared defensive which finally led to the new machine, though the effect of the H.E. shell of the French field gun may have prevented its necessity being felt so soon.

The French owed their tank[1] to the foresight and pertinacity of Col. (later Gen.) J. B. E. Estienne of the artillery, who, during the retreat of 1914, perceived the desirability for having some means of transporting infantry under cover across obstacles and swamps and ploughed land. Later, during the summer of 1915, on seeing the caterpillar gun tractors in use in the field by the British, his ideas took a more concrete shape in the direction of a *cuirassé terrestre* (land battleship). This was to be a caterpillar-propelled machine 4 metres long, 2·60 metres broad, 1·60 metres high, weighing nearly 12 tons. It was to be provided with a petrol engine, to travel at a speed of 6 m. per hour on the flat, to be protected by armour up to 20 mm. in thickness, to carry an armament of two machine-guns and one light Q.F. gun for the attack of machine-guns behind shields, and to be capable of crossing trenches two metres wide and forcing its way through barbed wire. It was also to draw an armoured trailer carrying 20 men and equipment. This was worked out in greater detail, but was in essentials the same as the scheme put forward in England in Oct. 1914, except that as projected the *cuirassé* was to be somewhat of a hybrid between a tug to haul a transport filled with men and a fighting machine, and not purely a destroyer which would open out a way for men to advance on their feet. Actually, however, both types were developed as fighting machines. Both, also, were inspired by the Holt tractor, of the existence of which the British originator had knowledge before the war, and of which the French originator first became aware when he saw it at work behind the British lines. Before these machines were introduced by the British in the early part of 1915 for moving heavy artillery, tractors on the caterpillar system were practically unknown in France. Later some brought over from Tunis were employed with the army of the Vosges. After communicating with the commander-in-chief, Col. Estienne on Dec. 1 1915 put forward his ideas in an official letter with a request for an interview. This took place on Dec. 12, which date can be taken as marking the official conception of the French tank. After consultation between Gen. Joffre and Col. Estienne, and discussions between the latter and representatives of the Renault and Schneider works during Jan., the French Army H.Q. submitted to the Ministry of War a demand for 400 tanks. These were to be of the design prepared jointly by M. Brillé of the Schneider Creusot Works, and Col. Estienne. For the French, therefore, this was the commencement of the solution of the problem of mobile protection for the infantry.

In regard to the French tanks, the year 1916 can be taken as one of gestation. The year 1917 covered the birth and infancy of the medium (Schneider and St. Chamond) tanks; the first half of 1918 the adolescence and maturity of the medium machines and the birth of the light (Renault) tank; and the last half of 1918 the adolescence and maturity of the light machine. But the period of gestation before the birth of the new arm, *i.e.* the appearance in the field of the *Artillerie d'Assaut*, or "A.S.," was, as in the case of the British Tank Corps, somewhat lengthy. Its promoters still had much opposition and many obstacles to overcome, for the question of production was handled by more than one department or directorate, a state of things which is usually bound to result in friction and delay. It appears, also, that whilst some officials were impressed with the vital urgency for expedition others were more concerned to conduct matters in accordance with the regular routine of peace procedure. But there was no intervention by an outside department or ministry to save the situation. It is not on record that the French Ministry of Marine collaborated in the creation of the *Chars d'Assaut*. On Feb. 25, after some inter-departmental discussion and trials of a baby Holt tractor, and without waiting for the construction of any experimental machine, an order was placed with the Schneider firm for 400 tanks, then called *tracteurs Estienne*, afterwards known as *Chars Schneider*, to be delivered within six months. This was only two weeks after orders had been placed by the British for the first 100 Mark I. tanks. So far the comparative progress in development of the new arm by the two nations had been as follows:—the idea of the tank had occurred at about the same time to both; the matter had been put forward officially by the British in the third month of the war and by the French 14 months later; the first actual order for machines, given by the British 18 months after war began, was followed by that of the French only a few days later. The British machines, however, took the field six months before those of their Allies. In addition to the 400 Schneider tanks a contract for 400 more machines of a different type was placed with the St. Chamond Works in April, without the knowledge of the commander-in-chief or of Col. Estienne.

Not long afterwards steps were taken for the formation and training of personnel for the new arm at Marly-le-Roi. In June French H.Q. received from British G.H.Q. official intimation of what was being done in England. Col. Estienne visited England, and after inspecting the Mark I. tank in the training area at Elveden reached three conclusions. One was that the two countries should collaborate in the production and coöperate in the use of the new weapon in the field. The second was that neither should forestall the other in employing it and so discount its maximum value for the Allies as a whole. On this Col. Estienne was specially insistent, because it was apparent that the British were far ahead in production and would probably be ready before the French. The third was that as a complement to the heavy, somewhat slow, British tanks, capable of negotiating almost any obstacle, the French should specialize in the production of a speedier and more handy machine, which would be to the British tank what field artillery is to heavy artillery, would perform the duty of a swarm of skirmishers in armour armed with a machine-gun, and would be capable of going wherever an infantry soldier could go. The scheme for light tanks did not meet with a favourable official reception, and sanction for the construction of 50 machines of this type was not given. Nevertheless designs were put in hand by the Renault firm and at the end of Nov. were so far completed that construction could have been started. Though no executive action was taken for some months, except that 150 machines for use as "command" tanks for the units of the *Artillerie d'Assaut* were given, this was the genesis of the Renault tank.

[1] For convenience the word "tank" will be used generally to describe the French machines.

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The French classified tanks in three categories:—

Chars legers, machines weighing under 10 tons.

Chars mediums, machines weighing 10 to 30 tons, which could be transported by rail on ordinary trucks.

Chars lourds, machines which would require specially constructed trucks for transport by rail.

As the medium tanks were the first constructed and used, their description will be given first. Both the Schneider and St. Chamond tanks were smaller and lighter than the British Mark I. or any subsequent pattern of heavy machine, and were, according to British nomenclature, males. The great difference between them and the British heavy tanks was that the designers of the former, in taking the caterpillar tractor as a model, had been content to employ tracks somewhat similarly placed under the body of the machine, and not extending all round it as in the case of the British heavies. The tracks were also shorter

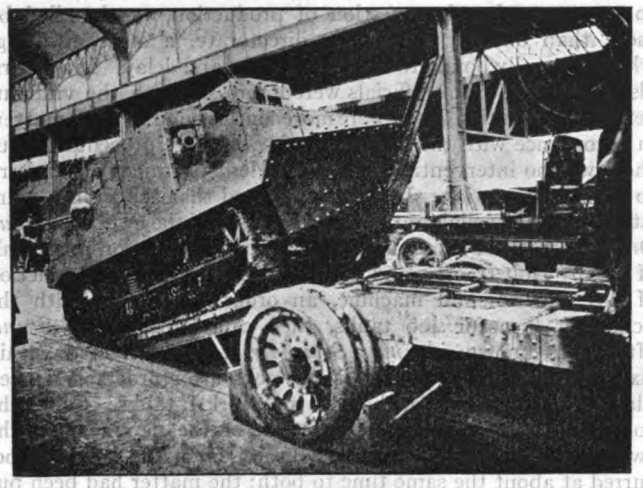

FIG. 9.—French Char Schneider.

than the full length of the body, instead of projecting well beyond it, at least at the front, as was the case with the British Whippets, and the French Renaults, and both tanks had a particularly "underhung" appearance. It was this arrangement of the tracks which militated against the climbing powers of the machines, whilst their comparative shortness limited the spanning powers across a trench.

The *Char Schneider* (see fig. 9) was 6 metres in length, 2 metres in width and 3·40 metres high. It consisted of an armoured body resting on two horizontal girders with the necessary bracing. The weight was taken by springs on two bogies on each side, which were carried by the track rollers. The track was actuated by a driving sprocket at the rear, there being an idle wheel at the front. The gear-box was at the rear, the radiator in front. Power was given by a four-cylinder Schneider engine of 60 horse-power. The petrol feed was by pressure. Steering was effected by driving the tracks at different speeds. The whole body formed a box of somewhat peculiar shape protected by hardened steel plate of 11·4 mm. thickness on the walls and 5·4 mm. on the roof. There were various openings with movable shutters for observation, etc., and the door was at the back. In front was a steel prow, or beak, to prevent the machine dipping too much when descending into a cavity. The armament consisted of one short 75-mm. gun, of a maximum useful range of 600 metres, mounted on the right cheek of the bows of the machine which could from its position fire only on the right side and not directly ahead. There was also one Hotchkiss machine-gun on each side firing through a spherical shield mounting. For the gun 90 rounds of ammunition were carried and for the machine-guns 4,000 rounds. One officer, one N.C.O., and four men, of whom two were machine-gunners and one a gunner, formed the crew. The officer drove. The total weight of the machine was 13·5 tons and its useful speed from 2 to 4 km. per hour. It could cross trenches of from 1·50 metres to 1·80 metres in width, and carried petrol for 6 to 8 hours' work.

The *Char St. Chamond* (see fig. 10) was a larger and heavier machine. It was 7·91 metres in length, 2·67 metres in width and 2·365 metres or 2·35 high, according to the pattern. It consisted of an armoured body in suitable framework suspended on spiral springs on three bogies on each side, which were carried by the track rollers. The drive was through the rear sprocket. The driving mechanism was petrol-electric and consisted of a four-cylinder Panhard engine of 80–90 H.P. with electric self-starter, a dynamo of 52 K.W. power and two electromotors, one driving each track. Driving was done by a "tramway" control, by which speed and direction were regulated. This system had great conveniences, for the machine could be driven from either end without effort, but it had the drawback of being somewhat complicated and delicate. The petrol feed was by pressure, and the tanks were two superimposed on the left side and one on the right. The whole body formed a box with a square sloping front without any beak. It was enclosed in hardened steel plate of 11 mm. thickness in the front shields, and 8·5 mm. at the sides and 5 mm. on top. On the roof there were three observation cylindrical *capots* with sides of 11-mm. steel above the commander's and driver's ports. The doors were at the sides. The armament consisted of one 75-mm. field gun, except in the first 175 machines which had a special gun, firing ahead in front, and four Hotchkiss machine-guns, one in front to the right of the gun, one on each side and one on the rear face. For the gun 106 rounds of H.E. were carried and for the machine-guns 8,488 rounds of S.A.A. The total weight, loaded, was 24 tons, and its useful speed on the flat 8·5 km. per hour. It could cross trenches up to 2·50 meters in width in good soil. The petrol carried was enough for from 6 to 8 hours. The crew consisted of one officer, one N.C.O., two gunners, four machine-gunners and one mechanic, or nine in all.

During Sept. the first tank of each type arrived at the training centre, where a considerable number of officers and men from different branches of the Service had already collected for preliminary individual instruction. An additional training centre for the formation of units was established at Champlieu, and also a depot for the assembly of *matériel* at Cercottes, near Orleans. It was then decided, also to create the new "*Artillerie d'Assaut*" and the charter of this organization may be said to date from the 30th of that month. Col. Estienne was promoted to the rank of general, and was appointed "*Commandant de l'Artillerie d'Assaut aux Armées*" and representative of the commander-in-chief in tank matters with the Ministry of Munitions, which department had been created and taken over tank production. In Oct., with the arrival of more machines of both types, the *Artillerie d'Assaut* started on its career. It seems that the use of the British tanks at Cambrai, which had been deprecated by the French beforehand, and criticized for the reasons already stated, may have stimulated the French to press on with their own service, though what had been looked upon as the supreme factor of surprise had been discounted.

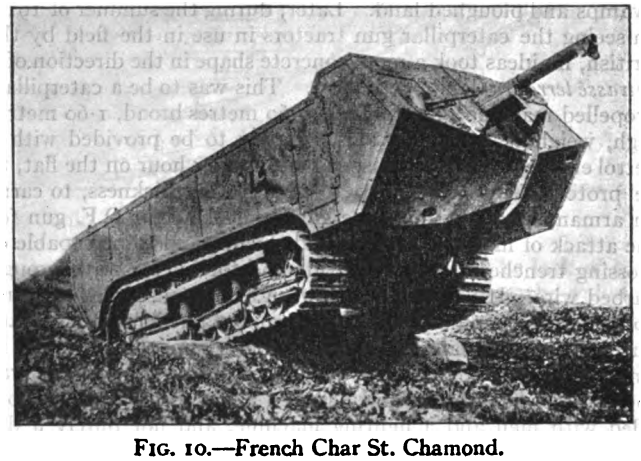

FIG. 10.—French Char St. Chamond.

The work of preparation, including training and equipment, continued throughout the winter, in preparation for the offensive to be undertaken in the spring of 1917. On March 31 1917, the organization of the *Artillerie d'Assaut*[1] was as follows: The tactical unit, under a captain, was the *groupe*, which was divided into four batteries, each consisting of four tanks. A *groupe*, therefore, comprised 16 tanks with a special "command" light tank (Renault). For a Schneider tank *groupe* the establishment was 18 officers and 92 other ranks, for a St. Chamond tank *groupe* 18 officers and 106 other ranks. A *groupement* consisted normally of four Schneider or three St. Chamond *groupes*, but was not rigid. For repair work each *groupe* had its own workshop and a *Section de ravitaillement et de reparations*

[1] Why this arm was ever called "artillery" is not clear. Its closer connexion with, and resemblance to, infantry was recognized later, and the names of the elements of the organization for the light tanks followed those of the infantry, *e.g.* battalion, company, etc.

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(S.R.R.), of 1 officer, 111 other ranks, was allotted to every 10 *groupes*. There was for the whole unit a *Section de pare*, or repair park, similar to that of the Mechanical Transport Service. This was found necessary so soon as tanks had been delivered in any number, owing to the amount of tuning-up, minor repair work and even alterations which had to be done.

Numerous faults at once developed in these entirely new machines (as had been the experience of the British), but thanks to the time available before they went into action, certain defects were discovered and remedied. The first was that some parts of the machines wore out very quickly, necessitating the maintenance of a very large stock of spares. The thickness of steel plate where vertical was not proof against the German "K" bullet, and it was found necessary to add an outer plate of 5·5 mm. to the vertical armour of the Schneider machines, and 8·5 mm. to that of the St. Chamond machines. On the whole the defects discovered in the Schneider tanks were not such as to give reason to suppose that they would not be able to go into action in the spring; but those of the St. Chamond were more serious. The design was found clumsy and the machine liable to ditch. In addition to breakdowns in the power system and failure in details, there was a lack of rigidity in the whole machine, and the tracks of the first machines were too narrow.

Delivery of both types was extremely slow, especially of the St. Chamond machines. At the end of March, though personnel for 15 of the latter was ready, there was not one machine serviceable. At this time, on the eve of the great 1917 offensive of which so much was expected, the *Artillerie d'Assaut*, instead of being in possession of the 800 tanks which were to have been ready by the previous autumn, had received not more than 208 Schneider and 48 St. Chamond machines. There were for this operation, therefore, only 8 fully and 2 partly trained *groupes* of Schneider and 1 of St. Chamond tanks, and not 40 *groupes* as originally contemplated; and of the 160 Schneider machines only one had been fitted with the extra bullet-proof protection. In view of the diminution of the tank force from what was expected to be available, and with the example of the result of the action of the British in the previous Sept. before it, the French High Command had grave doubts whether to make use of tanks in the coming operations or to wait until there should be sufficient to exercise a greater influence. It was finally decided to throw all possible weight into the attack.

April 16 was the baptism of fire of the French tanks, in Gen. Nivelle's unsuccessful attempt to break through the German line along the Chemin des Dames, E. of Craonne.

Eight Schneider *groupes* coöperated with the French V. Army. They were divided into two parts of three and five *groupes* respectively. One party did not succeed in crossing the German line, though a few machines reached it, and it suffered severely from the enemy's guns posted on the Craonne Plateau. The other party succeeded in crossing the enemy's second line, but were not followed up by the infantry, owing to the German machine-gun fire. Two Schneider *groupes* and one St. Chamond *groupe* allotted to the French IV. Army for employment on the 17th were not thrown into the fight, as the German artillery observation posts were not first captured by the infantry—a lesson of the action of the 16th. The offensive failed; and though the new arm showed the utmost devotion and gallantry, and its intervention saved many lives, it did not achieve the success that was hoped. But the conditions were almost as unfavourable for the employment of tanks as they could be, and the tactics employed were not those urged by those responsible for the new arm. The attack was not a surprise, being preceded by a heavy bombardment, which, however, did not succeed in overcoming the German artillery, and was made in broad daylight, without any smoke-screen, against a position which permitted of direct observed artillery fire against the tanks both when approaching and when they reached the enemy's positions. The plan, also, in which certain infantry units had been trained to coöperate, was that the tanks were to attack the German third defensive line after the infantry should have gained the first and second, and were not to advance until after this had been achieved. The Germans, who were prepared for the attack, therefore, had even additional time before the tanks appeared, and the result was that their guns caught many of the machines in column before they deployed.

The machines themselves showed certain faults—they were deficient in speed and climbing capacity, the latter defect being accentuated by the fact that since the Somme the Germans had increased the width of their trenches. They also proved, as was known before would be the case, vulnerable to direct hits of H.E. shell, by which many machines were set on fire. Amongst other points of design in which modification was found necessary was that of isolating the petrol tanks from the interior of the machine, improving the means of communication, the power of observation, the ventilation, and various details of mechanism, and of widening the tracks. On the whole the Schneider machines stood the trial best.

In the next tank attack, carried out on May 5 by the VI. Army, the battle of Laffaux Mill, the three *groupes* employed advanced with the infantry with marked success, especially in the case of the Schneider machines. The counter-battery work of the French was good and the enemy observation posts were destroyed or masked; and the tanks did not remain too long in advanced positions where the infantry were checked.

For nearly six months the tanks did not again go into action. During this period great efforts were made to remedy the defects disclosed, to expedite the delivery of machines, which was much in arrears, and of spare parts, the demand for which (as in England) had been found very greatly to exceed any anticipations, and to augment the establishment of repair units. In preparation for the next operation great care was taken in the training of infantry with the tanks in attack and in tank tactics generally. On Oct. 23 five *groupes* of tanks took part in the battle of La Malmaison along the Chemin des Dames. Their assistance was most valuable.

Owing to previous heavy rain, and the bombardment which had continued for six days and six nights, the ground was extremely difficult, and in the centre the tanks were not of so much help in the first phase of the attack as later. This state of the ground and the lack of surprise again discounted to a great extent the preparatory training undergone by the units of the *Artillerie d'Assaut*. The practice which had been carried out beforehand with the attacking infantry, however, proved of great value, as did the work of the special unditching sections. The ground had been carefully reconnoitred and aerial photographs supplied. The Germans relied on this occasion more on their advanced field guns for defence, and had also organized numerous special machine-gun posts furnished with plentiful supplies of armour-piercing ammunition. But owing to the counter-battery work of the French the tanks were not so much damaged by the German guns as in April, in spite of the fact that the attack was not a surprise. Two days later some St. Chamond machines again operated with success.

Apart from the projected light tanks, the necessity for an improved medium tank had been realized before April 1917, and the subject was under consideration throughout the year. The main directions in which the April offensive showed improvement to be necessary were the desirability of mounting the gun in a turret to give all-round fire, of mounting a 75-mm. field gun in place of the shortened 75, and of increasing the size of the tracks and the power of the engine. Designs for a new medium machine (C.A.3) were prepared in Aug. 1917, but were abandoned after the battle of La Malmaison because the further improvement then found desirable, *i.e.* the provision of 6 to 7 H.P. per ton weight, a trench-crossing capacity of 3 metres, and an ability to climb ahead or astern, showed that the designs were already out of date, and would be more so by the time the machines could be made. At the end of Oct. it was decided to suspend the construction of an improved type of medium tanks and to concentrate on that of the light machines; and in Dec. the idea was finally dropped. The question of providing heavy tanks was taken up at the end of 1916 as a result of the operations of the British machines in Sept., and in order to have available a machine which would be complementary to the light tanks it was hoped would be made. A project was put forward for a heavy tank weighing 38 tons to carry a 105-mm. gun, but its execution was postponed in view of the demands that might be made for other machines. Two experimental heavy tanks, one with mechanical and the other with electrical transmission, were tried, and it was decided to investigate in the direction of still heavier machines.

In regard to the type which will always be especially associated with the French, the *Char leger*, or Renault tank, first suggested by Gen. Estienne in July, and for which designs were prepared in Nov. 1916, the commander-in-chief in that month expressed his desire for 1,000 of such machines. But whereas those responsible for supply had, in the case of the medium tank, pressed forward the construction of one type, the St. Chamond, without military approval of the design, in the case of the Renault every obstacle seems to have been placed in the way of manufacture of this machine, for which army H.Q. and the *Artillerie d'Assaut*

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were pressing throughout the winter, though various trials were made. In March 1917, the demand of army headquarters was increased, being based on the requirements for an offensive on a 100-km. front. This entailed the production of 3,000 light, 400 medium (improved Schneiders) and 150 heavy tanks. In May an order was given for 1,000 Renault machines in addition to 150 which had been ordered in March as "command" tanks. Discussion as to design, armament and manufacturing facilities and trials continued during the summer of 1917. In Oct. it was settled that in addition to the 1,150 already on order, 2,380 more should be made, or 3,250 in all, the work being distributed between four French factories, the whole to be delivered by the end of July 1918. Of the total, 1,000 machines were expected to be ready by March 31 1918, for the contemplated offensive in the spring, and 1,000 were to be manufactured in the United States, of standard American parts and equipped with Liberty engines. The decision to devote so much money as this entailed and so much of the manufacturing power of the nation at a moment when the demands for munitions of war of other kinds was at its height illustrates the importance now attached to the new arm. The British success at Cambrai seems to have had considerable effect in influencing those who were still sceptical of the value of the tank and of the wisdom of relying on it for future operations. In Jan. 1918 a supplementary order was placed for 470 machines, the final total figure fixed for production in France being 4,000, divided into 1,000 armed with machine-guns, 1,830 with the 37-mm. gun, 200 signal tanks, and 970 for a reserve armed with the 75-mm. gun.

The Renault tank differed greatly from the Schneider and St. Chamond machines. Not only was it considerably smaller, but the tracks were outside the body and not underneath it and extended to a considerable distance in front. Its total length, without the movable tail, was 4·100 metres; its breadth 1·740 metres, and its height 2·140 metres. The body was supported on hollow longitudinal girders by a hinge arrangement at the rear end and suspended on powerful springs in front so that the front of the frame and body were capable of relative movement. Each girder was carried by springs on four bogies supported by wheels running on the tracks. The idle track pulley in front was of larger diameter than the driving-sprocket at the rear and this and the projection of the tracks gave the machine a greater grip in climbing over obstacles. The upper portion of the track ran in spring guide rollers which were arranged to regulate the track tension automatically. The interior of the tank consisted of a driver's compartment in front and the engine-room behind. The crew comprised two, one officer or N.C.O., who was also the gunner, and one man who was the driver. The driver was seated; and also seated, or standing, behind him was the gunner, with his head and shoulders in the turret. The latter revolved on ball-bearings which allowed of all-around fire, and was furnished with a lock and a door at its back. The whole of the machinery, engine, radiator, clutch, transmission gear and petrol tank were in the engine-room, separated by a steel bulk-head pierced by openings closed at will from the driver's compartment. Power was given by a four-cylinder Renault engine of 35 H.P., with the usual transmission. Steering and control could be done by one man. Protection consisted of hardened steel plate 16 mm. thick for the vertical portions (proof against the armour-piercing bullet) and 8 mm. for other parts. The armament was either a 37-mm. Puteaux semi-automatic gun, or a Hotchkiss machine-gun; and 240 rounds including 40 rounds of case shot, or 1,820 rounds of S.A.A. were carried. Fully loaded the female weighed under 6½ tons and the male just over 6½ tons. There were four speeds ahead and astern giving to the tank a maximum speed on the flat of 7·78 kilometres. It could climb slopes up to 45° and span openings up to 1·80 metres in width, in which it was assisted by the movable tail. This was the machine upon which the French relied for the operations of 1918. The question of the provision of Renault wireless signal tanks was taken up in May 1917, and a machine capable of sending and receiving wireless messages was constructed.

In the autumn and winter of 1917 the reorganization and training of the *Artillerie d'Assaut* continued with a view to its expansion. In addition to the medium tanks still being delivered, it was expected, by March 31 1918, to receive 800 of the Renault tanks then due. The establishment of the *Artillerie d'Assaut* was tentatively fixed as follows:—four *groupements* (16 *groupes*) of Schneider tanks, with four repair sections; four *groupements* (12 *groupes*) of St. Chamond tanks, with four repair sections; 36 companies of Renault tanks; one *groupe* depot for Renault tanks; one salvage *groupe;* three park sections. The number of Renault companies was fixed at 30 before the end of the year. The organization of the Renault tanks, which were regarded as an infantry arm, was to be by sections, companies, battalions and later by regiments and brigades. A company comprised three sections of five tanks each and an *échelon de combat* of 10 tanks (of which one was a wireless signal tank),[1] or 25 machines in all. A battalion contained three companies of 75 tanks. Changes were made in the administration, and Marly-le-Roi was given up as a training centre, two army group-training centres being established at Mailly-Poivres and Martigny, the training facilities and auxiliary services generally were increased and elaborated, and the relation of the *Artillerie d'Assaut* to the Ministry of War was defined and simplified. All these preparations were carried out with a view to the coöperation of the tanks in the French offensive in the spring.

When the German advance on March 21 1918 wrested the initiative from the Allies, amongst other results it upset all the plans carefully worked out for the French tanks. Instead of taking part in mass in a great offensive, as intended, whatever tank units existed had now hurriedly to be collected and thrown into the defence. The factor ruling the speed of the creation of the service had all along been the rate at which the *matériel* was delivered. This, for various reasons, was always much behind the scheduled time arranged. On March 21 the medium tanks in a serviceable state fit for immediate use amounted in number to 245 Schneider and 222 St. Chamond, or 467 machines of an obsolescent type, and of the new Renault tank 1 machine ready for action, with the army. (By the beginning of April over 400 had been turned out by the factories. But these were made up of training machines without armament or armour, pattern machines, machines issued to the American army for training, and those under test.) Moreover the approach of the Germans necessitated the hurried evacuation of the tank centre and main park at Champlieu. And so, not only was the new arm, still in its early infancy, forced to face an entirely fresh situation with improvised measures, but part of its organization was suddenly torn up almost before it had taken root. Great efforts were made both to assist in coping with the immediately urgent necessity of checking the enemy's advance and to prepare for subsequent action. Champlieu was reoccupied in the beginning of April, when the progress of the Germans to the north was checked; but a central reserve park farther from the front, near Fontainebleau, and three others were established.

Operations during April and till the end of May were confined to the medium tanks, which alone were available and mobilized. Four *groupements* of Schneider machines were allotted to the III. and I. Armies, joined later by three of St. Chamond machines. All the actions now undertaken were, as was the case with the British tanks, of the nature of minor counter-attacks, and not such as the tanks were best suited for. They took place, on April 5, at Grivèsnes; on April 7 at Sénécat; and on April 8 at Cantigny, the last being in coöperation with the American troops. The most successful was the last, in which the action of tanks had been legislated for. The artillery bombardment was short and portions of ground were left unshelled to allow of the passage of the tanks. Though not actually fighting, the tanks were at this period continually being moved about in readiness, and to save wear and tear the system was adopted of transporting them by road on special "tugs" drawn by caterpillar tractors.

On May 31 the Renault machines received their baptism of fire on the E. of the Forest of Retz. Three battalions of these machines now ready were allotted to the VI. Army, and were brought up by train, on lorries and on tugs. Six sections had to be flung into the fight. Without previous reconnaissance or any liaison with the already exhausted Colonial infantry, who had never seen a tank, they had practically to make a cavalry charge in broad daylight, without a smoke-screen, across a mile

[1] Owing to delays in manufacture and difficulty in technical training the first wireless signal tanks did not take the field until July 1918, when after some practice they were found of great value. As has been stated British tanks were fitted with equipment and trained operators ready for the field in July 1916.

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of open plateau under observation of captive balloons and without effective support from their own guns. One condition favoured their action; their attack was a surprise.

Though the tanks succeeded in clearing the enemy out of their positions, their success had no tactical result, for the infantry could not follow up and consolidate the ground gained. But they caused panic, and inspired a nervousness and hesitation amongst the Germans which was invaluable at the moment. This and their subsequent actions carried out during June served to prevent the enemy from penetrating into the forest.

Meanwhile, four *groupements* of medium tanks led and greatly assisted Gen. Mangin's counter-stroke at Méry-Belloy on June 11 against the flank of the German salient between Noyon and Montdidier, by which the enemy's progress toward Compiègne was arrested. The tanks played a great part in this operation which had such strategic importance, but this action was the high-water mark in the career of the medium tanks, for they were becoming worn out and were gradually replaced by the new and more efficient Renault tanks as the latter were produced.

By July considerable progress had been made in organizing and equipping fresh units, and the *Artillerie d'Assaut* was able to coöperate on a large scale in the battle of Soissons, Gen. Foch's decisive counter-stroke of July 18 and following days, against the German salient formed between Château-Thierry and Reims. This was the vindication of the French tank arm. To the X., V., and VI. Armies were allotted respectively six, one, and one *groupements* of medium tanks, and to each three battalions of Renault tanks, or a total for the operations of eight *groupements* of medium and nine of Renault tanks. The battle, which lasted from July 18 to the 23rd and 26th, so far as the tanks were concerned, formed a turning point in the war. The entire operation was based on the action of the tanks; every available machine was thrown into the fight; and they were given a chance of showing what they could do.

The tactics employed were those which had been urged all along by Gen. Estienne and M. Breton, and were a repetition of those initiated at Cambrai. The attack opened with the advance of a mass of tanks without preliminary bombardment, as it happened, in a slight fog, and was a complete surprise. Similar tactics on a smaller scale were made use of again after the first day, but on the 23rd the tanks suffered severely from the enemy's guns. Two battalions of Renaults acted with the VI. Army east of Reims on July 16–17, and coöperated with two medium *groupes* with the IX. Army on July 18 near the Marne, and some with the British on July 23 near Espilly. In these operations, especially the main attack on July 18, the tanks achieved what it had been claimed they would if properly used. On July 30 the commander-in-chief issued a special Order of the Day to the *Artillerie d'Assaut*—"*Vous avez bien mérité de la Patrie*," whilst Gen. Estienne was made a commander of the Legion of Honour and promoted general-of-division.

The battle of Soissons had a great effect on succeeding operations. It established the value of the tanks beyond all doubt, inspired enthusiasm in all that concerned the arm and expedited the manufacture of the machines and the training and organization of new units. Without giving even the list of actions in which the tanks took part to the end of the war, it can be said that the infantry now clamoured for their assistance, in spite of their faults and failings, and they were employed whenever possible. They were asked for by the commander of the VI. French Army when transferred to Flanders, and on Sept. 30 and several days in Oct. were in action. Some were also sent to Salonika. Out of the 120 days between July 15 and Nov. 11 they were used on 45 days, and the casualties suffered amounted to 300 officers and 2,300 other ranks. During 1918 3,988 individual engagements were fought: 3,140 by Renault, 473 by Schneider and 375 by St. Chamond tanks. Toward the end their actions amounted to disposing of the enemy rearguard machine-guns which continually held up the infantry.

By Aug. the machinery of production and training had been so improved that it was found possible to turn out one battalion of Renault tanks (75 machines) per week, which implied a vast increase in the whole of the rear organizations, which were now of a capacity for the continuance of the tank effort on a greater scale in 1919. As in England the production of tanks had become an industry. Though the construction of medium tanks had been abandoned, Gen. Estienne's opinion as to the necessity for heavy machines had not changed from the time in Feb. 1918, when he had asked for 900. But the same influences that had in 1917 retarded the introduction of the light tank were now adverse to the contemplation of heavy machines. To provide such machines an Inter-Allied factory was established, but this was not completed before the Armistice. In Oct., negotiations which had been carried on with the British Government resulted in the promise of some Mark V. and Mark V. Star tanks. Of the latter, 77 were handed over in November.

In Aug., at the instance of Gen. Foch, an Inter-Allied tank school was opened in France. It was equipped with a staff of French and British instructors and various types of British and French machines. This school was for the interchange of views and the establishment of a common basis for tactics and staff work concerned with tanks.

The reliance that had come to be placed on the *Artillerie d'Assaut* can be gauged by the fact that in Oct. 1918 its actual strength in the field amounted to 18,023 of all ranks.

Since the war the French have been continuing their development of cross-country machines. The construction of a very heavy armoured tank was in hand in 1921, while a much lighter machine, the "Kegresse," of Russian invention, had been tried. It consists of the substitution of small rubber tracks for the rear wheels of a motor-car. It is light, cheap, can travel on the flat at a speed of 15 to 20 m. per hour, and can cross any country over which cavalry can pass. An amphibious tank propelled on land by tracks and on the water by a screw has also been tried successfully.

American Tanks

Though the tank had not accomplished much in the way of results by the time that the Americans came into the war, in April 1917, its military potentialities were at once appreciated by them, while its mechanical side appealed to their national genius. But hostilities did not continue long enough for them to bring their vast resources to bear on its development. The Americans lost no time in inquiring into the subject, and at once requested information as to designs, etc. At this time there was some doubt as to whether the tanks should not be taken up by the American Marines, but the final decision was in favour of the Army. In June the commander-designate of the American Tank Corps, Col. Rockenbach, arrived in France, and an officer was detailed to inquire into the technical aspect of the tank arm. An Inter-Allied Tank Bureau was also established. In Sept. a scheme for an American Tank Corps, to consist of five battalions of heavy tanks and 20 of light tanks, was approved, and in Oct. an expert technical officer reached England to consider further the question of development.

The question of the provision of machines and spare parts, which had proved such a difficulty with the British and French, was also taken up. It was realized that in matters of design, it would be best for the Americans to profit by the experience of the British and French, whilst relying, as far as possible, on their own resources for *matériel*, and it was decided to adopt a heavy tank of the British type, and a light tank of the French Renault type. As a result of consultations between the British and French Ministries of Munitions and the American commander-in-chief as to joint production, an Anglo-American commission was appointed in Dec. to deal with the question, and in Jan. 1918, an agreement was signed by the two Governments for the manufacture of tanks in France. It contained, amongst others, the following main provisions:—that a factory capable of producing 300 tanks a month, and of being extended to turn out up to 1,200 a month, should be erected in France at the expense of the two Governments; that 1,500 machines, or more if required, should be made during 1918; that, in broad terms, in accordance with national facilities for production all the machinery should be of American and the structure and armament of British manufacture, the armour plate being of American steel, and that the first 600 tanks should be allotted to the Americans, and the remaining output as agreed upon, including sale to the French. The type of machine was to be the "Liberty" or "Allied" tank, which was the British Mark VIII. machine equipped with the Liberty aero-engine.[1] It was decided during the summer that an additional 1,500 of these tanks should be built in the United States, as well as several thousands of Renault machines. The scale of this programme shows what importance was attached to this arm by the Americans. The site chosen for the factory was Neuvy-Pailleux, near Chateauroux, and work was started there in the spring. But the building was not completed till Nov., so this scheme of joint production did not actually come to fruition,

[1] The first Liberty tank of British structure and American mechanism was assembled and successfully tried in America in Nov. 1918. One machine was constructed in England by the end of 1918.

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and although preparations were made for a vast output of machines in America, by the Armistice the manufacture had only recently reached the stage of production and only twenty odd American-built Renault machines had reached France. All the tank operations in which the Americans took part were therefore carried out with British or French machines.

As to *personnel*, in Feb. 1918, 500 volunteers from the American army assembled at Bourg in France for instruction, and from the next month onwards three companies of soldier mechanics assisted at the repair depot at Bourron. The establishment of the American Tank Corps was increased in May to 15 brigades (five per army), each consisting of one heavy and two light battalions. Owing to the lack of machines in America it was necessary to send the units of the Tank Corps for training with the machines to England and France, a camp being established at Bovington, in Dorset, the British tank-training centre, for training the heavy tank units, and at Bourg for that of the light tank units under French supervision. In addition to 25 instructional machines, with accessories and spares, previously supplied, 144 Renault tanks, the complement of two light battalions, were handed over in Aug. to the Americans. Two battalions were at once mobilized and took part in the attack of the St. Mihiel salient by the American I. Army on Sept. 12.

The entry into action of these units was somewhat disappointing. The tanks had to travel far from their positions of assembly to the battle, and on the first day they operated over such difficult ground that they did not catch up with the infantry, who were able to move forward rapidly owing to the comparatively feeble resistance of the enemy. On the second day they were unable to obtain petrol, and on the third day they did not have much fighting, but took a number of prisoners. The machines were practically undamaged by the action. Their next operations were with the French in the Argonne, where they were of considerable assistance. From this time until the middle of Oct., when they were re-formed into one company, they were continually at the disposal of the infantry commanders, but did not often take a coöperative part in action, though they travelled miles, being used mostly for reconnaissance and for attacks against strong points which had checked the infantry. After that date they accompanied the American forces in the advance right up to the end. One heavy tank battalion which had been trained in England took the field on Sept. 29 with the American II. Corps, in the attack on the Hindenburg line. On this occasion ten tanks were destroyed by running into an old British minefield, and the American infantry here suffered severely from the German machine-guns. On Oct. 8, the battalion coöperated most usefully with the American II. Corps, and again on Oct. 17, when the River Selle was crossed. Finally they assisted the British on Oct. 23 in the neighbourhood of Le Cateau. This ended the operations of the units of the Tank Corps.

The chief characteristics of the action of the Americans in regard to tanks was their quick appreciation of the value of the arm. But the extent of the preparations made for a continuance of the struggle in this as well as in some other directions prevented a greater part being played by the American tank forces in the field. Had the war continued it would have come into play with overwhelming effect.

Since the Armistice the Americans have pressed on with the development and application of the caterpillar track system for road and cross-country transport generally. Most of their efforts in this direction have been concentrated on the "motorization" of artillery traction, and a considerable amount of literature has been published foreshadowing the future ideal as elimination of the horse for military transport purposes. Experiments have been and are being carried out with different types of self-propelled vehicles on the caterpillar track, and combined wheel and track principles. One machine of the latter type recently covered 251 m. in 17 hours. Of fighting tanks, the Mark VIII. of 35 tons is still the standard heavy machine, but experiments are being made with modified Renault and Ford light tanks, and a water-crossing machine. On the whole the Americans seem to be greatly impressed with the part that will be played by machines in the warfare of the future and have made great steps in applying track propulsion to military uses.

German Tanks

In spite of rumours, the first appearance of the British tanks came as a complete surprise to the Germans. In Dec. 1913, and again toward the end of 1914, proposals had been made in Germany for an armoured automobile on caterpillar tracks; and in the summer of 1915 some experiments in this direction had been carried out; but no steps were taken to proceed with the idea. In Oct. 1916, after the appearance of the British tanks, of which they temporarily captured one, the question of constructing similar machines was taken in hand by a special commission, and drawings were prepared. Construction, however, was postponed, owing to the lack of coal and steel, and to the economic conditions generally. H.Q. appears then to have become doubtful as to the necessity for these weapons, and did not give this service first priority of urgency. This was actually not done until the summer of 1918. This lack of interest or apathy on the part of the Germans came as a surprise to the Allies, for it was anticipated that so soon as the secret was out the enemy would use every endeavour to copy and improve on the machine and press on with mass production so as to make up if possible for the start the Allies had gained. For a long time opinion in Germany remained divided as to the value of the weapon, partly owing to the mechanical imperfections of the original Allied machines and partly owing to the manner in which they were first used, especially during the summer of 1917.

Nevertheless, manufacture of a tank, known as type A.7.V., apparently the result of the deliberations of the commission already referred to, was commenced in the spring of 1917. Only 10 of these machines were ready for the offensive in March 1918, whilst not more than 20 were completed by the end of the war. Designs for a heavier type, also, were started about the same time, of which the first model was to have been ready in Dec. of that year, but it was still unfinished at the end of the war. Experimental construction of a small light tank was also commenced, and orders for these machines were placed in the summer of 1918, to be ready by the spring of 1919. This contract, also, was cancelled at the suspension of hostilities.

The French attack at La Malmaison in Oct. 1917, and then the British attack at Cambrai somewhat changed the aspect of affairs. The British tanks captured by the Germans in their counter-attack after the latter action were collected at Charleroi and repaired, and the question of production in quantity of a German tank based on the British type was considered, only to be dropped, owing to the shortage in man-power. In Jan. 1918, the first "Sturmpanzerkraftwagenabteilung" (Tank Section), of five German A.7.V. machines, was formed and brought with its auxiliary transport up to the western front for training. The captured tanks, also, were organized in sections of five machines. The personnel establishment was on an extravagant scale, no fewer than 176 of all ranks being allotted to a section of German machines, and 140 to a section of captured British machines, as against the British establishment for a similar section of 41 of all ranks. In all, three sections, comprising 15 of their own tanks, and six sections comprising 30 captured machines, were used by the Germans in 1918. Some of the latter were re-armed with 5·7-cm. Russian guns.

FIG. 11.—German A.7.V. Tank.

The description of the A.7.V. machine (see fig. 11) is as follows:—weight, 32 tons; length, 7 metres; width, 3·2 metres; height, 3 metres; armament, 6 machine-guns and one 5·7-cm. gun; protection, armour 30 mm., 20 mm. and 15 mm. thick; crew, 1 officer, 15 other ranks (mechanics, gunners, machine-gunners); power, two 100-H.P. Daimler engines, each driving one track; climbing capacity, trenches of 2·5 metres width. The German tank was a clumsy machine and a bad climber, owing to the underhung tracks. It was powerfully engined and its tracks were carried on spring bogies which enabled it to cover 8 m. per hour on the flat. The thick armour was proof against armour-piercing bullets at short range and also against light-field-gun shells; but the joints between the thick plates rendered the crew liable to bullet splashes, which was a serious defect.

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The Germans used their tanks on nine occasions in 1918, commencing with their advance on March 21, the most successful action being when they captured Villers-Bretonneaux on April 24, 12 German machines coming into action on this occasion. The result of the appearance against the British of hostile tanks, especially on this date and later, on Oct. 8 in the Cambrai sector, when 15 captured British machines were used, was sufficient to confirm their great moral effect and the feeling of helplessness engendered in infantry by them. It showed that it was not only the Germans who could not stand up against the attack of these machines, for the British infantry fell back on the report of the appearance of German tanks as did the German troops at each appearance of the Allied machines, when the Allies were pressing forward. The German tank tactics do not appear to have been very thoroughly thought out, and consisted mostly of "mopping up." This is probably due to the smallness of the number possessed by them and the improvised nature of the arm. Moreover, the belief in their own powers of the members of the tank units must have been somewhat shaken by the official propaganda campaign which had been carried out for months by the High Command to discount the effect of the British and French machines.

According to one authority, the reasons that the Germans did not during 1917 whole-heartedly take up the organization of tanks in large numbers for their great effort in the spring of 1918 were that when they first became aware of their existence it was too late to carry out the successive operations of design, experiment and manufacture in bulk; and that owing to lack of raw material and shortness of man-power the manufacture of the machines would have entailed the cutting down of the production of other war *matériel*. There does not seem to be much force in the first argument, if it be remembered that 80 British tanks were ready equipped in the field within 13 months of the receipt of the specification by the designers, and this without any existing machines to serve as patterns. All along, the attitude of the German High Command seems to have been that of the staff and not that of the troops; and great endeavours were made to inspire the latter with the official views. Though official disbelief was seriously shaken by the surprise of Cambrai, the success of the German counter-attack 10 days later was used, illogically enough, to discount the effect produced by the previous assault by tanks. There was, however, a general and absolute revulsion of feeling after the great French success on July 18 1918, and the British actions of Aug. 8 and 21, which almost amounted to panic at H.Q., and converted both critics and military authorities. There were numerous articles in the German press during Sept. severely censuring the High Command for having neglected to provide tanks for the German forces and to undertake measures against the Allies' machines. Popular opinion became so strong that a stormy debate on the subject took place in the Reichstag in the following month, when the Minister of War made an apology for the neglect to equip the German troops with this weapon. There is no doubt as to the opinion of the German army and the nation on the subject of tanks from then on to the end of the war. For months after the cessation of hostilities the tank was called "*Deutschland's Tod*"—"the Death of Germany."

Italian Tanks

A great part of the theatre of war in which the Italians were operating for so long was too mountainous for tank operations, and the question of the organization of a tank arm was not taken up by Italy until 1918. Manufacture of tanks was then started, and by the time the war came to an end one or more Fiat machines were ready to take the field, but none was actually used.

Anti-Tank Defence

The tanks used by the British and French during the war were designed to be bullet-proof only, not being strictly speaking "armoured," and were vulnerable to gunfire. The best active defence against them since they were moving targets, was the direct fire over the sights of as light a Q.F. piece as could insure penetration. Any field gun in use during the war, or light Q.F. guns of the "Pom-Pom" type, were sufficient. But as the tanks were mobile and could attack at any spot, often by surprise, to attempt to meet them with special or stationary guns in position would have entailed the distribution and locking up on the mere chance of attack of a prohibitive amount of artillery. The alternative was the provision of suitable guns themselves protected and capable of movement across country, so that they could be concentrated speedily when and where required. In other words, the correct reply to the tank was a type of male tank capable of rapid movement. The Germans eventually produced this reply in principle, in their own A.7.V. tanks, and by re-arming the male British Mark IV. machines and those of the French Schneider and St. Chamond (gunned) types which they had captured. This took place, however, too late and on too small a scale to influence the course of operations. Technically, also, the German machines failed in mobility across entrenched country. In order to effectively attack the German tanks by gunfire armour-piercing shell was required, for they were protected by hardened armour up to 30 mm. (1·2 in.) in thickness.

As the Germans were forced by circumstances to develop anti-tank defence, from which duty the Allies were almost entirely spared, the measures they adopted are here reviewed. Their action, which consisted for a long time largely of injunctions to the infantry not to lose their heads in the event of a tank attack, suffered from the continual inability or unwillingness of the High Command to take this weapon seriously, in spite of the lesson of Cambrai of Nov. 1917, till after the French attack on July 18 1918. In Sept. 1916 the Germans of course had no special means of defence against the tanks, of the existence of which they were ignorant, and these machines had an opportunity on their first appearance never to be repeated. After the Somme battle certain measures of anti-tank defence, seemingly based on a misunderstanding of the nature of the machine, were undertaken, mostly in the direction of obstacles, such as pits, etc., in roads, and indirect artillery fire. After April 1917, it was discovered that neither the British nor French tanks were proof against the "K" armour-piercing bullet with which the troops had been equipped for use against loop-hole shields, and considerable reliance was placed on this fact. But this discovery did not help the Germans much, the tanks (Mark IV.) used in the next action by the British having had this to a great degree remedied. During that year the value of gun defence against tanks was to some extent realized, attention being mostly given to indirect fire which of all kinds is least effective against moving targets. A certain number of special direct-fire, anti-tank guns often in concrete shelters, were emplaced along the front. But not much attention was paid to the use of direct fire from field artillery normally in the sector attacked. This was not so on the occasion of the French attack on the Crayonne Plateau on April 15 1917, when the guns of the defence of all kinds did great execution among the French machines. At the battle of Cambrai again, some of the German field artillery were most effective against the British machines, one well-concealed gun served by a German major putting 16 tanks out of action.

During the period of preparation for the 1918 offensive the anti-tank rifle, which was a definite step forward, was evolved. This was a heavy, single-loading rifle of 530-mm. calibre, 5½ ft. long, weighing 36 lb., firing armour-piercing pointed bullets. The bullets penetrated the tank plates, though they did not necessarily place a tank out of action; but the weight of the weapon and its recoil hampered free employment by the infantry.

It was after July 18 and Aug. 8 1918, that the German High Command awoke to the danger threatening the German defensive, and indeed issued almost panic instructions. Special anti-tank defence officers were appointed to the different formations; guns were brought up to the front line and emplaced for action against tanks alone; and sections of reserve batteries were allotted to this duty, whilst all batteries (including howitzers) were to take up positions from which they could engage tanks by direct fire. The most efficacious of these precautions was the employment of the mobile guns of reserve batteries which were not so likely to be knocked out by barrage fire as those in positions closer to the front. Tanks became a bugbear, all sorts of precautions in the way of signals to notify their approach were taken, such as the installation of rockets, syrens, Klaxon horns; and permanent alarm posts were established. The passive forms of defence employed were: obstacles in the roads and entrances to villages, such as steel palisades, concrete blocks set sufficiently

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close together to prevent the passage of tanks and of sufficient height to be unclimbable, and mine craters. In some cases elaborate *chevaux-de-frise* were erected across stretches of the front; "booby-traps" such as tank-pits were laid and certain areas in the later stages of the operations were flooded. Mines were employed to an increasing degree, sometimes in large minefields. It does not require a great amount of explosive to damage a tank, and the mines laid by the Germans were usually electro-contact, or mechanical "tread" mines, which were fired by the weight of a tank passing over them, the charge being a gun or trench-mortar shell. But land mines have the drawback of being dangerous to those who use them, and the greatest damage done to tanks by mines during the war was to the British machines manned by Americans in July 1918, by a British minefield prepared during the retreat in March and forgotten. On the whole, all these artificial obstacles proved a failure, for they could not be continuous, and could be avoided by a cross-country vehicle.

The Germans finally took the obvious step of producing a large-calibre, high-velocity machine-gun firing heavy armour-piercing bullets. This weapon, if fairly mobile, would have been an effective reply to the tank had it been introduced sooner. It was known as the "Tuf" (*Tank und Flieger*), was of 13-mm. calibre and could fire 200 bullets, said to be capable of piercing 30 mm. of hardened steel, a minute. Great efforts were made to produce it quickly and to keep its manufacture secret. Six thousand were to have been ready by April 1919, but by the Armistice none was in the field.

The greatest physical obstacle to the advance of tanks—one form of defence—experienced during the war was mud, and this was intensified by the concentrated and prolonged artillery fire which was generally carried out by both sides. In dry weather this rendered the ground almost impossible to negotiate and in wet weather made it absolutely impassable by any machine moving on the surface of the ground. This was well exemplified during the third battle of Ypres in 1917, when the Germans could not have arranged a better defence against tanks than the morass created in the low-lying battlefield by the British guns. Here the conditions were such as to render futile the employment of tanks which was attempted. The best anti-tank defence beyond this half-natural, half-artificial obstacle, is, as has been said, the fire of suitable, mobile, light Q.F. artillery and carefully disposed minefields. Inundations are likely to be rendered useless by the tank becoming an amphibious machine.

General Conclusions

The tank was the one complete British innovation in the war and a great one. The resurrection of an old weapon, it was forced into a fresh existence during hostilities by the needs of the war, and created for a special purpose. In essence it amounted to the addition of bullet-proof plate and armament to an existing agricultural machine which possessed the quality of cross-country mobility. Its immediate purpose was the destruction of the machine-gun—a weapon which, until the tank appeared, was responsible during the war for the loss of more human life than any other, and upon which the Germans at bay, on the defensive, placed so much reliance. With the machine-gun in this connexion is associated the wire obstacle. The combination of the two was the disease for which the tank proved to be the only cure; but, early as the disease was diagnosed, it had grown to be the scourge of the Allies on the western front, whenever they attempted to press forward as demanded by the strategic situation, long before the cure was applied. The tank was the great life-saver of the infantry. To it many thousands of the soldiers of the Allies, principally French and British, owed their lives—infantrymen who but for the tanks would have had to repeat, on a larger scale and possibly abortively, the bloody offensives of 1915, 1916 and the first half of 1917. It took the place of the old stereotyped and expensive artillery preparations, with more certain results, and also reintroduced the surprise factor, which the preliminary bombardment prevented, and which the conditions of trench warfare otherwise rendered impossible without the protection to the infantry afforded by it.

A remarkable feature about the introduction of the British tanks was the fact that they were to a great extent forced on the army by the action of certain enthusiastic individuals, of whom one only was a serving soldier. Some of those, also, who were responsible for the creation of the new weapon, from the beginning formulated the tactics for its employment, which were finally after an inexplicably long period put into practice in the field. This was the case with the British and the French. The British first used tanks in Sept. 1916, and first employed them correctly on a large scale on Nov. 20 1917, 14 months later. The French first used tanks in April 1917, and first employed them correctly, on a large scale, on July 15 1918, also 14 months later. And in each case this happened in spite of the proper method having been put forward, and its adoption urged. The only explanation of this policy is that it was due to inherent conservatism and lack of imagination, incredulity concerning the attributes of the new weapon, failure to understand what they implied, and initially lack of patience.

That the tanks achieved their object was shown by the preparations made by Great Britain, France, the United States, Italy and also Germany for the continuation of the struggle in 1919, and by the fact that their manufacture had begun to take up a large proportion of the munition-producing capacity of three at least of the combatants. In regard to results, it is only necessary to recall one major fact, so far as the British were concerned, *i.e.* that after the era of mechanical warfare, as it has been termed, set in, on Aug. 8 1918, and between that date and the Armistice, 59 British divisions were able to defeat 99 German divisions, a reversal of the proportion usually considered to hold between attackers and defenders. The offensive had at last obtained the superiority; and strength could no longer be estimated by the counting of heads. During the war the German infantry confessed itself impotent against tanks. But since the war not only have the infantry soldiers of other nations come to the same conclusion, but admit that they are often helpless without tanks to assist them. In certain circumstances they demand the assistance of these machines; and they are right. In regard to the influence of the new arm on the result of the war amongst a mass of corroborative evidence, one statement includes and covers all others. On Oct. 2 1918, when the end was fast approaching, the report to the heads of the Reichstag parties made by the representatives of German military headquarters began with the following words[1]:—

"The Chief Army Command has been compelled to take a terribly grave decision and declare that, according to human possibilities, there is no longer any prospect of forcing peace on the enemy. Above all two facts have been decisive for this issue. First, the Tanks—. . ."

Such an admission, wrung after four years from those who had confidently started the World War, is sufficient.

In regard to the different ways in which tanks established their military value, apart from the actual results achieved, some instructive statistics have been prepared of their action from the aspect of the "economics" of war.[2] In fighting man-power a brigade of 144 tanks has a fire-power equivalent to that of 24 light batteries of six guns each, and nearly 200 more machine-guns than are carried in a division. An infantry division accompanied by one battalion of tanks can attack three times the frontage that can be attacked by a division unaccompanied by tanks. The fighting infantry in three divisions is 21,000 men, of one tank battalion 500. The saving in man-power is therefore 13,500, or 63%, and with equivalent fire-power the chances of casualties are reduced. As to economy in infantry casualties, the losses on the first day at the battle of Cambrai (a tank battle) were approximately 1,000 per division engaged; at the battle of the Somme (an artillery battle) there were 3,000. Between July and Nov. 1917, when tanks were used on impossible ground 258,000 casualties were sustained by the British; between July and Nov. 1918, when tanks were used on possible

[1] Report by Col. Bauer, Chief of the Artillery Department.

[2] The Gold Medal (Military) Prize Essay for 1919 by Brevet-Col. J. F. C. Fuller (*Journal of the Royal United Service Institution*, May 1920). These statistics refer to the experience of the British.

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TABLE A.—Particulars of British Tanks.

Type of Machine.	Date of Commencement of Design.	Date of First Standard Machine.	Weight in Fighting Trim in Tons.	Horse-Power per Ton.	Length Overall.	Width Overall.	Height to Top of Tracks.	Armour Thickness.	At Normal Engine Revolutions. Speed in Miles per Hour. First Gear.	Second Gear.	Third Gear.	Fourth Gear.	Reverse.	Maximum Width of Trench that can be Crossed without Falling in.	Crew.	Number of 6-pdr. Guns Carried.	Number of Machine-Guns Carried.	Theoretical Tractive Force of Machine in First Speed, in Tons.
					ft. in.	ft. in.	ft. in.	mm.						ft.				
Mark I . .	Oct., 1915	Dec., 1915	Male, 28 Female, 27	3·75	32 6 with tail, 26 5 without tail.	13 9	7 4½	6 to 12	0·75	1·3	2·1	3·7	0·94	10	8	0, female 2, male	5, female 4, male	23·7
Mark II .	Feb., 1916	Jan., 1917	Male, 28 Female, 27	3·75	32 6 with tail, 26 5 without tail.	13 9	7 4½	6 to 12	0·75	1·3	2·1	3·7	0·94	10	8	0, female 2, male	5, female 4, male	23·7
Mark III .	Feb., 1916	Jan., 1917	Male, 28 Female, 27	3·75	32 6 with tail, 26 5 without tail.	13 9	7 4½	6 to 12	0·75	1·3	2·1	3·7	0·94	10	8	0, female 2, male	5, female 4, male	23·7
Mark IV .	Oct., 1916	Mar., 1917	Male, 28 Female, 27	3·75	26 5	13 6	7 4½	6 to 12	0·75	1·3	2·1	3·7	0·94	10	8	0, female 2, male	6, female 4, male	23·7
Mark V .	Oct., 1917	Jan., 1918	Male, 29 Female, 28	5·2	26 5	13 6	7 4½	6 to 14	0·9	1·5	2·6	4·6	0·9	10	8	0, female 2, male	6, female 4, male	27·3
Mark V* .	Feb., 1918	May, 1918	Male, 33 Female, 32	4·28	32 5	13 6	7 4½	6 to 14	0·9	1·5	2·6	4·6	0·9	13	8	0, female 2, male	6, female 4, male	27·3
Mark V** .	May, 1918	Dec., 1918	Male, 35 Female, 34	6·4	32 5	13 6	7 4½	6 to 14	1·04	1·7	3·02	5·2	1·04	13	8	0, female 2, male	6, female 4, male	36·1
Mark VII .	Dec., 1917	July, 1918	33	—	29 10	13 9	7 4½	6 to 12	0	Variable		to	4·25	10	8	0, female 2, male	6, female 4, male	32·3
Mark VIII .	Dec., 1917	Oct., 1918	37	8·0	34 2½	12 4	7 6½	6 to 16	1·4	—	—	5·2	1·4	14	8	0, female 2, male	7	42
Mark IX .	Sept., 1917	June, 1918	27, unloaded 37, loaded	4·05	31 11	8 1	7 8	6 to 10	0·86	1·4	2·5	4·3	0·86	12½	4 can carry 50 men	None	2	29·2
Gun-carrying tank	July, 1916	Jan., 1917	27, unloaded 34, loaded, with gun and ammn.	3·9	43 0 with tail, 30 0 without tail.	11 0	—	8	0·75	1·3	2·1	3·7	0·94	11½	4 and gun detachment	None	None	23·7
Medium Mark A Whippet .	Dec., 1916	Oct., 1917	14	6·43	20 0	8 7	4 6	5 to 14	1·5	3·25	5·5	8·3	—	7	3	None	4	12·4
Medium B	June,	Sept.,	18	5·5	22 9½	9 3	5 9½	9 to 14	1·2	2·3	3·8	6·1	—	8	4	None	4	14·0

ground, the Germans lost 284,000 prisoners alone. As to economy in artillery personnel, at the third battle of Ypres 121,000 artillery personnel, were used on a front of 17,000 yd., the maximum penetration attained on July 31 (one day) being 3,300 yards. At Cambrai 4,100 tank personnel carried out the work normally done by the guns on a front of 13,000 yards. The maximum penetration attained in one day was 9,500 yards. As to economy in cavalry personnel, the personnel of all ranks in a cavalry division (without the Royal Horse Artillery) would suffice to man and equip three brigades of Whippet tanks or 540 machines. As to economy in ammunition, at the battle of Arras, on a front of 17,000 yd., 2,007,534 shells, weighing 57,000 tons, were fired; at the third battle of Ypres, on the same frontage, 3,107,363 shells, weighing 93,463 tons, were fired. At Cambrai, on a 13,000 yd. front, 293,149 shells, weighing 5,824 tons, were expended. It is shown that the use of tanks also leads to economy in munition manufacturing man-power, in shipping and land transport, in weight carried by the soldier, in labour on the battlefields, in property damaged, in forage or food, in time and in cost of production. In regard to the latter item the cost of projectiles and explosives alone for 1918 was £329,860,344 and for the undeveloped new arm, tanks, £9,587,960. This inevitably leads to speculation as to what results might have been had Mr. de Mole's suggestion made in 1912 been taken up and developed, even at the cost of 12 hours' conduct of the war in 1918.

The principle of mechanical warfare and the advantage of using power-driven machines instead of human and animal muscle having been established in one particular direction, there is little doubt but that it will be applied in others. In future, there will be larger and smaller fighting tanks developed from those born in the World War. They will be speedier, more powerful and have a far longer range of action. Some will also be amphibious, and all will be less easy to stop than the present somewhat embryonic machines. The principle of track propulsion will be applied to vehicles of all types and not confined to fighting machines, and will to a great extent eliminate the necessity of using roads or railway, and place the movement of armies on a "two-dimensional" basis instead of being on a one-dimensional basis as it has in the past. Future fighting tanks will in certain theatres be able to replace cavalry and may against a civilized enemy be able to carry out, with aeroplanes, those long-distance raids against H.Q. and important points far behind the fighting-line, which since the advent of the machine-gun cavalry cannot execute, will give greater facility both for the release of gas in large quantities, if gas is used, and also for obtaining protection against gas. The fighting machines will be very largely used in conjunction with action in the air, and the two services will be complementary and mutually helpful. Large tracts of roadless country which have to be held against an uncivilized enemy, or a hostile population, will provide the first opportunities for the development of this combination, on account of the saving that will be effected in men and animals, the most expensive and delicate parts in an armed force. In killing-power, mobility, and endurance, one efficient mobile machine with its crew and machine-guns will be able to take the place of many infantry or cavalry soldiers and many horses, and will cost less to maintain and feed. In the United States the possibility of the "motorization" of all war transport and of eliminating the horse was in 1921 being fully discussed, and if the signs are read correctly this will be the general tendency, so that the great wars on land of the future will be practically horseless and conducted by far fewer men in the field and more men in the factory and workshop than has been the case in the past. Strength for war will not in the future be estimated by counting heads, for, beyond the minimum necessary, the greater the number of human beings in a force in the field the greater will be its vulnerability. The introduction of the tank in 1916 upset all the existing values of field defences, and its natural and inevitable evolution will cause a revolution in the methods of war as great as that in tactics caused by its original appearance.

In the compilation of this article reference has been made to the following works:—Clough William-Ellis and A. William-Ellis, *The Tank Corps* (1919); J. F. C. Fuller, *Tanks in the Great War* (1920); D. G. Browne, *The Tank in Action* (1920); Dutil, *Les Chars d'Assaut, leur création et leur rôle pendant la guerre, 1915–1918* (1919); M. Schwarte, *Die Militärischen lehren des Grossen Krieges* (1920).

Figs. 1, 9, 10 and 11 are from *Tanks in the Great War* by Col. J. F. C. Fuller, D.S.O., by permission of the author and Mr. John Murray. Figs. 2, 3, 4, 5, 6, 7 and 8, from "British Tanks" by Sir E. H. Tennyson d'Eyncourt, K.C.B., D.S.O., are reproduced on a reduced scale by permission of the publishers of *Engineering*.

(E. D. S.)

TANNENBERG, a village of East Prussia, 10 m. S.W. of Hohenstein. It has given its name to two battles of great importance in German history, the battle of July 15 1410, in which the Poles and Lithuanians destroyed the forces of the Teutonic Order (*see* 21.905), and that of Aug. 26–31 1914, in which the German VIII. Army under General-Oberst von Hindenburg destroyed the Russian II. Army commanded by General Samsonov. The latter is described in detail under the heading MASURIA, BATTLES IN. For a critical account of the former, the story of which has been overlaid by a mass of legends, see Delbrück, *Gesch. der Kriegskunst*, vol. iii., book iv., ch. 6.

TARKINGTON, [NEWTON] BOOTH (1869–), American writer, was born in Indianapolis, Ind., July 29 1869. After studying at Phillips Academy, Exeter, Mass., he entered Purdue University, Lafayette, Ind., but two years later transferred to Princeton, where he graduated in 1893. At first he intended to follow a business career, but after a few years devoted his time to writing. He was elected to the Indiana House of Representatives for the term 1902–3. In 1918 he received the degree of Litt.D. from Princeton. In 1920 he was elected to the American Academy of Arts and Letters. The same year he was engaged as a writer of photo-plays by the Goldwyn Pictures Corporation. His first story, *The Gentleman from Indiana*, was published in 1899, having appeared already as a serial in *McClure's Magazine*. In 1900 his reputation was established by *Monsieur Beaucaire*, which he successfully dramatized (with E. G. Sutherland) in 1901. In 1919 he was awarded the Pulitzer Prize by Columbia University for his novel, *The Magnificent Ambersons* (1918).

His other stories include *The Two Vanrevels* (1902); *Cherry* (1903); *The Conquest of Canaan* (1905); *Guest of Quesnay* (1908); *Beauty and the Jacobin: an Interlude of the French Revolution* (1912); *Penrod* (1914); *Penrod and Sam* (1916); *Ramsey Milholland* (1919); *Alice Adams* (1921). His plays include *Cameo Kirby* (1907); *Your Humble Servant* (1908); *Mister Antonio* (1916); *The Country Cousin* (1917, with Julian Street); *The Gibson Upright* and *Up From Nowhere* (1919, both with Harry Leon Wilson); *Clarence* (1919).

TATA, SIR RATAN (1871–1918), Parsee financier and philanthropist, was born at Bombay Jan. 20 1871, the son of the famous Parsee merchant Jamsetji Nasarwanji Tata (*see* 26.448). He was educated at St. Xavier's College, Bombay, and afterwards entered his father's firm. On the death of the elder Tata in 1904, Ratan Tata and his brother Dorabji Jamsetji Tata (b. 1859) inherited a very large fortune, much of which they devoted to philanthropic works of a practical nature and to the establishment of various industrial enterprises for developing the resources of India. An Indian institute of scientific and medical research was founded at Mysore in 1905, and in 1912 the Tata Iron and Steel Co. began work at Sachi, in the Central Provinces, with marked success. The most important of the Tata enterprises, however, was the storing of the water-power of the Western Ghats (1915), which provided the city of Bombay with an enormous amount of electrical power, and hence vastly increased the productive capacity of the Bombay industries. Sir Ratan Tata, who was knighted in 1916, did not confine his benefactions to India. In England, where he had a permanent residence at York House, Twickenham, he founded (1912) the Ratan Tata department of social science and administration at the London School of Economics, and in 1912 established a Ratan Tata fund at the university of London for studying the conditions of the poorer classes. He died at St. Ives, Cornwall, Sept. 5 1918.

TAUSSIG, FRANK WILLIAM (1859–), American economist (*see* 26.456), was during 1917–9 chairman of the U.S. Tariff Commission, which made a special study of commercial

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treaties and prepared much material for the American Peace Commission in Paris. In March 1919 he was called to Paris to advise in the adjustment of commercial treaties, and in Nov., on invitation of President Wilson, attended the second industrial conference in Washington for promoting peace between capital and labour. He was a strong supporter of the Covenant of the League of Nations. He was the author of *Principles of Economics* (1911; 2nd ed. 1915); *Some Phases of the Tariff Question* (1915); *Investors and Money-Makers* (1915); and *Free Trade, the Tariff, and Reciprocity* (1919).

TEISSERENC DE BORT, LÉON PHILIPPE (1855–1913), French meteorologist, was born in Paris Nov. 5 1855, the son of an engineer. He began his scientific career in 1880, when he entered the meteorological department of the Bureau Central Météorologique in Paris under E. E. W. Mascart. In 1883, 1885 and 1887 he made journeys to N. Africa to study geology and terrestrial magnetism, and during this period published some important charts of the distribution of pressure at a height of 4,000 metres. In 1892 he became chief meteorologist to the Bureau, but resigned in 1896 and founded a private meteorological observatory at Trappes, near Versailles, where he carried out investigations on clouds and the problems of the upper air. In 1898 he published an important paper in *Comptes Rendus* detailing his researches by means of balloons into the constitution of the atmosphere. His discovery of the so-called isothermal layer, or stratosphere as it is now generally called, will always stand out as one of the most important events in the study of the upper atmosphere. He also carried out investigations in Sweden and over the Zuider Zee, the Mediterranean and the tropical region of the Atlantic, and fitted out a special vessel in order to study the currents above the trade-winds. He was elected a fellow of the Royal Meteorological Society in 1903, hon. member in 1909, and was awarded the Symons gold medal of the society in 1908. He collaborated with Hugo Hildebrandsson in *Les bases de la météorologie dynamique* (1907). He died at Cannes Jan. 2 1913.

TELEGRAPH (*see* 26.510*).—Apart from the advances in Wireless Telegraphy (*see* WIRELESS) and Cable Telegraphy (*see* SUBMARINE CABLE TELEGRAPHY), progress since 1910 has been seen in various technical directions. The developments in the United Kingdom and in the United States in some respects have differed, and this article therefore considers them in two sections which differentiate not only certain technical and commercial aspects of the subject but also certain distinctive points of view.

UNITED KINGDOM

One of the most important developments in type-printing telegraphy is the adaptation of the Baudot for duplex working by A. C. Booth in 1905. This forms the basis of all modern multiplex systems, and has led to a great increase in the output and flexibility of such systems with a consequent considerable extension of their use.

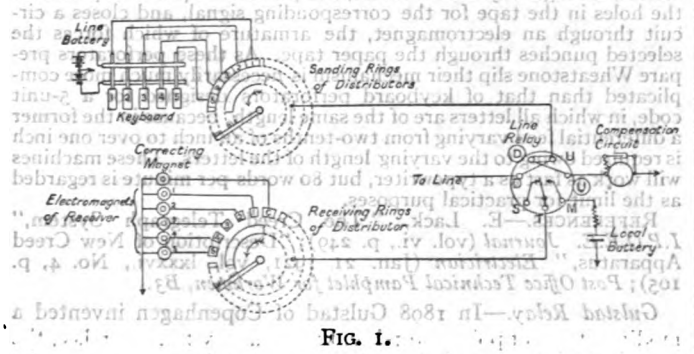

FIG. 1.

Booth-Baudot.—The underlying principle of the Booth-Baudot will be understood by reference to fig. 1. It will be seen that the outgoing signals from the sending rings of the distributor at the home station divide differentially at the line relay and therefore do not affect the receiving apparatus which is connected in the local circuit via the receiving rings of the distributor. Installations of double, triple, quadruple, quintuple, and sextuple duplex have given excellent results in the British Post Office service during a number of years. The method of driving the mechanism of the Baudot distributors and receivers has been changed from weight driven gear, to electric motor drive. In the case of the receivers, a small series motor with belt drive is used, while the distributors are driven by the La Cour phonic motor. In both cases a considerable saving is obtained in first cost and maintenance expenses with the advantages of more satisfactory working and greater facility in changing apparatus when necessary.

The Carpentier method of automatic transmission on Baudot circuits has recently been reintroduced in the British Post Office, but with several important improvements.

In offices where a large number of keyboard perforators are used, each having its own particular lay-out, the change from one instrument to another caused serious difficulty from an operating standpoint. This difficulty was much felt with the original Carpentier keyboard, in which, owing to the exigencies of the Baudot code, the keys for the numerals were spread over the keyboard instead of being arranged on the first row of letter keys as in most typewriters. Carpentier sought to minimize this difficulty by adding an extra row of keys for the numerals, and a similar arrangement was adopted in the Morse keyboard perforators such as the Gell and the Kleinschmidt.

Messrs. A. C. Booth and A. S. Willmott have now invented a device which enables the keyboard for any type of machine telegraph, whatever the code used, to be arranged exactly as in a typewriter, thus allowing the numerals to be placed in their standard positions without the extra row of keys.

The Booth-Willmott-Baudot keyboard perforator punches the 5-unit code transversely on a paper tape which is of the same size as that used in the Murray and Western Electric instrument (see hereafter), enabling the transmitters of either of these installations to be used in conjunction with it. Switches are provided on the instrument tables so that any particular arm of the multiplex may be worked automatically from a transmitter fed by a Booth-Willmott perforator or by direct-sending from an ordinary Baudot keyboard sender at will.

REFERENCES.—A. C. Booth, "Telegraph Keyboard Perforators," *I.P.O.E.E. Journal* (vol. xiv., p. 72); A. C. Booth, *The Baudot Printing Telegraph System* (1907), I.P.O.E.E. paper; H. W. Pendry, *The Baudot Printing Telegraph System;* A. C. Booth, "The Baudot Duplexed," *I.P.O.E.E. Journal* (vol. iii., p. 336); A. C. Booth, "Progress of Baudot System," *I.P.O.E.E. Journal* (vol. vi., p. 324); "Duplex Baudot Tests," *I.P.O.E.E. Journal* (vol. viii., p. 11); E. Montoriol, "Baudot System in France," *I.P.O.E.E. Journal* (vol. x., p. 25); E. Lakey, "Progress of Baudot Duplex," *I.P.O.E.E. Journal* (vol. xii., p. 216); *Post Office Technical Pamphlet for Workmen, B6.*

Murray Multiplex.—The difficulty experienced by Baudot operators in manipulating accurately the direct-sending keyboards

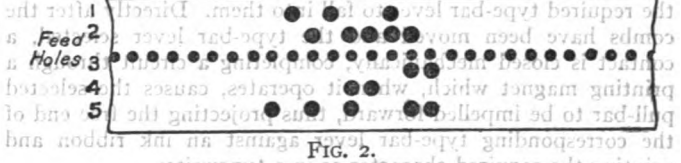

FIG. 2.

in time with the cadence signal at speeds much in excess of 30 words per minute led Murray to adopt the Carpentier method of automatic transmission in his multiplex system. The main features of the Booth-Baudot system are utilized, but the operators perform on perforators which have keyboards similar to that of an ordinary typewriter and do not have to keep in time with a cadence signal. Each key of the perforator, when depressed, perforates in a paper tape, a particular combination of holes in accordance with the arrangement of the five-unit code adopted by Murray. The tape thus prepared has its perforations across the slip and not longitudinally as in the case of the Murray automatic system, the use of which has been abandoned, so that a great saving in the cost of paper results.

Fig. 2 shows a portion of the Murray multiplex transmitting tape perforated to represent the word "telegraph." From the perforator, the tape passes directly into an automatic transmitter, which has five selecting needles, each controlling a contact lever resting

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normally against a bus-bar connected to the spacing pole of the line battery. When a needle passes into a hole in the tape the corresponding contact lever moves over and makes contact with a bus-bar connected to the marking pole of the line battery. The positions of the contact levers are therefore determined by the perforations in the tape and as each lever is connected to its own particular segment on the sending ring of the distributor, the signals representing a character are sent out to line, one after the other, as the brushes pass over the segments. Immediately the brushes have passed over the last of the segments allocated to a particular transmitter a current impulse is sent from another ring of the distributor through a "cadence" electromagnet in the transmitter, which when operated withdraws the selecting needles that have entered perforations and propels the tape forward sufficiently to bring the next group of perforations into position above the selecting needles. Provision is made for preventing mutilation of the paper tape when the transmitter overtakes the perforator, by arranging for the tightening of the tape to actuate a lever situated between the two instruments. When the lever is pulled down the armature of the cadence electromagnet is prevented from moving. As soon as the tape slackens the lever rises and transmission is continued. For the reception of signals Page printers are employed somewhat similar to those which were used in the Murray automatic system, but differing from them in that the five selecting combs, which determine the letter to be printed, are positioned by electromagnets instead of by a perforated tape. The normal speed of working of each arm of the Murray multiplex is 40 words per minute, although speeds in excess of this may be attained.

REFERENCES.—D. Murray, *Practical Aspects of Printing Telegraphy*, I.E.E. Paper (1911); latest edition of *Herberts Telegraphy; Post Office Technical Pamphlet for Workmen, B7.*

The Western Electric Multiplex.—This system is also based on the Booth-Baudot duplex and came into use in 1914. The adoption of a method of correction from the actual working signals themselves, instead of utilizing special correcting signals as in the Baudot and Murray systems, results in a saving of line time and therefore gives a greater output on difficult lines.

The transmitters and perforators are the modern developments of Carpentier's but the printer used types the message in page form instead of on a paper tape as in the Baudot system, from a type wheel which rotates from character to character as may be required. This printer has not given entirely satisfactory results, and is being superseded by one in which type bars are used in place of a type drum and the paper is kept central instead of being moved sidewise to and fro. The phonic wheel distributors are driven by electrically vibrated tuning-forks, which possess an advantage over vibrating-reeds in that they may be placed on the instrument table instead of being fixed to a steady support as is required in the case of reeds.

The Kleinschmidt Electric Co. of New York have recently designed a very compact column printer which may be used on Western Electric multiplex circuits. As in the Murray printer, there are five selecting combs which are operated by electromagnets. When the combs have been positioned, during the reception of a character, certain slots in the combs are thereby brought into alignment allowing a pull-bar attached to one extremity of the required type-bar lever to fall into them. Directly after the combs have been moved and the type-bar lever selected, a contact is closed mechanically, completing a circuit through a printing magnet which, when it operates, causes the selected pull-bar to be impelled forward, thus projecting the free end of the corresponding type-bar lever against an ink ribbon and printing the required character as in a typewriter.

REFERENCES.—P. M. Rainey, "A New Printing Telegraph System," *Electrical World* (April 3 1915); *The Western Union Multiplex System;* (Pamphlet printed by *Telegraph and Telephone Age);* A. H. Roberts, "A New Type Printing Telegraph System," *I.P.O.-E.E. Journal* (vol. viii., p. 193); *Post Office Technical Pamphlet for Workmen, B7.*

The Siemens Automatic System.—The original Siemens automatic system used an 11-unit code actuating a receiver which printed the incoming signals in Roman characters on photographic paper. The preparations required for the received slips, which had to be developed chemically, impaired its usefulness for actual traffic, and the system was superseded in 1912 by one using a 5-unit code and a revolving type-wheel. The latter is now extensively used in Germany and to a limited extent in other countries.

As in the case of the Creed and other automatic systems there are several perforating operators and one transmitting operator at the sending station. The prepared tape from the keyboard perforators is passed through the transmitter over five selecting needles, controlling their upward movement and determining the polarity of the current impulses sent to line during each revolution of a brush over the five segments of a distributor. The sending distributor brush arm is driven by a shunt wound motor whose speed is kept steady by means of a heavy flywheel mounted on the spindle. Unison with the brush arm of the receiving distributor at the distant station is maintained by the actual working signals. The receiving and translating arrangements of the receiver are almost entirely electrical, and printing is effected by the discharge of a condenser through an electromagnet, the armature of which presses momentarily a paper tape against a revolving type-wheel. This tape is afterwards pasted on ordinary message forms as in the Baudot system. In addition to the printing tape, the incoming signals can also actuate a keyboard perforator to provide a perforated tape for retransmission purposes. The system may be worked either simplex or duplex and is capable of giving a maximum speed of 166 words per minute in each direction.

REFERENCES.—*Herberts Telegraphy* (latest ed.); *Post Office Technical Pamphlet for Workmen, B7.* "The Siemens Automatic Fast-Speed Printing Telegraph," *Electrician* (July 11 1913).

The Morkrum Teletype.—This is a single-line system of printing telegraphy which has been recently developed by the Morkrum Co. of Chicago, U.S.A. It may be duplexed, and is suitable for short lines over which the traffic is not very heavy.

The apparatus comprises two units, a keyboard transmitter, and a printer, which are mounted on one base to form a very compact combined sending and receiving instrument. The keyboard is arranged as for a standard typewriter, and is a direct-sending instrument the keys of which when operated allow a camshaft to revolve opening and closing the line circuit according to the 5-unit code. Starting and stopping impulses are sent over the line to start and stop the selecting mechanism of the printer so that from transmission point of view the system has actually a 7-unit code. A feature of the system is the controlling and selecting mechanism of the printer, which is an ingenious combination of the Hughes and Baudot printers. The received message is printed on tape in exactly the same way as in the Baudot printer and afterwards gummed on ordinary message forms.

The maximum speed of operation of the keyboard is limited to 45 words per minute and a device is provided which is actuated when this speed is exceeded and prevents the keys being depressed too rapidly.

The Creed System.—One of the principal drawbacks to the original Creed system was the use of compressed air for working the apparatus, which in a large number of offices necessitated the installation of a special pneumatic plant. Moreover, the pneumatic Creed printer had a maximum speed of only 120 words per minute, so that on lines where the working speed was much in excess of this figure it was necessary to install two printers in order to deal expeditiously with the traffic. The latest Creed instruments, however, have been designed to work electrically; they are much simpler in their construction and give speeds up to 200 words per minute.

For the preparation of the transmitting tapes, Gell and Kleinschmidt perforators are generally used, each of which has a keyboard similar to that of an ordinary typewriter. The depression of a key selects, through a system of levers, the punches required to perforate the holes in the tape for the corresponding signal, and closes a circuit through an electromagnet, the armature of which forces the selected punches through the paper tape. As these perforators prepare Wheatstone slip their mechanism is necessarily much more complicated than that of keyboard perforators designed for a 5-unit code, in which all letters are of the same length, because in the former a differential feed varying from two-tenths of an inch to over one inch is required owing to the varying length of the letters. These machines will work as fast as a typewriter, but 80 words per minute is regarded as the limit for practical purposes.

REFERENCES.—E. Lack, "The Creed Telegraph System," *I.P.O.E.E. Journal* (vol. vi., p. 249); "Description of New Creed Apparatus," *Electrician* (Jan. 21 1921, vol. lxxxvi., No. 4, p. 105); *Post Office Technical Pamphlet for Workmen, B3.*

Gulstad Relay.—In 1898 Gulstad of Copenhagen invented a modified form of polarized relay, known as a vibrating relay, the use of which has enabled much greater speeds of working to be attained on underground and submarine circuits, and in some cases allowed repeaters to be dispensed with. In general construction it is similar to the British Post Office standard relay, but, in addition to the usual line coils, has two extra windings on the same cores. These windings are connected to a local battery

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in such a manner that the relay tongue is caused to vibrate between the contact points, when the current through the line coils is insufficient to maintain it on either of the contacts.

The principle of the relay may be understood by referring to fig. 3. It will be seen that the ends of the local windings are joined to terminals B and C and their centre to terminal A, which is joined through an adjustable resistance Y to the relay tongue. This resistance is for regulating the local current and keeping it below the value of the steady current through the line coils. Terminal B is connected to earth through a condenser K, while C has a resistance coil X in its earth lead.

Assuming that there is no current in the line coils and that the relay tongue has just reached the marking contact, there will then be a momentary rush of current through the winding AB to charge the condenser K, in a direction to keep the tongue to the marking side, thus preventing any tendency of the tongue to rebound. This charging current dies away rapidly, however, and directly its strength falls below the steady current flowing through the winding AC, the preponderance of the latter causes the tongue to move toward the spacing contact. Immediately the tongue leaves the marking contact, the condenser K discharges through both windings BA and AC in such a direction as to accelerate the movement of the tongue, so that its transit time from one contact to the other is thereby lessened.

When the tongue reaches the opposite contact the condenser K is again charged, but this time from the other pole of the battery; a similar cycle of effects therefore takes place on that side and the

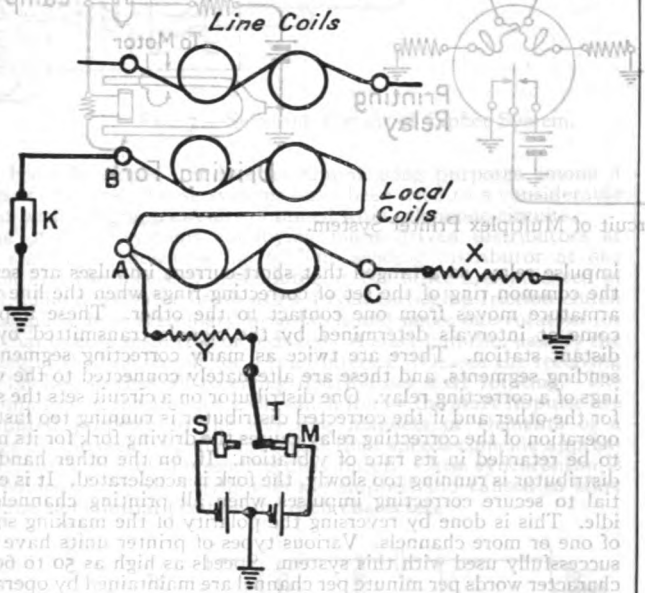

FIG. 3.

tongue moves in the reverse direction. In this manner the relay tongue is kept vibrating, at a speed depending on the values given to the condenser and resistance. In practice the adjustments are such that the rate of vibration of the tongue under the control of the local current is approximately equal to the rate at which the transmitter at the distant station sends reversals at working speed. When this obtains, the signals passing through the line coils merely determine the length of time that the tongue remains in contact with either stop, its movement therefrom being effected by the local current through the local windings as soon as the strength of the line current falls below that of the local current in the coil AC. It is this effect combined with the action of the condenser in lessening the time of transit of the tongue, that enables a higher speed of working to be attained on long and difficult circuits than if ordinary polarized relays were used.

In the original Gulstad relay the line coils were not differentially wound; it could be used, therefore, only on Bridge duplex or simplex circuits. To utilize the advantages of the Gulstad principal on differential duplex circuits, the British Post Office has modified the Post Office standard relay, by adding extra windings and terminals. This modified instrument is known as a "G" relay and is equally suitable for differential or bridge duplex working. The internal and external connexions of this relay are shown in fig. 4, in which the dotted lines indicate the extra coils. For the correct reception of the incoming signals a Wheatstone receiver is connected to the relay tongue.

REFERENCES.—E. Lack, "The Gulstad Relay," *I.P.O.E.E. Journal* (vol. vii., p. 183); *Electrical Review* (June 1898 and Aug. 1902); *Herberts Telegraphy* (latest ed.); E. Lack, "Post Office Standard Relay 'G'," *I.P.O.E.E. Journal* (vol. x., p. 34).

Tele-photographic Systems.—In 1909 T. Thorne Baker read a paper before the Royal Institution in London describing his "telectrograph" process of transmitting pictures over long distances. The method, which was used on a large scale by the *Daily Mirror* between London and Paris, is based upon the Bakewell copying telegraph.

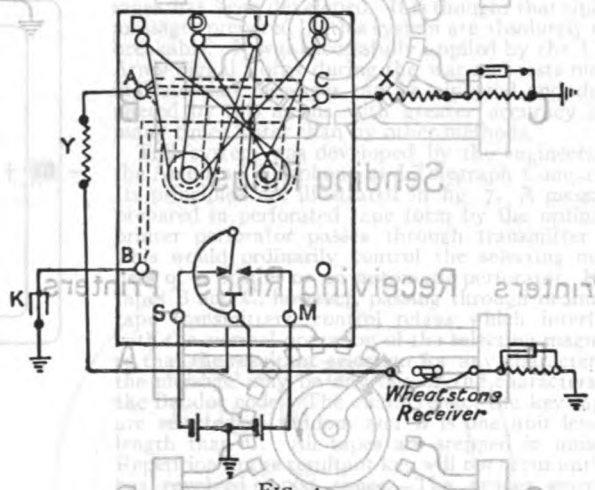

FIG. 4.

Synchronously rotating metallic drums, driven by electric motors, are employed one at each end of the telegraph line over which it is desired to transmit, say, a picture. A half-tone photograph of the picture is first printed upon thin sheet lead and subjected to a process which breaks up the photograph into a number of dotted lines printed in fish glue. This record is fixed round the transmitting drum, which is traversed spirally by an iridium stylus. The contact of the latter with the lead is interrupted every time one of the fish glue dotted lines comes beneath it, for duration depending upon the width of the line. The lead sheet is connected to the line, so that the transmitting instrument sends a series of electric currents whose periods of duration are determined by the width of the lines composing the photograph. At the receiving station, the rotating drum carries a piece of absorbent paper impregnated with a colourless solution, which turns black or brown when decomposed by an electric current. Every brief current through the paper causes a mark to appear, having a width depending on the duration of the current. The arriving currents are therefore arranged to pass through a platinum stylus under which the receiving drum rotates, then through the moistened paper resulting in the production of a number of marks on the paper due to chemical decomposition. These marks gradually combine to produce the picture at the transmitting station.

REFERENCES.—T. Thorne Baker, "Telegraphy of Photographs, Wireless and by Wire," *Royal Institution Proc. 1908–10*, vol. xix.

Foss and Petersen Method.—In this system a high frequency generator capable of producing sparks is used at the receiving station. The sparks so produced are capable of puncturing a paper wrapped round a metal drum which rotates in unison with a similar drum at the sending station.

The line wire is arranged so that when the sending end is connected to earth the generator is partly short-circuited, thus suppressing the sparking. At the sending end the shunting of the generator is effected by means of a contact pin passing over a cylinder on which the writing or illustrations are inscribed in insulating ink so that the shunt circuit is cut out each time the pin passes part of the writing (see Patent Specification No. 105,914, 1917). (W. No.)

UNITED STATES

Technical developments made after 1910 practically revolutionized telegraphy as practised in the United States. These include printing-telegraph arrangements applied to telephone as well as to telegraph circuits, simultaneous telephone and telegraph operation for long small-gauge cable circuits, and the use of alternating currents with resonant circuits in the so-called carrier systems for multiplexing wire conductors.

Radical changes were also made in the arrangements for and the methods of handling telegrams in large offices. Belt conveyers, typewriters, pneumatic tubes, automatic time-stamps and other labour-saving devices came to be used to a large extent. About 75% of all telegrams handled by the Western Union Telegraph Co. over trunk circuits in 1921 were transmitted and

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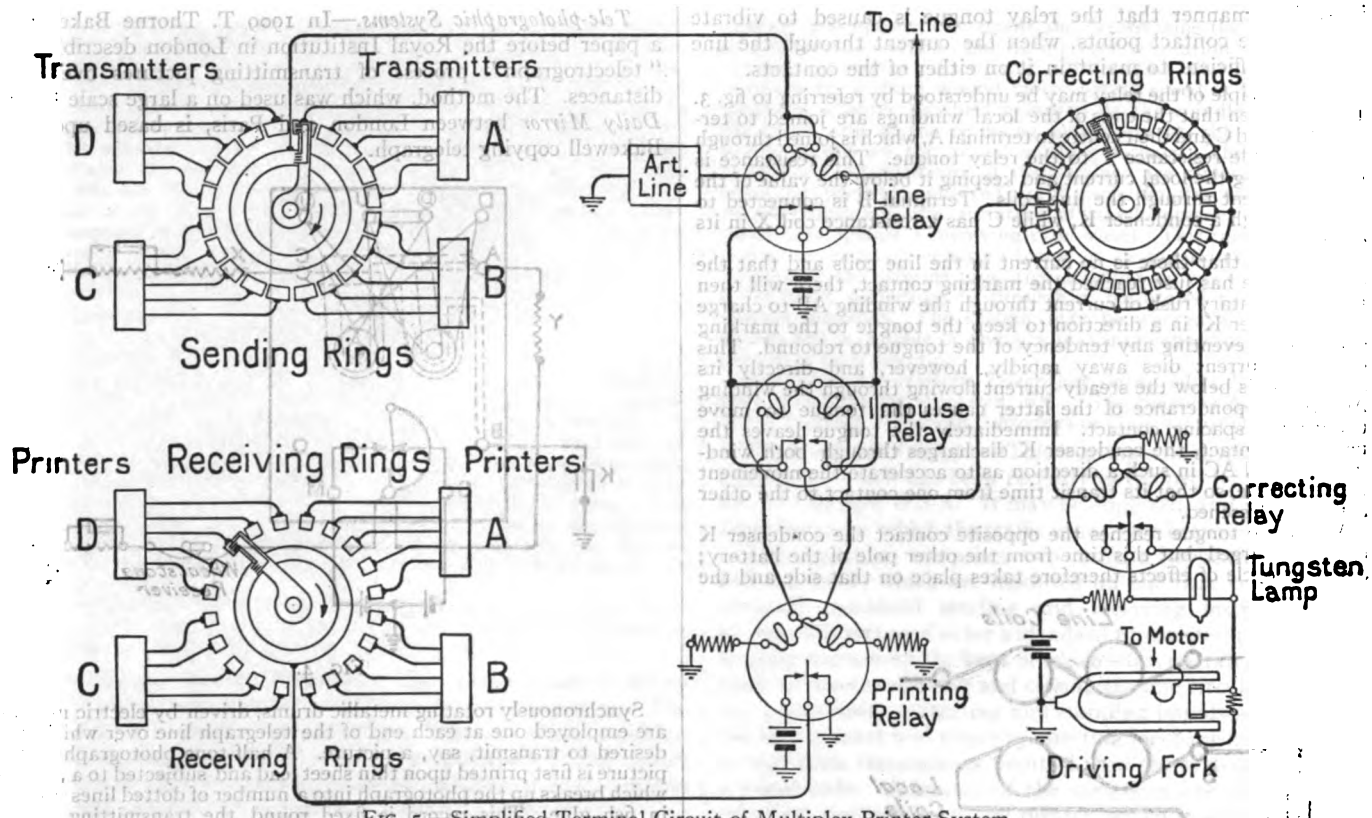

FIG. 5.—Simplified Terminal Circuit of Multiplex Printer System.

received by printing-telegraph apparatus. The introduction of machine telegraphy took place after 1910.

Progress can be divided into two general classes: (1) that relating to terminal equipment, such as printers; and (2) that relating to the methods of working lines.

Printing Telegraphy

(*a*) *Multiplex System.*—The multiplex system giving double-duplex, triple-duplex and quadruple-duplex service, as applied in America, was that developed jointly by the Western Electric Co. and the Western Union Telegraph Co. It uses the Baudot code and a system of speed correction for rotating distributors in which correcting impulses are generated from the character signals, thus saving line time.

The fundamental features of one arrangement for quadruple-duplex operation are shown in fig. 5. The sending, receiving and correcting rings are parts of a distributor driven by a La Cour or phonic-wheel motor. The common sending ring is connected to the midpoint of a differentially wound line relay and the common receiving ring to the armature of a printing relay included in the local circuit of the line relay. This local circuit also includes an impulse relay, so arranged that short-current impulses are sent to the common ring of the set of correcting rings when the line relay armature moves from one contact to the other. These impulses come at intervals determined by the signals transmitted by the distant station. There are twice as many correcting segments as sending segments, and these are alternately connected to the windings of a correcting relay. One distributor on a circuit sets the speed for the other and if the corrected distributor is running too fast, the operation of the correcting relay causes the driving fork for its motor to be retarded in its rate of vibration. If, on the other hand, the distributor is running too slowly, the fork is accelerated. It is essential to secure correcting impulses when all printing channels are idle. This is done by reversing the polarity of the marking signals of one or more channels. Various types of printer units have been successfully used with this system. Speeds as high as 50 to 60 six-character words per minute per channel are maintained by operators. The multiplex printer system has thus greatly increased operators' loads as well as the number of telegraph channels which can be obtained from each line circuit. Means have been developed for economically extending the single channels of a multiplex-printer system from the multiplex terminal station to branch offices.

(*b*) *Start-Stop Printer Systems.*—Successful systems giving single-channel working, or two-channel working when operated duplex,

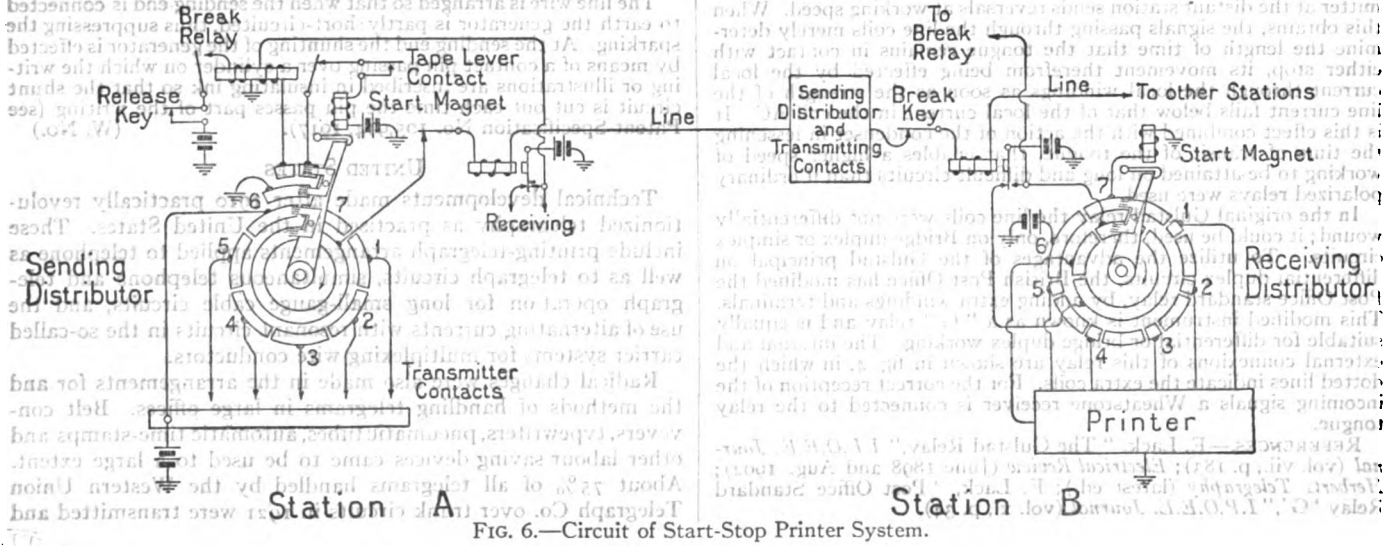

FIG. 6.—Circuit of Start-Stop Printer System.

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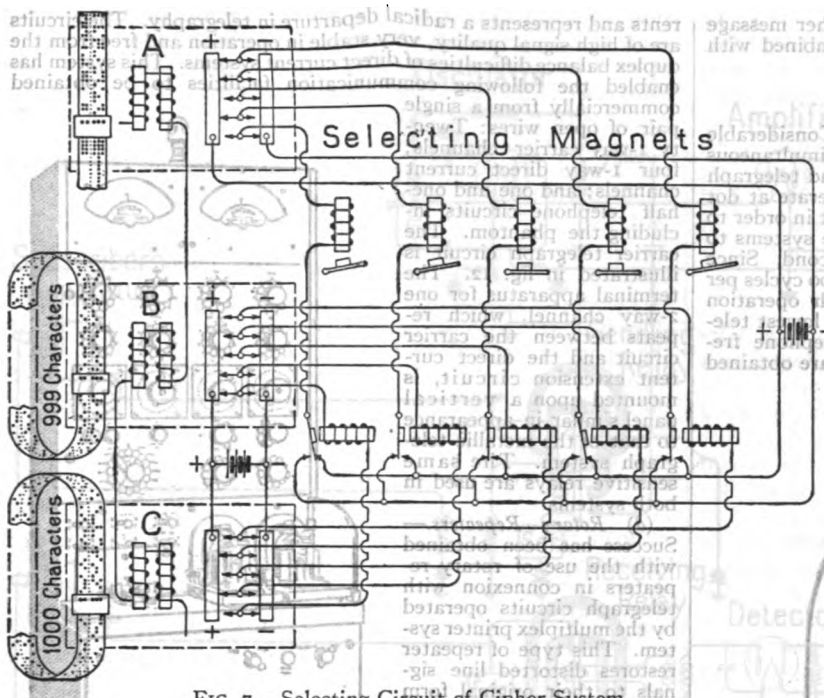

FIG. 7.—Selecting Circuit of Cipher System.

have been developed for inter-communicating purposes among a group of stations. These systems have been used to a considerable extent with telegraph circuits obtained from telephone circuits.

One of these systems employing motor-driven distributors at each station is shown in fig. 6. The sending distributor at one station and the receiving distributor at the other are indicated in detail. The distributor brush arms driven through a friction clutch are normally held stationary by a latch and make one rotation for each character transmitted or received. A start impulse, usually the opening of the line circuit for a brief interval, releases the receiving start latches so that all receiving distributors start rotating. The five impulses of the Baudot code which follow the start impulse are distributed properly to the selecting magnets or elements of a printer by the receiving distributors if their speeds coincide approximately with that of the sending distributor. Close synchronism is not required since all distributors are stopped and caused to start from the same initial position for each character.

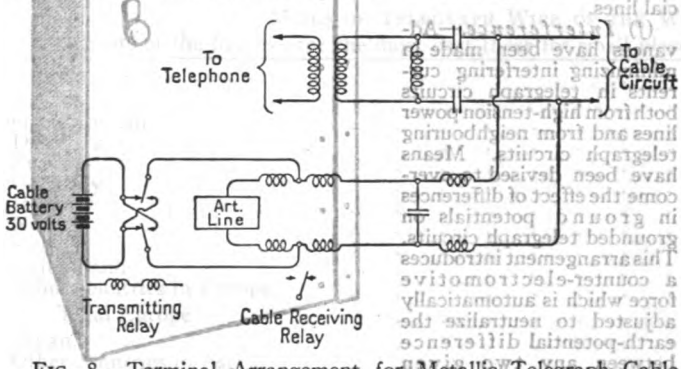

FIG. 8.—Terminal Arrangement for Metallic Telegraph Cable Circuit.

An important feature is the method by which any receiving station can interrupt the sending station and obtain control of the circuit. As shown, this is accomplished if the line circuit is interrupted by the break key during the time the sending brush is passing over the sixth segment when a break relay at the sending station will be energized to open the circuit of the magnet controlling the latch. The release key will then have to be operated to permit further sending. This printing system has been used to a considerable extent for news distribution, where in many cases a number of sending and receiving stations are connected to one circuit and means must be provided to allow any station to obtain control of the circuit. Keyboard arrangements which may be used for perforating tape or for sending directly to the line have been developed and found very satisfactory for this kind of service. The Western Electric type-bar printer has been found very satisfactory for news service. This is provided with a stationary paper platen and a moving type-bar basket. Books containing carbon paper for making a large number of copies and forms holding wax stencil sheets may be readily inserted into the machine. Means are provided for adjusting the strength of the blow of the type bars so that one to twenty copies can be secured.

(c) *Cipher Printing System.*—A printing system for rapidly ciphering and deciphering telegraph messages has been developed. It is thought that cipher messages prepared by this system are absolutely unbreakable. It was successfully applied by the U.S. Army Signal Corps during the war and tests made indicate that messages can be ciphered and deciphered by this means with greater accuracy and many times faster than by other methods.

This system was developed by the engineers of the American Telephone and Telegraph Company. Its principles are illustrated in fig. 7. A message prepared in perforated tape form by the ordinary printer perforator passes through transmitter A. This would ordinarily control the selecting magnets of a printer or an automatic perforator. Key tapes B and C, however, passing through ordinary tape transmitters, control relays which interfere with the normal operation of the selecting magnets so that the resultant selection for any character of the message may be any one of the characters of the Baudot code. The characters of the key tapes are selected at random and B is one unit less in length than C. All tapes are stepped in unison. Repetition in the resultant key will not occur until B has revolved 1,000 times. The proper starting position of the key tapes B and C for any message may be indicated by six characters which may be

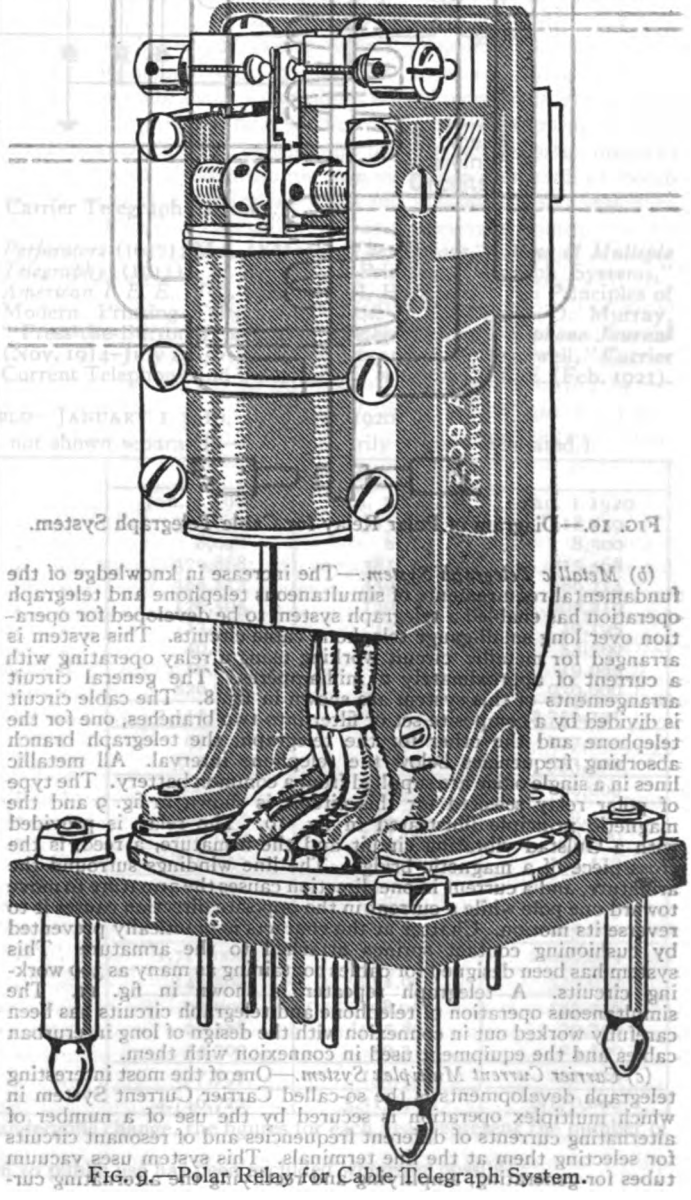

FIG. 9.—Polar Relay for Cable Telegraph System.

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ciphered by an additional key. In deciphering the cipher message tape is placed in transmitter A and the characters combined with the proper key to obtain the original message.

Methods of Working Lines

(*a*) *Simultaneous Telephone and Telegraph Working.*—Considerable advance has been made in the technical knowledge of simultaneous telephone and telegraph operation of line circuits. Hand telegraph systems and single-channel printer systems usually operate at dot speeds of 10 to 25 per second and it has been found that in order to secure satisfactory service it is necessary to design line systems to transmit a frequency band of about 100 cycles per second. Since telephone frequencies range from about 250 to about 2,500 cycles per second, it is possible to secure satisfactory telegraph operation from telephone circuits by using frequencies below the lowest telephone frequencies and frequencies above highest telephone frequencies. More than 600,000 m. of telegraph circuits are obtained from telephone circuits in the United States.

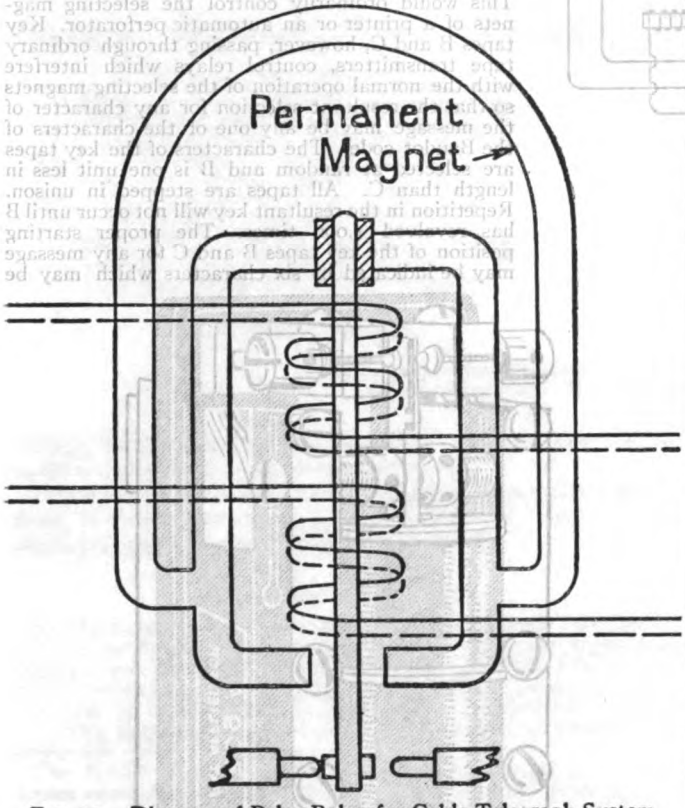

FIG. 10.—Diagram of Polar Relay for Cable Telegraph System.

(*b*) *Metallic Telegraph System.*—The increase in knowledge of the fundamental requirements of simultaneous telephone and telegraph operation has enabled a telegraph system to be developed for operation over long small-gauge telephone cable circuits. This system is arranged for metallic circuit working using a relay operating with a current of approximately 2 milliampères. The general circuit arrangements of this system are shown in fig. 8. The cable circuit is divided by a composite set or filter into two branches, one for the telephone and the other for the telegraph, the telegraph branch absorbing frequencies below the telephone interval. All metallic lines in a single office are supplied from a common battery. The type of polar relay selected for this circuit is shown in fig. 9 and the magnetic principle illustrated in fig. 10. The relay is provided with a Gulstad vibrating circuit and the armature, a reed, is the cross piece of a magnetic bridge. The line windings surround the armature, and a current in one direction causes the armature to move toward one pole while a current in the opposite direction causes it to reverse its motion. Chatter at the contacts is practically prevented by cushioning contact springs attached to the armature. This system has been designed for cables containing as many as 300 working circuits. A telegraph repeater is shown in fig. 11. The simultaneous operation of telephone and telegraph circuits has been carefully worked out in connexion with the design of long interurban cables and the equipment used in connexion with them.

(*c*) *Carrier Current Multiplex System.*—One of the most interesting telegraph developments is the so-called Carrier Current System in which multiplex operation is secured by the use of a number of alternating currents of different frequencies and of resonant circuits for selecting them at the line terminals. This system uses vacuum tubes for generating, amplifying and rectifying the alternating currents and represents a radical departure in telegraphy. The circuits are of high signal quality, very stable in operation and free from the duplex balance difficulties of direct current systems. This system has enabled the following communication facilities to be obtained commercially from a single pair of open wires: Twenty 1-way carrier channels; four 1-way direct current channels; and one and one-half telephone circuits including the phantom. The carrier telegraph circuit is illustrated in fig. 12. The terminal apparatus for one 2-way channel, which repeats between the carrier circuit and the direct current extension circuit, is mounted upon a vertical panel similar in appearance to that of the metallic telegraph system. The same sensitive relays are used in both systems.

(*d*) *Rotary Repeaters.*—Success has been obtained with the use of rotary repeaters in connexion with telegraph circuits operated by the multiplex printer system. This type of repeater restores distorted line signals to their original form and has enabled printer circuits 3,000 m. in length to be operated successfully at high speeds.

(*e*) *Fundamental Telegraph-Transmission Research.*—Considerable attention has been given to the telegraph-transmission problem and improvements have been made in the methods and means for measuring distortion of telegraph signals. The fundamental transmission requirements for different classes of service have been more carefully enumerated and advances made in the design of artificial lines.

(*f*) *Interference.*—Advances have been made in minimizing interfering currents in telegraph circuits both from high-tension power lines and from neighbouring telegraph circuits. Means have been devised to overcome the effect of differences in ground potentials on grounded telegraph circuits. This arrangement introduces a counter-electromotive force which is automatically adjusted to neutralize the earth-potential difference between any two given points.

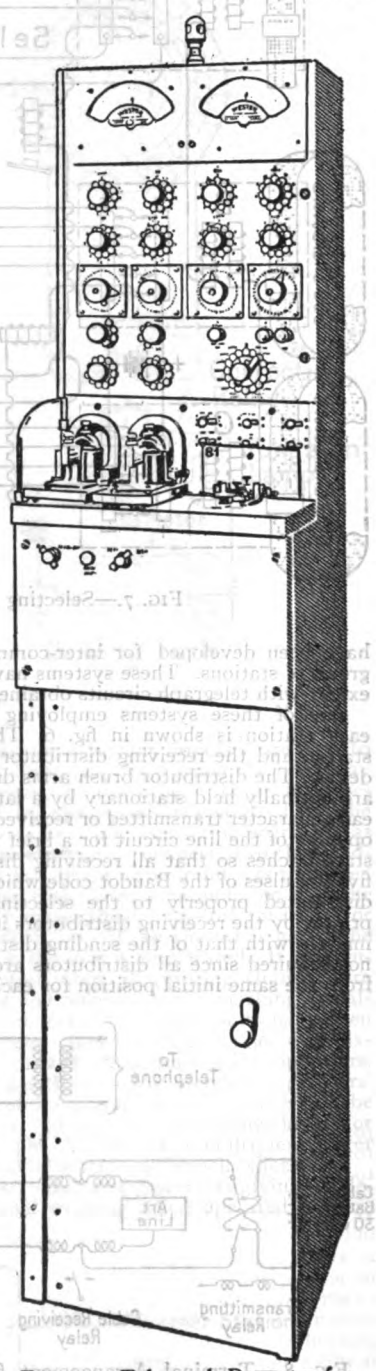

FIG. 11.—Telegraph Repeater for Cable System.

(*g*) *Codes and Sending Machines.*—Codes, abbreviations, typewriters and automatic sending machines are now widely used by operators to increase the capacity of manually-operated telegraph circuits. The automatic machine is merely a vibrating reed mounted in a convenient and portable manner, adjusted to vibrate at telegraph speeds and provided with contacts for controlling the telegraph circuit. A movement of the controlling lever in one direction causes the instrument to transmit a succession of dots, the number depending on the length of time the lever is thus held. A contrary movement sends a dash. This instrument permits higher speeds than are otherwise possible to be maintained with considerably less fatigue on the part of the operator. It may be readily connected with any ordinary telegraph circuit.

Codes and abbreviations for shortening messages are used especially in distributing news. The Phillips Code is one that has been generally adopted and an illustration of its use follows:—

Transmitted message:—

t potus wi ads cgs tsp q pip qsn.

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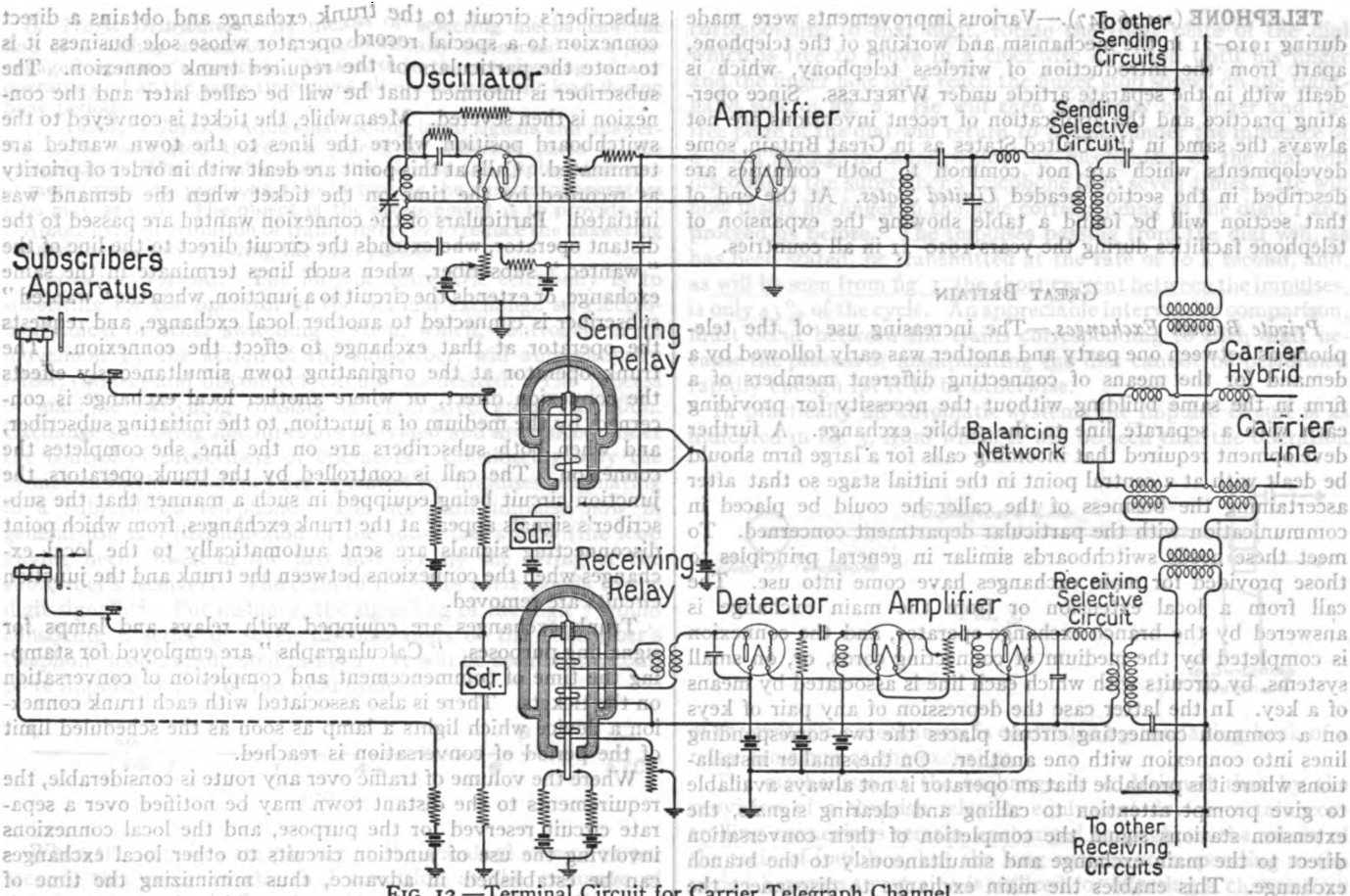

FIG. 12.—Terminal Circuit for Carrier Telegraph Channel.

This would be written by the receiving operator as follows:—

The President of the United States will address Congress this afternoon on the Philippine Question.

Many other schemes are used to save time and cost.

GENERAL BIBLIOGRAPHY.—H. H. Harrison, *The Historical Basis of Modern Printing Telegraphy* (1915); A. C. Booth, *Machine Telegraphy* (1914); H. H. Harrison, *The Story of the Keyboard Perforators* (1917); Maj. O'Meara, *The Various Systems of Multiple Telegraphy* (1911); J. H. Bell, "Printing Telegraph Systems," *American I. E. E.* (Feb. 1920); H. H. Harrison, "The Principles of Modern Printing Telegraphy," *Inst. E. E.* (1915); D. Murray, "Press-the-Button-Telegraphy," *Telegraph and Telephone Journal* (Nov. 1914–July 1915); E. H. Colpitts and O. B. Blackwell, "Carrier Current Telephony and Telegraphy," *American I. E. E.* (Feb. 1921).

MILES OF TELEGRAPH WIRE OF THE WORLD—JANUARY 1 1910, 1914 AND 1920

(Some of the figures—for the most part those for small places not shown separately—are necessarily in part estimated.)

	Single Wire		
	Jan. 1 1910	Jan. 1 1914	Jan. 1 1920
Great Britain	311,942	313,166	318,759
Denmark	8,048	8,191	8,500
France	379,888	381,000	715,468
Germany	388,412	459,811	486,714
Italy	126,505	129,500	208,210
Norway	13,120	13,211	16,195
Sweden	40,171	42,194	53,300
Switzerland	16,336	16,476	19,085
Other countries in Europe	826,730	929,072	930,000
Total Europe	2,111,152	2,292,621	2,756,231
Japan	97,300	106,946	127,000
Other countries in Asia	399,030	436,763	553,000
Total Asia	496,330	543,709	680,000
Union of South Africa	46,853	54,201	49,432
Other countries in Africa	110,000	122,159	140,000
Total Africa	156,853	176,360	189,432
United States	1,480,000	1,615,000	1,700,000
Canada	153,000	193,277	214,629
Other countries in North America	78,000	86,805	95,000
Total North America	1,711,000	1,895,082	2,009,629
Total South America	143,590	251,990	333,632
Australia	92,909	108,931	147,276
New Zealand	20,188	25,892	29,700
Other countries in Oceania	14,700	19,319	24,100
Total Oceania	127,797	154,142	201,076
Total throughout world	4,746,722	5,313,904	6,170,000

NOTE:—In the case of countries the boundaries of which have undergone change, the figures for each year represent the number of miles of telegraph wire within the boundaries of that year.

Telegraph wire used exclusively for railroad operation and not open to public use has been excluded wherever possible.

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TELEPHONE (see 26.547).—Various improvements were made during 1910–21 in the mechanism and working of the telephone, apart from the introduction of wireless telephony, which is dealt with in the separate article under WIRELESS. Since operating practice and the application of recent inventions are not always the same in the United States as in Great Britain, some developments which are not common to both countries are described in the section headed *United States*. At the end of that section will be found a table showing the expansion of telephone facilities during the years 1910–21 in all countries.

GREAT BRITAIN

Private Branch Exchanges.—The increasing use of the telephone as between one party and another was early followed by a demand for the means of connecting different members of a firm in the same building without the necessity for providing each with a separate line to the public exchange. A further development required that incoming calls for a large firm should be dealt with at a central point in the initial stage so that after ascertaining the business of the caller he could be placed in communication with the particular department concerned. To meet these needs switchboards similar in general principles to those provided for main exchanges have come into use. The call from a local extension or from the main exchange is answered by the branch exchange operator, and the connexion is completed by the medium of connecting cords, or, on small systems, by circuits with which each line is associated by means of a key. In the latter case the depression of any pair of keys on a common connecting circuit places the two corresponding lines into connexion with one another. On the smaller installations where it is probable that an operator is not always available to give prompt attention to calling and clearing signals, the extension stations signal the completion of their conversation direct to the main exchange and simultaneously to the branch exchange. This enables the main exchange to disconnect the circuit promptly, releasing the main exchange circuit and any junction circuits which may have been occupied by the connexion. The prompt release of these circuits is of extreme importance in the economical working of the whole system. On larger branch exchange systems where an operator is in continuous attendance, the main exchange clearing signals are controlled by the withdrawal of the cord connexion at the branch exchange. The advantage to be gained under this scheme lies in the fact that the extension station can call in the branch exchange operator during a conversation and get an established call from the main exchange transferred to another extension station when required. When a branch exchange is used in conjunction with a common battery or automatic switching system, the current for speaking purposes is fed over the main exchange lines on exchange to extension station connexions, and by means of a power lead from the main exchange in the case of extension to extension connexions.

When associated with automatic switching systems the branch exchange operator is provided with a calling dial, so that on each exchange connexion she can dial the number required by any extension station.

Trunk Line Working.—Trunk or long distance working is complicated by the necessity for recording the particulars of all calls, and because instantaneous connexion cannot always be effected owing to the prohibitive cost of providing lines with such liberality as would ensure a no-delay service at all times.

The system of the British Post Office is worked as follows: A subscriber desiring a trunk connexion calls up his local exchange and notifies his requirements. If circuits are available to the town required on such a basis as to afford a no-delay service, the connexion is effected at once and the signalling and control arrangements are similar to those described for junction working. The operator records the particulars of the call on a ticket which is used for future accounting purposes. Should a no-delay service not be available, the operator records particulars of the requirements herself, or, in cases where lines to the town required terminate at a separate trunk exchange, she extends the subscriber's circuit to the trunk exchange and obtains a direct connexion to a special record operator whose sole business it is to note the particulars of the required trunk connexion. The subscriber is informed that he will be called later and the connexion is then severed. Meanwhile, the ticket is conveyed to the switchboard position where the lines to the town wanted are terminated. Calls at this point are dealt with in order of priority as recorded by the time on the ticket when the demand was initiated. Particulars of the connexion wanted are passed to the distant operator, who extends the circuit direct to the line of the "wanted" subscriber, when such lines terminate in the same exchange, or extends the circuit to a junction, when the "wanted" subscriber is connected to another local exchange, and requests the operator at that exchange to effect the connexion. The trunk operator at the originating town simultaneously effects the connexion direct, or where another local exchange is concerned, by the medium of a junction, to the initiating subscriber, and when both subscribers are on the line, she completes the connexion. The call is controlled by the trunk operators, the junction circuit being equipped in such a manner that the subscriber's signals appear at the trunk exchanges, from which point disconnecting signals are sent automatically to the local exchanges when the connexions between the trunk and the junction circuits are removed.

Trunk exchanges are equipped with relays and lamps for signalling purposes. "Calculagraphs" are employed for stamping the time of commencement and completion of conversation on the tickets. There is also associated with each trunk connexion a device which lights a lamp as soon as the scheduled limit of the period of conversation is reached.

Where the volume of traffic over any route is considerable, the requirements to the distant town may be notified over a separate circuit reserved for the purpose, and the local connexions involving the use of junction circuits to other local exchanges can be established in advance, thus minimizing the time of occupation of the main circuits and securing the greatest possible effective use of the trunk lines.

Manual Exchanges.—The main features of the manual telephone system remained in 1921 what they were in 1910. Improvements had been introduced to some extent, to diminish or eliminate altogether portions of the operator's work, but common battery transmission and signalling, connecting by means of plugs, flexible cord conductors and jacks, lamp calling and supervisory signals—all these remained unaltered.

Among the improvements referred to may be mentioned: Keyless ringing; automatic listening; secret service; ringing tone; automatic ringing cut-off; traffic distribution; ancillary answering jacks.

1. *Keyless Ringing* is the feature of a cord circuit which provides that the ringing of the required subscriber's bell commences automatically on the operator connecting to his line and ceases automatically on the removal of the receiver from its rest by this subscriber. This renders unnecessary the provision of a key for ringing purposes—hence the term "keyless" ringing.

2. *Automatic Listening* is a feature which eliminates the listening key. The operator's telephone is automatically connected to the calling subscriber's line when the answering plug of the cord circuit is inserted in the answering jack of that line. The operator's telephone is later automatically disconnected when, after ascertaining the number required by the calling subscriber, the operator connects the calling plug to the line of the required subscriber.

3. *Secret Service* follows from 2. Automatic listening involves the feature that while conditions suitable for conversation are established the operator's telephone is disconnected—and without the aid of a listening key it is impossible for the operator to listen to a conversation.

4. *Ringing Tone* is a tone (distinctive from that intimating to a calling subscriber that the line he requires is engaged) applied to the calling subscriber's line while the bell of the called subscriber is being rung. Hearing this tone, which intimates that the bell of the called subscriber is being rung, and receiving no reply after a reasonable period, the calling subscriber infers that his correspondent is not available and restores his receiver. This facility reduces the time spent on "no reply" calls, by both operator and subscriber.

5. *Automatic Ringing Cut-Off* provides that the ringing of the required subscriber's bell automatically ceases when the calling subscriber, receiving no reply, decides to abandon the call and restores his receiver to its rest.

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6. *Traffic Distribution.*—By means of selecting mechanism the line of a calling subscriber is automatically connected to a disengaged operator's position. This avoids the overloading of any operator and at the same time gives all operators a fair load during busy periods.

7. *Ancillary Jacks.*—Additional calling lamp signals and answering jacks associated therewith placed at different parts of the switchboard. When a subscriber calls, signals are displayed at two or more operators' positions, thus increasing the number of operators who may answer. The object of the arrangement is to provide for the more even distribution of traffic and thus to reduce the answering time of the operators during the rush periods.

Automatic Systems.—The idea of automatic telephony is to substitute for the operator of the manual exchange an electro-mechanical or other switching system, which, controlled in its movement by the action of the subscriber, will automatically select, connect and disconnect circuits as desired. The process of machine switching consists of successive group selection. Exchange switching machines are provided and are placed under the control of subscribers or operators. Considering only the former case, the machines are operated by impulses originating in a subscriber's telephone. The standard impulse now in general use is a disconnexion of the subscriber's loop (the loop having been closed in the first instance by the lifting of the subscriber's receiver). The train of impulses corresponds to the digit signalled. For instance, the signalling of the digit 7 would constitute a series of seven disconnexions of the subscriber's telephone loop as indicated in fig. 1. It will be seen that a complete impulse is 57% of the total cycle.

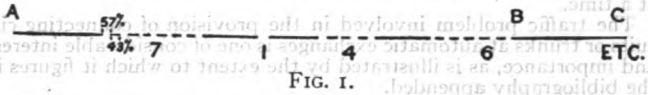

FIG. 1.

When the impulses are passing at the standard rate of 10 per second, this gives an electrical condition at the exchange of sufficient duration to effect reliable operation of the equipment.

On the base of the automatic telephone instrument a circular device, known as the dial, is provided for transmitting the impulses. Fig. 2 shows a full view of the face of a dial that has

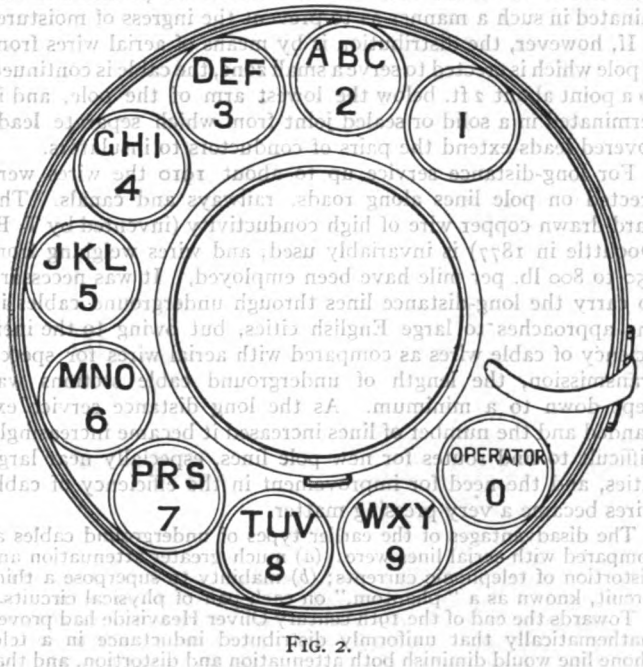

FIG. 2.

been designed for use in large cities. It will be seen that there are 10 holes each of which corresponds to a digit, also that eight of the holes contain letters. Dealing first with the digits, the method of operation is for the subscriber to lift his receiver and then if he requires to call "7146" he will operate these digits in turn. To call 7 he will place his finger in the hole corresponding to that digit, rotate the front plate of the dial which is free to move in a clockwise direction until his finger and the finger hole for 7 reach the finger stop shown on the right-hand side of fig. 2. He will then withdraw his finger and the free plate of the dial will return to normal under the influence of a main spring, in doing which the mechanism of the dial will disconnect the subscriber's telephone loop seven times. He will now insert his finger in the hole corresponding to the digit 1 and proceed as before. The impulses passing from the dial will, as has been stated, be transmitted at the rate of 10 a second, and, as will be seen from fig. 1, the short current between the impulses, is only 43% of the cycle. An appreciable interval, by comparison, must occur between the trains corresponding to each digit because the process of manipulating the dial cannot be performed rapidly enough for it to be otherwise.

In practically all automatic systems the impulse circuit is as indicated in fig. 3, from which it will be seen that the operation

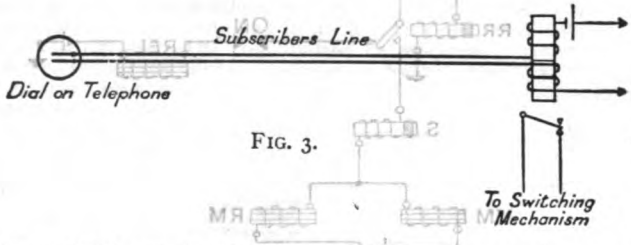

FIG. 3.

of the switching mechanism is controlled by the falling back of a relay armature at the exchange.

The mechanism at the exchange is so designed that by the provision of a sluggish relay or equivalent device certain controlling connexions remain unchanged throughout the whole of the train of impulses, but the long current corresponding to the period between two trains is utilized for effecting a change-over so that each train operates a separate switching device. Briefly the effect is to produce successive selection as already indicated. The operation of the digit 7 in a typical case would operate the mechanism so that an idle outgoing connecting line of the 7th thousand is found. The following digit, 1, will pick out an idle outgoing connecting line to the 1st hundred in the 7th thousand being the 71st hundred. At this point it is common practice to give the subscriber connexion with a switch that can select any one of the 100 lines in the group, so that the next two digits 4 and 6 will call line 46 in the 71st hundred, viz. line 7146.

Automatic systems may in the main be roughly placed in two classes: (*a*) direct impulse systems; (*b*) stored impulse systems.

In the direct impulse system may be placed the systems of The Automatic Electric Co., Siemens Bros. & Co., The North Electric Co., and The Relay Automatic Telephone Co. (including licensees of the firms concerned).

The Automatic Electric Co. and Messrs. Siemens Bros. & Co. manufacture what is known as the "Strowger" system, the switches of which in operating utilize two motions, first, a vertical action in which the brush is not making contact followed by a rotary action in which the brush is either hunting for an idle connecting line in the case of a preliminary switch or moving towards the contact of the wanted subscriber's line in the case of a final switch. Two magnets are involved in this operation. There is a third magnet used for effecting the release at the end of the conversation, the operation of release consisting in the restoration of the moving element to normal, first in a rotary direction by means of a main spring and, secondly, in a vertical direction under the influence of gravity.

Fig. 4 shows the elementary circuit connexions for one of these systems. The calling subscriber on lifting his receiver operates relay "LR" which in turn operates "RR." The impulses are received on "LR" whose armature falls back for each impulse placing an earth connexion intermittently on the circuit of "S" and "VM." Both "RR" and "S" are sluggish relays that release slowly so that the succession of "breaks" and "makes" from the impulses do not affect them. When the long current between two trains of impulses occurs the circuit of "S" is disconnected for a period which is long enough for its operation, and "S" electromagnetically operates the switch "SS" so that "VM" is thrown out of circuit and "RM" is substituted. "VM" is the magnet which operates the vertical stepping by means of a ratchet and pawl device. "RM" similarly effects the rotary stepping. The next train of impulses will clearly operate "RM" after which the change-over devices depending on "S" are made to cut out the accessory mechanical apparatus, leav-

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ing, only the connexions suitable for giving the engaged signal, ringing the subscriber, and talking. At the end of the conversation the caller hangs up his receiver, the armature of "LR" falls back permanently, "RR" is deënergized and the release magnet "REL" is operated thus restoring the switch to normal: "REL" disengages a detent which permits a coiled spring to restore the wipers or brushes in a rotary direction after which gravity carries them vertically to their home positions at which stage the "REL" circuit is opened at "ON." The transmission system consists of two relays "LR" and "LC" associated with two condensers as shown at the top of fig. 4. This will be recognized as the "Stone" C. B. system (*see* 26.552).

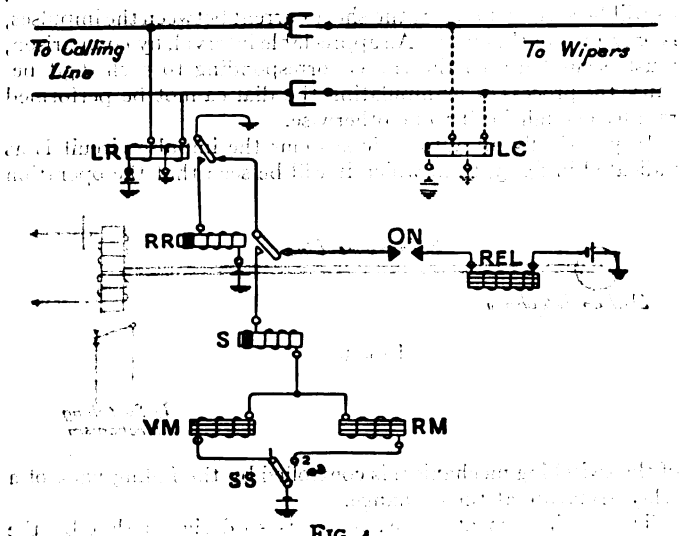

FIG. 4.

The North Electric Co. manufactures a switch operated by direct impulses in which the motions are the reverse of the systems just described. Rotary action, with the brush away from the contacts, is followed by "trunk" hunting in a vertical direction. This permits of vertical contacts which are less liable to the adverse influence of dust than horizontal contacts, and would also permit of a larger number of trunks than 10, being placed in one group without seriously interfering with the design of the equipment.

Both the Relay Automatic Telephone Co. and the North Electric Co. manufacture automatic systems which do not use mechanism as usually understood. The systems consist of aggregations of relays, combined so as to provide a number of connecting or "trunking" paths through the equipment. In the case of the Relay Automatic Telephone Co.'s system the calling subscriber operates his dial in the usual way and at the same time finds an "outgoing" trunk. His impulses operate relay devices known as the "recorder" and the "marker," which latter places an electrical condition on the called subscriber's line so that it immediately operates somewhat like a called line, and finds an idle "incoming" trunk which is placed in communication with the outgoing trunk already seized by the calling party. These two trunks are automatically placed in contact and together form the connecting link for the conversation.

The earliest practical stored impulse system is the "Lorimer" system as used at Hereford (England). In this case the dial as already described is not used, but a lever device is associated with each telephone. The levers are set in definite positions corresponding to the number to be called, and the switches at the exchange are set in motion by the subscriber operating a subsidiary crank that forms part of the calling device. The operation of this crank also winds up the mechanism of the calling device so that the operation of the switches on the exchange can electromagnetically release the calling device and run it down. The running down of the calling device in conjunction with the operation of the exchange switches controls the action of the latter by means of an electrical circuit established through the setting of the levers so that the exchange switches are made to trunk, hunt and find lines in a manner corresponding to the lever setting. The mechanism at the exchange is driven by a motor and can therefore be provided with robust contacts. A subsidiary device known as a pilot switch can be made to operate and alter the connexions between digits or at any other stage of the call so as to control the sequence of switching operations.

The Western Electric Co.'s rotary and panel type systems possess the obvious advantages to be derived from storing connexions and the interpolation of controlling operations at any stage of a call. In both these systems the subscriber's telephone is equipped with a standard dial, and the impulses are taken up by the sender storing device at the exchange. This device is set into position by the impulses and subsequently controls the action of the selective switches in a manner somewhat similar to that indicated for the Lorimer system above mentioned. In the Western Electric Co.'s systems banks of contacts for 200 and 500 lines respectively are employed, as against 100-line banks for direct-impulse systems, so that the number-storing device is also required to perform the functions of a numerical transformer changing the call record from the decimal system as dialled into whatever system is necessary for the correct operation of the switches. An additional feature associated with the panel system of the Western Electric Co. is the provision of a translator which consists of a cross-connecting device so arranged that any number dialled can be converted from time to time into some other number. This is particularly desirable in the case of large cities in which the selection of exchanges is effected by means of a code. It will be seen on reference to fig. 2 that eight of the finger holes have in addition to the digits a group of three letters. These are arranged in alphabetical order from A to Y omitting Q. The use of these letters is to facilitate the calling of subscribers in areas where manual telephones coexist, and where in the ordinary course very cumbersome numbers would otherwise be involved. The arrangement provides a means of facilitating the conversion of an existing manual area to automatic working. The number "Mayfair 2148" is printed in the directory "MAYfair 2148," and so long as any manual exchanges in the area exist the numbers would be passed in the ordinary way, but as automatic exchanges are introduced the subscriber will obtain connexion by dialling "MAY 2148." It will of course be recognized that to dial MAY is really to dial "629," and the switching equipment must be such that the dialling of this code will give the subscriber connexion to an idle junction circuit outgoing to the Mayfair exchange whether that exchange be an automatic or a manual one. Owing to variations in traffic the size of the junction groups to Mayfair will vary from time to time, and redistribution of junction lines in the automatic equipment will be essential. The translator mentioned provides the means whereby this can be effected, because the transformation by means of the "impulse cross connexion field" will make it practicable for "MAY" to be reconverted into any combination of the 10 digits when taken three at a time.

The traffic problem involved in the provision of connecting circuits or trunks at automatic exchanges is one of considerable interest and importance, as is illustrated by the extent to which it figures in the bibliography appended.

Wire Plant.—If the distribution to the subscribers is underground throughout, the main cables are now subdivided into smaller units, bifurcated or multiple branching joints being made between the main and subsidiary cables. The latter cables are accessible in footway boxes, and are terminated in such a way that one or more pairs of conductors can be led direct into any adjacent premises by a small lead-covered paper-core cable. The end of the small cable in the subscriber's premises is terminated in such a manner as to prevent the ingress of moisture.

If, however, the distribution is by means of aerial wires from a pole which is erected to serve a small zone, the cable is continued to a point about 2 ft. below the lowest arm of the pole, and is terminated in a solid or sealed joint from which separate lead-covered leads extend the pairs of conductors to insulators.

For long-distance service up to about 1910 the wires were erected on pole lines along roads, railways and canals. The hard-drawn copper wire of high conductivity (invented by T. B. Doolittle in 1877) is invariably used; and wires weighing from 150 to 800 lb. per mile have been employed. It was necessary to carry the long-distance lines through underground cables in the approaches to large English cities, but owing to the inefficiency of cable wires as compared with aerial wires for speech transmission, the length of underground cable sections was kept down to a minimum. As the long distance service expanded and the number of lines increased it became increasingly difficult to find routes for new pole lines, especially near large cities, and the need for improvement in the efficiency of cable wires became a very pressing matter.

The disadvantages of the earlier types of underground cables as compared with aerial lines were: (*a*) much greater attenuation and distortion of telephonic currents; (*b*) inability to superpose a third circuit, known as a "phantom," on each pair of physical circuits.

Towards the end of the 19th century Oliver Heaviside had proved mathematically that uniformly distributed inductance in a telephone line would diminish both attenuation and distortion, and that if the inductance were great enough and the dielectric conductance not too high the circuit would be distortionless, while currents of all frequencies would be equally attenuated. Following up this idea Prof. M. I. Pupin showed that by placing inductance coils in circuit at distances apart less than half the length of the shortest component wave to be transmitted, a non-uniform conductor could be made approximately equal to a uniform conductor.

Pupin's system of "loading" telephone conductors has been applied in England mainly to underground cables, and many im-

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provements have been made in recent years, so that it is now possible to obtain the same transmission efficiency from an underground telephone circuit as from an aerial circuit of equivalent gauge.

The difficulties encountered in working underground cable circuits were exhaustively investigated by the British Post Office in the first decade of this century, and it was proved that the inability to obtain phantom circuits was due primarily to want of balance between the electrostatic capacity of conductors in respect to (*a*) other conductors and (*b*) to earth. As a result of the earlier investigations the method of laying up the conductors in pairs to form a complete cable was radically changed. A type of cable known as the "quadruple pair" was introduced. In this type the conductors are lapped with insulating paper twinned together in pairs, and are arranged in "cores" each containing four twisted pairs laid up together around a centre, usually of yarn, forming a "quadruple pair" core. The cores are laid up together to the number required

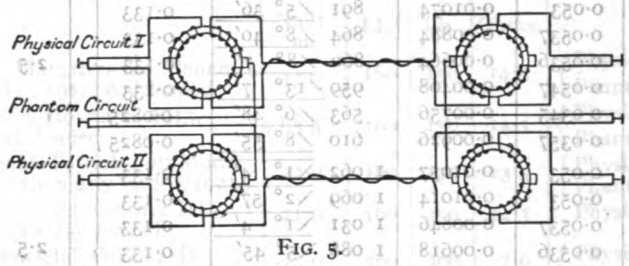

FIG. 5.

and sheathed with lead. This type of cable was a great improvement on the earlier "twin" cables, and permitted the formation of a superposed "phantom" circuit on two physical circuits. Diagonal pairs in the same core are selected for superposing.

In a later type of cable known as the "multiple twin cable" the centre of yarn is dispensed with, and the cable consists of a number of 4-wire cores made up of two 2-wire cores twinned together. The manufacture of this type of cable has been greatly improved in recent years, and cables are now produced with very small out-of-balance capacities between wire and wire, and between wire and earth. It is still, however, necessary to balance the cables after laying by a systematic method of jointing contiguous lengths, whereby conductors are selected and jointed in such a manner as to secure maximum uniformity of characteristics.

A method of loading the phantom circuit in telephone cables was invented by G. A. Campbell and T. Shaw in the United States and patented in Great Britain in 1911. This method was applied to a cable laid between London and Birmingham in 1914 and extended to Liverpool in 1916.

The phantom circuit is obtained by means of specially wound transformers joined across the ends of the physical circuits. The cores of these transformers consist of a ring made up of very fine soft iron wires. Fig. 5 illustrates the method of connecting.

Telephone Repeater.—The art of long-distance telephony was advanced a further and more important stage by the introduction of a practicable type of telephone relay or repeater in 1913.

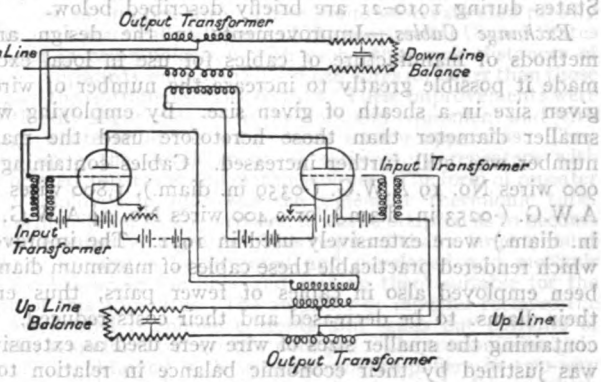

FIG. 6.

The conception of a repeater which could be inserted in a telephone circuit and fulfil the same functions as a repeater in a telegraph circuit is almost as old as the telephone itself. Early attempts at a solution of the problem were invariably in the form of a sensitive microphone attached to the reed or the diaphragm of a receiving apparatus, but the fundamental defects of repeaters of this type, due primarily to the inertia of moving mechanical parts, prevented their successful application in commercial service. It was not until the development of the 3-electrode thermionic tube had reached the stage of commercial production for wireless telegraphy purposes in 1913 that the problem of the telephone repeater could be solved. Since that time progress has been so rapid as to cause almost a complete revolution in long-distance telephony.

A modern telephone repeater for insertion at an intermediate point in a long telephone line consists essentially of two thermionic tube amplifiers, one for the up and one for the down side of the line circuit, associated with apparatus for balancing the line circuits for duplex working, the telephone circuit being necessarily a duplex circuit. The general arrangement is shown in fig. 6.

The telephone repeater may be used to extend the range of speech over existing lines, as for instance a London–Paris line may be extended by a repeater at Paris to any distant city in direct communication with Paris; a second repeater at the distant city may relay the line again to a further point and so on. In fact it may be said that telephonic speech is now possible over any length of wire circuit. Speech through submarine cables is, however, still limited to comparatively short distances.

The most important application of the telephone repeater, and one in which the greatest economies are possible, is in the internal communications of a country. For instance, in order to provide telephonic communication between, say London and Manchester, Leeds, Newcastle and Glasgow, it has hitherto been necessary to erect line conductors weighing on the average 600 lb. per circuit mile. A London–Newcastle line thus requires about 180,000 lb. of copper. It is now possible by using four telephone repeaters at intermediate points between those two cities to provide equally good communication over conductors weighing only 80 lb. per circuit mile, and these conductors may be contained in an underground cable which will carry 240 circuits. The combination of telephone repeaters with underground cables affords a service of greater efficiency than can be obtained from heavy aerial lines, and a service free from interruption by storms.

Fig. 7 is a plan illustrating a scheme for providing telephonic communication between all the important towns of Great Britain

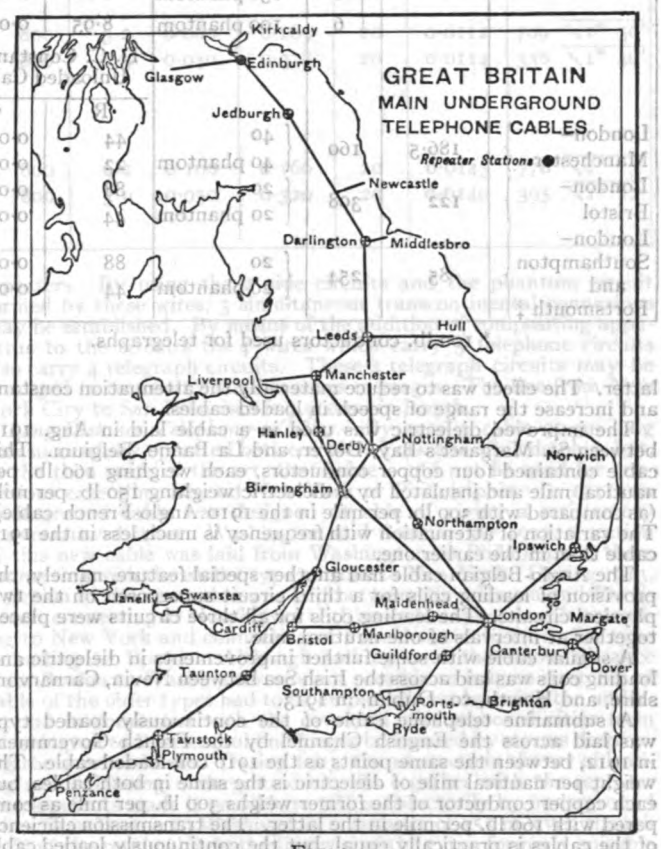

FIG. 7.

by means of underground cables and telephone repeaters. The construction of this extensive system was well advanced in 1921 and was due for completion in 1925.

A list of representative types of main underground telephone cables in Great Britain is given in the table.

Submarine Telephone Cables.—The problem of loading deep-sea cables with inductance coils, and thus increasing the possible range of speech transmission, was successfully solved in 1910, when Messrs. Siemens Bros. & Co. manufactured and laid for the British Post Office between Dover and Calais a 4-core submarine cable loaded with inductance coils at intervals of one nautical mile. The transmission efficiency of this cable was rather more than three times as good as that of a similar cable without loading coils.

In 1911 Messrs. Siemens introduced a form of balata dielectric as a substitute for gutta-percha in loaded submarine cables on account of the greatly reduced leakance of the former as compared with the

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Particulars of Representative Types of Loaded Main Underground British Cables.

Cable	Length	Number of Pairs	Weight per Mile Single Conductor	D. C. Constants of Cable per Mile Loop: Resistance, R	D. C. Constants of Cable per Mile Loop: Capacity Wire to Wire, C	A. C. Constants of Loaded Cable per Mile Loop at $\omega = 5{,}000$: Inductance, L	A. C. Constants of Loaded Cable per Mile Loop at $\omega = 5{,}000$: Attenuation Constant, β	A. C. Constants of Loaded Cable per Mile Loop at $\omega = 5{,}000$: Characteristic Impedance, Z_o	Inductance of Loading Coils	Average Distance between Loading Coils
	Miles			Ohms	μF	Henries			Henries	Miles
Leeds–Hull	58·6	48	70	28·7	0·065	0·052	0·0166	897 ∠3° 4′	0·133	2·55
		6	100 *	—	—	—	—	—		
London–Birmingham	109·5	24	100	18·95	0·0575	0·0535	0·01092	905 ∠5° 41′	0·133	2·5
			100 †	18·38	0·0568	0·053	0·01074	891 ∠5° 36′	0·133	
		12	150	13·13	0·0697	0·0537	0·00884	864 ∠8° 40′	0·133	
		14	200	9·62	0·0654	0·0536	0·00664	860 ∠8° 7′	0·133	
		2	300	6·55	0·0567	0·0547	0·00408	959 ∠13° 7′	0·133	
		6	150 phantom	6·56	0·1056	0·0345	0·00756	563 ∠6° 48′	0·0825	
		6	100 phantom	9·5	0·0905	0·0357	0·00926	610 ∠8° 55′	0·0825	
Birmingham–Liverpool	89·9	24	100	17·9	0·0579	0·053	0·01057	1 062 ∠1° 4′	0·133	2·5
			100 †	17·32	0·0575	0·053	0·01014	1 069 ∠2° 57′	0·133	
		12	150	12·44	0·0685	0·0537	0·00846	1 031 ∠1° 4′	0·133	
		14	200	9·19	0·0572	0·0536	0·00618	1 088 ∠5° 45′	0·133	
		2	300	6·28	0·0545	0·055	0·00413	1 074 ∠2° 26′	0·133	
		6	150 phantom	6·22	0·10075	0·0345	0·00682	565 ∠1° 18′	0·0825	
		6	100 phantom	8·95	0·0864	0·0357	0·00837	615 ∠2° 11′	0·0825	
				D. C. Constants of Unloaded Cables: R	C					
London–Manchester	186·5	160	40	44	0·065	0·109	0·0208	1 298 ∠2° 35′	0·175	1·6
			40 phantom	22	0·090	0·066	0·1625	857 ∠2° 11′	0·106	
London–Bristol	122	308	20	88	0·065	0·155	0·033	1 550 ∠3° 31′	0·175	1·125
			20 phantom	44	0·090	0·094	0·0255	1 023 ∠2° 58′	0·106	
London–Southampton and Portsmouth ‡	85	254	20	88	0·065	0·222	0·0292	1 855 ∠2° 33′	0·250	1·125
			20 phantom	44	0·090	0·138	0·0235	1 240 ∠2° 8′	0·155	

* 100-lb. conductors used for telegraphs. † Not phantomed. ‡ In course of construction.

latter. The effect was to reduce materially the attenuation constant and increase the range of speech in loaded cables.

The improved dielectric was used in a cable laid in Aug. 1912 between St. Margaret's Bay, Dover, and La Panne, Belgium. This cable contained four copper conductors, each weighing 160 lb. per nautical mile and insulated by a dielectric weighing 150 lb. per mile (as compared with 300 lb. per mile in the 1910 Anglo-French cable). The variation of attenuation with frequency is much less in the 1912 cable than in the earlier one.

The Anglo-Belgian cable had another special feature, namely, the provision of loading coils for a third circuit superposed on the two physical circuits. The loading coils for all three circuits were placed together at intervals of one nautical mile.

A similar cable with some further improvements in dielectric and loading coils was laid across the Irish Sea between Nevin, Carnarvonshire, and Howth, co. Dublin, in 1913.

A submarine telephone cable of the continuously loaded type was laid across the English Channel by the French Government in 1912, between the same points as the 1910 coil-loaded cable. The weight per nautical mile of dielectric is the same in both cables, but each copper conductor of the former weighs 300 lb. per mile as compared with 160 lb. per mile in the latter. The transmission efficiency of the cables is practically equal, but the continuously loaded cable provides an additional circuit by superposing. Experiments conducted on this cable in 1914 proved the possibility of obtaining four circuits from a continuously loaded 4-wire submarine cable by introducing an improved method of balancing the electrostatic capacity of the conductors. The fourth circuit has not yet been successful in a coil-loaded cable.

Several additional coil-loaded telephone cables were laid across the English Channel during the war period. Details of these cables are given in the Table.

With equal weights of conductor and dielectric, the relative transmission efficiencies of (*a*) coil-loaded and (*b*) continuously loaded 4-wire submarine cables are as 100 to 75, but the latter may provide four circuits as compared with three in the former. Experience has shown that the maintenance and repairs of coil-loaded cables are attended by difficulties which are not met with in continuously loaded cables.

The introduction of telephone relays has made it possible frequently to use submarine cables of a less efficiency than the coil-loaded cables previously required. Consequently, it is practicable to increase the use of continuously loaded cables, and the modern tendency is in that direction. (W. No.)

United States

The more important improvements made in the United States during 1910–21 are briefly described below.

Exchange Cables.—Improvements in the design and the methods of manufacture of cables for use in local exchanges made it possible greatly to increase the number of wires of a given size in a sheath of given size. By employing wires of smaller diameter than those heretofore used the maximum number was still further increased. Cables containing either 900 wires No. 19 A.W.G. (·0359 in. diam.), 1,800 wires No. 22 A.W.G. (·0253 in. diam.), or 2,400 wires No. 24 A.W.G. (·0201 in. diam.) were extensively used in 1921. The improvements which rendered practicable these cables of maximum diam. have been employed also in cables of fewer pairs, thus enabling their diams. to be decreased and their costs reduced. Cables containing the smaller sizes of wire were used as extensively as was justified by their economic balance in relation to other portions of the plant. This resulted in the employment of considerable amounts of No. 24 A.W.G. conductor cable.

For a long time cable sheaths were made of lead alloyed with about 3% of tin, unalloyed lead not having the requisite strength and resistance to corrosion. Extensive research, directed toward finding a cheaper but no less effective alloy, resulted in 1912 in the adoption of lead alloyed with a small amount of antimony. Readjustments in the thicknesses of sheaths and in the composition of the insulating and binding paper produced still further economies.

Loading Coils in Exchange Service.—Many thousands of trunk circuits in multi-office exchanges and circuits connecting large cities with suburban points have been equipped with loading coils, pro-

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British Submarine Telephone Cables.

Particulars of Cable	Length	Weight per naut. m.		Loop Resistance per naut. m. of Conductor without loading (at 60° F.)	Alternating Current Constants							
		Conductor	Dielectric		Circuit	Frequency of Test	Added Resistance per naut. m. due to Loading	Inductance (L) per naut. m.	Capacity (C) per naut. m.	*Leakance* Capacity or G/C.	Attenuation Constant per naut. m.	Characteristic Impedance (Z_o)
	Naut. m.	Lb.	Lb.	Ohms.		Per sec.	Ohms.	Henries	μF.			Ohms.
St. Margarets–La Panne III., 1911, coil loaded	47·9	160	150	14·3	Physical	800	11·5	0·100	0·157	12	0·0178	800 $\angle 1^\circ 24'$
					Phantom	800	4·6	0·050	0·314	12	0·0181	400 $\angle 1^\circ 16'$
Nevin–Howth I., 1913, coil loaded	63·3	160	150	14·3	Physical	800	6·8	0·100	0·166	15	0·0150	690 $\angle 2^\circ 40'$
					Phantom	800	3·2	0·050	0·320	15	0·0150	446 $\angle 0^\circ 52'$
Temple Patrick-Port Mora, continuously loaded, 1921	22·0	169	195	13·5	Physical	800	2·0	0·0245	0·195	20	0·025	356 $\angle 3^\circ 43'$
					Phantom	800	—	—	—	—	0·025	—
Abbotscliff–Grisnez III., 1910, coil loaded	21·0	160	300	14·3	Physical	750	6·0	0·095	0·186	120	0·0148	1,000
Abbotscliff–Grisnez IV., 1912, continuously loaded	21·0	300	300	7·6	Physical	1,000	—	0·0135	0·176	109	0·0185	278 $\angle 2^\circ 59'$
					Phantom	1,000	—	—	—	—	0·0185	—
Dover–Sangatte I., 1917, coil loaded	20·8											
Dover–Dunkirk I., 1917, coil loaded	41·6	310	200	7·4	Physical	800	5·2	0·080	0·189	20	0·0112	709 $\angle 1^\circ 50'$
					Phantom	800	2·5	0·040	0·378	20	0·0114	338 $\angle 1^\circ 40'$
Dungeness–Audrecelles III., 1918, coil loaded	26·0											
Dover–Sangatte II., 1918, coil loaded	21·0											
		160	150	14·3	Physical	800	6·2	0·100	0·166	20	0·0145	776 $\angle 1^\circ 3'$
					Phantom	800	3·0	0·050	0·320	20	0·0140	395 $\angle 1^\circ 2'$
Dungeness–Audrecelles II., 1918, coil loaded	27·6											

viding transmission of such a grade as would require from 5 to 10 times as much copper in the cable circuits if loading were not employed. Loading coils have been materially improved by constructing the cores of several rings, each of which is made by compressing finely divided particles of iron with a binding material which acts as insulation between the iron particles. There may be as many as thirty thousand million of these particles in the core of a cable loading coil. These cores are more uniform and stable than the wire cores formerly used and are much less affected by excessive currents which may accidentally come into the circuit.

Long-Distance Telephony—Open Wire.—At the beginning of the decade 1910–20, the limits of telephone transmission were about 1,200 to 1,500 m. in open wire. These limits were extended rapidly so that in 1921 practically all parts of the continental United States were placed in communication with each other over distances of 4,000 m. and upwards, employing overhead wires no larger than those used to give the restricted service of 1910. These improvements were made with only slight changes in the lines and equipment and with no change whatever in the subscriber's station apparatus. They depended upon the development of satisfactory repeaters with their associated apparatus and methods of use. The form of repeater generally employed in 1921 was the 3-element thermionic tube. Devised primarily for radio purposes, it was so adapted as to become a remarkably effective repeater. This required that a large amount of auxiliary apparatus be invented and developed and methods devised for balancing the lines and making them suitable for the operation of this apparatus. The amplifier or repeater receives the minute attenuated telephone currents and sends out currents of exactly the same form but greatly enlarged. The transmission gain which may be obtained with vacuum-tube amplifiers in two-way operation depends on the electrical conditions of the line in which the amplifiers are used. This has a great effect on line design.

Transcontinental Telephony.—By the development of methods by which the loading coil could be applied to the heaviest gauge wires and such wires, when equipped with loading coils, could be operated on the phantom principle, it became practicable, in 1911, to provide telephone service between New York City and Denver, Col., and greatly to improve the transmission of speech between cities less far apart. By the application of the phantom principle to such circuits the available facilities were largely increased so that, between the important telephone centres, notable improvements in service were accomplished. On Jan. 25 1915, the transcontinental line of the Bell System was formally opened for business and after that time commercial service was given between the cities on the Atlantic Coast and those on the Pacific Coast. The service in 1921 was handled over a group of 4 non-loaded wires equipped with telephone repeaters. By using the 2 side circuits and the phantom circuit formed by these wires, 3 simultaneous transcontinental connexions may be established. By means of the addition of compositing apparatus to the circuits the 4 wires which carry 3 telephone circuits also carry 4 telegraph circuits. These 4 telegraph circuits may be arranged to transmit 8 simultaneous messages. The line from New York City to San Francisco is 3,400 m. in length.

Long-Distance Telephony—Cables.—By 1906 a cable 90 m. long was successfully operated between New York and Philadelphia, but, in the then state of the art, that cable could not be used for connexions extending beyond New York or Philadelphia. In 1911, an underground cable was designed capable of giving a satisfactory conversation between Washington and Boston. By 1912, a section of this new cable was laid from Washington to Philadelphia, there connecting with the earlier type of cable to New York. During 1913, a section of the new cable was laid between New Haven and Providence, connecting at New Haven with an earlier type of cable extending to New York and connecting at Providence with an earlier type extending to Boston. Although talking over the whole distance from Boston to Washington was not possible so long as stretches of cable of the older types had to be employed, yet by using the underground in connexion with the overhead, the seaboard cities from Washington to Boston could no longer be isolated by storms destroying the overhead lines. During 1913, the advances in the art of loading and balancing underground circuits together with the repeater developments made it possible to talk satisfactorily by underground wires from Boston to Washington, a distance of 455 m. even though 47% of the total cable in the line was of the types formerly suitable for short-haul working only. In 1912, talking by underground wire for the first time between New York and Washington represented the longest distance achieved. By 1913, this distance had been doubled. The Boston–Washington cable was several times longer than any other in the world. There were in 1921 several cables working along the Boston–Washington route. During 1919, the extension of the toll cable system from Philadelphia to Harrisburg, Pa., was completed. Taken in combination with the cables already working between Boston and Washington, this gave a through toll cable route from the important points on the eastern seaboard as far west as Harrisburg. In 1921, this cable was extended from Harrisburg as far W. as Pittsburgh, a distance of 192 m. from Harrisburg and 304 m. from Philadelphia. For the greater portion of the distance the cable was supported aerially on poles. The composition of this cable was as follows:—

Section	Quads No. 16 A.W.G.	Quads No. 19 A.W.G.
Harrisburg–Ligonier	16	125
Ligonier–Pittsburgh	19	120

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At the intervals of about 60 m. substantial brick buildings were erected for use as repeater stations to house the equipment, apparatus, power plant and test boards that make up a modern repeater station. General plans were completed for extending this cable from Pittsburgh to Chicago.

The installation of these toll cables resulted in economies due not only to the reduced annual charges on additional circuits as required and less expense for routine maintenance, but also to the fact that the losses resulting from storm damage to open wire were avoided, as were also losses in revenue and reaction on the service during storm periods. Much is thus done to stabilize the toll plant and reduce expenditures as well as further to improve the service. By means of the improvements which had been made it became possible to carry on satisfactory talks over wires in cables more than 2,000 m. in length (where commercial conditions justify such cables) and this was accomplished with practically no more copper in each circuit than had been used in the earliest forms of cable which, as lately as 1882, caused serious interference with transmission when employed in lengths of only a fraction of a mile.

Repeater development reacted on the loading art, requiring the development of loading coils of great magnetic stability and uniformity. Such stability is also particularly important on long circuits which are composited for telegraph operation in order to prevent the telegraph from interfering with the telephone transmission. Although these loading and repeater developments greatly extended the use of cables for long-distance transmission they made it imperative to keep open-wire circuits as free as possible from cable in order to prevent the electrical irregularity thus introduced from reacting on the repeater operation.

Submarine Cables.—In 1921, telephone communication was established with Cuba by means of submarine cables connecting Havana with Key West. These cables brought all of the principal places in the United States into telephonic communication with Havana and other important places in Cuba. There were in 1921 3 cables, each about 115 m. in length. Except at the terminating points, the cables were laid some miles apart in order to minimize the danger of simultaneous interruption as the result of accident. The average depth was about 3,000 ft. and in some places depths of more than a mile were reached. The main portion of each cable had a single conductor, two conductors being employed in the shore ends. The main conductor weighed 350 lb. per m. and consisted of 7 strands of copper wire. The conductor bore a wrapping of fine iron wire, this being covered with gutta-percha enclosed in copper tape which served as a return grounded conductor. By the use of multiplex methods each cable handled simultaneously one telephone and two telegraph messages. Each cable is expected ultimately to handle two or more additional telegraph messages. The use of single conductor cables, the telephone amplifiers, the terminal telegraph apparatus, and the devices for permitting the telephone and telegraph to operate simultaneously, all differed from earlier practice.

The largest submarine cable equipped with loading coils in 1921 was that which crossed Raritan Bay from Staten Island to New Jersey. It was upwards of 28,000 ft. in length, was loaded at 5 points and contained 37 quads of No. 16 gauge wires and 12 pairs of No. 22 gauge test wires. Each loading pot was approximately 16 ft. long and weighed 4 tons. The cable was laid in shallow water, the average depth being 10 ft. at mean low tide.

Carrier Current Telephony.—From the earliest days of the telephone and telegraph there were many attempts to develop multiplex transmission of messages. It was while working on the problem of multiplex telegraphy that Dr. Bell had his first conception of the structure of the original telephone. The long series of inventors, scientists and engineers who have contributed to the development of the multiplex art includes Gray, Edison, Mercadier, Pupin, Hutin, Leblanc, Stone, DeForest, Vreeland, Ruhmer, Squier, Wagner and others. In 1918 research experts and engineers of the Bell System completed the development of a commercial multiplex telephone and telegraph system and put it into operation between Baltimore and Pittsburgh. By means of this multiplex system, 4 telephone conversations may be had simultaneously over one pair of wires in addition to the telephone conversation provided by the ordinary methods. Thus, over a single pair of wires, 5 telephone conversations are simultaneously operated, each giving service as good as that provided by the circuit working in the ordinary way.

In telegraphy, as compared with the ordinary duplex telegraph circuit, this multiplex system permits at least a tenfold increase in messages. Although the commercial installations in use in 1921 provided only 4 additional conversations, the limitations as to number of telephone or telegraph messages on a single circuit were determined entirely by economic considerations. The operation may be considered to consist of combining the telephone current with high frequency current, transmitting this combination over a line wire, and, at the receiving end, removing the high frequency current and leaving the telephone current. The high frequency current serves as a " carrier " for the telephone current over the line.

Simultaneous transmission of several telephone currents is accomplished by means of selective apparatus by which one particular receiving channel is made easily receptive to one particular set of high frequency currents and, at the same time, acts substantially as a barrier to the currents of other high frequencies which are carrying telephone conversations other than those which the channel in question is designed to receive.

The operation involves the following steps: (1) Generation of carrier current, (2) Modulation, (3) Demodulations, (4) Separation of channels by selective circuits, (5) Repeaters for amplifying currents of carrier frequency at intermediate points.

(1) *Generation of Carrier Current.*—Carrier currents of various frequencies are for convenience obtained from well-known forms of vacuum-tube oscillators. In general the telephone multiplex frequencies run about 10,000, 15,000, 20,000 and 25,000.

(2) *Modulation.*—This term is applied to the process by which carrier current, produced by an oscillator, is so combined with voice currents from a telephone transmitter that the variations of the latter are impressed upon the former. The carrier and voice frequencies are applied together in the grid circuit of a vacuum-tube modulator together with a steady battery voltage.

(3) *Demodulation.*—This is a complementary process of modulation. Modulation may be thought of as elevating the band of essential speech frequencies to a position adjacent to the carrier frequency, and demodulation may be regarded as restoring this band to its normal position in the frequency scale.

(4) *Separation of Channels by Selective Circuits.*—When a number of channels, each employing a different carrier frequency, are operated simultaneously on a common line, each channel must be connected with the line through selective circuits which transmit only the range of frequencies assigned to that particular channel. Not only must the demodulator assigned to a given channel be prevented from receiving, from the line, currents of other channels, but the sending modulator must be prevented from putting on the line currents or frequencies outside of its assigned band. The appurtenances specially developed for accomplishing this selection in carrier current telephony are known as " band-pass electrical filters."

(5) *Reaction on the Telephone Plant.*—Carrier currents have imposed new requirements as to transpositions and it has also been necessary to develop new types of loading coils capable of transmitting the carrier frequencies, and also extremely uniform in impedance over the whole frequency range.

Limitations.—From the nature of the apparatus and methods employed, the system is not practically advantageous on short lines. In 1921 it was being applied to lines of 250 m. or more.

Carrier telephone systems were in commercial operation between the following points: Baltimore and Pittsburgh, Harrisburg and Chicago, Harrisburg and Detroit, Boston and Bangor, San Francisco and Los Angeles.

Loud-Speaking Telephones.—By the use of vacuum-tube amplifiers in connexion with specially developed transmitters and receivers, supplemented by large projecting horns, the human voice may be magnified thousands of millions of times so that a public speaker can make himself heard by a vastly greater number of people than ever before. By the use of apparatus and methods of this kind developed by the Bell Telephone System, President Harding's inaugural address in 1921 was heard by over 100,000 listeners standing in an open space of more than 10 ac. before the Capitol.

Radio Telephony.—In 1915 the engineers of the Bell Telephone System succeeded in transmitting speech from Arlington, Va., to the Eiffel Tower in Paris, and, simultaneously, to the Hawaiian Islands in the Pacific Ocean. Two experimental radio telephone transmitting and receiving stations were erected on the Atlantic Coast, one near Asbury Park, N.J., and the other near Plymouth, Mass. By means of these stations, radio telephone communication was maintained between the commercial telephone system and two ships experimentally equipped, plying from Boston to southern ports on the Atlantic Coast.

In July 1920 regular commercial radio telephone service was established between Santa Catalina Is. about 30 m. from shore, and the mainland near Los Angeles, Cal., at the latter point making junction with the local and long-distance wires of the Bell System throughout the United States.

The circuit is provided with through-line ringing of a type which is free from interference and there is a superimposed telegraph circuit capable of forming a link in a duplex wire telegraph circuit. The volume and quality of telephone transmission are so good that the radio link is regularly connected, whenever required, with long-distance wire circuits. On several occasions conversations have been carried on between a steamship on the Atlantic and the Avalon office at Catalina Is. in the Pacific, using the transcontinental wire telephone line as the connecting link overland.

Machine-Switching System.—A retrospective examination of the manually operated switchboard discloses the fact that the tendency of development has been continuously in the direction of increasing the number and extent of the operating functions which are performed electro-mechanically and likewise decreasing the amount of time required of the operator for the handling of the connexion. When a point is reached where the operations performed manually at the central office are eliminated, except in the case of certain special classes of calls, the term " automatic " or " machine switching " is applied to the switching equipment.

There are two principal types of machine-switching equipment, the " step-by-step " and the " panel " type. In both the apparatus

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at the central office is set in motion and controlled by a dial, associated with the substation set, and rotated by the subscriber. The "step-by-step" type of equipment makes use of a series of selectors in each of which contact is made by means of a central arm that can be raised to any desired level and rotated, at that level, to the proper one of a series of terminals arranged in the arc of a circle. This type of equipment is mostly used in the smaller cities and for automatic private branch exchanges. The "panel" type of equipment has been developed to a point where it is now being installed on an extensive scale in a number of the larger cities of the United States. On account of its importance a brief description is given.

Panel Type System.—The panel type equipment is so named because the multiple of the selectors is built in panels. The selectors have, in general, capacity for 500 lines or trunks. The multiple of these selectors consists of punched brass strips about 3 ft. long and one in. wide piled one above the other with insulation between. Since 3 connexions are necessary for each line or trunk, 1,500 of these strips are provided. The strips are divided horizontally into 5 groups or panels of 100 lines or trunks each and are mounted on frames having capacity for 60 selectors each, 30 on each side. The selector consists of a tube running vertically, close to the banks, the tube being equipped with a set of brushes for each bank. The brushes normally are held mechanically so that they do not engage the terminals. At the bottom of the tube, a friction clutch is provided which, by engaging constantly rotating shafts, can cause the tube to be raised or lowered. The brushes are multipled together by wires within the tube, these wires being attached at the top of the tube to feeder brushes which move over insulated feeder strips. The process of selection consists in first mechanically tripping the desired brush into engagement with its multiple bank, next in moving the tube carrying the brushes upward to choose the desired group within the bank, and finally continuing the movement upward to choose the desired subscriber's line or an idle trunk within the selected group. The subscribers' lines appear on the multiple of panel type selectors known as "line finders." The function of the line finder is to make connexion with calling subscribers' lines. It corresponds to the "A" operator's answering cord and the subscriber's answering jack in the manual system. The brushes of the line finder are attached to the brushes of a panel type "district selector" and also to the brushes of a small selector known as a "sender selector." As soon as a calling subscriber's line has been picked up by a line finder, the sender selector selects an idle "sender" out of a common group. When the calling subscriber dials, the pulses are registered in the sender which controls the setting-up of the connexion and is then freed. The sender may be likened to the operator of the manual system. The sender causes the district selector to choose a trunk to the desired office, or, if more than 500 outgoing trunks from the office are required, causes the district selector to pick out an idle "office selector" of the panel type which selects the desired trunk. The trunk incoming to the full mechanical office ends in the sender of an "incoming selector" of the panel type whose function it is, under control of the sender, to pick out an idle panel "connector" having access to the group of 500 lines in which the called subscriber's line may be found. Controlled by the sender, the connector then selects the called line.

Calls from a machine-switching to a manual office are completed over "call indicator trunks." As the calling subscriber dials his call, the district or office selector picks out an idle trunk to the desired office. This trunk ends in a plug before a "B," or incoming trunk operator in the called office. When a call appears on that trunk, the "B" operator depresses a display key associated with that trunk, whereupon the number which is desired in that office is quickly transferred by the sender to a bank of numbered lamps appearing before the "B" operator, and the "B" operator thereupon plugs the trunk into the desired subscriber's line.

For completing calls from a manual to a full mechanical office "key indicator mechanism" is employed. This is a mechanism which indicates to the "A" operator an idle trunk to the desired office which ends at that office at an incoming selector. The "A" operator by using a small 10-button key-set is enabled to control the incoming selector to make connexion through the aid of connectors with the called line desired.

Other Improvements.—In the United States there is a large and growing use of the telephone for communications essential to the operation of both steam and electric railways. The problem of minimizing the disturbing effect upon telephone circuits produced by induction interference from electric light and power circuits has resulted in careful, coördinated work by the power and telephone engineers. Important improvements have also been made in local and toll line operating efficiency.

Organized research has not only enabled the limits of telephony to be greatly extended but, at the same time, improvements and economies have been made in every department of the business.

Telephone Development of the World—January 1 1910, 1914 and 1920.

(Some of the figures—for the most part those for small places not shown separately—are necessarily in part estimated.)

	Jan. 1 1910		Jan. 1 1914		Jan. 1 1920	
	Number of Telephones	Telephones per 100 Population	Number of Telephones	Telephones per 100 Population	Number of Telephones	Telephones per 100 Population
Great Britain	609,274	1·3	780,512	1·7	911,919	1·9
Denmark	87,436	3·2	129,277	4·5	219,460	7·3
France	211,664	0·5	330,000	0·8	418,901	1·1
Germany	968,101	1·5	1,420,100	2·1	1,766,571	2·9
Italy	63,131	0·2	91,720	0·3	107,190	0·3
Norway	57,945	2·4	82,550	3·4	122,796	4·7
Sweden	174,055	3·1	233,008	4·1	388,794	6·7
Switzerland	73,758	2·0	96,624	2·5	138,843	3·5
Other countries in Europe	506,636	0·2	848,918	0·3	925,000	0·3
Total Europe	2,752,600	0·6	4,012,709	0·8	4,999,474	1·0
Japan	109,780	0·2	219,551	0·4	298,000	0·5
Other countries in Asia	44,220	0·01	86,534	0·01	150,000	0·02
Total Asia	154,000	0·02	306,085	0·04	448,000	0·05
Union of South Africa	13,650	0·2	28,889	0·5	42,419	0·6
Other countries in Africa	18,000	0·02	36,207	0·03	53,000	0·04
Total Africa	31,650	0·02	65,096	0·05	95,419	0·07
United States	6,995,692	7·6	9,542,017	9·7	12,668,474	12·0
Canada	239,000	3·3	499,774	6·5	785,108	9·0
Other countries in North America	38,900	0·1	79,157	0·3	110,000	0·3
Total North America	7,273,592	5·5	10,120,948	7·5	13,563,582	9·0
Total South America	75,000	0·2	166,331	0·3	264,737	0·4
Australia	81,040	1·8	137,485	2·8	224,000	4·3
New Zealand	29,680	2·7	49,415	4·6	80,723	6·5
Other countries in Oceania	10,000	0·03	30,481	0·06	54,000	0·1
Total Oceania	120,720	0·3	217,381	0·4	358,723	0·6
Total throughout World	10,406,962	0·6	14,888,550	0·9	19,729,935	1·1

Note: In the case of countries the boundaries of which have undergone change, the figures for each year represent the number of telephones within the boundaries of that year.

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TELPHERAGE (*see* 7.63).—The World War saw, in the Italian army, amazing use made of the system of telpher transport for fighting on the Alps. When, after many years, snow, ice and avalanches will have all but cancelled every trace of the epic deeds performed in those regions, tourists who climb to the crests of the Adamello, the Marmolata, the Tofana and a hundred other peaks will hardly believe that thousands of men lived and fought for years in the very spots that they have reached only with difficulty, with the help of ropes and ice-axes, and in favourable weather.

Before the war it was thought impossible to conduct military operations on the high peaks. It was believed that the ordinary troops would be practically tied to the roads, that a company of "Alpini" with a few mountain guns would be the largest unit that could be used in places where only paths for mules existed, and that the rocky peaks, the snows and the ice, would be reached only by small groups belonging to specialist units, sent there to keep an eye on the enemy.

But from the earliest days of the campaign there happened on the Alpine front something very similar to what had occurred in France after the battle of the Marne, when Germans and French, in their common desire to outflank each other in the direction of the sea, finally reached the sea itself, thus forming one uninterrupted line from the Vosges to the Channel. On the Alps, with the object of capturing or turning the Austrian defensive lines, the Italians climbed higher and higher in ever-increasing numbers, the Austrians doing likewise, until the very tops of the mountains were reached and it became impossible to go farther. The most elevated points of the frontier having been thus occupied, the Italians put themselves in a position to meet enemy attacks as well as to face the inclemency of the climate: a hard and relentless struggle which had to be started afresh every time war operations involved a change of positions.

The first days of the war saw whole companies clinging hand and foot to the rocky summits; battalions encamped and freezing at a height of 3,000 metres. Field guns, drills, photo-electric stations were taken to pieces and carried up bit by bit to giddy heights, and there put together again. Food, water, ammunition were carried for many hours on mules, and thence transferred to columns of men who carried them for long hours more. At times the wounded and the sick had to be removed by securing them with ropes and letting them slide down gullies, or by allowing them to be jolted on stretchers along impossible paths. Very often they had to be attended to on the spot, behind a rock, because their condition did not allow of so painful a transport.

Numberless were the cases of men who, barefooted, with daggers in their mouths, would climb up the most impracticable summits during dark and stormy nights, and surprise the enemy where the latter felt sure that the ravines and precipices which surrounded him were his surest guards. Many times whole supply columns were crushed and buried by avalanches and rocks. Avalanches claimed thousands of victims among the troops on march, in hutments or in trenches. In certain places and at certain periods the danger was so great that when the men went out they were supplied with a long thin rope coloured in red. The colour came off with the damp and stained the snow, thus facilitating the search for men buried underneath.

The colossal work done at such great heights originated unheard-of conditions of defence and of existence. In places where until then a hurried visit with an experienced guide seemed a bold feat, in regions where there was perhaps one isolated Alpine hut in which it was considered an ordeal to spend one or two nights, there were constructed hutments, telegraph and telephone offices, infirmaries, workshops and stores. In such places, at a height of over 3,000 metres, tens of thousands of men spent several winters. To prepare these encampments both for shelter and for defence, it became necessary to excavate in the rock an enormous quantity of vast caves. In some places an underground city was cut in the rock with inter-communicating caves

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lined with timber and provided with water-pipes, electric lighting, etc. Galleries were excavated in the ice, between the Italian and Austrian trenches, leading under cover to advanced posts or even well into the enemy's lines. Gigantic operations with mines were also carried out. Cutting the rock was rendered possible thanks to the great perfection of the compressed-air drills. During the war the Italians turned out an admirable type of motor-driven air-compressor, which met with success also in the Allied armies. On the Italian front there were 20 large plants for fixed drills and about 4,000 groups of portable drills of from 5 to 45 horse-power. The remarkable skill of the Italian miners facilitated considerably the carrying out of most important and difficult mining operations.

In road-making wonderful results were obtained. Once operations were transferred to the highest and most inaccessible points, where in many cases there was not even the narrowest path, it became an absolute necessity to create means of communication at once. Roads were constructed which allowed heavy artillery and motor lorries to reach points where a few months before only a mountain expert would have trod.

The total length of the roads laid down by the Italian army was in round figures as follows:—

1,600 km. . . . . of roads for mules
1,100 " . . . . . " " " carts
3,100 " . . . . . of roads for motor lorries.

But the building of roads could not always meet the requirements of troops operating in Alpine districts. It happened very often that the number of men detailed to a certain point did not justify the building of a road on such difficult ground; or that snow and avalanches in the winter prevented the safe use of means of communication already existing; or that the enemy's fire swept them; or, finally, that the occupation of new positions made it necessary to send supplies out of proportion to the available transport and before there was time to build a road. The difficulty in such cases was skilfully overcome by means of special mechanical transport. Wire railways or "telphers" were provided, thus economizing time, labour and oil, and avoiding congestion of roads. These telphers are a kind of suspension railway. A double metal cable called "bearer" is extended on trestles placed in a straight line at different distances on the sides of the mountain. There are two stations, one at the starting-point and the other at the end of the line. In one of these stations there is a motor which works an endless cable (the "drawer"), to which are fixed two or more small waggons. The cable turns and draws the waggons supported by the "bearer" cable by means of small wheels which run on it.

Different kinds of telpherage plants were used.

1. *Telefori.*—These were provisional lines moved by man power and used in the most advanced zones to supply isolated posts or trenches. Their average length was 500 metres and each could carry about 50 quintals a day.

2. Dismountable *Telefériche.*—These were run by motors and were put up in advanced zones. Their average length was from 1,000 to 2,000 metres, and each could carry from 10 to 20 quintals an hour. They could be dismounted and were portable, and could be installed even where there were no roads. These lines proved most useful for the transport of supplies in newly occupied positions. When in 1917 the troops of the II. Army crossed the Isonzo and advanced on the Bainsizza (Bainitsa) plateau, they could not communicate with the lines in the rear except by means of the few and bad mule-paths; but after only four days a few telphers were already in working order, and on the tenth day there were no less than 12 doing service. Similar miracles of speed were performed in the new mountain positions between the Brenta and the Piave.

3. Permanent *Telefériche.*—These were run by motors and were fixed. They were employed at some distance from the lines, and reached a maximum length of 8,000 metres. They could carry about 150 quintals per hour.

Some permanent *telefériche* were already working before the war for the service of mountain fortresses, and some types of portable *telefériche* had been studied and estimates prepared. Oil and electric motors were in use.

The telphers covered on an average a rise of 650 metres from the starting-point to that of arrival; but in some cases even 1,500. The trestles were often at very great distances from one another and placed on peaks, while the waggons ran over fearful abysses. In the highest regions the lines often ran at a height of 2,000 to 3,000 metres; a few were installed even at 3,500 metres above sea-level.

On the eve of the retreat from Caporetto, in Oct. 1917, 380 *telefori* and 530 *telefériche* were in working order. The former had a total length of 190 km., the latter of 630. During the retreat about 550 *telefériche* and *telefori* were lost or dismounted. At the date of the Armistice there were 270 *telefori* and 460 *telefériche* run by motors. The former had a total length of 170 and the latter of 640 kilometres.

The telpherage lines laid on the Italian front transported in all 33,000,000 quintals, the load of 330,000 railway trucks.

The service was under a special central administration with a competent staff drawn from the telpher transport companies (one for each army). There was also a department for the supply and testing of the material and a depot-school with construction and repairing shops. The bulk of the material was built by private concerns, but set up by the military.

The services rendered by the telpherage lines were invaluable. It was only thanks to these lines that it was possible to maintain positions which the troops would otherwise have been compelled to abandon for want of supplies. They allowed detachments to be kept in almost impossible positions even during the winter, as well as assuring an adequate supply of ammunition for guns placed in the most inaccessible positions which men could not have reached if laden with shells. Thousands of lives were saved when their gently sliding waggons were used for the transport of wounded and sick, who were thus spared a lengthy and agonizing journey to hospital. (M. R.)

TENNESSEE (*see* 26.619).—The pop. in 1920 was 2,337,885 as against 2,184,789 in 1910, an increase of 153,096, or 7% as against 8·1% in the preceding decade. The negro pop. during 1910–20 decreased numerically from 473,088 to 451,758, and decreased proportionally from 21·7% of the total to 19·3%. The average density of pop. in 1920 was 56·1% per sq. m.; in 1910 it was 52·4. The urban pop. (in places of 2,500 inhabitants or more) increased from 20·2% of the total in 1910 to 26·1% in 1920. Only two cities, Memphis and Nashville, had in 1920 more than 100,000 inhabitants; only two, Knoxville and Chattanooga, had between 50,000 and 100,000. The following table shows the pop. and increase per cent. for the six cities exceeding 10,000 for the decade 1910–20:—

	1920	1910	Increase per cent
Memphis . . .	162,351	131,105	23·8
Nashville . . .	118,342	110,364	7·2
Knoxville . . .	77,818	36,346	114·1
Chattanooga . .	57,895	44,604	29·8
Jackson . . .	18,860	15,779	19·5
Johnson City . .	12,442	8,502	46·3

Agriculture.—During the decade 1910–20 the interests of the state remained predominantly agricultural. Although the total land area in farms decreased from 20,041,657 ac. to 19,510,856 ac., the improved land increased from 10,890,484 ac. to 11,185,302 ac., and the number of farms increased from 246,012 to 252,774. During the same period the average acreage per farm decreased from 81·5 ac. to 77·2 ac.; but the average value per farm increased from $2,490 to $4,953, and the value of all farm property increased from $612,520,836 to $1,251,964,585. The average value of land per acre in 1920 was $41.40; in 1910 it was $18.53. Of the 252,774 farmers in 1920 214,592 were whites and 38,182 were negroes. Of all farmers 148,082 were owners; 103,885 tenants; and 807 managers. Of the total 11,374 were women. The total value of farm crops in 1919 was $318,285,307, of which amount $144,778,157, or 45·5%, represented cereals; the total value in 1909 was $111,133,210, cereals representing 49·8%. The cereal acreage in 1919 was 4,186,373 ac. as against 4,136,647 ac. in 1909, an increase of only 1·2%. The following table shows comparative acreage, production, and value of the important crops for 1919 and 1909:—

		Acreage	Production	Value
Corn . .	1919	3,301,075	70,639,252 bus.	$127,150,649
" . .	1909	3,146,348	67,682,489 bus.	45,819,093
Oats . .	1919	162,417	2,413,409 bus.	2,534,082
" . .	1909	342,086	4,720,692 bus.	2,378,464
Wheat .	1919	684,497	6,362,357 bus.	14,506,174
" . .	1909	619,861	6,516,539 bus.	6,913,335
Hay and forage . .	1919	1,751,123	1,907,345 tons	49,649,657
Hay and forage . .	1909	1,060,480	1,100,838 tons	12,784,783
Cotton .	1919	807,770	306,974 bales	48,808,866
" .	1909	787,516	264,562 bales	17,966,517
Tobacco .	1919	138,561	112,367,567 lb.	24,720,869
" .	1909	90,468	68,756,599 lb.	5,661,681

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The value of vegetables sold in 1919 was $27,947,250 and of fruits and nuts $7,888,912; the values respectively in 1909 were $10,430,975 and $4,486,281. Of the chief domestic animals on farms in 1920 and 1910 the number and value were as follows:—

		Number	Value
Horses	1920	317,921	$35,582,960
"	1910	349,709	39,320,044
Mules	1920	352,510	51,042,649
"	1910	240,282	32,489,724
Cattle	1920	1,161,846	51,370,208
"	1910	996,529	20,690,718
Sheep	1920	364,196	4,021,678
"	1910	795,033	3,009,196
Swine	1920	1,832,307	19,477,775
"	1910	1,387,938	7,329,622

In 1920 there were 11,835,303 fowls valued at $10,591,690, and 191,898 hives of bees valued at $698,258. In 1919 the reported milk production was 115,119,224 gal.; the value of milk, cream, and butter fat sold and of butter and cheese made was $20,640,849. The office of inspector of apiaries was created in 1911. The Smoky Mountain area (59,213 ac. in Blount and Sevier counties) and the White Top area (33,619 ac. in Johnson and Sullivan counties and Washington co., Va.) were approved for purchase in 1912 by the National Forest Reservation Commission under the Federal Act of March 1 1911 to preserve upland watersheds. In 1920 254,118 ac. of farm land were reported as provided with drainage and 640,479 as needing drainage. Capital invested in drainage enterprises, Dec. 31 1919, totalled $2,925,944. On that date there were completed 777 m. of open ditches and 42 m. of levees; there were under construction 135 m. of open ditches and 10 m. of levees. Most of these enterprises are in the western division of the state, where the tributaries of the Mississippi are utilized. The above figures do not include private supplementary works installed by individual farmers.

Mineral Products.—Tennessee produces most of the copper mined in the southern states. Its entire product of copper, gold, and silver comes from mines worked primarily for copper in Polk county. Lead production, first reported in 1915 (1,660 lb.), amounted to 4,376,000 lb. in 1919. In the latter year gold was valued at $5,662. The silver output was 98,288 oz.; copper 15,623,589 lb.; zinc 47,494,000 lb. Because of strikes the coal amounted to only about 5,000,000 tons. The demands of the World War led to the working of known manganese deposits in 16 counties. In 1916 oil was discovered in Scott county, and later some producing wells were drilled. In 1919 the Bankers Petroleum Co., of New York, obtained large tracts of land in Robertson and Dickson counties, a promising shallow-oil field. In 1910 natural gas was found near Franklin. In 1919 the production of phosphate rock was 473,985 tons.

Manufactures.—The product of manufactures remains relatively small, the value of 1914 being less than 1% of the total for the United States. Their growth between 1909 and 1914 was as follows:—

	1914	1909
Establishments	4,775	4,609
Wage-earners	74,373	73,840
Capital	$211,423,167	$167,923,784
Salaries	11,828,691	9,186,243
Wages	33,082,987	28,251,591
Cost of materials	123,430,135	104,015,834
Value of product	212,071,489	180,216,548
Value added by manufacture	88,641,354	76,200,714

In 1914 lumber and timber products still led, having a value of $31,430,208. Flour-mill and grist-mill products were valued at $26,413,574; cottonseed oil and cake $11,414,243. There were nine other industries each with a product valued at over $4,000,000; food preparations; foundry and machine-shop products; general shop construction and repairs by steam railway companies; printing and publishing; hosiery and knit goods; cotton goods; patent medicines and druggists' preparations; fertilizers; bakery products. In 1914 84·6% of the average number of wage-earners were males over 16 years old, 13·6% females, and 1·8% children under 16. In 1909 the respective figures were 85·3%, 11·3%, and 3·3%.

Transportation.—On Jan. 1 1919 the total railway mileage of the state was 4,083 m., or 9·79 m. per 100 sq. m. of territory. The chief railways were: Louisville and Nashville 952 m.; Nashville, Chattanooga and St. Louis 903 m.; Southern railway 891 m.; Tennessee Central 291 m.; Illinois Central 143 miles.

Finance.—The balance in the state Treasury Jan. 1 1918 was $368,818. Receipts for 1918 were $7,954,650 and disbursements $7,481,756, leaving a balance, Dec. 20 1918, of $841,682. On the same date the total bonded debt was $11,481,000. On Dec. 20 1912 the balance in the state Treasury was $317,270 and the bonded debt $15,218,600. The number of all reporting banks, June 30 1920, was 546; aggregate resources $489,162,000; capital stock paid in $35,041,000; individual deposits $312,222,000.

Education.—By an Act of 1909 state normal schools were established in Johnson City, Memphis, Murfreesboro, and (for negroes) at Nashville. In Jan. 1911 Bruce R. Payne (b. 1874) was elected president of the George Peabody College for teachers in Nashville. Later in the year this college was moved from South Nashville to a new site adjoining the campus of Vanderbilt University. Arrangements were made for an interchange of courses of instruction between the two institutions. In 1918 the total school pop. was 790,959. The enrolment in the public schools was 604,633 and the average daily attendance 418,709 (368,888 in 1912). The number of teachers was 11,880, of whom 8,375 were women. In 1919 the compulsory school age was raised from 14 to 16 years.

History.—In 1910 Benjamin W. Hooper (b. 1870) was elected governor, following a serious split in the Democratic party over the prohibition question. He was the only Republican elected to state office, and was the first Republican governor since 1883. He took a strong stand for prohibition. The Democratic Legislature displayed much opposition to the governor, and his inauguration was delayed through lack of a quorum until Jan. 25 1911. The regular Democrats passed a bill depriving the governor of the power of appointing the state board of elections, and raising the number of members from three to seven. The bill was vetoed by the governor, and to prevent its passage over the veto the Republicans and independent Democrats migrated to Alabama, where they remained until acquiescence in the veto was forced. The governor also vetoed a bill giving $500 additional salary to each member of the Legislature, but approved an amended bill reducing the increase to $200. In 1911 the Legislature chose Luke Lea (b.1879) to succeed U.S. Senator James B. Frazier. In 1912 Hooper was renominated for governor and was reëlected over Benton McMillin (b. 1845; governor 1899–1903), the Democratic candidate. Robert Love ("Bob") Taylor (b. 1850), U.S. Senator since 1907, died March 31 1912. He was a representative in Congress 1879–81, governor 1887–91 and 1897–9, and unsuccessful candidate for governor 1910. He was long a picturesque figure in state politics and widely known as a popular lecturer. In the gubernatorial campaign in 1886 his Republican opponent was his own brother Alfred Alexander ("Alf") Taylor (*see* below). They stumped the state together, Bob everywhere winning favour by his stories and folk songs and his "fiddle." As his successor to the Senate the Legislature in 1913 chose John K. Shields (b. 1858), a member of the state Supreme Court since 1902 and Chief Justice since 1910. Another prominent politician, James D. Porter (b. 1828), governor 1875–9, died May 8 1912. In July 1915 the city of Nashville was placed in the hands of a receiver, as the result of the disappearance of the city's cash books covering the period 1908–12, and in 1916 the mayor was removed from office for remissness of duty. In Nov. 1915 the mayor of Memphis, the commissioner of fire and police, and the judge of the municipal court were removed from office for failure to enforce the prohibition law. In the presidential election of 1916 Wilson received 152,955 votes and Hughes 116,257. In 1920 Harding received 219,829 votes and Cox 206,558. For the first time since 1868 the Republican presidential candidate carried the state. A Republican governor also was elected, "Alf" Taylor, brother of the former Democratic governor. Taylor received 229,463 votes as against 182,836 for A. H. Roberts, who had been renominated by the Democrats.

Proposals made by the Legislature to call a constitutional convention were defeated in 1916, 1917 and 1920. In Sept. 1916 a new bridge across the Mississippi at Memphis was opened. An Act prohibiting the manufacture of intoxicating liquor in the state became effective Jan. 1 1910; in Oct. 1913 Gov. Hooper called a special session of the Legislature and secured passage of the so-called nuisance bill, intended to close every saloon in the state, forbidding the sale of intoxicating liquor within four miles of any school; in 1915 provision was made for removal from office of state, county, or city officials who failed to enforce the prohibition law; on Feb. 2 1917 Gov. Rye signed a bill forbidding the importation of liquor into the state. The hours of labour for women were reduced to 58 per week after Jan. 1 1914 and to 57 after Jan. 1 1915. In 1913 for the first time the reporting of accidents was required, wherever persons were employed; provision was made for enforcing the installation of additional fire escapes in factories; and a department of workshop and factory inspection was created. The same year an Act was passed

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providing "that married women be and are hereby fully emancipated from all disability on account of coverture, and the common law as to the disabilities of married women and its effect on the rights of property of the wife is totally abrogated." On April 1 1913 the Legislature ratified the amendment to the Federal Constitution for popular election of U.S. senators. In 1915 a law was passed providing for mothers' pensions. In 1917 the letting of prison labour to private contractors was prohibited, and an Act was passed forbidding the limiting of the output of coal for increasing the price. The same year a State Budget Commission was created, having as its members the governor, the comptroller, the treasurer, the secretary of state, and the auditor. The wilful setting fire to any woods was made a felony. On Aug. 18 1920 the House by 50 to 46 voted to concur in the Senate resolution (adopted Aug. 13 by five to four), ratifying the proposed amendment to the Federal Constitution, providing for woman suffrage. As the 36th state (out of the 48 in the American Union) to ratify, Tennessee brought the number up to the requisite three-fourths. The contest among the legislators was bitter, and there were attempts to rescind the House's action on constitutional grounds. Governor Roberts, however, on Aug. 24, sent certification of the state's ratification to Secretary of State Colby, who on Aug. 26 proclaimed the Federal amendment for woman suffrage to be in effect.

In the World War Tennessee furnished to the army, navy and marine corps 91,386 men. Contributions to the various war loans were as follows: First Liberty Loan $10,924,800; Second $26,043,650; Third $33,783,250; Fourth $55,867,250; Victory Loan $37,555,450.

Recent governors have been: Malcolm R. Patterson (Dem.), 1907–11; Benjamin W. Hooper (Rep.), 1911–5; Thomas C. Rye (Dem.), 1915–9; A. H. Roberts (Dem.), 1919–21; Alfred A. Taylor (Rep.), 1921– . (G. C. S.)

TENNIEL, SIR JOHN (1820–1914), English artist (*see* 26.626), died in London Feb. 25 1914.

TERMONDE (*see* 26.645).—Pop. (1914) 10,138. The town, up to 1906, was still considered one of the five "fortified places" in Belgium, but as the fortifications had not been demolished at the time of the German invasion in 1914 the Belgians decided to defend it. In an early attempt to outflank Antwerp the Germans bombarded and took Termonde, setting fire to it and destroying three-fourths of the town, including the Hôtel de Ville and the spire and vaulting of the 15th Century Gothic church of Notre Dame. The Belgians reoccupied the town on Sept. 10 1914; on Sept. 16 the Germans renewed the bombardment and completed its destruction. Von Beseler's army forced the passage of the Scheldt here on Oct. 7.

Rebuilding was being actively carried on in 1921, together with the reëstablishment of its industries of rope making, bleaching, wire drawing and cotton spinning. The old Butchers' Hall has been transformed into a museum.

TERRY, EDWARD O'CONNOR (1844–1912), English actor (*see* 26.660), died in London April 3 1912.

TERRY, ELLEN ALICIA (1848–), English actress (*see* 26.660), appeared as Mistress Page in *The Merry Wives of Windsor* at His Majesty's theatre, London, in 1911, on the occasion of a special performance to celebrate the coronation of King George V., and made her last regular stage appearance as the Nurse in *Romeo and Juliet*, produced by Miss Doris Keane at the Lyric theatre, London, in 1919. Her sister, MARION TERRY (b. 1856), appeared in H. Vachell's *Fishpingle* at the Haymarket theatre in 1916 and in Tolstoy's *Reparation* at the St. James's theatre in 1919.

TETANUS or LOCKJAW (*see* 26.669).—One of the chief triumphs of preventive medicine during the World War was in the treatment of this disease. The appearance of tetanus in the British army during the early days of the retreat from Mons was so terrifying a phenomenon that immediate steps were taken to cope with it. It had been suggested that the disease might be prevented if a dose of anti-tetanus serum was given as soon as a wound was sustained, for, as is well known, some days elapse before the bacilli, which remain in the wound, are able to secrete sufficient poison to precipitate an attack. The suggestion was carried out and was immediately successful. From that time every wound, no matter how slight, was followed as soon as possible by a dose of anti-tetanic serum. The War Office set up a committee for the study of tetanus (1914–8) under Gen. Sir David Bruce.

Sir David Bruce later presented to the Research Defence Society a paper dealing with the results of his labours. Out of 1,242,000 wounded men who were sent home to England 1,458 cases of tetanus arose, giving a ratio of rather more than 1 per 1,000. How favourably this general figure compares with earlier ones is shown by the fact that in Sept. 1914 the ratio of tetanus cases to wounds was 9 per 1,000. In Oct. 1918 the ratio was 0·5 per 1,000. Thus the incidence of cases of tetanus in Sept. 1914 was 18 times as heavy as in the last month of the war.

A sudden fall in the incidence took place in Nov. 1914 when preventive inoculation, which was introduced about the middle of Oct. 1914, had begun to exercise its beneficial effects. The following figures giving the number of cases of tetanus per 1000 wounded men make this clear:—

	Cases of Tetanus		Cases of Tetanus
Sept. 1914	9	Feb. 1915	1·1
Oct. 1914	7·3	March 1915	0·4
Nov. 1914	2·3	April 1915	2·3
Dec. 1914	1·4	May 1915	0·8
Jan. 1915	0·0	June 1915	0·2

The same experience was met with in the French and German armies. As soon as preventive inoculation with anti-tetanic

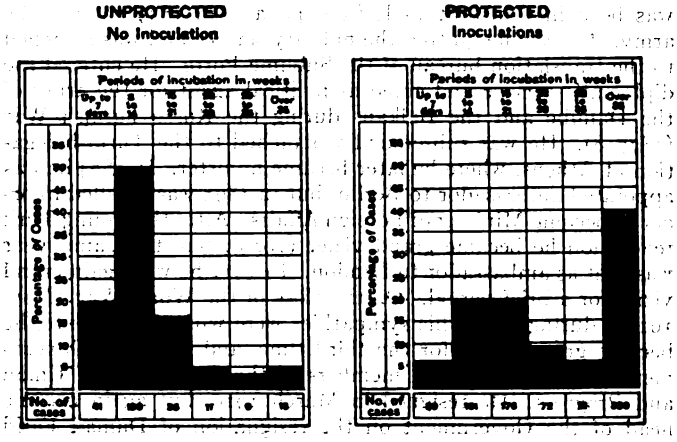

Fig. 1.

serum became a universal practice the incidence of tetanus dropped sharply and remained small. Later in the war, June 1917, it was ordered that each wounded man should receive not one inoculation as formerly but four, at intervals of a week. This was on account of the fact that the minimizing effect of the serum passes away rather quickly.

The effect is not always to prevent absolutely. But even in those cases in which tetanus does supervene in spite of the inoculations the incubation period is lengthened and the death-rate is lowered. It is well known that, other things being equal, a long incubation period tends to result in a milder attack than a short incubation period, thus any circumstance prolonging the incubation period will also tend to lower the death-rate. The diagram, fig. 1 (after Sir David Bruce), shows clearly how successful were the inoculations in lengthening the incubation period.

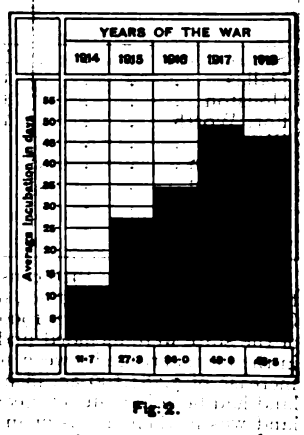

Fig. 2.

In other words only 26·9 % of the inoculated are attacked during the first fortnight, whereas 68·9 % of the uninoculated are attacked. Among the protected 40·0 % have an incubation period of more than 35 days; among the unprotected only 6·5 %. The average incubation among inoculated is 45·5 days, among uninoculated 10·9 days.

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Indeed, in each year of the war the incubation period tended to rise, as is shown in the diagram, fig. 2.

Further it was found that the inoculations tended to limit the degree of tetanus, converting what would be generalized cases into local or one-limb cases. The following table illustrates this:—

Tetanus type	Percentages				
	1914	1915	1916	1917	1918
General	98·9	98·6	87·0	76·6	83·5
Local	1·1	1·4	13·0	23·4	16·5

Local tetanus tends to occur in the wounded or injured limb and to be confined to that limb. It is much less severe and far less fatal than the generalized type.

Naturally the death-rate reflected these successes. Among the unprotected and unrecorded the death-rate per cent. was 53·5. Among the protected it was 23·0. The "unrecorded" here undoubtedly include cases which had received a dose. This accounts, in Sir David Bruce's opinion, for the fact that the death-rate is lower than the old pre-serum rate of 85%.

It is thus evident that the method employed during the war fully justified the hopes which were entertained concerning it, and that an immense amelioration of pain and distress was effected. Indeed, when the terrible character of this disease is recalled it will be seen that preventive inoculation did much to support the *moral* of troops by assuring them of safety, or comparative safety, in the event of exposure to the infection.

See Maj.-Gen. Sir David Bruce, K.C.B., F.R.S., *The Prevention of Tetanus During the Great War by the Use of Anti-tetanic Serum.* (Research Defence Society, Form D2, July 1920.) (R. M. Wi.)

TEWFIK, AHMED, Pasha (1843–), Turkish statesman, was born in Constantinople in 1843, and in 1859 entered the army. In 1870 he quitted the military service and was attached to the translation bureau of the Sublime Porte. He entered the diplomatic service and acted as political agent for the army of the Danube and the Balkans during the Russo-Turkish War (1877–8). He was subsequently attached to the Turkish legation at Athens, where he later became minister. In 1884 he was appointed ambassador to Berlin, but in 1895 was recalled in order to become Minister of Foreign Affairs. After the Young Turk revolution he became grand vizier (1909), but the same year was sent as ambassador to London. In 1912 he was again grand vizier for a brief period. On the close of the World War (Nov. 1918), during which his sympathies were with the Entente, he became grand vizier for the third time, and formed a Government which excluded all members of the Committee of Union and Progress. He resigned in March 1919, but again became head of the Government on the resignation of Damad Ferid Pasha in Oct. 1920.

TEXAS (*see* 26.688).—In 1920 the pop. was 4,663,228, as against 3,896,542 in 1910, an increase of 766,686, or 19·7%, as against 27·8% in the preceding decade. The urban pop. (in places of 2,500 or more) was 1,512,689, or 32·4% of the total as compared with 24·1% in 1910. The average number of inhabitants per sq. m. increased from 14·8 in 1910 to 17·8 in 1920. The following table shows the growth of the 10 cities in the state having in 1920 a pop. of more than 30,000:—

	1920	1910	Increase per cent.
San Antonio	161,379	96,614	67·0
Dallas	158,976	92,104	72·6
Houston	138,276	78,800	75·4
Fort Worth	106,482	73,312	45·2
El Paso	77,560	39,279	97·4
Galveston	44,255	36,981	19·7
Beaumont	40,422	20,640	95·8
Wichita Falls	40,079	8,200	388·8
Waco	38,500	26,425	45·7
Austin	34,876	29,860	16·8

Agriculture.—The 1910 census gave Texas 417,770 farms, with a total area of 112,435,067 ac., of which 27,360,666 ac. were improved. Owing to the fact that in 1900 the large ranches in the western part of the state were included under farm acreage, there was a decrease in the farm acreage between 1900 and 1910 of 13,361,950 ac., but an increase of 7,784,590 ac. in improved land. By 1910 much of this land had been bought by speculators for sale in small farms and the land was in their hands or in those of purchasers who had not yet begun cultivation, and so was not included under farm acreage. The value of all farm property in 1910 was $2,218,645,164. Advance figures for the 1920 census, subject to correction, gave Texas 435,666 farms. The principal crops for 1920, in the order of acreage (according to estimates of the U.S. Department of Agriculture), were cotton, corn, oats, grain sorghums, wheat, hay, rice, peanuts, sweet potatoes, cowpeas, potatoes, broom corn, barley, sorghum syrup, rye. These crops covered 25,435,000 acres. Their farm value, partly estimated, was $610,787,000. In 1919, at the peak of post-war prices, their value was $1,051,817,000. Texas is a large producer of fruits and vegetables. Ranked according to value of the 22 principal crops produced in the United States, Texas held first place in 1919 and 1920; and first in the value of all crops 1914–20. The average annual yield of corn 1911–9 was 126,600,000 bus.; of wheat 15,300,000 bus.; of cotton 3,600,000 bales. Figures (partly estimates) of the U.S. Department of Agriculture gave Texas Jan. 1 1921 4,500,000 range cattle and 1,184,000 milch cows of the combined value of $213,184,000; horses 1,187,000, valued at $89,000,000; mules just under 800,000, valued at $84,744,000; sheep 3,000,000, $19,335,000; and swine 2,427,000, $28,639,000. In the total value of live stock in 1920 Texas ranked second, between Iowa and Illinois.

Minerals.—The most important mineral products are oil, sulphur, coal and lignite. The first oil in paying quantities was discovered at Corsicana in the central part of the state, in 1894; but keen interest was not aroused until the "Spindle Top" discovery near Beaumont in 1901. Since that time the surface of the state has been covered with leases, and remarkable strikes have been made in a number of places. At the beginning of 1921 production was confined to two general sections—the coast, including mainly Harris and Brazoria counties (Jefferson, Hardin, and Matagorda counties have in the past been good producers); and a region in the northern and north-central part of the state, including chiefly Wichita, Eastland, Comanche, and Stephens counties. The Humble field in Harris county was opened in 1905, Goose Creek in 1911, and Blue Ridge in 1919. The west Columbia field in Brazoria county was also opened in 1919. The Burkburnett field in Wichita county first became important in 1917, Ranger in Eastland county in 1917, and Desdemona and Breckenridge in Comanche and Stephens counties respectively in 1918. Production dropped from 28,000,000 bar. in 1904 to less than 9,000,000 in 1910; rose to 27,644,000 in 1916; 32,413,000 in 1917; 38,750,000 in 1918; 85,312,000 in 1919; and 54,668,000 for the first three-quarters of 1920. Natural gas and natural-gas gasoline were developed as by-products of the oil industry. The value of natural gas marketed in the state rose from $127,000 in 1909 to $5,027,449 in 1918; and natural-gas gasoline in 1918 amounted to 7,326,122 gal., giving Texas fifth rank in that respect. Two sulphur plants in Texas and one in Louisiana were said in 1920 to yield 98% of all that produced by the United States. One of the Texas plants is at Freeport, near the mouth of the Brazos river, the other is near Matagorda, close to the mouth of the Colorado. The Freeport plant began producing in substantial quantities in 1916, and the next year, under war pressure, delivered 500,000 tons. The Matagorda plant began operation in 1919, producing about 500,000 tons a year. The sulphur lies about 1,000 ft. below the surface and is extracted from wells by "forcing superheated water (and steam) through pipes, dissolving and suspending the sulphur and pumping it back." Bituminous coal production from 1908 to 1918 remained practically stationary, varying from 1,010,000 tons in 1910 to 1,259,000 tons (value $3,140,253) in 1917. The yield in 1919 dropped to 793,000 tons. Lignite is mined principally for state consumption, and the relative backwardness of manufacturing and the competition of other fields keep down the demand. More than 1,000,000 tons were delivered in each of the years 1913–5 and 1917–8. The 1919 yield was 860,000 tons. The value at the mine was slightly under $1 per ton. The original supply was estimated in 1913 at 30,000,000,000 tons, of which about 9,000,000 tons had then been mined. Other minerals of fairly steady yield are silver, worth about $500,000 a year for many years, quicksilver, cement, and clay products. In quicksilver production the Terlingua mine in Brewster county has for more than a decade made Texas second to California only. The highest yield recorded was 10,791 75-lb. flasks in 1917, valued at $1,136,502. Cement production in 1919 was 2,288,000 bar., value $4,176,000; clay products (brick, tile, and pottery) in 1917 were valued at $3,451,806. Salt is produced in fairly steady quantities, and in 1917 yielded 85,181 short tons, with a value of $564,000.

Manufactures.—In 1914 there were 5,084 manufacturing establishments, capitalized at $283,544,000, employing 91,114 persons, and producing an annual value of $361,279,000, of which $108,135,000 was value added by manufacture. The principal industries were those concerned with lumber and timber, cotton-seed products, printing and publishing, oil-refining and allied products, flour and grist milling, and food preparations. The lumber production was 1,350,000,000 ft. for 1918, when Texas ranked sixth in this industry, as it had done in 1910 and 1915.

Commerce.—The noteworthy ports are Sabine, Port Arthur, Orange, and Beaumont in the Sabine district, importing chiefly crude oil, and exporting refined oil and oil products; and Houston, Texas City, Freeport, and Galveston in the Galveston district, which export cotton, grain and sulphur. Houston is a new port, opened in

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1915. Its access to the Gulf of Mexico is through the Houston Ship Channel, formed, for the most part, by the widening and deepening of Buffalo bayou. At the beginning of 1921 the controlling depth of the channel was 25 ft. and the width at bottom varied from 110 to 260 feet. The distance from the municipal docks to the Gulf is 54 miles. Unofficial but reasonably dependable figures for 1920 fixed the value of imports through Galveston, including the subsidiary ports of the district, at $30,964,285, and the exports at $627,498,478, making Galveston second to New York as an exporting port, a position which it had held for some years. These figures did not include coastwise traffic. During the year 1,233 vessels cleared for foreign ports, of which 849 were American, 222 British, 29 Norwegian, 26 Italian and 18 Mexican. The bulk of their cargoes was made up of 2,126,717 bales of cotton and 44,726,000 bus. of wheat. Through the coöperation of Galveston county and the Federal Government the Galveston sea-wall was extended and completed in 1920 to a length of 6·3 miles. The total cost of the wall (*see* 11.430) was $4,725,000. The concrete causeway connecting the island with the mainland, 10,642 ft. long, was nearing completion in 1921. The cost was to be $3,750,000, and was to be borne by the county and the railways entering the city. The county and city of Galveston were permitted by state Acts of 1901 and 1903 to apply their state taxes for 17 years to storm defence improvements. In 1917 the privilege was extended for 10 years; and subsequently the same authority was granted to several other maritime counties.

Finance.—The value of all property assessed for state taxation on Aug. 31 1919 was $3,012,819,287. The ratio of assessed value to real value varied from 66⅔% in some cities to 25% in some rural districts. Total receipts of the state treasury for the year were $28,410,724, and total expenditures $27,200,978. On Dec. 29 1920 there were 1,031 state banks, with capital, surplus and undivided profits of $71,768,997. They had individual deposits subject to check of $226,282,045, and time and savings deposits of $35,380,482. On Nov. 15 1920 there were 561 national banks with capital, surplus and undivided profits of $124,633,000; deposits subject to check of $447,898,000; and time and savings deposits of $69,374,000. Of the state banks 176 were members of the Federal Reserve system at the beginning of 1921.

Education.—For 1920 the school pop. (7 to 18 years of age) was 1,271,157; and the number of teachers employed in the public schools was 30,158, of whom 3,515 were negroes. The public schools are maintained by the income from the permanent school fund, by state and local taxes, and by legislative appropriations. The permanent fund consists of lands and interest-bearing notes derived originally from the sale of public lands. In Aug. 1920 it was slightly less than $74,000,000. State taxes for school maintenance are a poll-tax, one-fourth the proceeds of the occupation taxes, and an *ad valorem* tax of 35 cents per $100. The practice of making legislative appropriations to supplement the available school fund began in 1915 with $1,000,000 to aid rural schools. The practice continued, and for the biennium 1919-21 $6,000,000 came from this source for general maintenance. A constitutional amendment adopted in Nov. 1920 removed the limit of 50 cents per $100 which rural districts and unincorporated towns might appropriate for schools. The total available state fund for the year ending Aug. 1921 was $18,564,507, to which should be added nearly $13,000,000 from local taxes. A compulsory attendance law became effective in 1918, requiring, with specified exceptions, the attendance of children between 8 and 14 for at least 100 days each year. The following year a free text-book law went into effect. A law of April 3 1918 requires all public-school work to be conducted in the English language, but does not preclude the teaching of foreign languages.

Administration.—The attorney-general, comptroller, treasurer, and secretary of state head constitutional departments, and all are elective except the last, who is appointed by the governor. The more important statutory departments, in the order of their establishment, are those of the adjutant-general, superintendent of public instruction, state health officer, life insurance and banking commissioner, commissioner of agriculture, Railroad Commission, Live-stock Sanitary Commission, Fire Insurance Commission, the Industrial Accidents Board, the Board of Water Engineers, the Highway Commission, and the Board of Control. All are appointive directly or indirectly by the governor (with approval of the Senate), except the superintendent of public instruction, the commissioner of agriculture, and the Railroad Commission. Their terms vary from two to six years. The Industrial Accidents Board was created in 1913, primarily to administer the Employers' Liability Act. It consists of three members, one of whom must be a wage-earner, one an employer in some industry covered by the Act, and the third a practising attorney. The Board of Water Engineers was created in 1913 to regulate the use of public water for irrigation and all other purposes. The Highway Commission, established in 1917, consists of three members, and is charged with the administration of all highway laws, including that for the registration of motor vehicles. At the close of 1920 there had been completed under its supervision 976 m. of approved highways, costing $5,326,000, of which $1,308,000 was from Federal and $904,000 from state aid. The remainder was paid by the local counties. At the same time contracts were in progress for the construction of 2,039 m. of road at an estimated cost of $23,277,000, of which $8,650,000 was to come from Federal and $1,437,000 from state aid. Federal and state quotas are apportioned in a certain ratio to local expenditure. The Commission reported the registration during 1920 of 427,693 automobiles and trucks and 4,290 other motor vehicles. The state Board of Control, created in 1920, represents an effort to consolidate administration and to coördinate the state budget. It is composed of three members, holding office for six years, one retiring every two years. Its budgets are subject to review and amendment by the Legislature. Departments created during the decade 1910–20, but showing signs of instability, are those of markets and warehouses (including weights and measures) and an Industrial Welfare Commission, created in 1917 and 1919 respectively. The dwindling jurisdiction of the Railroad Commission, suffering from the encroachments of the Interstate Commerce Commission, was somewhat compensated by an Act of March 1919 placing pipe-lines and drilling regulations under its supervision, and another of June 1920 giving it authority over natural-gas production. The Commission reported in Dec. 1918 15,866 m. of railroad in operation, an increase of 1,922 m. since 1910.

History.—After about 1880 prohibition was perhaps the most bitterly contested issue in state politics. A constitutional amendment providing for state-wide prohibition was voted down in 1887 and again in 1911; but was carried in 1919. In the meantime prohibition by local option had made great progress, so that by 1918 more than three-fourths of the area of the state, including the cities of Dallas, Waco and Austin, was dry. The Legislature in March 1918 ratified the Federal amendment, and in April put into effect the "zone" law, prohibiting the sale of liquors within 10 m. of a military, naval, or shipbuilding establishment. In June 1918 statutory state-wide prohibition was established, and doubts of the constitutionality of the Act were ended by the amendment of the next year. The Dean law (July 1919) is one of the most drastic of enforcement Acts. A law of March 26 1918 permitted women to vote in party primaries and nominating conventions; but a constitutional amendment, submitted the next year, to enfranchise women in regular elections, failed. The Legislature nevertheless ratified the Federal Woman Suffrage amendment in July 1919. The effect of the World War is seen in a law of April 2 1918, confining the franchise in primary elections to citizens of the United States; and in another of March 23 1918, amended a year later, providing that assistance should be given at the polls only in the English language and to persons physically unable to write or to those past 60 years of age and unable to read. Aliens could not be debarred from voting in final elections without amendment of the constitution, but preponderance of the Democratic party makes the primary election, in effect, definitive.

The total registration in Texas under the Selective Service Act was 990,522. From the best figures available in July 1921, there were 13,191 voluntary enlistments in the regular army, and 18,573 in the National Guard (transferred to Federal Service in the summer of 1917), and 127,531 inductions (not including officers) under the draft law; while 13,599 men and 6 women served in the regular navy and 4,505 men and 107 women in the naval reserve. The total number in both services, not including all officers, was 177,512. The total losses (officers and men) were 2,722, of whom 1,164 were killed in action, 456 died of wounds, 942 of disease, and 160 from other causes. The wounded numbered 7,331. Figures for the Texan subscription to the First Liberty Loan were not separately available. The eleventh Federal Reserve district, in which the state is included, subscribed $48,948,350. The Texan subscription to the four following loans was $363,273,350. When the Armistice was signed the Emergency Fleet Corp. had wooden ships under construction at Beaumont, Orange and Rockport, and in the Houston Ship Channel. Contracts had been let for 97 hulls and for 18 barges, of which were completed 52 hulls with tonnage of 196,400; and 4 barges aggregating 9,000 tons.

The governors of Texas after 1910 were Oscar Branch Colquitt (Dem.) 1911–5; James E. Ferguson (Dem.) 1915–Sept. 1917; William P. Hobby (Dem.) 1917–21, and Pat M. Neff (Dem.) 1921– . Mr. Ferguson was removed from office by impeachment and was succeeded, *ex officio*, by Lt.-Gov. Hobby, who was subsequently elected for one term, 1919–21.

(E. C. Ba.)

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THAYER, ABBOTT HANDERSON (1849–1921), American painter and naturalist (*see* 26.728), died at Dublin, N.H., May 29 1921. During the World War he worked in England on the development of camouflage.

THAYER, WILLIAM ROSCOE (1859–), American writer, was born in Boston, Mass., Jan. 16 1859. He studied at St. Mark's Academy, Concord, N.H., travelled with a private tutor in Europe, and graduated from Harvard in 1881, in the class with Theodore Roosevelt. For several years he was assistant editor of the Philadelphia *Evening Bulletin*, then returned to Harvard, receiving the degree of A.M. in 1886. When the *Harvard Graduates' Magazine* was established in 1892 he was appointed editor, serving until 1915. In 1903, at the International Historical Congress at Rome, he represented both Harvard University and the American Historical Association, and in 1906 was their representative at the Italian Historical Congress in Milan. He was a member of the Harvard Board of Overseers from 1913 to 1919. In 1902 he was made Knight of the Order of the Crown of Italy, and in 1917 Knight of the Order of Saints Maurizio and Lazaro. In 1918 he was elected president of the American Historical Association. He was best known for his works on Italian history, especially *The Dawn of Italian Independence 1814 to 1840*, 2 vols. (1893); *A Short History of Venice* (1905), and *The Life and Times of Cavour*, 2 vols. (1911). His other works include *Italica* (1908); *The Life and Letters of John Hay*, 2 vols. (1915); *Letters of John Holmes* (1917); *Theodore Roosevelt—An Intimate Biography* (1918); *Democracy: Discipline: Peace* (1919, lectures at Brown University); *Volleys From a Non-Combatant* (1919); and *The Art of Biography* (1920, lectures at the university of Virginia).

THEAL, GEORGE McCALL (1837–1919), British historiographer, was born in Canada, where his family had long been settled. When 19 he went to Sierra Leone, removing two years later to Cape Colony, where he became a schoolmaster. He quickly developed an interest in the natives and in the history of the country. In 1877, on behalf of the Government he settled a dispute with the Gaika Kaffirs, and thereafter joined the Cape Civil Service, being attached to the Native Department. Shortly afterwards he was also appointed Keeper of the Archives, and in 1891 was made Colonial Historiographer, which position he held until 1905. Before joining the Civil Service he had published in one volume a *History of South Africa* and the first fruits of his Bantu studies were embodied in *Kaffir Folk Lore* (1882). From the time he obtained access to the Cape archives he devoted himself to research. In 1895 he was commissioned by Cecil Rhodes, then Prime Minister of Cape Colony, to go to Europe, where he stayed several years examining the Portuguese archives at Lisbon, the Dutch archives at The Hague and the British in London. He constantly enlarged and revised his *History* which in its final form was in eleven volumes, the first dealing with ethnography and conditions up to 1505, the others carrying on the story of S. Africa up to 1884. Theal also published official *Records of the Cape Colony, 1793–1827*, in 36 slim volumes, *Records of South East Africa* in nine volumes, and many other works, some in Dutch.

Theal's industry never flagged. He died at Wynberg, Cape Province, on April 17 1919, in the act of correcting the proofs of the last two volumes of his history. The founder of what may be called the Dominions school of historians, he was himself a chronicler rather than an historian. His passion for research brought to light a mass of unknown or forgotten documents of high value, but his narrative is overloaded with details, is essentially domestic, and not always impartial. He lacked the wider vision which sees events in their true perspective. Theal was given the honorary degree of Litt.D. by the Cape University in 1899; he had previously been made an hon. LL.D. of Queen's University, Kingston, Canada.

THERMIT, AND THERMIT WELDING.—Thermit is a mixture of aluminium powder and iron oxide. On ignition the reaction, $8Al+3Fe_3O_4=9Fe+4Al_2O_3$, gives a temperature estimated to be between 2,300° and 2,700°C. The reaction, stated in weights, means that 217 parts of aluminium plus 732 parts magnetite (iron oxide) equals 540 parts steel plus 409 parts slag, or approximately 3 parts of aluminium plus 10 parts of magnetite will produce, on combustion, 7 parts of steel. This steel represents about one-half of the original thermit by weight and one-third by volume.

Thermit was discovered by Dr. Hans Goldschmidt of Essen, Germany, in 1895, while trying to reduce chromium and manganese. Dr. Goldschmidt's principal discovery related to a simple and safe method of ignition, as the action of aluminium when mixed with various oxides, sulphides, and chlorides was well known. Fine aluminium will not burn below the temperature of molten cast iron, and previous experimenters had resorted to heating their mixtures in a crucible. This made the initial temperature so high at the moment of ignition that there was an explosion. Dr. Goldschmidt obtained ignition of a cold mixture by means of a barium-peroxide fuse, which was set off by a storm match. Later magnesium powder or ribbon was used, being set off in the same way. A red-hot iron rod may also be used to set off the magnesium, which in turn ignites the thermit. Dr. Goldschmidt's original American patent No. 615,700 was granted March 16 1897, and related principally to the use of aluminium as a reducing agent for the production of carbon-free metals such as cobalt, chromium, magnesium, tungsten, etc., by what is now known as the aluminothermic process.

Thermit is now used considerably in the foundry for purifying iron and steel in the ladle. For this purpose the thermit is placed in a can on the end of a rod and plunged to the bottom of the molten metal. The intense heat generated tends to liberate many impurities which are carried away in the slag. The principal and better-known use, however, is in welding.

THERMIT WELDING.—Two methods are employed, known as the plastic and the fusion. The first is used for welding pipe and the latter for solid or large sections. In the plastic method, in which the thermit is used merely for heating purposes, the ends of two pieces of pipe are machined square and clamped in a cast-iron mould with the ends butted together. This mould is in two parts, so arranged that the pipe ends may be forced together when heated. The thermit is placed in an open-top crucible lined with magnesia-tar, and ignited. After the reaction takes place the slag rises to the top of the molten metal, and is first poured into the mould as shown at the left in fig. 1. This slag forms a protective coating on the pipe and on the inside of the mould, and keeps the thermit from melting or burning through. At the right the thermit is shown flowing into the

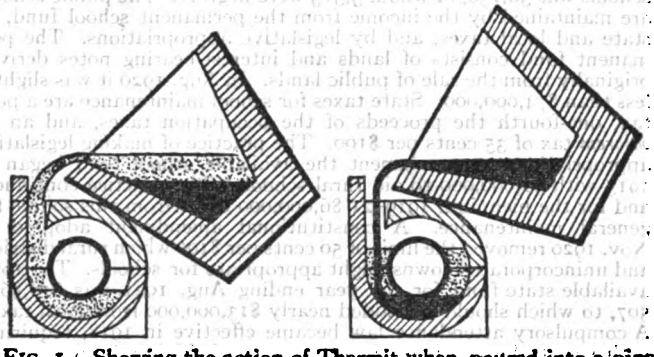

FIG. 1.—Showing the action of Thermit when poured into a pipe welding mould.

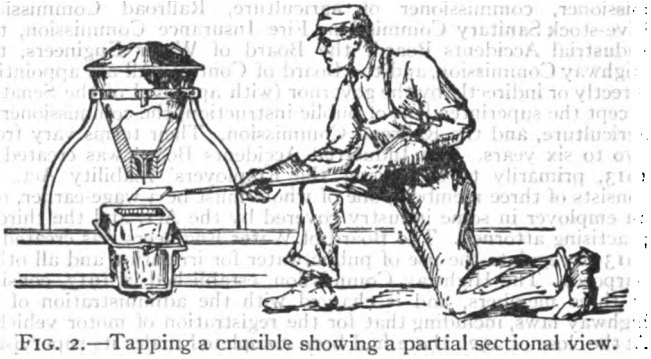

FIG. 2.—Tapping a crucible showing a partial sectional view.

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mould and forcing out the bulk of the slag, but leaving a coating as mentioned. When the pipe ends become plastic they are forced together, completing the weld. After cooling the mould is easily knocked off, since the slag coating prevents adhesion. To weld a pipe takes from ¼ to 1½ minutes.

In fusion welding on solid sections, in which the thermit mixture forms a casting holding the parts together, a special V-shaped magnesia-tar-lined crucible, open at the bottom, is used. The hole in the bottom is closed by a headed plug, covered with refractory sand, which may be pushed upward. This crucible is placed over the mould, as shown in fig. 2, the proper amount of thermit put in and ignited. After the reaction, which takes about 35 seconds, the plug in the bottom is pushed up and the molten thermit allowed to run into the mould. In this method great care is taken to keep the slag from contact with the surfaces to be welded, and consequently enough thermit must be used to fill the mould before the slag on top of the melted metal can enter.

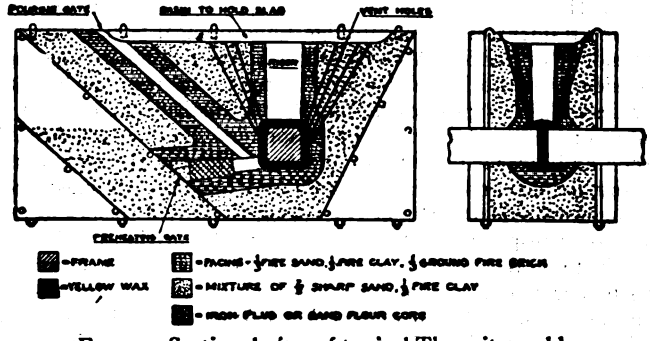

FIG. 3.—Sectional view of typical Thermit mould.

A typical mould for heavy sections is shown in fig. 3. In preparing to weld, the surfaces to be joined should be cut or set so as to be ½ in. or more apart. Yellow wax is then built up around the joint in the same shape as the weld is to be. Next the mould box is placed and sand rammed up round the wax, wooden patterns being placed for the pouring gate, riser and preheating gate. The mould is vented, the patterns withdrawn, and a gas or oil flame used to melt out the wax. The heating is continued until the sections to be welded are red-hot. This prevents chilling of the thermit, which is poured in after the preheating gate has been plugged. The steps in making a typical thermit weld on a locomotive frame are graphically shown in

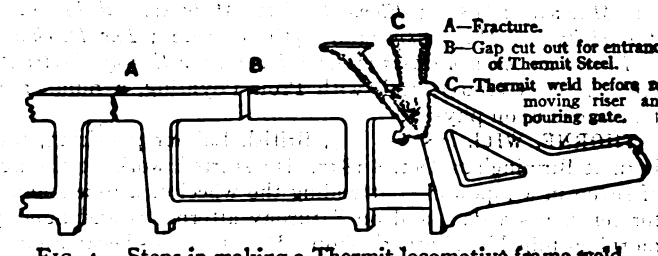

FIG. 4.—Steps in making a Thermit locomotive frame weld.

fig. 4. Thermit welding is largely used in repairing broken rudder frames, propeller shafts, locomotive frames, steel rolling-mill pinions and other heavy sections, but it cannot be economically used for welding thin sheet metal sections. Welds have been made where from 3,000 to 4,000 lb. of thermit were used.

For commercial purposes there are now produced three varieties of thermit, known as plain thermit, railroad thermit and cast-iron thermit. The plain thermit is simply a mixture of aluminium and iron oxide, as already given. Railroad thermit is plain thermit with the addition of ⅛% nickel, 1% manganese and 15% mild steel punchings. Cast-iron thermit is plain thermit with the addition of 3% ferrosilicon and 20% mild steel punchings. The names of these mixtures indicate their principal uses. (E. VI.)

THOMAS, AUGUSTUS (1859–), American playwright, was born in St. Louis, Mo., Jan. 8 1859. He was educated in the public schools, for several years worked in railway freight offices, and, after serving as special correspondent for various newspapers, became in 1889 editor and proprietor of the Kansas City (Mo.) *Mirror*. As a youth he had been a member of local amateur dramatic companies and had tried his hand at dramatic composition. One of these early pieces, *Editha's Burglar*, based on Mrs. Burnett's story of the same name, was enlarged to a four-act play and presented with great success at the Madison Square theatre in New York in 1889. This led him a little later to devote all his attention to the drama. His play *Alabama* (1891), depicting the old-time South, contributed to the removal of sectional prejudice resulting from the Civil War. His numerous dramas include *In Missoura* (1893); *The Hoosier Doctor* (1898, by many considered his best); *Oliver Goldsmith* (1900); *Soldiers of Fortune* (1902); *The Earl of Pawtucket* (1903, highly successful in England); *Mrs. Leffingwell's Boots* (1905); *De Lancey* (1905); *The Embassy Ball* (1905); *The Witching Hour* (1909); *As a Man Thinks* (1912); *Mere Man* (1912); *Indian Summer* (1912).

THOMAS, JAMES HENRY (1878–), English Labour politician, was born at Newport (Mon.), of working-class parents, Oct. 3 1878, and was educated in the board schools. He started at nine years' old as an errand boy, but he soon passed into the service of the Great Western Railway Co., first as engine-cleaner, afterwards becoming fireman and engine-driver. He was elected town councillor of the famous Great Western railway centre, Swindon, and became chairman of the Finance Committee and of the Electricity and Tramways Committee. At an early date he associated himself with the development of the policy of unions among the railway servants. He became president of the A.S.R.S. in 1910, and for many years was secretary of the National Union of Railwaymen, and the most powerful voice in deciding their policy. He was elected to Parliament in the Labour interest for the great Midland railway centre, Derby, in 1910. For some years he took no very prominent part in Parliamentary life, being actively engaged outside in the interests of his railwaymen, who, besides many smaller disputes, came out in a body in the great strike of 1911. Another matter of vast importance in which he was deeply involved, was the organization of the so-called "Triple Alliance" between the unions representing coal-miners, transport workers, and railwaymen. When the war came, he took his stand, with the bulk of the Labour leaders, on the national and patriotic side; but, like many of them, deprecated the introduction of compulsory service, until it should be clear that the necessary men could be got in no other way. In Sept. 1915 he declared in Parliament that trade unionists were absolutely against conscription, that to introduce it might provoke revolution. Nearly every branch of his own railwaymen's organization, he said, had not only passed resolutions against the policy, but had threatened on its introduction to stop work. There were many who questioned at the time the justice of his estimate of the workmen's feelings; and, though he renewed his vehement protest against the first Military Service bill in Jan. 1916, and though the Labour party in conference condemned the measure, there was no difficulty in applying it and no agitation arose for its repeal. Even against the stronger measure of the following April only nine Labour members were found to go into the lobby on the second reading. Throughout the war Mr. Thomas, while securing large advances of wages for the railway servants, used his unique influence with them in composing disputes and preventing any stoppage which should interfere with national interests; and for this considerable service he was made a privy councillor in 1917. It was a bitter blow to him when in Sept. 1918 the rank and file disregarded an agreement which the executive of the National Union of Railwaymen had come to with the Government for an advance of 5s. for adults and 2s.6d. for boys. In spite of this, there was a general strike of railwaymen in S. Wales, and the disturbance spread partially to London and elsewhere; but the courts, on the application of the Board of Trade, prohibited the Union from paying strike pay, and the movement collapsed. In disgust at his advice being disregarded, Mr. Thomas resigned the secretaryship of the Union, but was eventually persuaded, on promises of better discipline, to resume office. He approved of the subsequent decision of the Labour party to sever itself from the Coalition, and to appeal to the electorate in Dec. 1918 for independent support, announcing as his own battle-cry "No more war." He was once more returned at the head of the poll for Derby, and by a huge majority. After the war he became a more prominent figure both in Parliament and in the national life. He made a strong speech in support of the Labour amendment to the Address in 1919, stating that he stood both against Bolshevists and against profiteers. He called upon the Government to deal with

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the reactionaries in Labour disputes as they would with Bolshevists, and upon the employers to recognize that the working classes could no longer be treated by them as hewers of wood and drawers of water. He welcomed both the bill establishing a Ministry of Health and that establishing a Ministry of Transport; but he warned the House of Commons not to expect cheaper passenger fares and freight charges; the railwaymen would not allow themselves to be sweated for the benefit of the travelling public. But, once again, his real activity was outside. In the disputes in March 1919, between the railwaymen and the Government, he was the chief leader of the men, and at a moment of crisis he flew across to Paris to discuss the question with Mr. Lloyd George, then in attendance at the Peace Conference. The terms which he finally arranged with the Government, involving an approximate addition of over £10,000,000 per annum to the railway expenditure, included a standard week of 48 hours, and a standard wage for that week; for the fixing of the new standard rates of wages negotiations were to be continued. In the last week of Sept. he suddenly announced that a crisis had arisen in these negotiations, and after a futile conference with the Government on Sept. 25, a strike began without further notice on Sept. 26. Neither the community nor the Government was intimidated; and Mr. Thomas used his power for peace, and for a settlement, after ten days, on terms not materially different from what the men might have had at first. His efforts for the men had already, it was calculated, amounted to a permanent annual increase in the railway wage bill of £65,000,000, and an increase of 50%—which in Aug. 1920 became 75%—in passenger fares, and more than 50% in goods rates. In 1920 he and his executive were faced by the difficult problem of the refusal of Irish railwaymen to handle munitions of war; and the only solution he and they could suggest was that the Government should cease to send such munitions and that the Labour party should make an appeal to the Irish people—a solution which ministers, of course, could not accept. His own policy for Ireland was the gift of Dominion Home Rule. During this year he published a book *When Labour Rules*, in which he, speaking, of course, only for himself, depicted the kind of policy which Labour in power would favour—such as the right to work, development of nationalization, better homes, shorter hours, state endowment of motherhood, great extension of university facilities and a national theatre and opera.

THOMPSON, SILVANUS PHILLIPS (1851–1916), English physicist, was born at York June 19 1851, and educated at a school in Yorkshire belonging to the Society of Friends, of which body he was a lifelong member. He went later to the Royal School of Mines, having previously received a B.A. at London University when he was only eighteen. He obtained a B.Sc. from London University in 1875 with high honours and a D.Sc. in 1878, when he became professor of experimental physics in University College, Bristol. There he began his lectures on electrical science which brought him invitations to lecture all over the United Kingdom and made him a power in both the scientific and industrial worlds. In 1881 appeared his *Elementary Lessons in Electricity and Magnetism*, twice reprinted in 1882 and 16 times in the ensuing 12 years. A new edition was called for even as late as 1914. Two other courses of lectures were published in volume form, *Dynamo-Electric Machinery* (1882), and *The Electro-magnet and Electromagnetic Mechanism* (1891). By that time he had removed to London, becoming professor of Physics in the City and Guilds of London Technical College, Finsbury, in 1885 and subsequently its principal. He was elected a fellow of the Royal Society in 1889. In his desire to bring science home to the imperfectly educated he published anonymously *Calculus made Easy* by "F.R.S." (1910), written in colloquial style. His deep interest in religion, which led to his recognition in 1903 as a minister of the Society of Friends, inspired *The Quest of Truth* (1915) and a posthumous work *A Not Impossible Religion* (1918). He also published biographies of Reis, Faraday and Kelvin. He died in London June 12 1916.

See *Silvanus Phillips Thompson, D.Sc., LL.D., F.R.S.*, by his wife and daughter (1920).

THOMSON, SIR JOSEPH JOHN (1856–), British physicist, was born near Manchester Dec. 18 1856 and was educated at Owens College, Manchester, and subsequently at Trinity College, Cambridge, where in 1880 he graduated as second wrangler. In the same year he was elected a fellow of Trinity College, and became second Smith's prizeman. In 1883 he was appointed lecturer in Trinity College, and in the following year Cavendish professor of experimental physics in the university of Cambridge, a position he occupied until his resignation in 1918. He developed a great research laboratory of experimental physics, attracting numerous workers from many countries and colonies; advances were made in the investigation of the conduction of electricity through gases, in the determination of the charge and mass of the electron and in the development of analysis by means of positive rays. He was elected a fellow of the Royal Society in 1884, became president of the Cambridge Philosophical Society in 1894, president of Section A of the British Association in 1896, and president of the Royal Society in 1915. In 1905 he held the professorship of physics in the Royal Institution, London, in addition to his Cambridge professorship. He was knighted in 1908 and awarded the O.M. in 1912. He was the recipient of many British and foreign awards and honours, amongst these being the Royal and Hughes medals of the Royal Society in 1894 and 1902 respectively, the Hodgkins medal of the Smithsonian Institute of Washington in 1902, the Nobel Prize for physics in 1906, enrolment as honorary graduate of many universities, and as honorary fellow of numerous American and continental scientific academies. During the World War he presided over several research committees and he assisted various Government departments in an advisory capacity. In 1918 he was appointed master of Trinity College, Cambridge, and in the following year was elected to a newly established professorship of physics in the Cavendish Laboratory, where he continued to prosecute his researches. In addition to a large number of publications in the *Proceedings of the Royal Society* and the *Philosophical Magazine*, he has published *A Treatise on the Motion of Vortex Rings* (1884); *The Application of Dynamics to Physics and Chemistry* (1886); *Recent Researches in Electricity and Magnetism* (1892); *Elements of the Mathematical Theory of Electricity and Magnetism* (1895, 5th ed. 1921); *The Discharge of Electricity through Gases* (1897); *The Conduction of Electricity through Gases* (1903); and, with Prof. Poynting, a number of text-books upon physics.

THORNE, WILL (1857–), British Labour politician, was born at Birmingham Oct. 8 1857. He started work at the age of seven in a ropeworks, attending the wheel of a rope-spinner for ten hours a day, and on Saturday afternoons and Sunday mornings toiled in a barber's shop. He afterwards became a gas-worker, and in 1889 he helped to found the National Union of Gas Workers and General Labourers, becoming its general secretary. This union (under the title of the National Union of General Workers) had in 1921 a membership of over 600,000. He became a member of the parliamentary committee of the Trades Union Congress in 1894. He was chairman of the Congress in 1912. In 1900 he contested West Ham unsuccessfully in the Labour interest, but in 1906 was elected to Parliament and came to the front as an active and energetic member of his party. At the general election of 1918 he was returned with a majority of 11,505. From 1890 he was a member of the West Ham town council, being elected mayor in 1917. He had been a member of the Social Democratic Federation since 1883.

THORNYCROFT, SIR WILLIAM HAMO (1850–), English sculptor (*see* 26.881), was knighted in 1917. His more recent works include the King Edward memorial at Karachi (1915) and "The Kiss" (1916), now at the Tate Gallery.

THÓRODDSEN, PORVALDR (1855–), Icelandic geographer, was born on the isl. of Flatey, in Breidifjördr, Iceland, June 6 1855, the son of Jón Thóroddsen (*see* 26.881), the poet and novelist. His father's death in 1868 left the family in poor circumstances, but the boy went to school at Reykjavik and in 1875 to the university of Copenhagen, where he studied natural science and geography. In 1876 he was sent to Iceland by the

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Danish Government with Prof. Johnstrup to investigate the causes of the eruption which had occurred the previous year at Askja in Dyngjufjöll, and this proved the beginning of a long series of Icelandic explorations. In 1880 he was appointed master at the school of Mödruvellir in northern Iceland, and in 1882, 1883 and 1884 made extensive explorations in the interior. From 1884–6 he travelled in England and on the Continent, and in 1886 was appointed master of the school at Reykjavik. Until 1898 he made a journey of exploration nearly every year, the later expeditions being undertaken from Copenhagen, where he settled in 1895. Reports on his work appeared from time to time in the Danish *Geografisk Tidskrift*, but he also produced various important works, including *Oversigt over de islandske Vulkaners Historie* (1882); *Vulcane im nordöstlichen Island* (1891) and *Landfraedissaga Islands* (1892), a monumental work for which he collected material from the beginning of his career. Thóroddsen received many honours from universities and learned societies, and was awarded the gold medal of the Swedish and the La Roquette medal of the Paris Geographical Society.

THURINGIA (*see* 26.901), a Territory and Free State of the German Reich. Pop. 1,508,025. Area 11,763 sq. kilometres.

On April 30 1920 the union of the Territories Saxe-Weimar-Eisenach, Saxe-Meiningen, Saxe-Altenburg, Saxe-Gotha, Reuss, Schwarzburg-Rudolstadt and Schwarzburg-Sondershausen, in one Territory "Thuringia," was recognized by a law of the German Reich, on the basis of article 18, section 2, of the Constitution of the Reich. The consequence was thereby drawn from the abolition of the dynasties, whose policy of dynastic interests had in former centuries caused the disintegration of central Germany into small states. The removal of these dynasties had been effected in the Thuringian States, as in the Empire in Nov. 1918, by the method of revolution. A noteworthy exception was Schwarzburg-Rudolstadt, where the republic was established by a law enacted conjointly by the sovereign (the Prince of Schwarzburg-Rudolstadt) and the Diet.

The unification of the Thuringian States in one single State was preceded by the union of the two principalities of Reuss into one democratic State of Reuss. On the other hand the personal union of the two States of Coburg and Gotha was dissolved, and each of them went its own way. In all the States of Thuringia elections were instituted after the revolution by the revolutionary Governments for Constituent Assemblies to vote new constitutions. Only in Gotha was the meeting of the new State Assembly delayed. The Council of Workmen and Soldiers in that Territory was subject to Communist influence and endeavoured to establish a Councils (Soviet) Republic. Gotha had to be occupied in Feb. 1919 by detachments of the *Reichswehr* (regular army of the Reich). The workmen replied by a general strike which lasted more than a month. When the Assembly met, the Government of Gotha, which was composed of Independent Socialists, submitted the draft of a constitution which attempted to maintain the system of Councils (Soviets). The work of framing constitutions in all the Thuringian States had meanwhile been anticipated by the movement for forming a unified single State of Thuringia.

Steps in the direction of a union had been taken in some of the States of Thuringia before the revolution, but it was only by the revolution that the path was cleared. All the Thuringian States, with the exception of Saxe-Meiningen and Saxe-Coburg, concluded a "treaty of community" (*Gemeinschaftsvertrag*) in order to prepare for their amalgamation. They formed a kind of federated state with an organ of legislation, the *Volksrat* (Council of the People), and an organ of administration, the *Staatsrat* (State Council). Saxe-Meiningen subsequently joined this Community of States; in Saxe-Coburg a great majority of the citizens decided on Nov. 30 1919 for union with Bavaria, which was ratified by a law of the Reich on April 30 1920. on the basis of article 20 of the Constitution.

The *Volksrat* of Thuringia passed a law on Jan. 28 1920, by which it assumed the right to include within its competence the enactment of a constitution for the State of Thuringia. Nevertheless, there was to be reserved for the first Diet (*Landtag*) of the new State, which was to be elected on the basis of this constitution, the right of making alterations in the constitution within a period of three months by ordinary legislation. On May 12 1920 the provisional constitution voted by the *Volksrat* (Council of the People) was promulgated. On March 11 1921 the newly elected Diet (*Landtag*) ratified this provisional constitution with certain amendments. The birth of the new State dates from May 1 1920, the day on which its establishment was voted by a law of the Reich. While the Thuringian Community of States (*see* above) was organized on the lines of a confederation, what was in contemplation is a single, unified State. For the period of transition, however, the separate Thuringian States continued to exist as communities or territorial regions (*Gebiete*); their former constitutions remained in force as regional regulations (*Gebietssatzungen*). If any disputes should arise between the Territory of Thuringia and the former Thuringian States, the Court of Jurisdiction for State affairs (*Staatsgerichtshof*) was to decide them; for the settlement of financial differences a court of arbitration, half of whose members were to be elected by the Thuringian Diet and half by the popular representative assemblies of the former States concerned, was to be set up.

In accordance with the Constitution of the Reich, Thuringia is a republic with parliamentary government. The Diet, as in the other Territories, consists of a single Chamber elected on a system of proportional representation. It can be dissolved by a popular vote (*Volksentscheid*). The peculiarity of the Thuringian Constitution is that the committees of the Diet may call in experts to supplement their membership. The executive power is in the hands of the Ministry, which is formed on the principle of equal colleagues (*Kollegialprinzip*) and consists partly of members who hold office and partly of members who hold no office and who are designated State Councillors (*Staatsräte*). The members of the Ministry are appointed by the Diet. The president of the Ministry is chosen by the Ministry and is merely its chairman. The Thuringian constitution does not provide for any President of the State. The legislative prerogatives of the Diet are limited, as in the other German Territories, by the right of the people themselves to vote laws; the people can be invited to give their vote (referendum) upon a law which has already been passed and may likewise by their own initiative cause the expression, in a vote, of their will (*Volksbegehren*).

(W. v. B.)

THURSTON, ERNEST TEMPLE (1879–), English novelist, was born at Halesworth, Suffolk, Sept. 23 1879. At the age of 16 he published two volumes of verse. Two years later he published his first novel, *The Apple of Eden* (1897, republished 1905), followed by *Traffic* (1906); *The Evolution of Katherine* (1907); *The Realist* (1907); and two widely differing but very successful novels, *Sally Bishop* (1908) and the *City of Beautiful Nonsense* (1909). His later work includes, on the realistic side, *The Antagonists* (1912) and *Richard Furlong* (1913); and on the sentimental side *The Greatest Wish in the World* (1910); *The Garden of Resurrection* (1911); *Enchantment* (1917) and *The World of Wonderful Reality* (1920). He dramatized his wife's novel, *John Chilcote, M.P.* and one or two of his own, and wrote also, as original plays, *Driven* and *The Cost* (1914), and *The Wandering Jew* (1920).

His wife, KATHERINE CECIL THURSTON (d. 1911), was born at Cork, the daughter of Mr. Paul Madden. She married Mr. Thurston in 1901, but in 1910 her marriage was dissolved on her own petition. She was well known as a writer of novels, notably *The Circle* (1903); *John Chilcote, M.P.* (1904); *The Gambler* (1906) and *The Fly on the Wheel* (1908). The second of these, a study of dual personality, created a considerable stir, both as a novel and as a play. She died at Cork Sept. 6 1911.

TIBET (*see* 26.916).—In Feb. 1910, at the approach of a small Chinese force, which had invaded Tibet under Gen. Chun Ling from Szechuen, the Dalai Lama fled to India and was deposed by imperial decree. In exile at Darjeeling, he appealed for British intervention at Peking, but the British Government declined to dispute the authority of the *de facto* Government in Tibet. At the same time, H.M. Government took occasion to draw the attention of the Government at Peking to the necessity

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for strict adherence to the terms of the treaty concluded in April 1906, and particularly to the inviolability of the frontiers of Nepal, Bhutan and Sikkim. The last two years of the Manchu dynasty witnessed the restoration of China's effective suzerainty in Tibet from the border marshes to Lhasa, a result chiefly due to the energetic and capable administration directed by Chao Erh-feng, viceroy of Szechuen.

But the province of Szechuen was among the first to be reduced to anarchy by the upheaval of the revolution of 1911, and after the assassination of Chao Erh-feng, the authority of China as suzerain power in Tibet was speedily challenged and overthrown. When the news of the revolution reached Lhasa, the Chinese garrison hastened to throw off its allegiance and following the example of the troops in China, indulged in lawlessness and looting at the expense of the civil population. The latter, led by the ever-restless lamas, took up arms against the invaders and the Chinese garrison found itself cut off from its base and besieged. Desultory fighting continued until the return of the Dalai Lama from India; peace was then (Aug. 1912) locally concluded, under an agreement by which all Chinese troops (with the exception of the Chinese resident's body guard) evacuated the country, departing via India after depositing their arms at Lhasa. By this time China's garrisons had been expelled and her authority overthrown in eastern Tibet by the semi-independent chieftains of that region. The Government of the republic at Peking, desiring to recover the prestige thus lost, authorized the despatch of a punitive expedition, consisting of forces raised by the military governors of Szechuen and Yünnan. The expedition started from Chengtu in July 1912; it had reached and captured Batang in Aug., when, as the result of representations made by Great Britain at Peking (Aug. 19), its advance was stopped and the project subsequently abandoned.

The British Government, in requesting China to abstain from these military operations in Tibet, took the ground that such action constituted a violation of the treaty of 1906. While China's suzerainty was not disputed, the Government could not consent to the forcible assertion of full sovereignty over a State which had established independent treaty relations with Great Britain. The Chinese Government was therefore invited to negotiate a new tripartite agreement defining the status of Tibet. To this communication China replied on Dec. 23; meanwhile the expedition had been countermanded, but desultory fighting continued between Szechuen troops and the Tibetans of the border marshes. The Chinese Government's reply justified its military operations, on the ground that the Tibetan trade regulations of 1906 gave them the right to police the trade marts and protect lines of communication. The republic, it declared, had restored the Dalai Lama to his former position and titles and had no intention of making Tibet a Chinese province, but would scrupulously respect the traditional system of Tibetan Government. Reference was made to the Indian Government's unfriendly act in preventing communication between China and Tibet, via India, and the hope was expressed that this policy might be reconsidered; but the Chinese Government saw no reason for negotiating a new treaty. Before the end of the year, the last of the Chinese forces had been driven out of Tibet, and on Jan. 11 1913 the Dalai Lama proclaimed the independence of the country by concluding a treaty with the Living Buddha (Hutukhtu) of Urga (Outer Mongolia). In April, hostilities were resumed by the military governor of Szechuen; at the same time negotiations with the Dalai Lama were opened by President Yuan Shih-k'ai, who sent a delegate to Chamdo to discuss terms of peace. In May the British Government renewed its proposal for a tripartite conference, which was ultimately accepted. The conference opened at Simla on Oct. 13; Great Britain was represented by Lt.-Col. Sir A. H. M'Mahon, China by Mr. Ivan Chen, and Tibet by her prime minister, Long Chen Shatra.

China's position at this conference was generally negative; while promising not to convert Tibet into a Chinese province, the Peking Government asked that Great Britain should respect China's position as suzerain and undertake not to annex any portion of the country. Great Britain proposed the creation of an Inner and an Outer Tibet, the former to enjoy autonomy, the latter under Chinese control. The Tibetan representative asked for complete independence and frontier rectifications. The result of the subsequent negotiations, which continued till July 1914, was a draft treaty, which the Chinese Government declined to ratify. It provided for Tibetan autonomy and recognized China's position as suzerain power, while limiting the representation of that power to a Resident with a suitable guard at Lhasa. It differentiated between the complete autonomy of Inner and the semi-autonomy of Outer Tibet. China's refusal to ratify this treaty was not due to any definite objection to its specific conditions, but to her unwillingness to accept the geographical definition of the frontiers of Outer Tibet, as proposed at Simla.

After the break-up of the conference, the Chinese Government agreed to the suspension of all hostilities against Tibet pending a renewal of negotiations, and for the next three years a state of armed vigilance was maintained on the Szechuen border. In July 1917, however, a fresh cause of strife occurred in the arrest of two Tibetans by Chinese troops near Chamdo. The Kalong Lama's request for negotiations on the subject was refused, and the armistice was broken by the Chinese general commanding in the marshes, without reference to Peking. In the fighting which ensued, the Tibetans proved victorious; by Feb. 1918 the Chinese garrison at Chamdo was surrounded, and the whole country to the eastward, as far as the right bank of the Yangtse, in the hands of the Tibetans. Chamdo surrendered in April, and the Chinese proposed to negotiate for peace. In July an armistice was arranged, at the instance of Mr. Teichman, the British vice-consul; this was followed by a peace conference at Chamdo, at which it was agreed to suspend hostilities for a year, the Tibetans retiring within the boundary of Derge and the Chinese to Kansue. In Sept. 1919 the Chinese Government at Peking proposed a renewal of the negotiations abandoned at Simla in 1914 and gave evidence of its desire to put an end to hostilities; on the Tibetan side there were also indications of a desire for peace. The situation, however, was (and remained) complicated and difficult by reason of the fact that the authority of the Peking Government was ignored by the usurping provincial satraps of Yünnan and Szechuen, and also because the delimitations of any permanently satisfactory frontier for Outer Tibet presented serious problems, ethnological as well as strategic and political.

See *Blue Book on Anglo-Tibetan Relations* (1910); Sven Hedin, *Trans-Himalaya* (1913); Reginald Farrer, *On the Eaves of the World* (1917); *The China Year Book* (1919). (J. O. P. B.)

TIDES (*see* 26.938).—The present century has seen a marked increase in the interest taken among foreign scientists in the study of the tides, while in Great Britain the subject again received much attention after the close of the World War.

Observation.—The automatic tide gauges which are distributed along the coasts (in Great Britain very irregularly and chiefly according to the needs or caprices of harbour authorities) require much more attention than it has been the custom to pay to them. The errors in both elevation and time of their elevation-time graphs should be determined by independent observation at least once a day, as such errors very easily attain serious dimensions.

But the outstanding scientific need of the present time is for off-shore observations. Not only do the great tidal movements of the ocean remain practically unobserved, but in the middle of the Irish Sea, for example, there is a discrepancy of 40 m. between the co-tidal lines of different authoritative charts.

Off-shore elevations have been recorded by personal soundings (at the Dutch lightships, for example) but a number of attempts have been made to construct a self-registering gauge which, when placed on the bottom of the sea, will give a continuous pressure-time record. From such a record it is of course easy to pass to an elevation-time relation. Up to 1921 the gauge which appeared to have met with most success was that of M. Favé, of the French Marine, and even this had not worked in water of depth greater than 200 metres.

Continuous current observations are required at all depths. A knowledge of currents is of immense importance both commercially and scientifically, and the effect of currents on mines during the World War caused much attention to be paid to them by naval authorities. Tidal currents are oscillatory, but observed currents have, as a rule, a residual drift which is of particular importance in general oceanographical or fishery research.

Surface currents have been measured by floating logs (as for most of the data published by the British Admiralty) but series of ob-

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servations at frequent intervals, especially of currents below the surface, are usually made by current meters. One of the commonest of these—the Ekman meter—registers the mean speed and direction of the current during the interval of time it is in operation, the former by a small propeller actuating a revolution counting apparatus and the latter by a vane attached to an apparatus dropping shot into sectorial boxes on a compass card. It has thus to be hauled up to the surface for each reading. Continuous recording instruments are much needed and though some have been invented they do not appear to have been much used. Owing chiefly to the trouble of keeping a meter fixed relatively to the bottom, the accurate measurement of currents is a matter of great difficulty. Other data for residual currents or drifts are given by observations of weighted bottles or other forms of floating bodies, or by instruments so contrived as to float near the sea bottom.

General Distribution of Off-shore Tides.—Much attention is now paid to the "amphidromic points," at which there is no rise and fall of the water and out from which the co-tidal lines radiate. Harris' charts of co-tidal lines contain a number of these points and so does the new chart of R. Sterneck (*Sitsb. d. Akad. Wissensch., Wien*, 129, 1920), which is based on all available data.

All recent charts of co-tidal lines for the North Sea agree in placing an amphidromic point in the southern region, and one of the services of the Favé gauge has been to give fresh observational verification of its existence (*Comptes Rendus*, 151, p. 803, 1910).

Dynamical Theory of the Tides.—As regards the tidal dynamics of completely defined bodies of water, the only basins which had yielded to mathematical treatment up to 1914 were those of a flat circular sea, the depth of which was a function only of the distance from the centre, and an ocean covering the whole globe with the depth a function only of the latitude. The details for zonal basins of uniform depth have since been worked out by G. R. Goldsbrough (*Proc. London Math. Soc.*, 14, 1914; 15, 1915).

Two attempts have been made, however, to bring some of the latest results of pure mathematics to bear on the general problem. In 1910 Poincaré published his transformation of the dynamical equations from the differential to the integral form (*Leçons de Mécanique Céleste*, t. 3). The theory of integral equations has grown up almost entirely since 1900; its results are perfectly general and are stated explicitly in terms of direct operations. But in the case of tidal problems the arithmetical labour necessary to carry out these operations is so prodigious as to prove quite prohibitive even for the reproduction of known solutions: nevertheless, the theory is valuable for the establishment of existences.

Utilizing these existence-theorems J. Proudman (*Proc. London Math. Soc.*, 18, 1917) has been able to specify the tidal state of an ocean by means of an infinite number of coördinates of the Lagrangian type, and then to transform the differential equations into an infinite set of linear algebraic equations. This has afforded a real prospect that the number of geometrically simple basins for which the tidal dynamics is completely known, may be increased.

The explanation, on dynamical principles, of the observed features of tides in small seas has been considerably advanced, chiefly by A. Defant and R. Sterneck. See *Denkschr. d. Akad. Wissensch., Wien*, 96 (1919). *Sitzungsberichte*, 123 (1914), 124 (1915), 129 (1902). The method of treatment only applies to elongated bodies of water and applications have been made to the Red Sea, the Persian Gulf, the English Channel, the Irish Sea and the Adriatic Sea. The motion is assumed to consist of a longitudinal oscillation sustained chiefly by the tides outside, with a transverse surface gradient sustained by the longitudinal current through the earth's rotation.

Other parts of the dynamical theory which have undergone development are those relating to slowly rotating seas and oceans, limiting forms of long period tides and the diffraction of tidal waves. See Rayleigh, *Proc. Roy. Soc.* (A) 82 (1909); J. Proudman, *Proc. London Math. Soc.*, 12 (1913), 13 (1913), 14 (1914). In this connexion it may be mentioned that there is an erroneous statement in 26.957 §34, to the effect that the existence in the ocean of continental barriers would have the same effect as that attributed by Laplace to friction. In the actual oceans limiting forms of long period tides are possible which do not take the "equilibrium" values.

Harmonic Analysis.—From 1883 up to the present time the standard harmonic development of the generating potential has been that of G. H. Darwin. Quite recently A. T. Doodson has made a new development, working to a much higher order of approximation than Darwin, and has found that there is a very large number of other constituents which, while certainly being smaller than those of Darwin, are not very much smaller, and in their aggregate may be important. In other words, the convergence of the series of constituents is not so rapid as has been assumed.

A corresponding state of affairs exists with regard to *over tides and compound tides*. For certain British stations A. T. Doodson, being led by dynamical principles, has found it possible to obtain a practically complete representation of the quarter diurnal tides, but it involves many more harmonic constituents than have ever been sought for by the customary methods. This representation is susceptible of very simple algebraic statement and numerical application but cannot be used on the existing predicting machines.

The present state of analysis is not satisfactory. *The harmonic constants* do not represent completely the records analysed: for certain British stations the discrepancy may have a quarter-diurnal range of one foot and a semidiurnal range of one foot.

J. Proudman (*British Assoc. Report*, 1920, p. 323) has given an account of British work on harmonic analysis with a bibliography and lists of analyses made.

Tide Tables cannot be regarded as satisfactory even for such practical purposes as docking large vessels or navigating over shallows, while for a hopeful study of meteorological effects they are almost useless. The main deficiency appears to be one of analysis of records; for others, see A. T. Doodson, *Brit. Assoc. Report*, 1920, p. 321.

When the astronomical tides can be predicted with the same degree of accuracy as the resultant tides can be observed, there appears to be no reason why short date predictions of meteorological tides—obviously of great importance—should not be attempted.

Atmospheric Pressure and Wind.—The effects of meteorological influences on the tides have been much studied, especially by the Scandinavians. As regards the relative importance of atmospheric pressure and wind, a general conclusion appears to be that at a station in the immediate neighbourhood of a wide expanse of deep ocean, the direct pressure effect predominates, whereas at a station in a landlocked and shallow sea, the wind effect predominates. The detailed study of these effects is rendered very difficult by the uncertainties in the predictions of astronomical tides, and most investigations have dealt with mean effects over long intervals of time. There is much literature on the subject: see for example D. la Cour, *Danske Meteorologiske Institut, Meddelelser*, 1 (1913), 4 (1917); R. Witting, *Fennia* 39, 5 (Helsingfors 1918). The 1917 memoir of la Cour is a detailed study of the effects of a storm.

Friction.—If tidal motion were everywhere non-turbulent then the amount of friction in the oceans would be quite insufficient to account for the outstanding discrepancy between theory and observation in the motion of the moon. See R. O. Street, *Proc. Roy. Soc.* (A) 93 (1917). But the motion associated with large tides in shallow seas is undoubtedly turbulent and though this has long been recognized it is only recently that numerical estimates of its amount have been made. See G. I. Taylor, *Phil. Trans.* (A), 220 (1920). H. Jeffreys, *ibid* 221 (1920), concludes that the total amount of friction is just about sufficient to account for the discrepancy mentioned. He takes the chief contributing areas to be Bering Sea, the Yellow Sea, Malacca Strait and the American N.W. Passage.

History and Bibliography.—To the list of outstanding names in the history of the theory of the tides should be added those of G. H. Darwin and H. Lamb. The chief contributions of the former were his elaboration of the methods of harmonic analysis and his far-reaching cosmogonical deductions as to the consequences of tidal friction. The chief contribution of the latter is in connexion with steady motions and the discrimination of free oscillations in the general dynamical theory. Additions to the list of books on tides are R. A. Harris, *Manual of Tides* v. (1907); H. Poincaré, *Leçons de Mécanique Céleste*, t. 3 (1910) and O. Krümmel, *Handbuch der Ozeanographie*, B. 2, C. 3 (1911). (J. P.*)

TIENTSIN, China (*see* 26.963).—After the Chinese revolution of 1911 the political and social importance of Tientsin considerably increased, inasmuch as it became an unofficial place of residence, and often of refuge, for high Chinese officials in times of trouble, and a neutral ground convenient for the conferences of the northern military governors. The number of Chinese residents in the Foreign Concessions steadily increased after 1912 and building operations continued unabated. The World War naturally led to a greatly increased demand in most branches of the port's export trade, so that, in spite of floods, famines and brigandage, business was very prosperous after 1915. Local industrial enterprise was stimulated by the curtailment of imports from Europe and a lack of shipping facilities. In 1919 it received a fresh impetus from the boycott of Japanese goods, with the result that many new factories were established for the manufacture of goods heretofore imported.

The city produces cotton yarn in steadily increasing quantities, seed and groundnut oils, canvas, leather, soap, candles and numerous articles for domestic consumption; its chief exports during the war were furs and skins, wool, bristles, strawbraid, carpets and prepared eggs. The value of the export trade in 1919 was 71 million taels, as against 51 millions in 1918, and 42 millions in 1917. Tientsin's prosperous growth was indicated by the opening of four new Chinese banks in 1919. The coal trade, from the Kailan Mines in Chihli and the Peking Syndicates in Honan, has greatly increased since the adoption of the system of Anglo-Chinese coöperative working.

In Sept. 1917 the Foreign Concessions and the trade of the port suffered severely from floods, which burst the banks of the Grand Canal and inundated all the plain surrounding the city. Before normal conditions could be restored in the British, French and Japanese Concessions, the municipal councils were compelled to surround them with dikes and pump out the water. This flood also produced a shoaling of the river bar at Taku, with results seriously prejudicial to the trade of the port. With a view to preventive and remedial

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measures, a Joint Commission for the improvement of waterways in Chihli was formed in 1918, upon the recommendation of the Haiho Conservancy Board, under the presidency of Hsiung Hsi-ling, with the assistance of European engineers and experts; in addition to the local work of river conservancy, this Board is charged to report on ways and means for restoring the navigability of the Grand Canal between Tientsin and the Yellow river, which has been for many years impracticable at certain seasons.

The foreign garrisons (American, British, French, German, Japanese and Russian) stationed at and around Tientsin under the terms of the Peace Protocol of 1901, for the protection of railway communication between Peking and the sea, were considerably increased after the outbreak of the revolution in 1911. At the end of 1913 their combined forces at Tientsin amounted to 6,000 men; but in the autumn of 1914 most of those belonging to the belligerent Powers were withdrawn. In March 1917 the Chinese Government took over charge of the German Concession; on Aug. 14 the Austrians were similarly dispossessed. Since then, both Concessions have been administered, in accordance with preëxisting municipal regulations, by the Chinese authorities. (J. O. P. B.)

TILAK, BAL GANGADHAR (1856–1920), Indian nationalist leader and orientalist, was born July 23 1856, at Ratnagiri, where his father, a Chitpavan Brahman, was an educational officer. At the Deccan College, Poona, he graduated in arts with honours in 1876, and took the LL.B. degree in 1879. In the following year he took the lead in providing secondary and higher education in Poona under Indian direction by founding an English school and the famous Fergusson College. Tilak conducted law classes till 1890, by which time he had become the sole proprietor as well as the editor of the two weekly papers, the *Mahratta* (in English) and the *Kesari* ("Lion" in Mahratti) which he and his friends had founded in 1880. These were the chief printed media of his anti-Government propaganda; but he took every advantage of public activities, such as membership of the local municipality and the organizing of Shivaji and Ganpati celebrations, to work upon the prejudices and passions both of the masses and of the educated minority. Identifying himself with Brahmanical orthodoxy he bitterly opposed social reforms. His violent condemnation in 1897 of the plague prevention regulations was followed by the assassination of the local plague commissioner (Mr. Rand) and a young British officer driving with him at the time. Convicted of sedition, he was sentenced to 18 months' rigorous imprisonment, but he was released within a year under pledges of good behaviour. In prison he pursued the Vedic studies which had already given him a place in oriental scholarship. His elaborate paper on "The Orion, or Researches into the Antiquity of the Vedas," read at the International Congress of Orientalists, London 1892 (published at Poona, 1893), was followed in 1903 by his "Arctic Home in the Vedas"—expounding a theory of extremely remote Aryan origins which has failed to secure the acceptance of other scholars. Tilak was twice elected to the Bombay Legislature for triennial terms. Again indicted for sedition in June 1908, he was sentenced by a Parsi judge (Mr. Justice Davar) to six years' transportation, afterwards commuted on account of age and health to simple imprisonment at Mandalay. On release in 1914 he actively promoted the home-rule campaign, and at last succeeded, after the death in 1915 of G. K. Gokhale, in his prolonged struggle to secure for his party control of the Indian National Congress. A libel suit he instituted in London against Sir Valentine Chirol for statements made in *Indian Unrest* (1910) ended in a verdict for the defendant with costs (Feb. 21 1919). On returning to India he refrained from definite association with the non-co-operation cult. His death in Bombay, Aug. 1 1920, was followed by demonstrations of mourning throughout India, showing his remarkable hold on the popular mind.

Tilak's formative part in the cult of Indian unrest is shown in the *Report of the Rowlatt Sedition Committee*, 1918. His speeches are collected with an appreciation by Aurobinda Ghose in *Lokamanaya B. G. Tilak*, Madras, 2nd edition, 1920. (F. H. Br.)

TILLETT, BENJAMIN (1860–), British Labour politician, was born at Bristol, Sept. 11 1860. He started work in a brick-yard at eight years and was a "Risley" boy for two years. At 12 years he served for six months on a fishing smack, was afterwards apprenticed to a bootmaker and then joined the Royal Navy. He was invalided out of the navy and made several voyages in merchant ships. He then settled at the London Docks, and organized the Dockers' Union of which he became general secretary in June 1887, taking a prominent part in the dock strike of 1889. He was subsequently one of the pioneer organizers of the General Federation of Trades, National Transport Workers' Federation, National Federation of General Workers, International Transport Federation, and the Labour party. For many years he was an alderman on the L.C.C. After standing for Parliament unsuccessfully four times, he was elected in 1917 as Labour member for N. Salford. In 1910 he published *A Brief History of the Dockers' Union*, commemorating the 1889 dockers' strike, and in 1911 *A History of the London Transport Workers' Strike*.

TIME (*see* 26.983).—The progress of wireless telegraphy has greatly simplified accurate determination of Greenwich time and consequently of longitude.

Determination of Time.—The chief difficulty in determining local time from observations of the altitudes of celestial objects is that of getting a satisfactory horizon. In the case of airships the view of the horizon is much interfered with by cloud, and the dip of the horizon is a more important and uncertain factor than in ordinary navigation at sea. When the airship R34 crossed the Atlantic in 1919 observations were made from a "cloud horizon" the height of which could not be known with accuracy. During the World War several sextants were designed in which the use of a pendulum or level enables the altitude of celestial objects to be determined without reference to the horizon, but they have not come into general use.

For the determination of Greenwich time at sea astronomical methods have been practically abandoned, and extreme accuracy in chronometers is no longer necessary. Signals are sent out daily at specific instants of Greenwich mean time from such stations as the Eiffel Tower, Lyons, Nauen, Annapolis, Darien, Honolulu and Cape Town, and it should be possible to pick up one or more of these signals at any point on the earth's surface. The time shown by a chronometer can, therefore, be checked by wireless at least once a day, and since the astronomical observations made by a navigator for ascertaining local time are accurate only to 1′ of arc, corresponding to 4 sec. of time, a chronometer which can be relied on to within 4 sec. a day is sufficient. This is far within the limit of modern chronometers.

A new method of determining positions on the earth's surface, independently of time altogether, has recently become possible, although it is still far short of attaining the desired degree of accuracy. The direction of a wireless transmitting station can now be determined by the receiving station to within about 3°, and if the directions of two transmitting stations are known the position of the receiver can be found. Accuracy is of course greatest where the two transmitting stations subtend a wide angle, and the best results are obtained when the wireless waves can be sent out from the point, the position of which is to be determined and the directions found by two land stations. The method promises to be of great service in aerial navigation, and for ships near the coast in foggy weather. In the beginning of 1921 nine wireless direction stations in the British Isles, sixteen in France, four in Germany and one in Italy were available for navigational purposes.

The position of buoys in the North Sea has been determined by the time required by sound to reach special receiving apparatus at fixed points on the coast. This method was introduced soon after the Armistice in Nov. 1918, but its application is limited to distances of 100 or at most 200 miles.

Accurate Determinations of Time and Longitude.—The precision of time observations has been greatly increased by the use of the self-registering micrometer in observing transits. With this micrometer the personality of different observers is reduced to $0^s.01$ to $0^s.02$, so that the exchange of observers for longitude determinations is only necessary in work of the very highest accuracy. The sending and receiving of rhythmic wireless time signals has reached such a degree of accuracy that the clocks at distant stations can be compared to $0^s.01$ or less. It should therefore be a simple matter to make accurate longitude determinations. The value of the new methods was fully established in the determination of the difference of longitude between Paris and Washington in 1913–4, when the result obtained was $5^h\,17^m\,36^s.653 \pm {}^s.003$.

Standard Time.—The use of a system of zones of standard time has been considerably extended.

Greenwich time is now (1921) adopted in the British Isles, Spain, Portugal, Belgium, France and the Faroe Islands. Mid-European time (1 h. fast on Greenwich) is used in Germany, Denmark, Italy, Switzerland, Norway, Sweden, Austria and the western parts of the Balkan peninsula; and E. European time (2 h. fast on Greenwich) in the eastern parts of the Balkan peninsula, including Greece. Time in Iceland is 1 h. slow on Greenwich. Russia still adheres to Pulkovo (Pulkowa) time, 2 h. 1 min. fast on Greenwich. Divisions of less

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than an hour are used in several British colonies. Standard time in the E. African Protectorate is 2 h. 30 min., in India 5 h. 30 min., in Indo-China 6 h. 30 min., in S. Australia 9 h. 30 min., in New Zealand 11 h. 30 min. fast; in British Guiana 3 h. 45 min., the Sandwich Is. 10 h. 30 min., Samoa 11 h. 30 min. slow. In all other countries adopting standard time the most suitable whole hour is employed. The standard zones in Brazil are from 2 to 5 h. slow on Greenwich. Uruguay, the Argentine Republic and Siam adopted standard time in 1920.

In the United States in 1918 to the four zones already established (1883) was added a fifth for Alaska alone. Standard time for this zone is based on 150° W. longitude. Standard time in the four other zones is based, as from the beginning, on the 75th, 90th, 105th, and 120th meridians. The marking of the limits of the various zones lies with the Interstate Commerce Commission, and they may be changed at its discretion. The first four zones differ from each other 1 h. in standard time; the fifth differs from the fourth by 2 hours. The first zone is 5 h. slow on Greenwich.

Until recently no definite time system was employed at sea, each ship adopting the local time corresponding to its position at a certain instant, usually noon. In 1919 a system of hour zones similar to that used on land, previously adopted in the French and Italian navies, came into official use in the British navy, a change which will greatly facilitate the interpretation of entries in ships' logs. The "zone description" of each zone is denoted by a positive or negative number equal to the number of hours slow or fast on Greenwich.

The central zone or Zone O lies between long. 7½° E. and long. 7½° W.: the zones to E. of this are numbered −1, −2 . . . −12, and those to W. +1, +2. . . +12. Zone 12 is divided centrally by the 180th meridian (the date line) and the + or − prefixes are used in its two halves. Near land the boundaries between the zones are modified so as to agree with the time used ashore.

Civil and Astronomical Times.—The civil day reckoned from mean midnight, instead of the astronomical day reckoned from mean noon, is to be adopted in the *Nautical Almanac* in 1925, and a similar change has been decided on for the *Connaissance de Temps* and the *American Ephemeris*. The same course will probably be followed by astronomers, but some confusion may arise if the old expression "Greenwich Mean Time" is employed in a new sense.

TINAYRE, [MARGUERITE SUZANNE] MARCELLE (1872–), French novelist, was born at Tulle, Corrèze, in 1872. She was educated at Bordeaux and Paris, and in 1889 married the painter Julien Tinayre. Her earliest novel was *Avant l'Amour* (1897); but the one by which she is best known is *La Maison du Péché* (1902). Her later works include *La Rebelle* (1905); *La Consolatrice* (1907); *Madeleine au Miroir* (1912); *L'Ombre de l'Amour* (1910); *La Douceur de Vivre* (1911); and *Le Départ; Août, 1914* (1915). She also published in 1910 a book of travels, *Notes d'une Voyageuse en Turquie*.

TIRE (*see* 26.1006).—The modern motor vehicle (*see* MOTOR VEHICLES) would not be possible without some cushioning or shock-absorbing medium at the periphery of its wheels. India rubber, properly fashioned and fabricated with metals and fabrics into tires, plays an essential part in providing this necessary cushion. Structurally, tires are divided into two main classes: solid rubber and pneumatic. The cushioning properties of solid

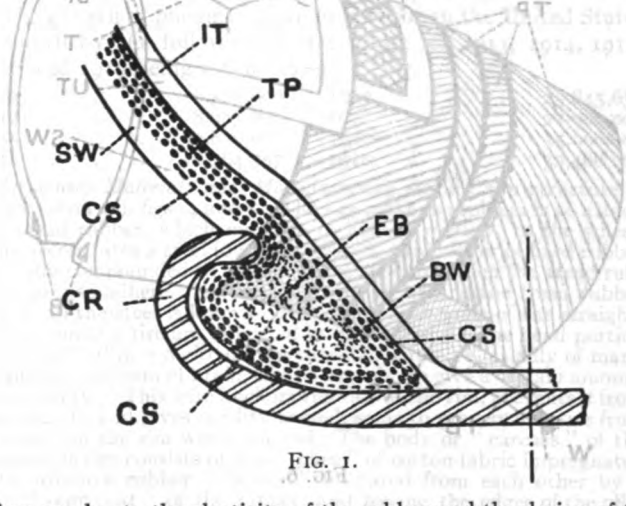

FIG. 1.

tires are due to the elasticity of the rubber and the design of the tread, while in the pneumatic type compressed air is the cushioning medium; the rubber tire in this case serving as a flexible, yielding container for the compressed air. In both classes the various types are made in a progression of sizes, varying in outside diameter to give the proper road clearance, and in width to accommodate properly the weight the tires have to support.

History from 1910 to 1921.—This period opened with the motor vehicle industry served by clincher or beaded edge pneumatic tires (fig. 1) of square woven fabric not larger than 5½ in. in section, suitable for use on passenger cars only, and giving 3,000 to 4,000 m. service. The trend of tire development had only recently settled on this clincher type as the most logical of the many inventions, and the shortcomings of the product were varied and numerous. Americans, following British design, were especially unfortunate in having a great deal of premature failure due to "rim cutting." This clincher type was also difficult to apply to the rims in the larger sizes, and troublesome security bolts were necessary to keep the tire from creeping around the rim. Progress in tire development has been influenced by three considerations: first, the method of attachment to the rim; second, increase in the durability of the tire; and third, the development of new types of tires for new fields of usefulness. The principle of the Dunlop-Welch wired-on bicycle tire had been tried experimentally in motor vehicle tires by using a bulky inextensible wire bead fastened to the wheel rim with "straight-side" bolted-on flanges. This straight-side tire idea first became practical for motor vehicle use in 1907 when an American manufacturer offered to the American public in perfected form his

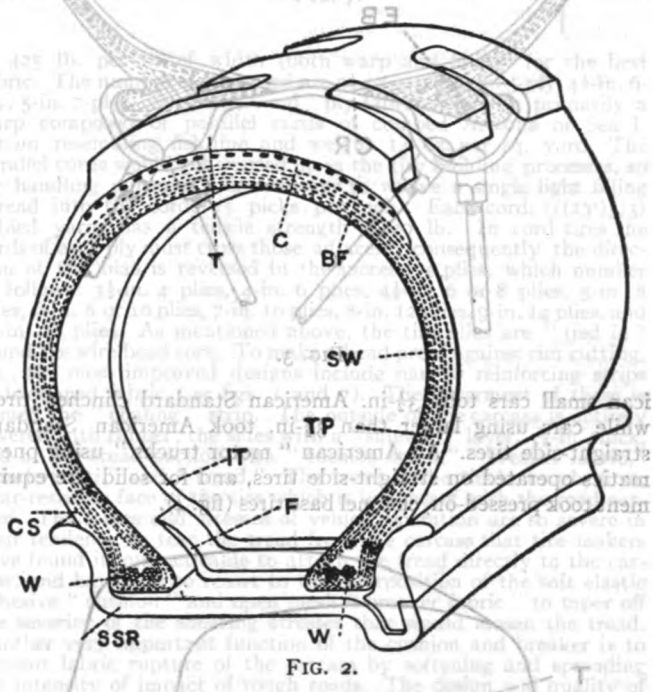

FIG. 2.

"detachable" straight-side rim and tire. Its progress was slow because of competitive hindrances, but by 1910 the detachable rim had become so much appreciated that the clincher tire manufacturers were obliged to furnish some sort of a detachable tire. The result was the "quick-detachable" (Q.D. clincher), a tire fitting a detachable clincher rim and having its beads shaped like the regular soft bead clincher but with an inextensible wire bead core like the straight-side tire. During this period of development the Q.D. clincher served admirably as a transition type.

The merits of the straight-side (fig. 2), however, gradually made it more popular than the Q.D. clincher, with the result that the last Q.D. clincher rims were made in 1916. In the meantime the European demand continued to be for the clincher type exclusively, while except in the Ford sizes, they were discontinued in American production. American army vehicles and motor vehicles exported on straight-side tires have recently opened a market for straight-side in other countries. The year 1921 found the situation as follows: bicycles were fitted with single tube tires in America and wired-on tires in Europe.

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Motorcycles were fitted with clincher tires both in America and Europe, and aeroplanes with either clinchers (fig. 3) or wired-on according to the demand. Passenger cars were fitted with European Standard clincher tires for European productions. American small cars took 3½-in. American Standard clincher tires, while cars using larger than 8½-in. took American Standard straight-side tires. All American "motor trucks" using pneumatics operated on straight-side tires, and for solid tire equipment took pressed-on, channel base tires (fig. 4).

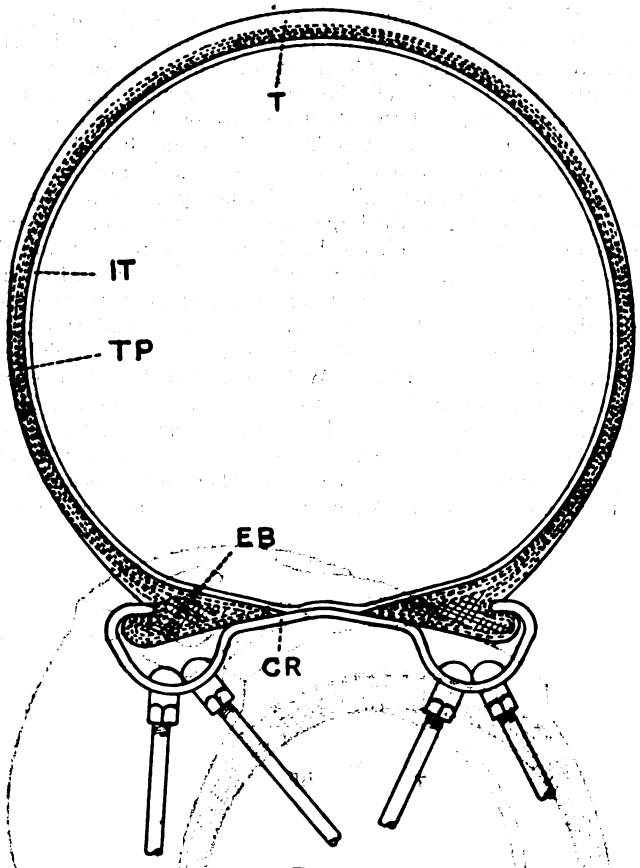

FIG. 3.

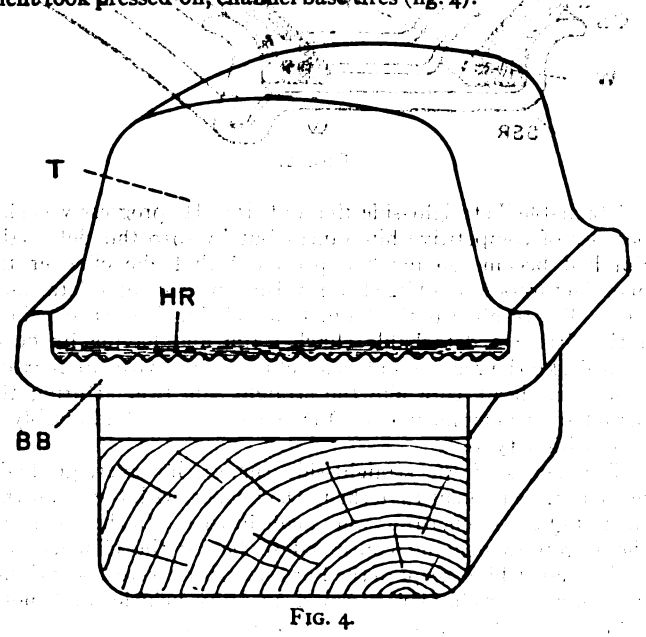

FIG. 4.

European "lorries" were fitted with the typical English band tire (fig. 5). Progress in details of design, materials, and methods of manufacture was very gradual, the general idea being always to build a "balanced" tire, that is, one in which all parts were equally durable. There are practically no formulae or theories on tire design (except the rubber compound formulae) of value to the tire manufacturer; whatever good qualities any particular make of tire embodies are the result of persistent and constant experimentation, combined with the policy of the individual company controlling the standard of quality which it desires to offer to the public. The square woven tires of 1920 averaged 5,000 to 6,000 m. of service. There was one outstanding development during the period 1910–20, namely, the "cord construction." The cord idea was old, having been used in bicycle tires in the 'nineties, but the "square woven tire duck" appeared to be more practical for motor vehicle tires.

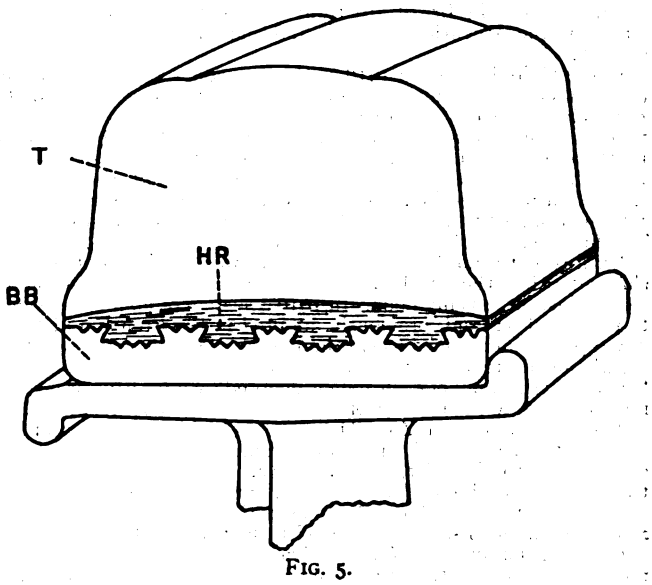

FIG. 5.

About 1912 electric automobiles in America created a demand for "power saver" tires to which the tire makers responded by offering special casings of cord fabric structure for which exceptional resiliency and lack of internal friction were claimed. Not at all durable at first, as they were gradually perfected the leaders of the industry became convinced that this was to be the quality tire of the future (fig. 6).

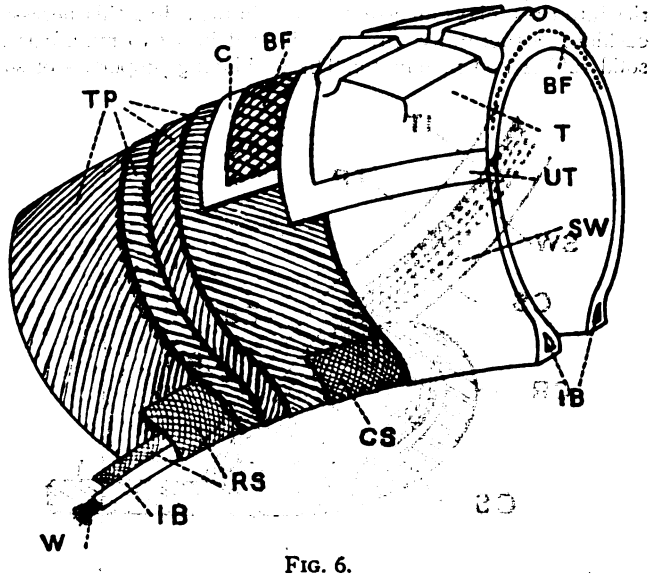

FIG. 6.

Ply separation and fabric breaks in cord tires are effectively prevented because the cords, being completely insulated from each other, provide a flexibility of the "carcass" without chafing,

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that greatly reduces injury from under-inflation and overloading. Development in the two-ply "cable" cord construction and the "multi-ply" construction paralleled each other. In 1920 the merits of the multi-ply construction had prevailed to such an extent that the "cable" cord was no longer made. After the World War European tire manufacturers began to duplicate American multi-ply cord construction in their millimeter beaded edge sizes. The cord tires of 1920 averaged 7,000 to 8,000 m. of service. Durability was also materially improved by increasing the cross-section size of the tires. In 1920 practically all American straight-side cord tires were made 10% over the nominal size. Also the tire manufactures gradually succeeded by persistent educational work, in getting car manufacturers to fit tires adequate for the loads to be carried. During this decade a new use was developed for pneumatic tires, namely their application to motor trucks up to 3½ tons capacity. The movement made very little progress from 1910 to 1915. "Dual" (or twin), square-woven fabric tires in passenger car sizes were first tried. Then square-woven fabric tires of 8-in. and 9-in. sections were employed with results encouraging enough to justify putting a limited number on the market. By 1916 automobile cord tire construction had been mastered sufficiently for trial in the truck sizes. Success with 6-in., 7-in. and 8-in. sections immediately demonstrated the superiority of the cord construction and was followed by regular demand from the public. The 9-in. and 10-in. sections were used to some extent but their future was in 1921 uncertain. The typical solid tire of 1910 was the British "pressed-on" band tire then in use in Europe and soon to be duplicated in America. These tires were fitted to the wheels by simply forcing or pressing on with a special press, but in the absence of conveniently located tire presses, some American manufacturers adapted the metal base idea to a "bolted-on" design (called "Demountable"), having bevels on the inside edges of the steel band so arranged that hoop-shaped "wedges" could be fitted to mount the tire, the whole assembly being bolted in place with "side flanges." Early metal base tires in America failed prematurely from fracture of the exposed hard rubber at the edge of the base band due to rough streets. To remedy this the band was made in "channel" form and the hard rubber protected by the side of the channel. In 1913 as an experiment, a "channel base" tire made to press directly on the S.A.E. (Society of Automotive Engineers) standard wheel without traction plate or staples, previously considered necessary, was tried. The experiment was successful, and this new type was so much simpler and less expensive that it rapidly superseded all other types in America. In 1915 wide single solid tires were introduced in America (8 in., 10 in., 12 in. and 14 in. wide) on the rear of heavy trucks in place of dual or twin tires. In 1920 wide singles and duals were almost equal in popularity.

The growth of pneumatic tire production in the United States is shown by the following figures, those for 1913, 1914, 1915, 1918 and 1919 being estimates:—

1913	6,588,000	1917	25,845,656
1914	8,983,000	1918	21,000,000
1915	12,840,000	1919	35,000,000
1916	18,564,957	1920	32,400,000

Structure, Materials and Manufacturing.—Solid tire structure is clearly shown in figs. 4 and 5. The tire maker's problem is to attach the tread rubber, which must be of highest quality, to the wheel. This necessitates a steel foundation band, a thin layer of hard rubber specially compounded to adhere to the steel, to which the tread rubber will also adhere. No practical way of making the tread rubber adhere to the steel is known. The component parts of the straight-side pneumatic tire are indicated in figs. 2 and 6. The bead portion has imbedded in it a circular inextensible wire core, usually of many strands in the form of braid, cables, or coils (to give a certain amount of flexibility). This wire anchors the tire to the rim, prevents it from blowing off, and gives rigidity enough so as to prevent the tire from creeping on the rim when inflated. The body or "carcass" of the pneumatic tire consists of bias "plies" of cotton fabric impregnated with adhesive rubber "friction," insulated from each other by a thin "skim coat" of the rubber, and having the edges of the plies folded or "tied in" alternately over and round the wire bead core. (*See* fig. 7 showing detail of a typical bead "tie-in.")

Since the function of the carcass is to serve as a strong yet flexible container for the inner tube with its charge of compressed air, the specifications covering the fabric call for great strength, uniformity of weight, freedom from grit, and particular grades of long staple cotton (Arizona, Sea Island, Egyptian, Sacalarides, Pealer, etc.). The two general classifications are: first, "square-woven" fabric, weighing 17½ oz. per sq. yd., woven from warp and filling, twisted of 11 strands of No. 23³ yarn and having a tensile strength

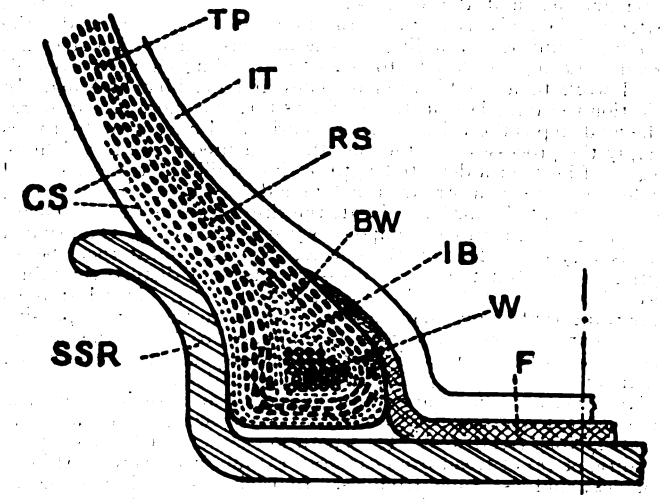

FIG. 7.

of 425 lb. per in. of width (both warp and filling) for the best fabric. The number of plies used are 3½-in. 4-ply, 4-in. 5-ply, 4½-in. 6-ply, 5-in. 7-ply. Second, "Cord" ply-fabric, which is primarily a warp composed of parallel cords of combed Arizona or Sea I. cotton resembling fish line and weighs 14 oz. per sq. yard. The parallel cords would get snarled up in the tire building processes, so for handling purposes it is necessary to weave a single light filling thread into the cord, 2½ picks per inch. Each cord, (((23³)5)3) cabled yarn, has a tensile strength of 20 lb. In cord tires the cords of each ply must cross those adjacent, consequently the direction of the bias is reversed in the successive plies, which number as follows: 3½-in. 4 plies, 4-in. 6 plies, 4½-in. 6 or 8 plies, 5-in. 8 plies, 6-in. 8 or 10 plies, 7-in. 10 plies, 8-in. 12 plies, 9-in. 14 plies, and 10-in. 16 plies. As mentioned above, the tire plies are "tied in" round the wire bead core. To make a bead proof against rim cutting, etc., the most improved designs include narrow reinforcing strips of frictioned fabric (*see* figs. 1 and 7). The outermost of these is named the "chafing" strip. The outside of the carcass is entirely covered with rubber; the sides with a "sidewall" layer, $\frac{1}{16}$-in. thick, and at the tread portion with "cushion stock," "breaker fabric," "undertread," and "tread." The tread is the thick, tough, firm, wear-resisting face of the tire which is in contact with the road surface. The forces and stresses of vehicle operation are so severe in their tendency to tear the tread from the carcass that tire makers have found it impracticable to attach the tread directly to the carcass, and have had to resort to the interposition of the soft elastic adhesive "cushion" and open mesh "breaker fabric" to taper off the severity of the shearing stresses that would loosen the tread. Another very important function of the cushion and breaker is to prevent fabric rupture of the carcass by softening and spreading the intensity of impact of rough roads. The design and quality of the tread rubber must be worked out to wear at least as long as any other part of a balanced tire. The simplest smooth tread is a thin crescent in cross section; and in the case of non-skid designs they are generally crescent cross section with geometrical depressions or protuberances. The physical properties most desired are toughness, to resist cutting and chipping, and attrition resistance to provide against abrasion from road surface friction.

There are no particular differences of design for the inner tubes; nearly all makes resemble each other very closely. Highest quality rubber with little or no compounding except sulphur is used for grey tubes. The best red tubes are compounded with antimony sulphide. To be satisfactory the tube must hold air; not crack nor check in storage; not stretch out of shape; not stick to the casing; not split nor tear easily; not be affected by heating; and must be repaired easily. "Flaps," made of inexpensive rubberized fabric, are used in straight-side tires to prevent the tube from being pinched or nipped under the edge of the bead, and to keep water and rim rust away from the tube.

Only general ideas of manufacturing can be mentioned. First, there is "stock preparation"; the rubber and "compounds" are mixed, the fabrics "frictioned" and "skimcoated" with rubber, gauged to a very exact thickness, the frictioned fabrics cut to proper widths on a machine called the "bias cutter," the cushion, undertread, and sidewall stocks are sheeted out and cut to width on the calender, the tread rubber is prepared either on the calender or the

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"tubing" machine, and the bead wires are padded with rubber and frictioned fabric and cold pressed into shape. (*See* RUBBER for stock preparation.) "Building" the tire is the next step. A "core" in shape and size like the inside of a finished tire used as a building form, is mounted on a stand which permits the core to revolve. The tire plies are drawn taut around the core and rolled down smooth one after another, and at the proper time the bead is put in position. After the last ply is in place the tie-in at the bead is made; the building is finished by adding the sidewall, cushion, breaker strip and tread. During the decade 1910–20 tire building changed from all hand work to a combination of hand and machine building. In addition to saving labour, the machines turn out more perfect work. The final step is the vulcanizing or "curing." Fundamentally this is simply the processes of subjecting the "uncured" tire to a definite degree of heat for a definite length of time while the tire is confined under pressure in a strong iron "mould" (with an iron "curing core" or inflated "air bag" inside the tire). The heat effects chemical changes in the rubber compounds just as in cooking. Quality in a tire is very dependent on the curing. Not only must there be an optimum cure but the mould pressure must not disturb the fabric lest "buckles" or "mould pinches" be formed. This last is so important that many manufacturers resort to the more expensive double cure process—the carcass is semi-cured to "set" the rubbers and fabrics with much less danger of fabric displacement, after which the tread is cemented in place and the cure finished.

Tire Troubles.—For the purpose of general analysis in pneumatic tire service, five major tire troubles are recognized. They are: (1) unsatisfactory tread wear; (2) separation either (*a*) between plies of fabric or (*b*) of tread from carcass; (3) fabric ruptures; (4) bead troubles; and (5) tube troubles. In each case it is possible to classify pretty completely the origins of the mischief. Of course, many instances of premature tire failure are due to defects of design, materials or manufacture; on the other hand, by far the more frequent cause of tire trouble is abuse in the hands of the user as outlined below:—

Unsatisfactory Tread Wear	caused by	Abrasion Wheels out of alignment Too much power Improper use of brakes Skidding Abrasive road surfaces Under-inflation Sharp stones cutting tread Deterioration from oil
Separation (*a*) between plies of fabric (*b*) of tread from carcass	caused by	Excessive flexing Riding under-inflated Riding car tracks Overloading Riding flat Abuse of rough roads Cuts Heating from speeding Water-soaked fabric
Fabric Ruptures	caused by	Overload Over-inflation Under-inflation Stone bruises Premature ply separation Cuts Exposed fabric water-soaked Speeding on rough roads
Bead Troubles	caused by	Bent rims Under-inflation
Tube Troubles	caused by	Riding flat Leaky valves Puncture Heating from speeding Pinching under bead Tears from rough handling Neglect of spare tube

Solid tire troubles are confined to premature wear in the form of cutting, chipping, and breaking large chunks out of the tread; disintegration in the heart of the tire due to the accumulation of the heat of internal friction on long trips (rubber is such a poor conductor that heat is not adequately dissipated by windage); and separation of the whole mass of the tread rubber from the steel base-band. This last is a defect in materials or manufacture except in cases where external abuse fractures the hard rubber. In order to cushion a specific load properly a tire must not have too high air pressure; on the other hand, under-inflation results in excessive flexing which in turn brings on premature ply separation and fabric breaks. Experience has demonstrated that a pneumatic tire should not flex more than 11% (for large tires) to 15% (for small tires) of the section diameter of the tire. Recommendations designed to advise vehicle manufacturers and users as to the proper conditions under which the tires should be used are given in their "carrying capacity" schedules, as indicated in the following table.

Carrying Capacities and Inflation Pressures of Pneumatic Tires
S.A.E. Standard.

Tire Size	For passenger cars: Fabric tires		For passenger cars: Cord tires		For commercial vehicles: Cord tires	
	Max'm load per tire lb.	Air pressure lb. per sq. in.	Max'm load per tire lb.	Air pressure lb. per sq. in.	Max'm load per tire lb.	Air pressure lb. per sq. in.
3 "	375	45	400	40	..	..
3½ "	570	55	600	50	..	..
4 "	815	65	850	60	850	70
4½ "	1,100	75	1,200	70	1,200	75
5 "	1,500	85	1,700	80	1,700	80
6 "	..	..	..	..	2,200	90
7 "	..	..	..	..	3,000	100
8 "	..	..	..	..	4,000	110
9 "	..	..	..	..	5,000	120
10 "	..	..	..	..	6,000	130

(J. E. HA.)

TIROL (*see* 26.1010), an Austrian Territory, divided by the Treaty of Peace of St. Germain into two separate parts—*Northern Tirol* and the district of *Lienz*. Northern Tirol is bounded on the E. by Salzburg, on the N. by Bavaria, on the W. by Vorarlberg and Switzerland and on the S. by Italy (German Southern Tirol). It lies mostly in the valley of the Inn, the northern part in the Kalk-Alpen and the southern in the schists and the central zone of the eastern Alps. The southern frontier almost coincides with the watershed between the Inn and the Adige. In the N., Tirol extends into the basins of the Lech and the Isar. The "*Fähnstrasse*" of the Brenner renders the cultivation of maize possible in some parts of the Inn valley. The new Territory has an area of about 4,787 sq. m. and its pop. was in 1910, 304,713, in 1920, 306,156 (64 per sq. mile). The area of the Lienz district is about 763 sq. m.; pop. in 1910 about 29,000.

The population is almost entirely German and Roman Catholic (1910, 98·9%). The proportion of males to females in 1910 was as 1,000 to 981 but in 1920, 1,000 to 1,053.

For administrative purposes Northern Tirol is divided into seven districts and the autonomous city of Innsbruck, the capital (pop. in 1920 55,659). Lienz is a district of itself. Other important places besides Innsbruck are Hölting bei Innsbruck (pop. 9,503), Schwaz (pop. 7,385), Hall (pop. 6,984), Kufstein (pop. 6,662), Lienz (pop. 5,756), Wörgl (pop. 4,030), Landeck (pop. 3,919).

Agriculture and Forestry.—In 1910, 23·7% of the present Tirol was unproductive. Of the productive areas (1910), 5·9% was arable, 0·2% gardens, 7·4% meadows, 41·5% pasturage (almost entirely high summer grazing lands) and 44·9% forest.

Cattle-raising and farming on the high lands are well-developed industries, although less care is bestowed on them than in Switzerland. But in 1918 there were only 159,398 head of cattle (of which 91,219 were cows) and 24,421 swine. The Tirolean breeds of cattle are highly esteemed. Forestry also holds an important place among the industries of this Territory.

Minerals.—The salt mines yielded 15,000 tons in 1915 (9% of the whole Austrian output) at Hall bei Innsbruck. The production of lignite, 40,000 tons in 1915 (scarcely 2% of the Austrian output), is chiefly from Häring in the Unter-Innthal. Copper, lead, zinc, antimony and sulphur and asphalt are also mined.

Manufactures.—Industry is still little developed although the use of the abundant water power is rapidly increasing; there are electrical stations at Innsbruck and elsewhere. Mention should be made of the wood, iron, textile, earthenware and glass industries. Innsbruck is as yet hardly an industrial city but has commercial importance and is visited by great numbers of tourists.

Communications.—Mountain railways from Innsbruck to the Stubai-Thal and to Mittenwald, the junction for Munich, have led to a great development of tourist traffic and are of marked importance for trade and industry.

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TIRPITZ, ALFRED VON (1849–), German admiral and politician, was born at Küstrin March 19 1849. He entered the Prussian navy in 1865, and by 1890 had risen to be chief-of-staff of the Baltic station in the Imperial navy. In 1892 he was in

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charge of the work of the chief-of-staff in the higher command of the navy. He was promoted to be rear-admiral in 1895, and in 1896 and 1897 he was in command of the cruiser division in east Asiatic waters. In 1899 he reached the rank of vice-admiral and in 1903 that of admiral. For the long period of 19 years, from 1897 to 1916, he was Secretary of State for the Imperial navy, and in this capacity advocated the navy bills of 1898, 1900, 1907 and 1912 for increasing the German fleet and successfully carried them through the Reichstag. In 1911 he received the rank of grand-admiral, and he retired in 1916.

The best account of Adml. von Tirpitz's naval achievements and political activities is contained in the book which he published in 1919 under the title of *Erinnerungen*. In that book he shows how gigantic was the task of creating the new German navy with which Great Britain had to reckon at the outbreak of the World War. Not only had a whole array of subsidiary industries to be established and supplies of raw materials secured; thousands of skilled workmen and hundreds of directing personalities of strong character and exceptional ability had to be found and trained. It has been customary to attribute the creation of the German navy to the Kaiser William II., and it is true that in large part the initiative for successive increases, and the demagogic appeals by which they were supported, originated with the Emperor. On the other hand, it was Tirpitz who not only conducted the practical advocacy of these schemes in the Reichstag, but also organized the service of propaganda in the German press and on the platform, putting popular pressure on the parliamentary representatives of the nation and constraining them to agree to the enormous expenditure which these schemes entailed. William II. was often a hindrance as well as a help, and Tirpitz gives instances in which the work of the construction departments and even that of the Secretary of State were interrupted or hampered by wild-cat Imperial projects for the construction of architecturally impossible vessels or of mechanically impossible machinery. One of these projects, on which an elaborate report had actually to be submitted to the Emperor, was a device for which it was claimed that it had solved the problem of perpetual motion. In the conduct of the naval war the official rôle of Tirpitz was confined to reporting and advising at general headquarters, the actual conduct and initiative in operations being in the hands of the higher command of the navy at Wilhelmshaven, subject to the Emperor's approval or veto. Tirpitz advances two contentions; first, that he would have sent the navy into decisive action at an earlier stage of the war; secondly, that he would have made an earlier and more ruthless use of the German U-boats; but his opponents traverse both these claims, and in particular assert that as Secretary of State he had neglected the construction of submarines, so that Germany entered the war with a comparatively small supply of these vessels.

In the political sphere Tirpitz was a bitter opponent of Bethmann Hollweg, whom he charged with indecision, half-heartedness and nebulous conceptions of the necessities of German policy. His own experiences in the Reichstag, and the close contact with the political parties which his advocacy of successive naval bills had involved, made him a master of political intrigue. During the years which immediately preceded the war, as well as during the first 18 months of the conflict, he was himself a candidate for the office of Imperial Chancellor, in the sense that many of the reactionary Conservatives and of those who advocated a ruthless conception of policy in peace and war regarded him as their political hope. Lord Haldane, in his book *Before the War* (1920), records his impression of Tirpitz when he visited Berlin in Feb. 1912 in order to make tentative proposals for an agreement regarding the limitation of new construction. Bethmann Hollweg, Lord Haldane thought, was willing to entertain the British suggestions; it was Tirpitz who behind the scenes offered a most strenuous opposition to any restrictions. Tirpitz himself maintains that his naval aspirations were directed not towards a war with Great Britain, but to the creation of a state of naval equilibrium or of German superiority, which would have enabled Germany to insist upon the unreserved coöperation of British policy in her world aims. It was probably true that Germany's policy was directed rather towards being so strong at sea as to make England unwilling to fight her unless absolutely necessary, than towards actually challenging British naval supremacy. But this policy was, in any case, bound to make England peculiarly sensitive to provocation by Germany,—a point which was ignored by the champions of a great German navy. Tirpitz's book, in so far as his statements may be trusted, throws much light upon the circumstances in which German policy was directed or drifted in July 1914 into paths which inevitably led to war. He enlarges in particular upon what he considers the folly of the declaration of war upon Russia (*see* BETHMANN HOLLWEG). He is naturally influenced to some extent in what he says by his poor opinion of Bethmann Hollweg's capacities and by his own thorough knowledge of the Emperor's fickle and impetuous character.

His resignation in 1916, and the stages of his relations with the Emperor and the Higher Naval Command which led to it, are described in his *Erinnerungen* with almost tragic vividness. Tirpitz remained a leading figure in the political agitation against the Chancellor's policy and was selected as president of the "Vaterlandspartei," a political association started in Sept. 1917 under reactionary auspices to combat all attempts at peace by compromise, and to advocate the prosecution of the U-boat warfare with extreme ruthlessness. This association offered a vigorous opposition to the movement, which succeeded only when it was too late, for obtaining alterations in the constitution limiting the power of the Emperor and laying the foundations of real parliamentary government in the Empire and in Prussia.

After the revolution Tirpitz was one of those against whom German popular animosity was chiefly directed as being the inspirer of the naval and world policy which led to the war, and also the most powerful influence in prolonging it. He was one of those who found it inadvisable to remain in Germany, and he departed to find a refuge in Switzerland. After the republican Government seemed fairly established, and the reign of law and order was being restored, he returned; but, possibly on account of his advanced age, did not appear during 1921 to be taking any further part in political intrigue or agitation. (G. S.)

TISZA, STEPHEN, COUNT (1861–1918), Hungarian statesman (*see* 26.1017). During the Coalition Ministry (1906) Tisza retired into private life on his estate of Geszt. It was only in the House of Magnates that he expressed his views against the extension of the franchise. When Count Khuen-Hedervary took office in 1910, Tisza was his most earnest and effective opponent in the country. His return to the political arena took place during a period of obstruction. In 1912 he became president of the House of Deputies, and on July 10 1913 again returned to power as prime minister. When the World War broke out a truce was arranged between Tisza and the Opposition, but it did not last long, and in 1917 he was compelled to resign. Though hitherto he had been the most zealous adherent of Dualism and the partnership with Austria, he declared for the scheme of personal union after the manifesto of King Charles on Oct. 17 1918, the Pragmatic Sanction to hold good on the question of national defence, but with a separate Hungarian army and separate diplomatic representation abroad. When he saw no prospect of winning the war he pleaded for a peace in common with Germany on the basis of President Wilson's Fourteen Points. On Oct. 31 he was assassinated in his villa by men in military uniform, said to have been worn as a disguise.

Tisza had a power over Austria and Hungary such as had hardly ever been exercised before by an adviser of the Crown. He was distinguished by his determination and inflexible convictions, and was opposed to any policy involving weak concessions. In the newspapers *Magyar Figyelö* (Hungarian Observer) and *Ignazmondó* (Truth), he published articles on many subjects; in addition he published the historical study *Von Sadowa bis Sedan* (in Hungarian and German).

See the biography by Karl Szaz (Hungarian); and David Angyal, *In Memory of Stephen Tisza* (Hungarian). (E. v. W.)

"TITANIC" DISASTER, 1912.—No single event in 1912 could compare, in the intensity of its universal appeal to human

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emotion, with the awful disaster to the British steamship "Titanic." At. 2:20 A.M. on April 15, that great White Star liner, the largest afloat, on her maiden voyage, went to the bottom of the Atlantic in lat. 41° 46′ N., long. 50° 14′ W., about 2¼ h. after striking at full speed on an iceberg, with a loss of 1,513 souls out of 2,224 on board.[1] It had been supposed that such a vessel was unsinkable, and the tragedy raised numerous questions as to methods of ship construction, and additional provision of life-saving equipment. The "Titanic" had nominally boat accommodation for double the number saved, and the 20 boats launched were meant to hold 1,178 persons instead of the 652 they actually contained when they left the ship; moreover, the disaster occurred under exceptional conditions for getting people safely off, in the way of smooth water and fine weather. The most salutary lessons seemed to lie in the following directions: first, improved design and construction so as to provide a really unsinkable ship; secondly, greater precautions in navigation and look-out—for the "Titanic" was going at 18 knots (according to Lord Mersey an "excessive speed"), though it was known that icebergs were exceptionally numerous on the course; thirdly, better and more regular organization on shipboard—by boat drill (there had been none on the "Titanic") and otherwise, for the emergency of having to abandon ship; and fourthly, a compulsory service of wireless on all liners, working day and night—for it was one of the most lamentable incidents in the whole terrible story that the "Titanic's" wireless call for help, picked up all over the ocean and nobly responded to by the "Carpathia" (Capt. Rostron), 70 m. off, fell on deaf ears on the "Californian" only 8 or 10 m. away.[2] The full record of the disaster is contained in the reports of the inquiries held at once in America by a committee of Congress under Senator Smith, and later in London by a special commission presided over by Lord Mersey (report issued July 30). Painful and difficult though it was to distribute blame in such a case, there could be little doubt that the loss of life—817 passengers out of 1,316, and 696 out of a crew of 908—was much greater than ought to have been possible. Capt. E. J. Smith (b. 1853), a highly experienced seaman, who had been for 38 years in the service of the White Star Co. and who now went down with his ship, seems to have been averse from taking steps at first which might cause a panic on board; otherwise there should have been time, if adequate means of organization and of commanding discipline had existed, not only to get more people into the boats but to improvise rafts. In naval circles the opinion was strongly held that this should have been done, since the injuries received by the ship made it certain that she would sink in a given time. If so, there was a weakness in the higher command, or the means provided for exercising it in the organization of the crew on the "Titanic," for which no merely material equipment could compensate. A natural expectation of security had been engendered, alike among the owners, officers and passengers of these magnificently appointed liners, which, until a crisis actually came, had made it almost unthinkable that it could come in that way; but the fact remains that responsibility for the lives of passengers rests with those who control the ship. In this case, it was not the inadequacy of the physical means of escape that accounted for the large proportion of the lost who remained on board; it was the inadequate organization for purposes of using them, and inadequate information as to the necessity. Apart from that, both Great Britain and America could mingle sorrow and pride over many fine incidents of the tragedy, with its long death roll of prominent people from both sides of the Atlantic. When it came to the sending away of the boats, the order was "women and children first." The figures of the 711 saved by the "Carpathia" (including about 60 who were picked up in the boats after the ship went down) speak for themselves:—Women: first class, 140 out of 144; second class, 80 out of 93; third class, 76 out of 165; crew, 20 out of 23. Children: first class, 6 out of 6; second class, 24 out of 24; third class, 27 out of 79. Men: first class, 57 out of 175; second class, 14 out of 168; third class, 75 out of 462; crew 192 out of 885. Altogether the percentage of women saved was 74·35, of children 52·29, of men 20·27. The comparatively small proportion of third-class passengers saved was shown to be purely accidental and not due to any preference being deliberately given to others; they were handicapped, however, by their quarters being remote from the boat deck, and by so many of them being unable to speak or understand English.

[1] The exact figures remained doubtful, but those given are from Lord Mersey's report.

[2] Apart from the "Californian's" wireless operator having gone to bed, however, Lord Mersey was satisfied that if her captain had realized the situation properly she could have saved "many, if not all, of the lives that were lost"; for evidence showed that distress rockets sent up on the "Titanic" were actually seen from the "Californian," though no action was taken in response to them. The incredibility of such a disaster appears, in that case, to have paralysed the capacity for interference.

TITTONI, TOMMASO (1855–), Italian statesman, was born in Rome 1855. His father, Vincenzo, a tenant farmer on a large scale at La Manziana, had taken part in the defence of the Roman Republic under Garibaldi in 1849, was exiled by Pius IX., and reëntered Rome in 1870 through the breach of Porta Pia. Tommaso Tittoni was educated first at Naples, and subsequently at Oxford and Liége. He began his parliamentary career as deputy for Civitavecchia in 1886, sitting on the Right, but he resigned his seat in 1897, having been appointed prefect of Perugia; three years later he went to Naples in a similar capacity, and in 1902 he was raised to the Senate. When Giolitti became premier for the second time in 1903, Tittoni became his Foreign Minister. He aimed at improving relations with Austria, and also tried to bring about a reconciliation with France; it was in fact under his auspices that President Loubet visited Rome. On the resignation of Giolitti in March 1905 Tittoni became interim premier for a few days and remained in the Fortis Cabinet as Foreign Minister. His proposal to reduce the duty on Spanish wines in connexion with an Italo-Spanish commercial treaty aroused a storm of indignation among the agricultural classes and caused the fall of the Cabinet on Dec. 24 1905; and although Fortis composed a new administration, Tittoni did not enter it. A few months later he was appointed ambassador in London (March 1906), but in May, on the fall of the Sonnino Cabinet and the return of Giolitti to power, he was again summoned to the *Consulta*. He continued the policy of improving relations with Austria, which did not contribute to his popularity; after the annexation of Bosnia and the Herzegovina his imprudently worded speech at Carate created the illusion that Italy was to be compensated, perhaps by the cession of the Trentino, and the disappointment when nothing of the kind materialized greatly weakened his prestige. He remained in office until the fall of Giolitti in Dec. 1909. In April of the following year he was appointed ambassador in Paris. When the World War broke out, in spite of his Triplicist policy he openly expressed himself in favour of Italian neutrality, and on Italy's entry into the war he was careful not to compromise himself with Giolitti's attitude. But he was not at his ease in the French capital and in Nov. 1916 he resigned from the Paris embassy. On the fall of the Orlando Cabinet in June 1919, the new Premier Nitti chose Tittoni as Foreign Minister and first delegate at the Peace Conference, but the severe strain of the work told on his health and he was forced to resign in November. He was chosen president of the Senate in Dec., and soon after was appointed Italian delegate on the Council and Assembly of the League of Nations, but ill-health again forced him to relinquish both appointments. In 1910 he had published a volume of speeches, which was translated into English, and in 1919 he brought out a work on political conflicts and constitutional reform.

TOBACCO (*see* 26.1035).—In 1913 the quantity of tobacco retained for home consumption in the United Kingdom was: unmanufactured 94,079,343 lb., and manufactured 1,896,668 lb. The year 1914 showed the beginning of the abnormal business in the factories. In that year, apart from tobacco sent to H.M. forces through the bonded factories, the quantity retained for home consumption was: unmanufactured 99,415,786 lb., and manufactured 1,585,411 pounds. In 1915 the amount of unmanufactured

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tobacco retained for home consumption rose to 106,516,337 lb.; the following year it was 101,719,199 lb.; and then from 1917, when the total was 104,501,452 lb., the amount went to 106,566,549 lb. in 1918 and to no less than 142,826,314 lb. in 1919. With imported manufactured tobacco, including cigars, cigarettes and snuff, the total consumed in 1919 was 145,344,604 lb. In 1914 the amount of unmanufactured tobacco which went through the factories and was consumed represented a consumption per head of population of 2·16 lb.; in 1919 it was 3·09 lb. per head.

The imports of tobacco into the United Kingdom by no means follow in the same ratio as the figures of consumption. When the World War broke out, thanks to the tradition of the trade and the prudent foresight of manufacturers, there were large stocks in the country. In view of the heavy requirements, fresh importations of raw tobacco were secured as before, but when the submarine activity added to the already urgent call upon shipping, imports dropped off very considerably and tonnage was only allowed sparingly for tobacco freights. The import of unmanufactured tobacco in 1913 was 162,365,925 lb.; in 1914 it was 158,692,857 lb.; 1915 202,650,863 lb.; 1916 164,265,861 lb.; 1917 46,543,000 lb.; 1918 171,639,313 lb. and in 1919 348,906,624 lb. It will be seen that the curve of imports drops in 1916 and is much lower still in 1917, and that so soon as shipping became available the depleted stocks of manufacturers were promptly renewed. Manufacturers had been purchasing but shipment had been held up. In addition to the manufactured tobacco imported in 1919, the following manufactured products were also brought into the country in that year: cigars, 1,670,735 lb.; cigarettes, 4,460,535 lb.; other tobacco, including snuff, 1,755,447 lb.

Before examining the Control Board's activities and retail prices in England it is interesting to note how the Treasury got on in the matter of revenue and under the influence of taxation which was several times heavily increased. The net receipts of British Government revenue in each year ended March 31 were as follows: 1913–4 £18,263,479; 1914–5 £19,272,007; 1915–6 £25,743,149; 1916–7 £27,342,339; 1917–8 £33,285,107; 1918–9 £46,231,430; 1919–20 £60,857,917. This crescendo of revenue gains was the result of two principles working together: the war impetus given to the use of tobacco, including the fact that ladies were in many cases smoking as well as men, and secondly the increased tax. The rate of unstripped tobacco leaf containing 10% or more of moisture, which was 3s. 8d. per lb. in 1914, was raised to 5s. 6d. per lb. from Sept. 22 1915, and this rate lasted till May 1917, other duties such as that on manufactured tobacco being correspondingly increased. On May 3 1917 the duty was increased from 5s. 6d. per lb. to 7s. 4d. but out of deference to the working-classes this increase of 1s. 10d. was reduced on July 15 to an increase of 11d. only, which brought the tax down to 6s. 5d. per lb., at which it remained from July 16 1917 to April 22 1918. The yield kept on the up-grade, notwithstanding the duty, and on April 23 1918 the duty was raised to 8s. 2d. per lb. at which it remained, the 1921 budget having left the main tax unaffected.

There were, however, some specialties in English taxation of distinct note apart from the ordinary tobacco duties. These special features consisted in the application of preferential treatment to empire-grown tobacco and in a surtax on imported cigars. On and after Sept. 1919 the ordinary duties were reduced by one-sixth in the case of tobacco consigned from, and grown, produced or manufactured in, the British Empire. On and after April 1920 an additional duty of 50% *ad valorem* was imposed on imported cigars, reduced by one-third in the case of cigars entitled to preferential rate of duty. This surtax was abolished as from May 10 1921.

War Supplies.—In examining the actual consumption of tobacco one has not merely to consider the imports and revenue figures. There was the large quantity of duty-free cigarettes, cigars and tobacco supplied to H.M. forces, whether in the form of rations or sent out duty free from manufacturers' premises, on orders obtained through tobacconists and from other sources. The dimensions of this most essential portion of the tobacco consumption can be gauged by several indications beyond the broad fact that every soldier or sailor who desired to smoke was well supplied. For instance the British Government chemist in his report for 1916 announced that the samples of tobacco exported on drawback numbered 32,004 or appreciably more than double the highest number examined in any previous year since the introduction of the drawback regulations in 1863. The number of laboratory certificates issued in connexion with samples was 81,889, an increase of no less than 48,179 over the corresponding number for the previous year. This was due to the dispatch of tobacco for the Expeditionary Force. The most direct indication however is afforded by the customs and excise report. This document for 1917–8 records the fact that, apart from ships' stores, the following were in that year the weights of cigarettes, etc., sent to the British Expeditionary forces and on which drawback was granted: tobacco, 123,256 lb.; cigarettes, 7,080,449 lb.; cut, roll, cake or other manufactured tobacco, 5,877,968 lb.; snuff, 525 lb. These figures include the large quantities of cigarettes supplied through tobacconists sending customers' orders to the manufacturers for sending out duty-free tobacco, and also orders sent from firms and other organizations who specialized in soldiers' parcels. They do not include the considerable number of parcels of cigarettes bought from a tobacconist's duty-paid stock and forwarded in a composite parcel by the soldier's friends. At a Navy and Army Canteen surplus stock sale in Aug. 1920 over 80 million cigarettes and 100 tons of tobacco were disposed of, 60 million of the cigarettes and the tobacco being sold for export only. The cigars for disposal were for the most part replaced into trade channels.

The British Tobacco Control.—The control of food in the United Kingdom, for war purposes, was followed by that of tobacco. The form of control was defined in two orders issued under the Defence of the Realm Regulations. One was called the Tobacco Restriction Order (No. 1) 1917, dated May 24 1917, and made by the Board of Trade under Regulations 2F and 2JJ, and the other the Tobacco Restriction Order (No. 2) 1917, dated July 11 1917. These two orders between them put the grip of the Board of Trade firmly upon every shred of tobacco which entered the country or was in stock, and controlled its movements, sale and price. The powers given were so full that an immoderate use of them could have paralysed the industry. The fact was that the control was a complete success, alike from the military or munition point of view, from the public point of view, and, greatest feat of all, from the trade point of view. The control lasted from its inception by the Restriction Orders named down to Jan. 11 1919 when the Board of Trade revoked the Orders, stating that "the effect of this revocation is that from the date named all powers exercised by the tobacco control board in regard to the control, importation and distribution and prices of tobacco will be abolished." During the period of control the board had systematized powers in regard to production, manufacture, treatment, use, consumption, transport, storage, distribution, supply, sale or purchase of or dealing in tobacco; they had power to place stocks at the disposal of the Board of Trade; any person delivering tobacco had to keep a record of the quantities delivered; tobacco sold by manufacturers, importers and wholesale dealers was ordered to be as nearly as possible of the same description and was to be sold in similar quantities and under like conditions and to the same customers as in the year 1916. In view of the shortage of shipping and the consequent necessity of economizing the available supplies of tobacco in Britain, an order was made bringing under control the stocks of manufactured and unmanufactured tobacco (of the latter a census was taken) and prohibiting the owners of stocks from dealing with them otherwise than as authorized by the Board of Trade. The order also provided for the regulation of the prices at which tobacco might be sold as from June 5 1917. No restrictions were imposed on the supply of tobacco to H.M. forces overseas. The Control Board at first consisted of the following: Mr. Lancelot Hugh Smith (chairman), Major F. Towle (quartermaster-general's department), and Mr. Gerald Bevan. They were assisted by an advisory committee, representative of all sections of the tobacco trade. The work of the Control Board was arduous; they were called upon to make numerous decisions and the way in which they exercised their powers helped the trade to keep going, guaranteed fair prices to the public and gave general satisfaction. A retail price schedule was issued, and one of these had to be exhibited prominently by every dealer in tobacco. Non-compliance rendered the tobacconist liable to a fine.

The Control Board's issue of Restriction Orders was to conserve supplies, but as time went on, owing to the large requirements of H.M. forces and the continued heavy demand at home, it became evident that the supply to the army might be jeopardized and a rationing system rendered necessary unless additional importations were allowed. The diminution of stocks in the bonded warehouses rendered some step advisable. The Control Board, therefore, though originally formed to restrict, now appeared in a new rôle, that of encouraging supplies, and in Jan. 1918 it was reported that the board were asking that tobacco should, with food and ammunition, be given priority of importation. From March 12 1917 there had been a restriction of clearances. The daily amount of tobacco allowed to be delivered out of warehouse or ship's side was restricted to the daily average quantity for the year ended Dec. 31 1916. But now that more tobacco was needed the question of further imports became urgent. Eventually an arrangement was made by which the British-American Tobacco Co., who had chartered the steamers of the Garland line, should bring in a supply for what became known in control circles and in the trade as "necessitous manufacturers." The result was that all were able to carry on.

Germany and France.—The difficulties of war-time conditions were thus successfully grappled with by the British Control Board. France, under its State *Régie*, did not do so well. It was reported in Dec. 1917 that under the stress of prolonged war the tobacco *régie* had practically broken down. It became well-nigh impossible to buy either tobacco or cigarettes in France. It was stated that owing to the intensification of consumption, due in part to women smoking, the monopoly administration had been taken unawares. Whatever the explanation, the State control did not produce the good results which control of an industry founded on private enterprise brought about in Great Britain. Still France was not so badly off as Germany and Austria. In Oct. 1917 permission was given by the German Government for the manufacture of tobacco-like substances without the employment of tobacco. These substitutes were allowed to be introduced into the trade and were made subject to the tobacco tax.

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A schedule of permissible substances was drawn up. What the substances were was made evident to the trade in England by the photographic reproduction in the English trade paper *Tobacco* of advertisements from the *Süddeutsche Tabakzeitung*. One of these advertisements read: "Beech, Chestnut, Lime, Maple, Plane, and Vine leaves in withered and quite dry condition, sound and cleanly sorted in sacks for instant delivery, against banker's security will be purchased. Samples asked for." Another advertiser offered for sale "Cherry leaves, tobacco brown, can be promptly delivered." Meanwhile the proportion of German-grown tobacco in cigars had increased until they were hardly fit to smoke. Large consignments of tobacco acquired by the manufacturers of Bremen, Hamburg, and Dresden from the Balkans were destined for the army, the civil population having to rely upon the substitutes. A similar shortage was experienced in Austria. In both countries drastic control regulations were enforced.

United States.—In accordance with an Act of Congress, approved April 30 1912, the Bureau of the Census collects and publishes (quarterly since 1916) statistics of leaf tobacco held throughout the country. The statistics deal with all manufacturers who during the preceding calendar year produced more than 50,000 lb. of tobacco, 250,000 cigars, or 1,000,000 cigarettes; and dealers who had on an average more than 50,000 lb. of leaf tobacco in stock; included also is the imported leaf tobacco held in bonded warehouses and bonded manufacturing warehouses. No account is taken of smaller establishments or of amounts held by growers.

On Oct. 1 1912 (first official report) there were on hand 1,047,404,560 lb.; on April 1 1921 1,818,781,268 pounds. In every case the April report was the largest, as by that time the gathered crop has been sold. The largest production is "Bright yellow," from Georgia, North Carolina, South Carolina, and Virginia (571,148,382 lb. held April 1 1921); "Burley," from Indiana, Kentucky and Ohio (399,001,690 lb.); and "Dark fired," from Kentucky and Tennessee (178,847,170). Of "Cigar" types the "Pennsylvania" usually ranks first (93,918,626 lb. held April 1 1921); other important types are "New England," "Ohio," and "Wisconsin." A census of the tobacco crop was taken every 10 years after 1839 and of acreage after 1879. The peak of production was reached in 1920 with 1,508,064,000 lb., estimated; the largest producing states were Kentucky (467,500,000 lb., 550,000 ac.), North Carolina (384,120,000 lb., 582,000 ac.), and Virginia (177,390,000 lb., 240,000 ac.). Since 1869 Kentucky has been the leading state. For 1920 the estimated average yield per acre for the United States was 796 lb., as against 894 in 1911, the record year; the variation of production among the states is remarkable, ranging from 600 lb. per ac. in Georgia to 1,510 in Pennsylvania. Of the two recognized classes of tobacco—"Cigar" and "Chewing, Smoking, Snuff and Export"—the former constitutes only one-sixth of the production.

The peak of average prices was reached in 1919. That year the farmers sold 1,440,979,349 lb., ranging from 17 cents in Pennsylvania to 65 cents in Louisiana. The averages for these states in 1911 were 9½ and 31 cents respectively; in 1920 20 and 40 cents. In the latter year Alabama led with 55 cents.

Although the United States surpasses all other countries in tobacco production, there are large imports of leaf for cigars and cigarettes. In 1920 imports were 82,231,396 lb., of which 18,856,091 lb. came from Asiatic Turkey, chiefly for cigarettes. Cuba furnished 23,616,999 lb., Porto Rico 14,728,645 lb., and the Philippine Is. 1,842,613; the Netherlands 7,720,255 lb. and the Dutch East Indies 2,102,664 pounds. Imported cigars and cheroots come chiefly from the Philippines (over 5,000,000 in 1920). Over five-sixths of tobacco imports enter through the district of New York.

Exports of domestic tobacco and tobacco products from the United States amounted in 1920 to $288,693,799 as against $306,861,519 in 1919. Of cigarettes there were exported 15,833,870,000, valued at $35,977,374; of these over 8,500,000,000 went to China, over 2,000,000,000 to Italy, and over 1,000,000,000 each to British India and the Straits Settlements. Most of the tobacco exports pass through the district of New York.

On Jan. 1 1920 there were in the United States 13,591 tobacco factories, of which 11,483 produced cigars, 1,871 tobacco and snuff, and 237 cigarettes; of bonded manufacturing warehouses there were 13 producing cigars, 2 cigarettes and tobacco, and one tobacco. New York has the greatest number of establishments. The tax on tobacco is an important source of Government revenue. The amount collected rose from $3,097,620 in 1863 to $88,063,948 in 1916. Revenue in 1917 was $103,201,592; in 1918 $155,757,278; in 1919 $204,982,560; in 1920 $294,267,609.

The war period in America has been reviewed in a report of the U.S. War Industries Board. Herein it is stated that men in service used on an average from 60% to 70% more tobacco than they did in civil life. The civil population, due probably to increased prosperity, the cutting down of alcoholic beverages and the sentiment developed by the various campaigns for supplying "smokes" to soldiers, used 15 to 20% more tobacco. No important control beyond some conservation in methods of packing was found necessary, though a price-fixing plan was under consideration when the war was closed. The demand from Europe, it was pointed out, as well as from the U.S. manufacturers, continued to increase, and when producers saw in the autumn of 1917 that they could successfully increase the price of their manufactured articles, even in face of the increased revenue taxes, very high prices for leaf were assured. It was not until the middle of 1917 that the price of finished products began to rise. The advance was steady and rapid, reaching, 200% of normal on many products by Sept. 1918. The tax on tobacco was increased in Oct. 1917 and Feb. 1919, but these increases formed a relatively small part of the increase in prices.

Leaf Prices.—The unprecedented consumption of tobacco products both in America and Europe reacted on the growers, who planted large crops which they sold under favourable conditions. Prices of the raw material steadily mounted owing to the competition. A really accurate estimate of the effects of war conditions on the price of raw tobacco would detail the various grades and growths and show the alteration as it affected each. The bright cigarette tobaccos of Virginia and the Carolinas were among those which commanded very greatly increased prices, but perhaps the best way of dealing with the question is to take the average prices from 1913 to 1919. The statistical abstract for the United Kingdom gives these average prices in pence per lb. for unmanufactured tobacco as follows: 1913 9·92; 1914 9·75; 1915 8·92; 1916 9·44; 1917 15·47; 1918 21·93; 1919 26·29. Thus it is seen that manufacturers were paying more and more for leaf tobacco, but prices later became more moderate. The cost of eastern leaf from Macedonia and other oriental countries was somewhat high in 1921, but was likely to get lower with increased production.

Waves of Fashion.—Long before 1914 the cigarette had already grown so in public favour that it was rapidly supplanting the pipe and cigar. The war intensified the process. Up to 1914 the most esteemed cigarettes were of the finest Turkish or of bright Virginia tobacco. If anything, the Turkish cigarette was the more used by the fastidious smoker. War conditions caused the cigarette of Turkish or Macedonian tobacco gradually to diminish and the British forces did their arduous work for the most part (and especially after the stocks of the better class Turkish cigarettes had become scarce) on cigarettes of American tobacco. Cigars were of course in request in officers' messes and among certain people at home. Pipes were used by comparatively few. After the Armistice both the cigarette and the cigar, but mostly the latter, seemed to be yielding ground to the pipe. Great Britain has for many years been the home of smoking mixtures in which various kinds of tobacco are blended to make a satisfactory pipe mixture. These mixtures are much appreciated too in America, to which country there is a fair export trade. The British-made briar pipe also sells well in the United States. An influence towards making pipe smoking once more the fashion was the imposition in 1920 by the British chancellor of the exchequer of the *ad valorem* surtax of 50% on imported cigars. This made imported cigars too dear and gave the impression to the public that all cigars were dear. When Mr. Austen Chamberlain subsequently stated, on April 25 1921, in the House of Commons, that "the surtax has lowered the revenue instead of raising it and has entirely failed to justify itself. Let others learn by the mistake I committed," he might have added that the surtax had temporarily killed the cigar trade.

British Empire Tobacco.—A new prospect was opened in the economic history of tobacco by the institution of the principle of preferential fiscal treatment of tobacco grown, produced, or manufactured in the British Empire. A reduction in the tax of one-sixth is acting as a stimulus to the young tobacco-growing industry of British Africa from Cape Colony to Rhodesia, of Canada and of some other portions of the empire. Growers in the United Kingdom and Ireland have also been encouraged by an allowance. This preferential taxation will probably be found of greater significance to the tobacco manufacturing industry and to the smoker than is even the attainment of the laudable object of helping the tobacco farmers of the empire. A quasi-monopoly such as that possessed by the United States and the Balkans does not economically suit the direct buyer (the manufacturer) or the eventual buyer, the smoker. A widening and multiplication of the sources of supply must have a steadying effect on prices. The lesson of the war was that, quite justifiably under the new conditions, very heavy prices had to be paid for all tobacco, whether from America, Nyasaland or elsewhere. For many years the Imperial Tobacco Co. have been large buyers of African tobacco. Their headquarters in Africa are at Blantyre, where they have encouraged the grower. Tobacco grown in Ireland and also in England has been put on the market with some success. In the British system of taxation a rebate of one-third of the excise duty was allowed on tobacco grown in Ireland for experimental purposes prior to 1909, and on tobacco grown in Great Britain up to 1913 inclusive. From those dates arrangements have been made under which certain grants sanctioned by the Treasury are applied in encouragement of the industry. In 1918 the following quantities were grown: England and Wales, 31,844 lb.; Ireland, 77,978 lb.; total, 109,822 lb.; net receipt of duty, £34,482. In 1919: England and Wales, 78,825 lb.; Ireland, 77,837 lb.; total, 156,662 lb.; net receipt of duty, £60,785. (E. S. C.)

TOGOLAND (*see* 26.1046).—This German protectorate in W. Africa was conquered by Anglo-French forces in 1914, and German sovereignty was renounced by the Peace Treaty.

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For some years preceding 1914 efforts had been made to reconcile the natives to German rule. This process began in the schools, where the children were taught to sing the German national anthem and to wave German flags; the teaching of English formerly common in the mission schools was abandoned. But the emigration of natives to the Gold Coast, which had resulted from the harsh methods of Herr W. Horn (governor 1902–5) and other officials was still marked in 1913, while on the east there was a similar attraction to Dahomey. Herr Horn had been dismissed for misconduct; his successor, Count J. von Zech, was more conciliatory to the natives and gave much attention to the development of railways and trade. In 1912 Germany made a departure in its colonial appointments by sending out as governor a member of one of the reigning families, Duke Adolf Friedrich of Mecklenburg, who was known as leader of an expedition which had crossed Africa. The duke was on leave when the World War broke out. He had, however, seen the linking up of Togoland to Germany by submarine cable (Jan. 1913), the extension of agriculture and an expansion of exports.

Maj. von Döring, the acting governor, had the advantage in the critical days of July 1914 of direct communication with Berlin by a wireless station at Kamina, which had just been erected. He made preparations to invade Dahomey, on the assumption that Great Britain would not enter the war. When this supposition was proved to be wrong Maj. von Döring received instructions from Berlin to propose that Togoland and the adjacent French and British colonies should remain neutral. The offer was made to the local authorities concerned but was rejected, in the case of the British by order of the Colonial secretary in London. The chief concern of Berlin in regard to Togoland was to preserve the use of the Kamina wireless station, through which they could communicate with all the other German colonies in Africa, and when the neutrality offer failed, orders were issued for the defence of Kamina. Von Döring made no attempt to defend the coast region: Senegalese Tirailleurs from Dahomey under Capt. A. Castaing occupied Little Popo (Anecho) on Aug. 6 and Togo on Aug. 8. Meanwhile an officer, Capt. E. B. Barker, had been sent under a flag of truce by the acting governor of the Gold Coast to Lome on Aug. 6 to demand the surrender of Togoland to the British. Twenty-four hours' delay was given; on Capt. Barker's return on the 7th he found that the German troops and Maj. von Döring had retired and that the official left behind had instructions to surrender the colony as far as a line drawn [illegible] N. of Lome. The next day co-operation between the French and British forces was arranged and the chief [illegible] Capt. F. C. Bryant[1] [illegible] officer on the spot [illegible]

Capt. (temp[illegible]) [illegible] Lome, by sea, with two companies [illegible] Gold Coast Regt., on Aug. 12—a total strength of 57 [illegible]ans and 535 natives with 2,000 carriers. He marched N. along the railway towards Kamina, being joined by Capt. Castaing's French contingent (three Europeans and 155 natives) on Aug. 18. The enemy had blown up the railway bridge over the Chra river and strongly entrenched a position in dense bush N. of the stream. This position was attacked on Aug. 22, but was not carried. The German force consisted of 60 Europeans and 400 native soldiers, and they had three machine-guns which were used to good purpose. The German losses were slight, the Allies' casualties were 73 (including 23 killed) or 17% of the force engaged. During the night the Germans evacuated their position and fell back on Kamina. Maj. von Döring had probably learned that a separate French column from Dahomey was within two days' march of Kamina and that a second British column was also approaching that place from the west. While Col. Bryant was preparing to attack Kamina, the Germans, on the night of Aug. 24–5, blew up the wireless station and on Aug. 26 after vain efforts to obtain terms, von Döring surrendered unconditionally. There were found to be 206 Europeans in Kamina. In the previous fighting five Germans had been killed and 32 taken prisoner. Thus southern Togoland was in the hands of the Allies; in the northern part Yendi surrendered to a British force of one officer and eight men on Aug. 18, while a French column of 630 rifles under Capt. Bouchez, coming from Upper Senegal, covered 310 m. in 20 days in the height of the rainy season and occupied Sansanne Mango and the rest of Togoland with little opposition. Many of the German native troops deserted to the French. Some 200,000 rounds of soft-nosed bullets issued by the German authorities were captured. The conquest of Togoland—a region the size of Ireland—was notable not only for its rapidity and neatness of execution, but for the fact that the operations were conducted entirely by the local authorities and by the troops on the spot when the war began—in this respect the little campaign was unique. After the conquest the country was divided for administrative purposes into British and French zones, the British occupying the western part, including Lome. The natives settled down rapidly under their new masters.

By decision of the Supreme Council May 7 1919, the mandate to administer Togoland was given to Great Britain and France. An agreement of July 10 1919 divided the country into areas to be administered by Britain and France respectively. This agreement, which left the port and district of Lome to Britain, caused some dissatisfaction in French colonial circles and was amended by a convention of Sept. 30 1920 when in exchange for an enlarged area in the interior Lome and the whole of the seaboard—but 32 m.—went to France. The formal transfer of Lome to France followed in Oct. 1920. In the N. the area acquired by Britain included Yendi and adjoining districts, thus bringing the whole of the Dagomba country under British control. Of the total area of the German colony 13,506 sq. m. came under the British mandate and 20,200 sq. m. under the French mandate. Of the pop., estimated (1920) at 1,250,000, some 850,000 lived in the French area. Europeans, mostly British and French officials and traders, numbered about 500. There was also an energetic colony of Syrian traders.

The railways fell within the French area. They consisted (1921) of a line from Lome N.E. to Atakpame, completed in 1911 and 102 m. long; from Lome along the coast to Anecho (27 m.) and from Lome N.W. to Palime (74 m.). They are all of metre gauge. The principal articles of commerce are products of the oil and coconut palms, cotton, maize, cocoa, live stock, rubber, sisal and other fibres. Of these the most important are palm oil and kernels. There is a considerable transit trade between the Gold Coast and Lome and between Anecho and Dahomey. In 1910 exports were valued at £360,000, and imports at £570,000. In 1913, the last full year of German rule, exports were valued at £455,000 and imports at £530,000. Cotton yarns, textiles, hardware and building material were the chief imports. In 1913 Germany took 60% of the exports and supplied 42% of the imports. After the Allied occupation trade for several years was mainly with neighbouring countries and the United Kingdom. In 1918 the value of exports from Lome reached £434,000, and the value of imports £385,000. In 1919 the figures were: exports £880,000, imports £680,000. After 1914 the cultivation of maize, cotton, sisal and cocoa increased—the cocoa exported in 1919 was worth £140,000, the cotton £120,000.

Togoland was the only German protectorate in Africa which had become self-supporting, revenue rising from £132,000 in 1909 to £169,000 in 1913. The Germans levied a poll tax of 6 marks on the natives; on the Allied occupation direct taxation was abolished. Under the British and French the respective portions of Togoland continued to be self-supporting. The British portion was attached to the Gold Coast Colony, the French portion to Dahomey. Local autonomy was preserved. In Aug. 1920 the French established in their area an administrative council, on which non-officials, including one native, had seats, with a consultative voice in drawing up the budget.

See *Togoland* (1920) a British Foreign Office handbook, with bibliography, and for the 1914 campaign the British White Paper *Correspondence relating to the military operations in Togoland* (Cd. 7872, 1915). See also A. F. Calvert *Togoland* (1918). (F. R. C.)

TOKUGAWA, YOSHINOBU [KEIKI], PRINCE (1837–1913), Japanese statesman, was the last Shogun of the Tokugawa Government (*see* 26.1047), succeeding the 14th Shogun, Iemochi, in 1866. At that time already a man of matured intellect and high capacities, although his succession had been obtained by the conservatives, he soon displayed an advocacy of liberal progress. He showed great diplomatic tact in the solution of the feuds between the Satsuma and Chosu, and also in opposing the anti-foreign agitation supported by the latter. Realizing after a year's time that the proper government of the country was impossible if continued on the lines of feudalism, which was a bar to all progress and a source of continual internal strife, the Shogun handed in his resignation to the Emperor on Oct. 14 1867. This

[1] It may be noted that the Colonial Office attempted to direct the movement of troops on the Gold Coast from London. Capt. Bryant, however, "did not see fit" to modify his plan of operations.

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act of sacrifice was the prelude to the dawn of the enlightened Meiji era at the beginning of 1868. The anti-foreign agitation ceased, the Emperor received and treated as honoured guests the representatives of foreign Powers, and Japan was thrown open to the world. Tokugawa, having renounced his shogunate rights, retired to a strictly private life from which he never emerged. He even renounced the succession to his title for his direct heir in favour of a collateral branch of the family. The Emperor Meiji accepted that renunciation, but he gave him another title of prince to be bequeathed to his own son.

TORONTO (*see* 27.52), the chief city of Ontario, Canada, is the second city in size in the Dominion. In 1911 its pop. was 376,538; in 1921 the estimated pop. was nearly 600,000. Canada's greatest manufacturing district centres about Toronto. The city contained in 1921 about 1,400 factories employing 85,000 hands and producing goods annually to the value of $300,000,000. The bank clearings in 1920 amounted to $5,410,214,802, Montreal being the only Canadian city that surpassed Toronto in this respect. Fourteen of the chartered banks of Canada had their headquarters in Toronto in 1921.

Buildings erected since 1911 include St. Paul's Anglican Church, a fine edifice in the early English Gothic style, seating 3,000 persons; the Timothy Eaton Memorial Church, the greatest architectural ornament of Canadian Methodism, erected by the Eaton family at a cost of nearly $1,000,000; a 20-storey office building by the Royal Bank of Canada; a similar building by the Canadian Pacific railway, and several buildings for the university of Toronto. For several years preceding 1921 a large new Union station was under construction, and in that year was close to completion.

The Toronto hydro-electric system is one of the largest municipal supply undertakings on the continent of America. The management of the distributing system of the city was vested in 1911 in a board of three commissioners. The history of the enterprise has been one of phenomenal growth. Over 171,000,000 k.w. hours were sold during 1917 with a connected load of over 169,000 H.P.

The total assessed property in the city in 1919 was $642,816,090, an increase of 900% since 1885. A project was under way in 1921 for the building of a 63 m. boulevard driveway by the municipality. The main boulevard which would be 33 m. long and from 100 to 500 ft. wide would completely encircle the city. Toronto took over its own street railways from a private company in 1921, and has since operated them for the benefit of the municipality. The Toronto Exhibition, the largest annual exhibition held on the continent of North America, drew 1,201,000 visitors in 1919. The construction of the Welland Ship Canal, which was in hand in 1921, was expected to make the port of Toronto accessible to the larger vessels plying on the Upper Lakes. A scheme for the development of the harbour, which had been begun previous to 1917, was well under way in 1921. The project included the reclaiming of Ashbridge's Bay, known now as the Harbour Terminal Industrial District, the improving of the waterfront, the deepening of the harbour, and the construction of permanent breakwaters and concrete piers.

Toronto University has benefited greatly by large gifts from Sir John and Lady Eaton, Sir Edmund Osler and Sir Joseph Flavelle. In connexion with it a School of Engineering Research was founded in 1917 and a Faculty of Music was inaugurated the same year. A department of Social Service was founded, and in war time the university established courses for the training of masseuses that drew students from all over Canada. Hart House, a magnificent building in the Gothic style, was built by the university during the war and housed a number of war activities. It contains quarters for both the students' and Faculty unions, a dining hall, a gymnasium, a theatre and extensive offices for undergraduates' use. Dormitory residences were secured for students in the departments of Political Science and Medicine, and new residences were opened for woman students. An Electrical Engineering building, to cost $350,000, was under construction in 1921, and a University Press was also being built. The attendance at Toronto University in 1921 was well over 5,000, the highest university attendance in the British Empire.

TORPEDO (*see* 27.53).—In the World War of 1914–8 the torpedo played a most important part, especially as employed by the German submarines during the "ruthless" submarine campaign, which reached its height in April 1917, when enormous losses were caused by it to British and Allied merchantmen and fishing vessels. The total losses of British merchant ships due to submarines during the period Aug. 1914 to Nov. 1918 amounted to over six and a half million tons, and a very large proportion of this can be ascribed to torpedoes. In addition, British naval losses by torpedo over the same period included:—6 battleships, 5 cruisers, 3 light cruisers, 10 leaders, T.B.D's and T.B's, 4 submarines and 36 miscellaneous craft. Among these were H.M.S. "Goliath," a battleship of 12,950 tons, sunk by a Turkish T.B.D. in May 1915 in the Dardanelles. That the torpedo menace largely influenced Adml. Jellicoe's tactics at the Battle of Jutland is plain from his own book (*The Grand Fleet, 1914–1916*). At Jutland the Germans on their side sustained considerable loss or damage from torpedoes; the battleship "Pommern" and the light cruisers "Frauenlob," "Wiesbaden" and "Rostock" were sunk in this way, and 10 other ships were hit, three of which subsequently sank from other causes. The Germans fired between 60 and 70 torpedoes during the action and obtained two hits, one on the "Marlborough" and one on the "Shark"; the latter ship was sunk.

FIG. 1.—Aeroplane carrying torpedo.

Apart from their use of the torpedo by larger ships, torpedo-boats and destroyers, the World War saw them also made the weapon of the coastal motor boat (C.M.B.), the development of which in 1916 had been made possible by the installation of the internal combustion engine. The first operation on record carried out by British C.M.B's armed with torpedoes was an attack on German T.B.D's off Ostend, several destroyers being sunk. These C.M.B's operated from Dunkirk. Subsequently C.M.B's were extensively used off the Belgian coast, and played a most important part in the blocking operations at Zeebrugge. They were also largely used in the Baltic (notably at Kronstadt) and Caspian Seas, and also at Murmansk.

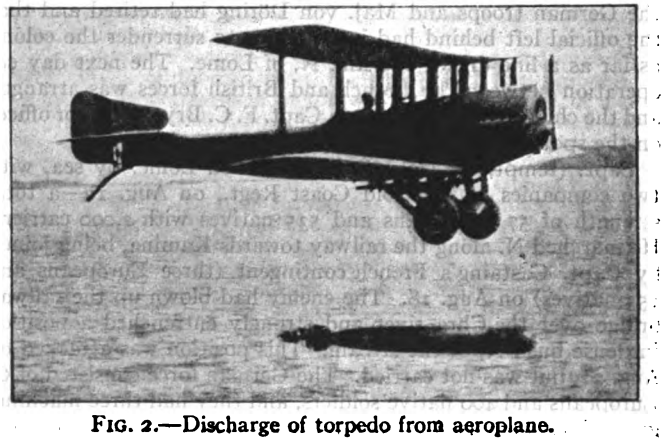

FIG. 2.—Discharge of torpedo from aeroplane.

A more novel use was the discharge of torpedoes from aeroplanes (*see* figs. 1 and 2). It is claimed that this was first accomplished in 1911 by an Italian, one Capt. Guidoni, who released a 350-lb. torpedo from an 80-H.P. Farman machine. In the same year the matter was taken up by various British naval experts who realized the possibilities of this form of attack from the air. Notable amongst these was Comm. (later Adml.) Murray Sueter. Adml. Fiske of the U.S. navy was also writing on the subject as early as 1912. By the end of 1913, the first British flight was carried out with a Sopwith seaplane carrying a 14-in. torpedo off Calshot, Southampton, and special machines were subsequently ordered by the British Admiralty. During 1914 experiments were proceeded with using "Short" seaplanes, and a

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specially light torpedo was designed for aircraft purposes. When the World War broke out, it was realized that means would have to be provided to carry the torpedo planes into proximity to their objectives, and H.M.S. "Engadine" and "Riviera" were fitted out for North Sea operations. Later, in May 1915, H.M.S. "Ben-my-Chree" was sent out to the Dardanelles as an aircraft carrier. She carried two torpedo seaplanes, in addition to reconnaissance aircraft. In 1916–7 the first torpedo planes were produced capable of flying off a ship's deck. About this time British naval authorities became convinced of the value of torpedo aircraft, and a large number were ordered. Delivery commenced in 1918 concurrently with special training of torpedo plane pilots, and in Oct. H.M.S. "Argus" embarked the first completed squadron of torpedo planes. In the first instance, experimental work was concentrated at Felixstowe in 1916, and in 1917 a torpedo seaplane school was established at Scapa Flow, which latter station was closed down after the Armistice. A torpedo seaplane school was also opened at Gosport, and experimental work and training is now carried out from here, pilots being embarked from time to time on board the aircraft carriers attached to the fleet.

In Aug. 1915 an attack was made on a 5,000-ton merchant ship by a short torpedo seaplane from H.M.S. "Ben-my-Chree" in the Dardanelles. A hit was obtained amidships, and spray and flying fragments observed. A few days later three Turkish ships at anchor were attacked, one being hit and subsequently gutted by fire, though the hull was salved. In the early part of 1917, the Germans, who had a squadron of torpedo planes at Zeebrugge, made several attacks on British merchant ships in the Downs. Three were sunk and one enemy aircraft shot down.

Construction.—In the British service the 18-in. and 21-in. torpedoes are the only sizes now made; the former are supplied for use in submarines, C.M.B.'s and aircraft, and the latter in capital ships, light cruisers and destroyers.

Constructed of steel plating, except for the air chamber, and of circular cross section, the profile of the torpedo is cigar-shaped, with a blunt-shaped head, a parallel portion and a fine run aft to the tail. Commencing from the forward end, the torpedo is divided into six compartments:—the head, the air vessel, the balance chamber, the engine room, the buoyancy chamber, the tail. These may be described as follows. (1) *The Head.*—There are two types, the War-head containing the explosive and the Collision-head used for practice. The former carries a charge of T.N.T. which is detonated on contact by a device known as the pistol, through the medium of a detonator of fulminate of mercury and a suitable priming charge. The pistol itself consists of a metal body which is screwed into the War-head and carries a striker which has externally projecting arms. On one of these arms, coming into contact with any object, the striker is forced in against the resistance of a shearing pin (which is provided for safety), and the detonator is struck. This in turn detonates the "primer" and the main charge. In the case of the "net cutter," used when attacking ships protected by nets, the action is similar, but the cutter is provided in addition with sheering devices for cutting through the meshes and opening up a hole sufficiently large to enable the torpedo to pass through. Nets are not now carried by modern capital ships of any nation, but the net cutter might be of use against net-defended bases. The Collision-head, used for practice, is a steel shell partially filled with cork to insure buoyancy in case of impact with a target ship. It is brought up to approximately War-head weight by filling it with water before practice running, and is so constructed that, on hitting, the fore part collapses, thereby lessening the blow on the plating of the ship and the shock on the torpedo itself. To facilitate recovery, an indicating light is fitted in a pocket in the Collision-head, consisting of phosphide of calcium in a tin container. On coming in contact with water this chemical has the property of spontaneously bursting into flame, which shows on the surface, thereby indicating the position of the torpedo. (2) *The Air Vessel.*—This consists of a special nickel-steel forging containing the compressed air which provides the motive power of the torpedo. It is closed at either end by special dome-shaped pieces, screwed and sweated into place. To the sides of the vessel are secured the lugs or brackets which take the weight of the torpedo in the case of above-water discharges and the stresses on the torpedo on discharge from submerged tubes. (3) *The Balance Chamber* is rivetted and sweated on to the after end of the air vessel, and forms a watertight compartment which contains the depth-keeping mechanism, the heater apparatus and the supply of fuel (either alcohol or petroleum in some form) in a special flask. In this compartment is also situated the charging valve and the stop valve in the main air pipe, which enables pressure to be isolated when it is necessary to remove the after part of the torpedo for examination of engines, etc. The depth-keeping mechanism, Mr. Whitehead's secret, consists of a pendulum weight and a hydrostatically operated valve, linked together by rods in such a manner that the weight corrects departures from the horizontal trim of the torpedo, whilst the valve keeps the torpedo at its set depth. Their joint action operates the horizontal rudders of the torpedo through the medium of a small air engine termed the servomotor. (4) *The Engine Room* is the next compartment abaft the balance chamber. It is not watertight, and together with the "buoyancy chamber," to which it is rivetted and sweated, forms what is known as the "afterbody." This portion of the torpedo is secured to the "air vessel—balance chamber" portion by a number of screwed bolts, which allows of the torpedo being easily "parted" for examination of the mechanism in the engine room. This mechanism consists of: (*a*) the engines, which are of the single-acting four-cylinder Brotherhood type; (*b*) the steering engine or servomotor; (*c*) the starting valve and counter gear; (*d*) the reducing valve, which maintains a constant reduced working pressure at the engines, irrespective of the air-vessel pressure, thus insuring an approximately constant speed throughout the set range; (*e*) oil bottles for lubricating various working parts. The starting valve is operated by an air-lever which projects through the shell of the torpedo and is thrown aft by a downward projecting bolt in the torpedo tube on discharge. In addition to opening the starting valves, the air-lever in its backward movement presses against a rod which releases the gyroscope. The counter gear, which is mounted on the starting valve casing is a piece of mechanism driven off the engines for stopping the torpedo at a pre-determined range. Off the counter is also driven the ignition gear, whose function is to fire the cordite igniters in the "heater" arrangement at a pre-determined moment, and start the combustion of the air and fuel. In the earlier torpedoes, the counter also operated the "sinking gear." This gear can be set to "float" for practice or "sink" for action and when set for the latter adjustment a small valve is lifted at the end of the run and water is admitted into the buoyancy chamber, thus sinking the torpedo, which might otherwise remain a dangerous floating mine. (5) *The Buoyancy Chamber* provides a large proportion of buoyancy of the torpedo, and consists of a thin sheet-steel shell, strengthened up by internal angle rings, to enable it to withstand external pressure, due either to immersion at great depths or to impulse pressures on discharge. To the foremost bulkhead of this compartment are secured the engines. Two watertight tubes run through it, one centrally carrying the propeller shaft, and the other to one side carrying the rod connecting the servomotor or steering engine, and the horizontal rudders. The sinking valve is on this bulkhead. The remaining fittings in this compartment consist of the gyroscope which is fixed to suitable brackets secured to the shell, and the gyroscope rudder rod, which passes through a watertight gland in the after bulkhead. A watertight removable door is also fitted at the bottom of the chamber to obtain access to the gyroscope. This piece of apparatus consists of a comparatively heavy bronze wheel, delicately mounted in ball bearings in an inner horizontal gymbal. This in turn is mounted in an outer vertical gymbal capable of rotational movement within the framework of the instrument. The wheel is initially spun at a high rate of revolution about its axis in the inner gymbal, due to the release of a strong spiral spring in torsion. This release takes place when the air-lever is thrown aft on discharge, after which the whole system of wheel and gymbals is freed from external constraint. The design is such that all axes of rotation of wheel and gymbals meet in a common point at the centre of gravity of the wheel. Consequently, in theory, if the instrument is in adjustment there are no external forces acting on the wheel or system except friction and windage, and, following the well-known dynamical laws of rotating bodies, the spinning axis tends to maintain its direction in space no matter how the apparatus is moved bodily. Practically, of course, slight errors do creep in, due to minute manufacturing differences, etc., but if the gyroscope is in good condition, the effect of these is barely noticeable until the initial wheel speed has dropped considerably. It will therefore be seen that the axis of the spinning wheel provides a datum line, the direction of which is the direction of the gyro wheel on release, *i.e.* in the longitudinal axis of the tube and torpedo. Subsequent deviations of the torpedo from the correct line in a horizontal plane, cause relative movement of the spinning axis, and fore and aft line of the torpedo. These relative movements are communicated to a delicate rotary valve through the medium of a small pin mounted on the outer gymbal. This rotary valve controls the air supply to a small steering engine which operates rudders on the vertical fins, so bringing the torpedo back to its original direction. (6) *The Tail* is a non-watertight conical steel shell carrying the horizontal and vertical fins and rudders. The fins are fixed to the tail and the rudders are carried in suitable brackets on their after edges. This portion of the torpedo also contains the gearing which enables the two four-bladed propellers to be driven in opposite directions off the same engine. The provision of two propellers is necessary in order that the torpedo shall remain upright during the run, and these are so shaped that the turning effect of one is balanced by that of the other.

The Director.—The name of "director" is given to the sight by means of which the firing officer is enabled to fire the torpedo at the correct moment. This he does by pressing a key which completes the circuit of the electrical portion of the firing gear at the tube. There are a number of types of sight extant, each of which has been

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designed to suit special conditions, chiefly as regards environment, *e.g.* the director on an above-water tube in a torpedo-boat destroyer, the director in the conning tower of a capital ship, etc. The same underlying principle obtains in every case. Suppose, a torpedo be discharged (*see* fig. 3) from A so as to hit a ship steaming in the direction BC at C. B is the position of the enemy ship at the moment of firing. Completing the triangle on a convenient scale, clearly

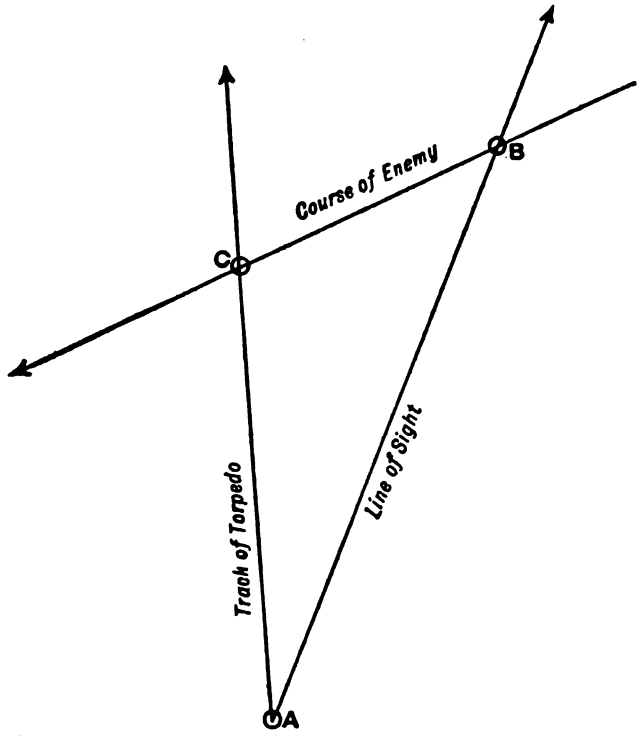

FIG. 3.—Diagram illustrating the principle of the Director Sight (A) on own ship at moment of firing, (B) target ship at moment of firing, (C) position of target when torpedo hits.

AC is to BC as "speed of torpedo" is to "speed of sailing"; and AB is the line of sight, its length and direction representing the velocity and direction of the torpedo relative to the target. Alternatively AC is to BC as the "running range of torpedo to hit" is to the "distance the target moves during time of flight of torpedo," and the length of AB is a measure of the firing range. In addition, if AC is taken to represent the maximum running range of the torpedo, the length AB is a measure of the maximum "possible shot" range under a given set of conditions as regards enemy speed and course. If the range-finder range when the sights come on is greater than that represented by the length AB, the torpedo will not reach its objective. It is obvious that a set of three bars, arranged so as to be capable of sliding and pivoting over each other, provide a torpedo sight which can be graduated so that the possible shot range can be read off direct after the sight is adjusted and torpedo fire withheld if necessary. Earlier types actually took this form, a foresight being fitted at the B end of the bar AB and a backsight at A.

It will be seen that the chances of obtaining hits with torpedoes are almost entirely dependent on the correct estimation of the enemy's course and speed, and the officer handling the instrument has to be a highly skilled specialist in these duties. It will also be seen that the *effect* of errors in estimation will vary in direct proportion to the number of ships comprising the target, and to the running range to obtain a hit, and are inversely proportional to the speed of the torpedo, for any particular speed of enemy. It is therefore clear that attacks on single ships under way are not likely to be successful unless carried out at short range, and that to insure success against an enemy fleet at long range, it is necessary to fire a large number of torpedoes. A large proportion of these will be wasted, but a torpedo-infested zone will result, which the enemy will find difficult to avoid, unless he is prepared to make large alterations of course, and these will undoubtedly affect the efficiency of his gunfire very seriously. The most obvious way of producing these torpedo-infested zones is to employ large numbers of torpedo-boat destroyers against the enemy, but this must not be considered to be an argument for the abolition of torpedo tubes in big ships, the mere fact that torpedoes are carried by opposing capital ships having a considerable bearing on the tactics employed and the ranges at which the action is fought. (W. M. M. R.)

TOSTI, SIR FRANCESCO PAOLO (1846–1916), composer and teacher of singing, was born at Ortona, Abruzzi, April 9 1846. He began his musical studies at Naples at the age of 14. In 1876 he paid his first visit to England; five years later he was appointed teacher of singing to the Royal family and settled in England. He published many songs, which from the first had a wide success, the most famous being "Goodbye," "Ask Me No More," and "For Ever." He was knighted in 1908. He died at Rome Dec. 2 1916.

TOURNEUX, JEAN MAURICE (1849–1916), French man of letters (*see* 27.107), died in Paris Jan. 13 1916.

TOWNSEND, MEREDITH WHITE (1831–1911), English journalist, was born at Bures, Suffolk, April 1 1831, and educated at Ipswich grammar school. In 1848 he went out to India, and four years later became editor of the *Friend of India*, acting also for some years as *Times* correspondent. In 1860 he returned to England and purchased the weekly *Spectator* (*see* 19.562). With R. H. Hutton he was joint-editor until 1898, and he was largely instrumental in making it an established success, writing most of the political articles and the opening paragraphs every week. His two chief publications were *The Great Governing Families of England* (1865), written in conjunction with Langton Sanford, and *Asia and Europe* (1901). He died at Little Bookham, Surrey, Oct. 21 1911.

TOWNSHEND, SIR CHARLES VERE FERRERS (1861–), British general, was born Feb. 21 1861, and joined the Royal Marines in 1881. He served at Suakin in 1884, and in the Nile expedition of the following year. He joined the Indian army in 1892 and was present in the Hunza-Nagar operations of that year. He greatly distinguished himself by his gallant defence of the Chitral fort during its prolonged siege in 1895, for which he was rewarded with the C.B. and a brevet majority. Then, in 1897–8, he served with the Egyptian army in the reconquest of the Sudan and won the D.S.O., shortly after which he was transferred to British Infantry. He served for some months in the field during the S. African War, was promoted colonel in 1904, was for some time on the staff in India, afterwards commanded a district in S. Africa, and was promoted major-general in 1911. He was then for some months in charge of a Territorial division at home, after which he went to India to command a brigade.

In April 1915 he was sent to Mesopotamia to take over command of the 6th (Indian) Division in that theatre of war. Aided by some other troops his division worked its way up the Tigris, driving the Turks out of more than one fortified position, and on Sept. 28 Townshend signally defeated the enemy near Kut-el-Amara and occupied the town, while detachments pursued the enemy halfway to Baghdad; shortly afterwards he was instructed to advance and occupy that city. On the move being made, he encountered the enemy in superior numbers at Ctesiphon, and after severe fighting was obliged to effect a retreat of 120 m. to Kut, and there he and his force were speedily hemmed in. A skilful and resolute defence was made, lasting 143 days till the end of April 1916 but then, supplies being exhausted and all efforts at relief having failed, he was obliged to capitulate. He was rewarded with the K.C.B. for his services. He remained a prisoner of war near Constantinople until Oct. 1918, when he acted as intermediary between the Porte and the Allies in adjusting the Armistice. He retired from the army in 1920, and entered Parliament as member for the Wrekin division of Shropshire.

TOY, CRAWFORD HOWELL (1836–1919), American Hebrew scholar (*see* 27.114), died in Cambridge, Mass., May 12 1919. In 1913 he published *Introduction to the History of Religions*.

TRACTORS.—The petrol tractor for agricultural and kindred purposes is a development of the steam traction engine, widely used for operating grain threshers and to a small extent for ploughing. Steam ploughs were used toward the end of the 19th century on the large ranches of the north-western section of the United States, in Canada and in Egypt. Their usefulness was limited, however, owing to their great weight, which resulted in the packing of the soil and in rather inefficient operation. When the weight of the petrol engine was greatly reduced by motor-car engineers, about 1900, the idea of substituting that type for the heavy steam plant naturally suggested itself.

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The first petrol tractors seem to have been those built by the Huber Mfg. Co., of Marion, O., in 1898. These were not successful and only 30 were completed. In 1901 the Hart-Parr Mfg. Co., of Charles City, Ia., engaged in the manufacture of petrol tractors, and, although this company met with many difficulties, it was successful and, after 19 years of continuous manufacture, produced in 1920 5,000 tractors. There are two general types of agricultural tractor, the wheeled and the crawler, or caterpillar, types. The crawler type, in which the weight is spread over a large supporting surface on the ground, can pass over marshy land where the wheeled tractor would be mired, and when used for pulling barrows, seeders and other implements over ploughed ground, does not pack the soil as a wheeled tractor would. Early technical development was chiefly toward large tractors, designed to operate from 6 to 12 plough bottoms, because the only farmers who then took an interest in tractors were the owners of large ranches in western America. The largest producers of petrol tractors in the United States between 1905 and 1913 were manufacturers whose main line was general agricultural machinery and steam traction engines, such as the International Harvester Co., the J. I. Case T. M. Co., and Emerson-Brantingham Co. The large petrol tractors of that period were crude in design and very heavy; their frames were built up of heavy rolled channels, and they had driving wheels of enormous diameter. Their great weight naturally rendered them inefficient, for a large proportion of the engine power was consumed in moving the tractor itself. The oil-pull tractor shown in fig. 1 is characteristic of tractors of that period.

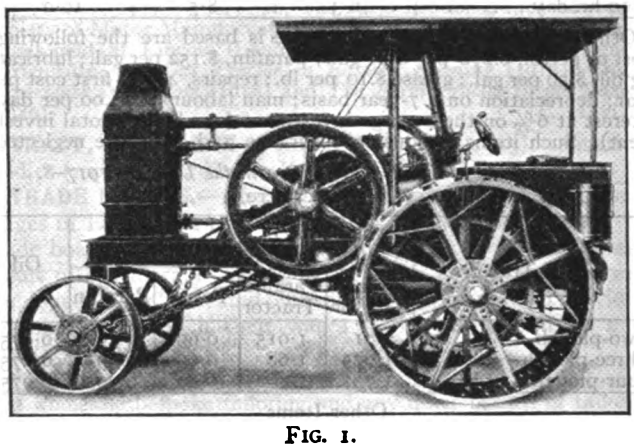

FIG. 1.

Agricultural Tractors.—Tractors are usually rated in terms of the number of 14-in. plough bottoms which they will pull. In 1920, of 100 models on the American market capable of pulling two or more bottoms, 20 were two-plough tractors; 42 three-plough; 17 four-plough and the rest were capable of pulling five or more ploughs. Table 1 shows the production of tractors in the United States each year from 1909 to 1920.

Table 1. Tractor Production in the United States.

1909	2,270	1915	21,900
1910	4,500	1916	29,670
1911	7,400	1917	62,742
1912	11,400	1918	132,697
1913	7,450	1919	136,162
1914	10,400	1920	203,300

According to a statement issued by the Ministry of Transport, there were 10,161 agricultural tractors in the United Kingdom in 1921. Of the tractors produced in the United States 14,854 were exported in 1917, 36,351 in 1918, 19,693 in 1919, and 29,143 (valued at $30,850,000) in 1920. It will be seen from the above table that a slump in tractor production occurred in 1913. It was in 1912 that the business in the large tractors of 6-to 12-plough capacities reached its zenith, and thereafter it declined rapidly. The first popular small tractor, the Bull, was brought out the following year, and in 1914, no fewer than 3,000 tractors of this make were sold. Although smaller, it was still of the same crude design as the larger machines, with exposed gears, plain bearings and similar features. About 1916 a number of engineers with motor-car experience entered the tractor field, and as a result of their efforts tractor design was greatly improved. Before 1920 many farm tractors were designed to use paraffin as fuel, because paraffin was considerably cheaper than petrol, and the conditions of engine operation on a tractor (constant speed and steady, heavy load) made it comparatively easy to burn paraffin with a moderate degree of success. Petrol, however, proved much more satisfactory in the average engine, and when in 1919 the price of paraffin advanced sharply, tractor users generally turned to petrol. The consumption of petrol in gallons per acre is less, there is less difficulty in cold weather and the oil in the crank case does not lose its lubricating value so quickly. For the sake of economical manufacture many of the earlier small tractors were made with only three wheels, but the buying public did not approve of this feature of construction, and the typical 1920 wheeled tractor had four wheels, two in front steering and two in the rear for driving. The Twin City 12–20 H.P. tractor shown

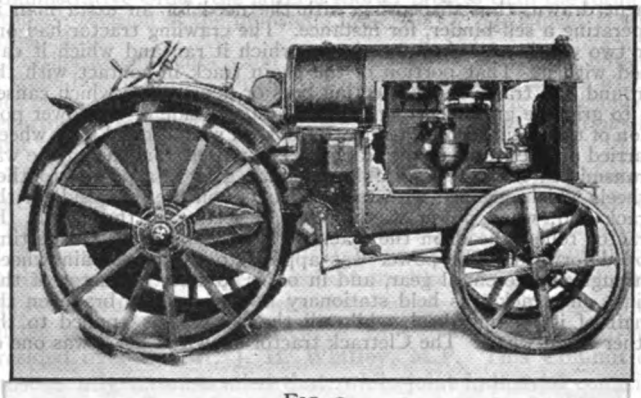

FIG. 2.

in fig. 2 is a good example of the lighter tractors based on motor-car practice. The following is a composite description of a 1920 model three-plough tractor, the features mentioned being those found on the greatest number of models of this capacity; there was a four-cylinder, four-stroke vertical engine at the front, of about 4¼-in. bore by 6-in. stroke, adapted to burn either petrol or paraffin. Ignition was by a high-tension magneto with impulse starter. (The latter device consisted of a spring attachment for magnetos specially developed for use on tractors, which made it unnecessary to "spin" the heavy engines in order to generate a spark in the magneto.) The carburetor was fitted with an air cleaner, which prevented gritty dust from getting into the engine and rapidly wearing out the cylinder barrels. These air cleaners usually acted on the centrifugal principle, but in the lava-ash districts on the Pacific coast it was necessary to employ air washers, owing to the lightness of the dust. Behind the engine there was a friction clutch, and then came the change-speed gear, which gave two forward speeds and one reverse. The higher forward speed was for regular use in ploughing and the lower for emergencies, for ploughing up steep inclines, in heavy soil, etc. Then there was a further reduction by gears to the rear axle. The engine speed was limited by a governor to about 800 revolutions per minute, and as the ploughing speed was about 2¾ m.p.h., with 48-in. driving wheels, a reduction of roughly 40 to 1 had to be provided between engine crankshaft and rear axle or rear wheels. In the early tractors the final drive was through exposed bull gears directly on the driving wheels, but the typical 1920 tractor had all its gearing enclosed and protected from dust and mud, which is an important feature in a machine

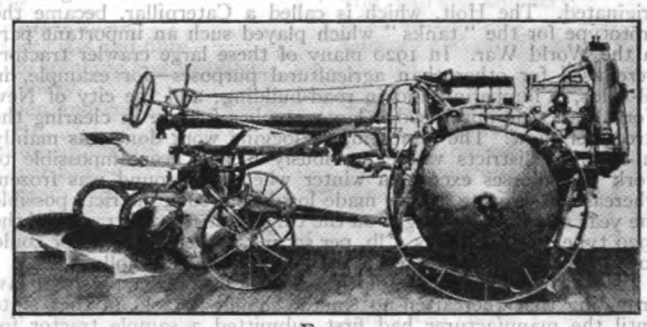

FIG. 3.

operating in the fields during the wet season as well as when the soil is dry and dusty. The wheelbase of the tractor was 96 in. and its weight about 5,000 pounds. The wheels were built up of rolled rims and flat spokes riveted to the hubs and rims. The driving wheels were provided with angle-iron lugs to increase the traction, and the front wheels with central skid rings to make the steering more positive. The front axle was swivelled to the frame at the middle, to permit the wheels to accommodate themselves to uneven ground. In addition to the pivot joint a spring could be used between the axle and the frame at the front to relieve shocks. These 1920 tractors were provided with a belt pulley for operating threshing

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machines, wood saws, silo fillers, etc. It was customary to apply a double horse-power rating; for instance, a three-plough tractor was often rated as a 12–25 H.P. machine. This signified that the tractor could develop 25 H.P. on the belt and 12 H.P. on the drawbar, the difference of 13 H.P. being required for moving the tractor itself over the field. In 1917 the Society of Automotive Engineers standardized tractor belt speed at 2,600 ft. p.m. and the drawbar height at 17 inches. Another class of wheeled tractor, having only two wheels, is exemplified by the Moline Universal illustrated in fig. 3. This is intended for cultivating as well as for ploughing and similar work, and has the necessary clearance to pass over plants 2 ft. or more high. Another feature is that, by means of an extension to the control apparatus, it can be operated from the implement drawn, thus dispensing with the need for an extra man in operating a self-binder, for instance. The crawling tractor had one or two continuous-chain tracks on which it ran and which it carried with it. That portion of the chain track in contact with the ground had transverse projecting bars or depressions which caused it to grip the ground firmly, while the upper side of the lower portion of the chain formed a smooth track on which rolled idler wheels carried on the frame of the tractor. The power from the engine was transmitted through a suitable reduction gear to a pair of toothed wheels which engaged with teeth or rollers on the inner side of the track and, when power was applied by letting in the clutch, the tractor rolled ahead on the track and the track at the same time rolled forward. The power was applied to the two chain wheels through a differential gear, and in order to steer a tractor of this kind, one track was held stationary by means of a brake on the shaft of its chain wheel, while all the power was applied to the other chain wheel. The Cletrack tractor shown in fig. 4 was one of

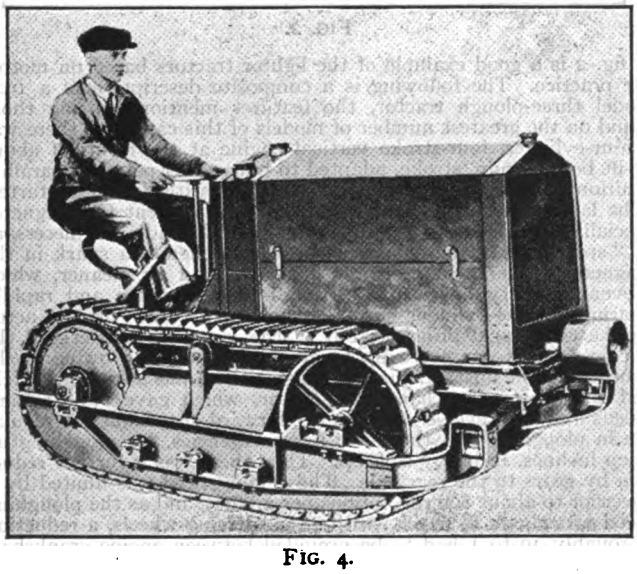

FIG. 4.

the smallest tractors of this type. Much of the development work in connexion with crawler tractors was done in California, where the Holt, the Best and the Yuba, all tractors made in large sizes, originated. The Holt, which is called a Caterpillar, became the prototype for the "tanks" which played such an important part in the World War. In 1920 many of these large crawler tractors were used for other than agricultural purposes—for example, in oil-fields, in lumbering and in road-building; and the city of New York that year purchased a large number for use in clearing the streets of snow. The lumbering or logging work done was mainly in swampy districts where previously it had been impossible to work with horses except in winter when the ground was frozen, whereas the crawler tractor made logging in such districts possible the year round. The weight on the track of a crawler tractor of the 1920 type was as low as 5 lb. per sq. in., and such a tractor could go into boggy places where no wheeled vehicle could follow.

In 1919 the Legislature of the state of Nebraska passed a law providing that thereafter no tractor should be sold in that state until the manufacturer had first submitted a sample tractor for trial to the Agricultural Engineering Department of the university of Nebraska and the tractor had satisfactorily met the test required. The manufacturer must also satisfy the state authorities that he is maintaining an adequate supply of repair parts within the state. This legislation was the result of complaints of farmers that manufacturers were overrating their tractors. The result was that, during a period when 66 tractors were tested, the makers of 8 were compelled to increase their rated engine speed, 13 lowered their horse-power rating, 14 changed some part and 4 withdrew.

Cost of Tractor Ploughing.—The three chief items of cost in tractor ploughing are fuel, depreciation and labour. At the tractor trials held at Lincoln, England, in the autumn of 1919, the fuel consumption per ac. averaged almost exactly 4 imp. gal. for ploughing in heavy clay soil, and 3 gal. for ploughing on cliff lands. In the corn belt of the United States, where the soil is comparatively light, it has been customary to reckon on a fuel consumption (either petrol or paraffin) of 2·5 U.S. gal. (2 imp. gal.) per acre. On the other hand, in a bulletin of the U.S. Department of Agriculture on "The Gas Tractor in Eastern Farming," a fuel consumption of 3½ U.S. gal. per ac. is made the basis of cost calculations of the eastern section, and in the tractor trials held at Harrisburg, Pa., in 1919 the average fuel consumption of all tractors using paraffin worked out at 3·28 U.S. gal. (2·62 imp. gal.) per acre. The fuel consumption in tractor ploughing varies both with the character and condition of the soil and with the depth of ploughing. The average depth of ploughing at Lincoln was 5¾ inches. The resistance of the soil (drawbar pull) averaged 11·5 lb. per sq. in. for the heavy clay soil and 9 lb. per sq. in. for the cliff land. In the corn belt of the United States the soil resistance generally varies between 5·5 and 7 lb. per sq. in., and this explains the low fuel consumption in ploughing there. The estimate here given of the cost of ploughing one acre is based on the results of an inquiry by the U.S. Department of Agriculture among 400 tractor farmers in the Dakotas concerning their experiences in 1917 and 1918. Only one change is made from the estimate of the department, namely, the assumption of a tractor life of seven instead of nine years, which latter figure is admittedly too high. The answers to the questionnaire yielded the averages shown in Table 2.

Table 2. Average Cost and Performance of Tractor Ploughing in the Dakotas.

	Two-plough Tractors	Three-plough Tractors	Four-plough Tractors
First cost	$1,050	$1,460	$2,000
Full working days per year	45	52	64
Acres ploughed per 10-hr. day	6·3	8·5	10·9

Other factors on which the estimate is based are the following: Cost of petrol, $.276 per U.S. gal.; paraffin, $.152 per gal.; lubricating oil, $.50 per gal.; grease $.10 per lb.; repairs, 4% of first cost per year; depreciation on a 7-year basis; man labour at $4.00 per day; interest at 6% on the average investment (one-half of total investment). Such items as housing, insurance and taxes are neglected.

Table 3. Cost of Tractor Ploughing in the Dakotas 1917–8.
(Dollars per acre)

Size of Tractor	Total Cost of Ploughing		Fuel		Oil
	Petrol Tractor	Paraffin Tractor	Petrol	Paraffin	
Two-plough	2·21	1·915	0·69	0·395	0·075
Three-plough	1·975	1·68	0·69	0·395	0·075
Four-plough	1·757	1·462	0·69	0·395	0·075

	Other Items				
	Grease	Repairs	Depreciation	Man Labour	Interest
Two-plough	0·02	0·15	0·53	0·635	0·11
Three-plough	0·02	0·13	0·49	0·47	0·10
Four-plough	0·02	0·11	0·409	0·368	0·085

With the data here indicated it is possible to make a close estimate of the cost of tractor ploughing under different conditions, as all the basic costs are given. The average soil resistance in the Dakotas may be assumed to be 8 lb. per sq. inch. In heavier soils the area ploughed per day will be less in substantially the inverse ratio of the soil resistance (provided the latter is not excessive). This is borne out by estimates of the ploughing capacities of the tractors which competed in the Lincoln trials of 1919, made by the judges of the event. Averaging the estimates for heavy clay soil (soil resistance 11·5 lb. per sq. in.), and reckoning on the basis of a 10-hr. instead of an 8-hr. day, the following results are obtained: Two-plough tractor, 4½ ac., three-plough tractor, 5⅝ ac., four-plough tractor, 6¾ acres.

To the American and Canadian farmer the advantage of the tractor is not so much that it reduces the cost of ploughing as compared with horses, as that it enables one man to work a much greater acreage. Approximately one-third of several hundred tractor farmers in Illinois circularized by the U.S. Department of Agriculture had increased their acreage by purchasing tractors. Another great advantage is that the tractor permits work to be done quickly when the weather is favourable. For instance, a southern Illinois farmer estimates that in his neighbourhood the yield of Indian corn is reduced by 1 bus. per acre for every day that planting is delayed after May 8. In 1920 the spring was so wet that he was able to work in the field only the first day and the last day of April, not a day in between; but when the weather turned he was able, owing to his tractors, to get his crop in quickly.

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Power farming has proved particularly advantageous in the wheat belt of Kansas. For the best yield the land must be ploughed in Aug., when the temperature is often above 100° F. in the shade and very little work can be accomplished with horses. The tractor works as efficiently at this temperature as in winter. Moreover, the tractor can be used also for threshing, and the old practice of contract threshing has been largely superseded by the plan of four or five farmers owning a small threshing machine coöperatively and helping each other thresh their grain, each using his own tractor as the motive power. A three-plough tractor is generally recommended for a 20x36 in. grain separator. Sometimes it is necessary to get a crop into the ground very quickly, and, with a double shift of operators, tractors can then be operated continuously day and night.

Interest in farm tractors increased greatly in Europe during and following the World War. In 1919 and 1920 tractor trials were held at Lincoln, England, the first under the auspices of the Society of Motor Manufacturers and Traders and the second under that of the Royal Agricultural Society. The French Government in 1920 paid a bonus of 25% on the purchase price of tractors of domestic manufacture and 10% on tractors of foreign manufacture. During the war the British, French and Italian Governments contracted for large numbers of farm tractors in the United States. In 1919 there was an international tractor demonstration and test at Säbyholm, Denmark, in which Danish, Swedish, German, British and American tractors were entered. Several demonstrations were also held in France in the years immediately following the World War; French engineers paid particular attention to tractors for use in vineyards, which must be very narrow. Those for use in orchards, on which a number of American manufacturers specialize, must be very low. A somewhat distinct type is the garden tractor for the cultivation of row crops and general work in market gardening. The Beeman, the first model of this type, was put on the market in 1915, and in 1919 about half a dozen other tractors of this type were brought out. For rubber-tired road tractors, see MOTOR VEHICLES; for artillery tractors, see ARTILLERY.

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TRACY, BENJAMIN FRANKLIN (1830–1915), American soldier (*see* 27.127), died in New York City Aug. 6 1915.

TRADE BOARDS.—An important factor in the regulation of wages in England is now represented by the functioning of the trade boards. The Trade Boards Act of 1909 was passed, as a result of considerable agitation on behalf of workers who were employed under "sweated" conditions, with a view to providing machinery by which their wages might be raised to a more satisfactory level.

This Act applied at once to four trades, namely: (1) readymade and wholesale bespoke tailoring and any other branch of tailoring in which the board of trade considered the system of manufacture was generally similar to that prevailing in the wholesale trade; (2) the making of boxes or parts thereof made wholly or partially of cardboard, chip, or similar material; (3) machine-made lace and net finishing and the mending or darning operations of lace curtains and lace finishing; (4) hammered and dollied or tommied chain-making. Provision was further made that the Act should be applied to other trades by Provisional Order if the board of trade was satisfied that the rate of wages prevailing in any branch of those trades was exceptionally low as compared with that in other employments. These Provisional Orders required confirmation by Parliament.

In addition to the trades originally specified four trades were subsequently added under the Provisional Order procedure, making a total of eight. The small number of trades to which the Act of 1909 was applied was due partly to the fact that the procedure by Provisional Order was necessarily a slow and cumbrous process, and partly to the severe limits imposed by the provision that a board could only be established where wages were exceptionally low.

In 1918 an amending Act largely extended the scope of the previous Act. During the World War the whole basis of the payment of wages to women had been altered by the Orders made by the Minister of Munitions under Section 6 of the Munitions Act of 1916; and, for a number of women largely in excess of a million, the provisional rate at the conclusion of the war was in the neighbourhood of 7d. to 8d. per hour. It was recognized that if upon the return of peace the protection offered by the Munitions Acts was suddenly withdrawn a reduction of wages of a very disturbing character might ensue, and that it was desirable that the large number of persons, both men and women, in the unorganized trades, should have a similar measure of protection to that which had been already offered by the Trade Boards Act to those whom it covered.

The new Act made two amendments of a far-reaching character:—

(*a*) The minister was empowered to apply it to any specified trade "if he is of opinion that no adequate machinery exists for the effective regulation of wages throughout the trade, and that accordingly, having regard to the rates of wages prevailing in the trade, or any part of the trade, it is expedient that the Act should apply to that trade."

(*b*) In place of the procedure for application of the Acts by Provisional Order, provision was made for the making of a special Administrative Order, the latter a shorter process than the former, although revision of the minister's proposals by Parliament is still provided for.

Further amendments made by the new Act extended the powers of trade boards with regard to the classes of rates of wages which they could fix, and gave them also the right of requiring Government departments to consider any proposal concerning the conditions in their trade which they might care to make.

The effect of the new Act was to make the Acts applicable to a much larger area of industry and to render legislation no longer a means of protection for sweated trades only. This extension of the scope of the Trade Boards Acts, apart from its desirability, having regard to the special conditions likely to prevail during the reconstruction period, was recommended also by the Committee on the Relations between Employers and Employed, presided over by Mr. J. H. Whitley, M.P. This Committee subsequently recommended that, while joint industrial councils should be established for trades which were sufficiently organized to control their own wage matters, it was equally desirable that trade boards should be established for trades which had not yet reached that degree of organization on both sides which would make possible the complete observance of agreements arrived at between organizations. It was made clear that there was no conflict between the two forms of joint organization, and that each was adapted to and intended for a different degree of organization in the trades concerned. In practice the principle indicated by the Whitley Committee was the guiding principle in the establishment of joint industrial councils and trade boards.

A rapid extension of existing trade boards followed, with the result that, at the end of 1920, 49 additional trade boards for England, Scotland, Wales and Ireland had been set up in the following trades, covering about 3½ million persons:—

Great Britain.

Boot and shoe repairing.
Brush and broom.
Button making.
Coffin furniture and cerement making.
Corset.
Cotton waste.
Flax and hemp spinning and weaving.
Fur.
General waste.
Hair, bass and fibre.
Jute spinning and weaving.
Laundry.
Linen and cotton handkerchief, etc.
Made-up textiles.
Paper bag.
Perambulator and invalid carriage.
Pin, hook and eye and snap fastener.
[1] Retail bespoke tailoring. Readymade and wholesale bespoke tailoring.
Rope, twine and net.
Stamped or pressed metal wares.
Tobacco.
Toy.
Wholesale mantle and costume.

England and Wales.

Aerated waters.
Dressmaking and women's light clothing.
Grocery and provisions.
Hat, cap and millinery.
Milk distributive.

Scotland.

Aerated waters.
Dressmaking and women's light clothing.
Hat, cap and millinery.
Milk distributive.
Grocery and provisions.

Ireland.

Aerated waters.
Boot and shoe repairing.
Brush and broom.
Dressmaking and women's light clothing.
Flax and hemp spinning and weaving.
General waste.
Hat, cap and millinery.
Laundry.
Linen and cotton handkerchief, etc.
Milk distributive.
[1] Retail bespoke tailoring. Readymade and wholesale bespoke tailoring.
Rope, twine and net.
Tobacco.
Wholesale mantle and costume.

[1] Previously the Readymade Tailoring Trade Board (1909). In 1919 two new boards were constituted.

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The Trade Boards Acts provide for the appointment of joint bodies, consisting of an equal number of employers' and workers' representatives, together with a minority, usually three or five, independent members known as appointed members. In trades in which women are employed one of the appointed members is a woman. The members of trade boards are all appointed by the Minister of Labour (originally the president of the Board of Trade), who, in the appointment of the employers' and workers' representatives, is bound to consult the organizations on each side respectively. The appointed members are impartial persons of standing nominated by the minister. The procedure of the boards is regulated by statutory regulations made by the Minister of Labour. Such regulations usually make provisions for a method of voting, and the regular reconstitution of the board; in all cases it is provided that no new appointment shall be made to the board by the minister until the board has had an opportunity of being heard. The boards are provided with secretarial assistance by the Ministry of Labour. They have power to form district committees for such areas as they may consider to be necessary, the members of which, like the members of the boards themselves, are appointed by the Ministry of Labour.

The boards are compelled, unless the Minister of Labour relieves them of the duty, to fix a general minimum time-rate for the workers engaged in the trades concerned. A trade board must also in certain cases fix special minimum piece-rates on the application of an employer. A board has power also, if it so desires, to fix general minimum piece-rates, guaranteed minimum time-rates, overtime-rates, rates for special classes of workers, rates for special areas, rates for special processes, rates for any class of work in any special process or in any special area and piece-work basis time-rates. Rates may be fixed so as to come into operation successively on the expiration of specified periods, or to be valid during a specified period. For the purposes of fixing overtime-rates a trade board may declare what are the normal number of hours in the trade during which ordinary rates of wages are payable, but they have no power to limit the number of hours worked.

In fixing a minimum rate so as to apply to any class of workers in a trade, a board may attach to the fixing of the minimum rate a condition that workers who are members of a class must be holders of a certificate from the trade board, or, if the persons are learners, such conditions as the trade board considers necessary for the instruction of these persons in the trade.

Decisions of trade boards come into obligatory operation by confirming order of the Minister of Labour, and the determinations of trade boards have no force until so confirmed. A board's proposals must be published for two months, during which time employers or workers may lodge objections. On the expiration of the two months the board may proceed to fix the rates. If, in the light of objections, they wish to make substantial alterations, they must issue new proposals. The rates when fixed are sent to the Minister of Labour, who must forthwith take them into consideration and, except in special circumstances, either make an order within a month making the rates obligatory or refer them to the board for reconsideration. By this procedure all those engaged in the trade are fully informed as to the proposals, and are given full opportunity of making observations on them, and, further, Parliament, through the Minister of Labour, can be assured that conditions harmful to the general interests of the community are not made binding by statutory rates. If district committees have been established, a trade board, before proposing rates, is compelled to give the district committee concerned an opportunity of being heard on the subject.

The Minister of Labour may at any time direct a trade board to reconsider rates of wages which may be in operation, although he has no power himself to fix rates of wages.

When rates of wages have been made operative they are enforced by inspectors appointed by the Ministry of Labour, and penalties for offences, such as non-payment of rates of wages, failure to post such rates, or keep records, are punishable by fine or imprisonment.

A trade board has power to exempt employers from the payment of minimum rates of wages in respect of workers who, through age or infirmity, are rendered incapable of earning the minimum time-rate, provided that the cases cannot suitably be met in the opinion of the board by employing the worker on piece-work.

Apart from the fixing of minimum rates of wages, the certification of learners and statutory and wage-fixing duties, the trade boards also act as joint consultative bodies for their trades, and have been so recognized by the Government for the purpose of advising them as to the training of disabled men, the training of apprentices, the settlement of disputes and other important matters.

In Sept. 1921 a Committee of Inquiry into the working of the Trade Boards (which was being severely criticized in various quarters) was appointed by the Ministry of Labour, under the chairmanship of Viscount Cave. (H. Wf.)

TRADE UNIONS (*see* 27.140*).—The history of Trade Unionism in the United Kingdom and in the United States, during 1911–21, is dealt with in detail, in separate sections, below; and in the various articles under country headings information regarding foreign countries will be found. The industrial unrest of the years immediately preceding the World War was not by any means confined to Great Britain, and in the chief industrial countries notable developments took place in the growth of trade unionism. Trade unions in such countries as France, Germany, Belgium and Austria, where the movement was of comparatively early growth, received large accessions of membership, and trade unions arose in other countries where any form of labour association had been hitherto unknown. Even before the war, however, there were certain notable exceptions. In Russia and Japan, for example, every form of trade union was illegal, and persons participating in trade union organizations did so at the risk of death or imprisonment. Trade unions, therefore, in those countries, either were secret associations working underground, or masqueraded under the guise of friendly societies or other bodies of a similar character. The war had many diverse effects on the various trade union movements. In the Central European countries the privations of the last two years of the war were reflected in a great falling-off in trade union membership. In Germany this was more than compensated for by the reliance of the Republican governments which followed the Armistice upon the help of the trade unions. This brought to the trade unions a great number of new members, with the result that in 1920 the German trade union movement was actually the largest in the world. In Hungary, on the other hand, the "White" government of the regent Horthy, which succeeded the short-lived Soviet republic of 1919, put down Trade Unionism with the utmost severity, some 70% of the leaders being executed. In the new States created by the Treaty of Versailles, trade unionism was in 1921 generally weak, owing to the existence of strong nationalist movements which absorbed the energies of the population; but in some, such as Czechoslovakia, having a large industrial element, there was a trade union movement of some size. In Russia, on the other hand, the trade unions were an integral part of the Soviet Government, and hence the inducement to the average workman to become a trade unionist was greater than in any other country.

International Trade Union Associations.—The chief international trade union body is the International Federation of Trade Unions, to which most of the chief national trade union bodies are affiliated. Its headquarters are in Amsterdam, and in 1921 it had a membership of just under 24 millions. There was an International Federation of Trade Unions in existence before the World War, to which 19 countries were affiliated, with a membership of about seven and a half millions. The structure of this Federation was extremely loose; its activities included the issue of statistics and reports, the passing of resolutions on social legislation, the promotion of unity within the national movements, and the arrangement of international appeals for funds; but as a whole it was of little importance. For instance, the British Trade Union Congress was not affiliated, Great Britain's representative on the International being the General Federation of Trade Unions. Its centre was at Berlin. During the war this Federation fell to pieces, and a new one, the present Federation was founded in 1919. Twenty-four countries were affiliated in 1921, the most important exception being the American Federation of Labor.

The structure of the International Federation of Trade Unions remains very loose. It endeavours to promote the interests of the affiliated bodies and of trade unionism in countries not affiliated, to prevent international blacklegging, to provide funds for purposes laid down in the rules and to promote combined action on questions of trade union interest. In 1920 the Federation attempted, in pursuit of the last object, to carry out a blockade of the White Government in Hungary by international action, but the blockade was unsuccessful. The Federation makes no attempt to interfere with the policy or organization of its affiliated membership. In contrast, the International Council

** These figures indicate the volume and page number of the previous article.*

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of Trade and Industrial Unions (the "Red" Trade Union International) was found to act, in its own words, as a "militant international committee for the reorganization of the trade union movement." Its headquarters in 1921 were at Moscow and it was dominated by the ideals and influence of the Russian Communist party. It would only accept as members trade unions or minorities of trade unions which it recognized as revolutionary bodies. Besides these two general groupings, there were in 1921 a number of international federations of workers in different trades, of ever varying membership and importance. A list of these, with their membership, where known, and headquarters, is given in the table on page 744.

A table is also given showing comprehensively the membership of trade unions in different countries after the war. This table does not take into account some minor associations and trade unions which are not for various reasons affiliated to any of the important central bodies. Nor does it include overlapping membership, *e.g.* in Great Britain the General Federation of Trade Unions, whose members are also affiliated to the Trades Union Congress. In such countries as Brazil, Armenia, Lithuania, Turkey, Ukraine, China, the state of organization is not sufficient to include them. In some countries which have been included the figures of membership given are approximate only. This is naturally the case where trade unionism is subject to severe repression, or where a particular organization, such as the Industrial Workers of the World in the United States, has come under the ban of the executive.

Membership of Trade Unions in Different Countries after the War.

	Central Organization	No. of Trade Unionists Affiliated	Membership of International Federation July 1921
EUROPE:			
Austria (1919)	Trade Union Commission	928,146	1,000,000
Belgium (1920)	Industrial Branch of Parti Ouvrier Belge	670,000	718,410
Bulgaria (1920)	General Federation of Trade Unions (Social Democratic)	28,000	4,000
Czechoslovakia (1920)	Federation of Czechoslovakia Trade Unions	352,000	740,000
	Federation of German Trade Unions	360,000	..
Denmark (1919)	Federation of Trade Unions	277,392	279,255
	Association of Free Trade Unions (Syndicalist)	80,000	..
Esthonia (1919)	Trade Union Congress	30,000	..
Finland (1920)	Trade Union Federation	55,000	..
France (1920)	Confédération Générale du Travail	1,500,000	1,500,000
Germany (1919)	Allgemeiner Deutscher Gewerkschaftsbund	7,338,132	8,000,000
	Hirsch-Duncker Trade Unions	102,108	..
	Federation of German Trade Associations	1,700,000	..
	Independent Unions (1918)	214,360	..
	Alliance of Clerical and Technical Employees (1918)	270,000	..
Great Britain (1920)	Trade Union Congress	6,505,482	6,600,000
Greece (1920)	General Confederation of Labour	60,000	170,000
Holland (1920)	Federation of Trade Unions	250,000	216,581
	National Labour Secretariat (Syndicalist)	50,000	..
	Christian Trade Union Federation	70,000	..
	Roman Catholic Trade Union Bureau	150,000	..
Holland (*continued*)	General Trade Union Federation (non-political)	50,000	..
Hungary (1920)	Ungarländischer Gewerkschaftsrat	215,000	152,441
Iceland	Four Trade Unions	Not known	
Ireland (1920)	Irish Trades Union Congress and Labour Party	300,000	..
	Membership of Ulster Unions	40,000	..
Italy (1920)	Confederazione Generale del Lavoro	2,000,000	2,055,773
	Unione Sindacale Italiana	150,000	..
	General Secretariat of Professional Unions (Catholic)	100,000	..
Latvia		25,000	30,000
Luxemburg (1920)	Commission Syndicale de Luxembourg	27,000	27,000
Norway (1920)	National Trade Union Federation	150,000	150,000
Poland (1920)	Trade Union Congress	948,000	403,138
Portugal (1919)	Confederação General do Trabalho	100,000	..
Rumania (1920)	Trade Union Wing of Social-Democratic Labour Party	200,000	..
Russia (1920)	All-Russian Congress of Trade Unions	5,222,000	..
Spain (1920)	Confederacion General del Trabajo	800,000	240,113
	Union General de Trabajadores	300,000	..
Sweden (1920)	National Federation of Trade Unions	280,987	277,242
Switzerland (1920)	Federation of Trade Unions	225,000	223,558
Yugoslavia (1920)	Centraluo Radmitchko Sindikalno Vetche	250,000	25,000
AMERICA:			
United States (1920)	American Federation of Labor	4,079,740	..
	Industrial Workers of the World (1919)	about 70,000	..
Canada (1919)	Dominion Trades and Labour Congress	173,463	260,000
	Total Trade Unionists in Canada	378,047	..
	"One Big Union" (1920) about	40,000	..
Argentina (1920)	Federacion Obrera Regional Argentina	70,000	749,518
	Other Unions and Federations	40,000	..
Chile (1920)	No Central Authority	c.20,000	..
Mexico (1921)	Regional Confederation of Labour	c.500,000	..
	Syndicalist and Communist Federation	..	..
Peru	Federation of Artizans and General Federation of Workers	c.25,000	25,000
ASIA:			
India	Indian Trades Union Congress	unknown	..
Japan	Japanese Federation of Trade Unions	unknown	..
	Federation of Trade Unions of Western Japan	unknown	..
AFRICA:			
South Africa (1920)	South African Industrial Federation	60,000	60,000
AUSTRALASIA:			
Australia (1919)	No Central Body	627,685	..
New Zealand (1920)	New Zealand Workers' Union and Alliance of Workers	82,553	..

Membership of Trade Unions (Continued).

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International Trade Union Federations and Estimated Membership, 1919–1920.

Industry	Membership	Headquarters
Agriculture	2,133,835	Holland
Baking	..	Switzerland
Bookbinding	249,667	Switzerland
Boot, Shoe, and Leather Trades	..	Germany
Building Trades	800,000	Germany
Carpenters	..	Germany
Commercial and Clerical Employment	1,000,000	Holland
Diamond Workers	27,000	Belgium
Factory Industry	2,417,300	Holland
Food and Drink Trades	331,374	Switzerland
Fur Trade	..	Germany
Glass Trades	..	Germany
Hairdressing	..	Germany
Hat Trades	..	Germany
Hotels and Restaurants	200,000	Holland
Lithographic Printing	..	Belgium
Metal Trades	3,200,000	Switzerland
Mining	2,606,215	Great Britain
Painters	74,470	Germany
Paviors	..	Germany
Post Office	520,000	Austria
Pottery Trades	..	Germany
Printing Trades	..	Switzerland
Saddlers	..	Germany
Mercantile Marine	..	Belgium
State and Municipal Employment	..	Holland
Stonemasons	155,350	Switzerland
Tailoring Trades	..	Holland
Textile Trades	..	Great Britain
Tobacco Trades	..	Holland
Transport (excluding Railways and Mercantile Marine)	2,560,000	Holland
Woodworking Trades	800,000	Holland

United Kingdom

The history of British trade unionism in 1911–21 was one of almost continuous and unparalleled expansion. Not only did the percentage of trade unionists in all trades materially increase, and the trades and industries in which trade unionism was previously almost unknown reach a comparatively well-organized condition, but the status of trade unions enormously increased and their programmes and policy were canvassed in quarters where before 1910 they met with no attention.

In numbers alone the growth is sufficiently remarkable. At the end of 1910 the Board of Trade reckoned the total number of trade unionists as 2,435,704; at the end of 1919 the official figure was 8,023,761. At the annual Trades Union Congress of 1910 the number of trade unionists represented was 1,639,853; in 1921, it was 6,389,123. This increase was not, of course, evenly distributed between the several industries, though all received a certain share. It was most remarkable on the railways and in agriculture, among employees of the State, such as postal workers and civil servants, among semi-skilled and unskilled workers and women, in several minor industries, particularly those affected by the Trade Boards Acts, and in the later years among professionals and "salary-earners." Draughtsmen, foremen, architects, professional engineers, actors, law clerks and commercial travellers are only a few of the classes in which trade unionism found a new foothold, while in professions such as teaching and journalism it gained a great deal of ground.

The causes of this great increase are many, some operating generally and some in particular cases only. Undoubtedly a very potent factor in all cases was good trade. Trade unions have always, throughout their history, tended to flourish in times of good trade and to decline in trade depressions, when unemployment makes the weekly contribution a serious drain on their members' pockets, and unemployed benefit uses up the central funds. The years from 1910 to 1914 were years of comparatively good trade, and, after the first shock of war was over, they were followed by such a trade boom as had never been known. With five millions of workers withdrawn to the colours, needing to be clothed and provisioned and supplied with munitions, the demand for the services of those who remained was enormous. There was practically no unemployment during the war, and, although wages did not begin to rise until many months after the war started, they yet rose much more rapidly than trade union contributions, so that the worker found the burden of contributing to a trade union relatively light. The boom continued long after the Armistice, and it was not until 1920–1921 that the subsequent depression began to be heavily felt.

The factor of good trade would reflect favourably upon trade union membership whether in war or peace; but the war years gave an impetus of another kind to organization on trade union lines. From the Treasury Agreement (March 1915) onwards, the Government recognized the trade unions in essential industries as part of the economic and political structure of the country. They were called in to assist in the production of munitions, to share in the running of Government controls, in such cases as the Cotton and Wool Control Boards, and particularly to coöperate in the selection of men for the army. In many cases the trade unions succeeded in gaining exemption for men engaged upon certain occupations, and at one time certain unions were even empowered to issue Trade Cards to their members, protecting them from military service. They were also of necessity consulted in the "dilution" and "substitution" of labour, and they entered into a very large number of agreements fixing the conditions upon which dilutees should be employed, the wages they were to receive, and the restoration of normal practices at the end of the war.

At the same time the cost of living was rising rapidly, and the trade unions were the bodies concerned with demanding commensurate increases in wages. Thus the average worker found that whether he wished to preserve his standard of life, to retain his exemption from the army, or to secure his job against his return, the best way was to become a member of his trade union; and the Government, which preferred in general to negotiate with representative bodies, whether of workmen or employers, contributed in no small degree to their growth.

Again, certain legislative enactments played a large part in increasing trade union membership. Of these, undoubtedly the most important was the National Insurance Act of 1911, with its subsequent amendments. The Act of 1911 was divided into two parts, Health and Unemployment Insurance, and these parts were subsequently amended by separate Acts. Under the Act dealing with Health Insurance, State benefit payable to insured persons who fell ill is administered by Approved Societies, and a number of trade unions, in order to secure closer contact with the workmen in their industries, decided to form Trade Union Approved Societies for the purpose of administering Health Insurance. Many trade unions thus gained a number of members who joined for health insurance and became full trade unionists, as in most cases they were not allowed to join the Approved Society only.

Unemployment Insurance was originally a much smaller experiment, covered by Part II. of the 1911 Act; but it gained considerably in importance when the Government in 1920 compulsorily included under unemployment insurance all the industries of the country in which there was any appreciable amount of unemployment. Under the new Act, trade unions which ordinarily paid unemployed benefit were allowed, subject to certain conditions, to administer the State benefit to their members, an allowance being made to them, under certain conditions, for administration costs, and a considerable number of them availed themselves of these provisions. Some trade unions, particularly those catering for skilled workers, also act as labour exchanges for their trades, notifying vacancies and supplying workers, where they are wanted.

Two further enactments, the Trade Boards Act of 1909 (amended and widened in 1918), and the Corn Production Act of 1917, which set up Agricultural Wages Boards with power to fix binding rates of wages, did much to increase the membership of trade unions, particularly in lowly paid industries. It is a commonplace of trade union organization that very low wages make labour difficult to organize, and the Trade Boards and the Agricultural Wages Boards, by raising the rates of the lowest paid classes, enabled them for the first time to afford trade union

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contributions. The results of this can be seen from the agricultural industry, whose trade union membership rose to approximately 300,000 in the summer of 1921, when the repeal of the Corn Production Acts abolished the Agricultural Wages Boards. Something of the same result was achieved by the fixing of rates of wages under the Munitions of War Acts for women and unskilled workers in the munitions trades, and their subsequent stabilization for a year and a half after the Armistice.

The last of the causes contributing to trade union growth is impossible to estimate in terms of figures. From 1910 onwards the working classes showed a diminished faith in political action, and a belief in industrial action, strikes and the power of large industrial organization. The theories of French Syndicalists and American Industrial Unionists, and later of English Guild Socialists, began to gain ground, and these all stressed the importance of strong trade unions, and the necessity for "blackleg-proof" organizations. All these tendencies combined to drive the workman into his trade union, and to induce him to canvass among his fellows, and the assumption that a worker must be a trade unionist steadily gained ground.

Nearly every trade union showed an actual increase of membership in the decade. But beside this, there was a marked tendency towards larger industrial groupings. A large majority of the trade unions known to the Ministry of Labour are small local societies, survivals of an earlier period, having in many cases no more than a hundred or two hundred members, and of no practical importance. Even in 1910 practically the whole effective force of the trade union movement was confined to about a hundred societies, and further amalgamations, speeded up by the Trade Union Amalgamation Act of 1917, which lessened the restrictions upon amalgamation, had by 1921 reduced the number to something like fifty. Thus, large national associations have come into existence on the railways, in road and water transport, in the Post Office, the iron and steel trades, the building trades and the woodworking trades, and the distributive industry; the various unions of general workers are now united in a single federation, and many other schemes of union were in 1921 either in process or under discussion. The movement towards federation is no less important than the amalgamation movement proper. In many cases, where the existence of many trade unions on differing financial bases render amalgamation difficult, there are often formed strong federations which fulfil many of the functions of a single organization. Of this kind are the federations in the building, printing and transport industries, and among general workers. In contrast to this unitary tendency must be mentioned the newer unions of non-manual workers, who are in most cases organized separately from their manual fellows, but even here the tendency to federate or in other ways to ally themselves with the unions of manual workers is evident.

This tendency towards large aggregations must be set down partly to the increased integration of capital since the beginning of the century, and partly to the theories of workers' control and industrial unionism, which have been making rapid headway. The day of the small master, and even of the single firm, is all but over, and the tendency of workers in the employ of one employer or of one company to unite in a single union is a natural sequel. The influence of the movement towards workers' control is equally obvious. Where trade unions were content to be "continuous associations of wage-earners for the purpose of maintaining or improving the conditions of their employment" (S. & B. Webb, *History of Trade Unionism*, 1892 edition), the "craft" or "kindred craft" union, which organized together workers employed on a single process or on processes nearly related, was a sufficient instrument. But as the plans of the Syndicalists, the Guild Socialists, and others for the "control of each industry by the workers engaged therein" gained ground, the old craft union was regarded as ineffective, and plans were made on all sides for the absorption of all workers engaged in a single industry into one organization. Many of the important amalgamations mentioned above are due to this idea, though it must not be assumed that the whole or even the major part of the British trade union movement is organized on industrial lines. Craft unions and "kindred craft" unions continue to exist in a number of trades; many amalgamations are directed merely to the abolition of competing craft unions, as in the printing industry; and there is the further complication of the General Labour unions, which, beginning by enrolling the real "general labourer," the man whose skill is in the strength of his muscles, and who shifts from industry to industry as he finds an opening, have gone on to organize the mass of semi-skilled workers which machine industry requires, and even in certain cases to compete with the skilled unions on their own ground. There is thus no clearly defined principle governing the whole of British trade unionism, and bitter disputes over membership have not by any means ceased to occur; but the tendency to unite, by differing means in differing cases, the trade unionists of a single industry with one another, and even, as in the case of the Triple Industrial Alliance of miners, railwaymen, and transport workers, to unite several separate industries, made very great progress during the decade.

Apart from increase in membership, the trade union movement as a whole gained considerably in consideration and importance after 1910. This was shown in two ways. The trade unions secured, by general public consent, a much larger place in the mechanism of society than they had hitherto held, and at the same time they steadily turned their attention to new fields of activity. Before the passing of the Trade Disputes Act in 1906, the trade unions were hardly recognized as a political factor of importance. Even in 1910, though their importance had greatly increased and they were known to be the main support of the Labour party, that support had in many people's opinion been knocked away by the Osborne Judgment; and both before and after the Trade Union Act of 1913 enabled trade unions to take a direct part in politics, the view was openly expressed in many quarters that trade unionism was a dangerous growth, unwisely fostered by the legislature, which would be well advised to sweep it away at the first favourable opportunity. Dismissal of workmen for belonging to a trade union was comparatively frequent, and many strikes were fought on the question of the right of a trade union to negotiate on behalf of its members. The great Dublin strikes of 1913, the most considerable industrial upheaval before the war, arose out of Mr. W. M. Murphy's refusal to recognize the Irish Transport Workers' Union as a body competent to negotiate with him on behalf of his employees. Similarly, up to and during the war the three unions of railway workers were engaged in a struggle to obtain recognition from the general managers of railway companies, who, during the war, formed the Railway Executive Committee for administering the railways under Government control. The position was entirely changed by 1921. The Government itself had contributed to raise the status of the trade unions during the war, offering them a semi-partnership on many industrial questions, and both the Government and the larger employers found that they preferred on the whole to negotiate with organized than with unorganized bodies of workmen. During the war, for instance, the practice gradually grew up of appointing a representative of organized labour to any committee whose subject was of importance to the working classes, and such representatives were generally chosen from the trade unions. Recognition given at headquarters could not be denied locally; trade unionists *qua* trade unionists were appointed to Local War Pensions Committees, Food Advisory Committees, and the like, and were generally recognized as qualified to speak on behalf of their fellow-members. The result was to raise the trade union movement to a position such as it enjoyed in no other country save Germany or revolutionary Russia. Although cases might still be known where workmen were discharged because their individual trade union activities were not approved by their employers, the "victimization" of a man simply for being a member of a trade union was no longer likely to occur. Discrimination is, however, occasionally exercised both by public and private employers against a particular union's claim to organize a particular section. Thus the Railway Clerks' Association was long forbidden to speak on behalf of

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station masters. The most important instance of this is the Government's refusal to permit members of the police forces to belong to the Police and Prison Officers' Union.

All this growth has naturally led trade unions to expand their activities, and in many cases to amend their internal administration. The constitutions of some unions in 1921 dated back 50, 60 and 70 years, and were obviously inadequate to the changed situation, so that many experiments in altering them had come under discussion. One particular point of contention, the "shop branch" versus "residence branch" controversy, is dealt with below. Other difficulties centre mainly round the representation, in a large union, of the interests of different crafts and sexes, the method of electing the governing body, the relative power to be assigned to the governing body, to the officers, and to the members themselves, the amount of local autonomy, financial and otherwise, to be granted, and so on. Different unions adopt different solutions. The executive committee or council, for example, is generally elected by vote of the members, either by districts (as in the Iron and Steel Trades Association), or by departments (as in the National Union of Railwaymen); but it may also be elected by general vote of the whole union. Only two important unions, the Amalgamated Engineering Union, and the United Society of Boilermakers, have adopted the principle of an executive committee in permanent session. In some unions the executive committee is theoretically the final governing body, though in such cases the practice of taking a referendum upon most questions of importance really leaves the decision in the hands of the members; others have a general council or delegate meeting sitting for some time which has power to override the decisions of the executive committee on certain subjects; most, though not all, held at fixed intervals a conference or meeting of representatives to receive the report of the executive committee and to discuss policy. The merits of delegate and other representative conferences and of ballot, secret or otherwise, in ascertaining the will of the membership is one of the problems most frequently canvassed among the trade unions. In some cases the general secretary and other officers are appointed and paid by the executive committee, in others they are elected by vote of the members. It will readily be understood that the latter method gives in effect much more power to the secretary than the former, and the position of a trade union secretary and the extent to which he is able to speak for his union and to conclude binding arrangements on its behalf is another problem claiming much discussion.

Differences of practice also exist with regard to the autonomy of branches and sections of trade unions, and the method of declaring or calling off a strike. Some societies allow great freedom of action to their branches and district committees or councils; others, such as the Iron, Steel and Kindred Trades Association, retain all contributions in the hands of the head office, and only allow money to be spent by branches or districts for purposes specifically approved by the central organization. Between these two extremes there is room for a large variety of different methods. Some unions specifically provide in their constitutions that a ballot of the membership must be taken before a strike is declared. In many other cases this is secured by the general practice; and some unions, such as the Miners' Federation insist further that a two-thirds majority in favour of a strike must be secured. The National Union of Railwaymen, on the other hand, allows a strike to be declared by the executive committee, without prescribing any consultation of the membership. Local strikes may in some cases be declared by the local committee, but in most cases, since the strike pay is centrally administered, the sanction of the central office is necessary for a local strike, and the central executive has also power to order the men back to work. All these problems of administration require the services of trained men, and the position and education of the trade union official has begun to receive consideration. The trade unions have been slowly coming to the opinion that the work of a trade union official is specialized and requires special training; salaries have been raised, and classes and summer-schools for trade union officials and organizers are regularly held. Specialization, however, upon organizing and routine work often tends to remove the trade union official from contact with and understanding of the problems of the members whom he serves, and this difficulty has not yet been satisfactorily solved.

Trade unions have gradually extended their activities in many new directions, of which the principal are politics, education, and the control of industry. The political Labour party in its origin rested upon the support of the trade unions; but in 1909 their political activities appeared to have received a check. This was removed by the passing of the Trade Union Act in 1913, which enabled every trade union, after the prescribed ballot had been taken, to collect contributions for political purposes. By 1921 almost every trade union had its political fund, lists of Labour candidates backed by trade union money appeared, and locally the trade union branches played a regular part in the activities of local Labour parties and supported Labour candidates at local elections. Trade unions also began to show considerable interest in the education of their members. During these years the movement towards adult working-class education experienced a great revival. The Workers' Educational Association, a body which in connexion with the universities ran a large number of evening courses and summer-schools for working-class students, was supported by the trade unions, some of which became actual partners in its work. The Central Labour College—now the Labour College—a residential college for students of Marxian economics, founded in 1909 by a secession of students from Ruskin College, and subsequently supported by the National Union of Railwaymen and the South Wales Miners' Federation, extended its activities; and class-centres called Labour colleges, on more or less Marxian lines, were set up in Manchester, Glasgow and elsewhere. Trade unions provided a number of scholarships for their members at the Labour colleges and at Ruskin College, Oxford; and in 1921, when the General Council of the Trades Union Congress was set up, a resolution was carried to provide for the unification of working-class education under it.

Trade union interest, however, has not been confined to education proper. The *Daily Herald*, a newspaper founded during a printers' strike in 1912 by the London Society of Compositors, was supported by Labour and trade union funds, and became an important political force, although it was forced temporarily to become a weekly soon after the outbreak of war. Later, in 1913, the trade unions revived an ancient project of running their own newspapers, and the *Daily Citizen* appeared as the first daily newspaper entirely owned and conducted by the British trade union movement. This paper had a short career, and ceased publication in 1915, mainly owing to war conditions, but the trade unions played a large part in the reissue of the *Daily Herald* as a Labour daily, early in 1919. Besides the daily papers, there are a number of local weeklies and monthlies to which trade unions contribute, and some of them also run papers and printing presses of their own. The Labour Research Department, which in 1916 became a federal body composed of trade unions and other Labour bodies contributing to the endowment of research into the history and problems of the Labour movement, shows the increasing interest of the trade unions in specialized research work.

The inclusion of the phrase "control of industry" (*see* GUILD SOCIALISM) in the aims of the trade unions has played a considerable part in forming their policy, although it has not been generally translated into fact. In the early years of the century, most trade unions, like the Labour party and the Socialists, were assumed to be in favour of the transference of the important industries of the country to the ownership and control of the State. The experience of workers in State-owned industries, notably in the Post Office, suggested that this was inadequate to fulfil trade union aspirations, and between 1911 and 1921 most of them altered it to a demand for "nationalization of industry, with control by the workers engaged therein," amounting in some cases to a demand for a National Guild

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(*see* NATIONALIZATION). The establishment of a National Guild was part of the official programme of the Union of Post Office Workers (founded in 1920). Perhaps the fullest exposition of the new demand was made by the Miners' Federation in its programme presented to the Coal Commission in 1919, but by the autumn of 1921 it had only been translated into action in the building industry. The unprecedented shortage of houses following the war encouraged the Building Trade Unionists of Manchester to form a Building Guild, which offered to produce houses at cost price for the City Council, themselves controlling and providing the labour, guaranteeing full pay in sickness and bad weather to all members of the Guild, and relying upon the credit of the municipality to obtain the necessary materials. The example proved infectious, and after many experiments had been made in different towns, the National Building Guild was formed in 1921, with a number of branches, prepared to undertake work upon the same terms for local authorities or private companies or persons. In every case the Guild was initiated by the local branches of the Building Trade Unions, and none but trade unionists were admitted to membership.

Pre-war Developments.—Trade union history from 1910–1921 falls into three well-marked periods: the period of industrial unrest which had already begun by 1910 and which increased in intensity right up to the outbreak of war, the war period, and the revival of activity immediately following the Armistice. The two latter, as has been observed, coincided with great trade union prosperity, which continued unbroken for some months after the Armistice, and gradually came to an end, as the slump in trade became more pronounced, from 1920–1921. It may be said that the miners' strike, in the summer of the latter year, and the subsequent acceptance by the miners of heavy reductions in wages, brought to an end the first post-war period in trade union history (*see* STRIKES).

The years 1910 to 1914 were years of growing industrial unrest. The chief factor underlying this was the steady rise in prices after the year 1906, which more than offset the slight increase in money wages, and produced a feeling in the workman's mind that his real wages were imperceptibly disappearing. Retail prices in London, which in 1906 stood at 2% above the figure for 1900, had reached, in 1911, 9·4% and in 1914, 16·8% above that figure.

Four of the industrial disputes which occurred during those years were of importance in trade union history—the railway and transport strikes of 1911, the miners' strike of 1912, the Dublin strikes of 1913 and 1914, and the London building lock-out of 1914. The principal interest of the first series of strikes lies in the fact that the railwaymen's unions succeeded in paralysing for some days the greater part of the railway system of the United Kingdom, and thereby brought home to many who had not previously realized it, the potential power of trade unionism. The actual disputes, though partly connected with wage-rates, centred mainly around the question of recognition by the employers of the unions of shipping and railway workers. In the former case the owners agreed after some time to negotiate with the trade union representatives, and a settlement was eventually reached; in the latter, a Royal Commission was set up to investigate the working of the Conciliation Board, established in 1907, which had given rise to many complaints, and the Commission's report was accepted by both sides in conference, although the point of "recognition" of the trade unions was never conceded by the railway companies, and remained in dispute until the end of the war. An important result of these strikes was the consolidation of the railwaymen's trade unions. The existence of several separate unions was felt to be a weakness, and in 1913 three of them united to form the National Union of Railwaymen, which enrolled members rapidly and became by far the largest trade union representing railwaymen.

The coal dispute of 1912 brought to the forefront one of the most important principles of trade unionism, that of the legal minimum wage. In the case of "sweated" industries, this had been recognized in the Trade Boards Act of 1909 but had not yet been applied to comparatively highly-paid workers, although in many industries, minimum rates, established by agreements between both sides, but not enforceable at law, were in existence. These rates varied generally from district to district. The principle of a legal minimum, it should be stated, does not necessarily demand that the minimum should be national in its scope, though many trade unions, especially during the war, demanded national minima, and even a national minimum wage for all workers. The Miners' Federation first claimed that miners working in abnormally unfavourable places should be guaranteed a minimum daily rate, and, when this was refused by the coal-owners, extended their demand to cover all men and boys working in coal-mines, and further put forward a schedule of minimum district rates for the various coal-fields. The strike was terminated by both sides' acceptance of the Miners' Minimum Wage Act. This Act provided that rates should be fixed by joint boards, representative equally of mine-owners and mine-workers, in each of 22 specified areas. If the two sides of any board failed to agree upon a rate, the rate should be fixed by the chairman. The Miners' Federation thus secured the principle of a minimum, but failed to get their schedule generally adopted. They were very unwilling to accept this position, but the ballot having failed to disclose a two-third majority in favour of continuing the strike, it was declared at an end.

The Dublin dispute raised the question of "recognition" in a more acute form, and also provided many examples of "sympathetic" strike action. The employers in Dublin, as a protest against the aggressive trade union policy of the Irish Transport Workers' Union, discharged its members in their employment, bound themselves not to employ in future members of the union, and in many cases insisted that applicants for work should sign a form undertaking to have no dealings with the union. This action roused a great deal of feeling both in Ireland and Great Britain; sympathetic strikes occurred, and in British ports dockers and railwaymen refused to handle goods loaded in Dublin by non-union labour. The imprisonment of James Larkin on a charge of sedition greatly increased the upheaval. Dublin shipping was practically paralysed by a general strike of dock labourers, and large contributions in money and in kind were sent to the Irish Transport Union by English trade unions and the Coöperative Wholesale Society. The points in dispute were never definitely settled, but the strike petered out gradually in the early months of 1914.

Two important pieces of legislation, the National Insurance Act of 1911 and the Trade Union Act of 1913, were passed during this period.

The War Period.—On the outbreak of war, a general truce between Capital and Labour was immediately arranged. Outstanding disputes, such as the building lock-out, were settled by one side giving way, or by compromise. Trade unions such as the National Union of Railwaymen, which had prepared a national programme of demands, delayed its presentation indefinitely, and the number of industrial disputes dropped from 682 in the first seven months of 1914 to 107 in the last five. For some time trade union history was in abeyance, until the rapid rise in prices and the necessity for increased production, in the munitions trades in particular, turned public attention to it again. The natural concern of most of the unions, as soon as the cost of living began seriously to rise, was with negotiating increases of wages. Other developments of interest took place mainly in two directions, of which the first was the abrogation of trade union conditions and the establishment, over a large number of trades, of compulsory arbitration under the Munitions of War Acts, and the effect of these two upon trade union government; and the second, the tendency, already mentioned, of the Government and the employers' association to admit the trade unions to a quasi-partnership on certain questions—a partnership which endured, as a rule, only as long as rising prices made increased wages both possible and inevitable (*see* LABOUR SUPPLY).

The necessity for greater production, particularly of munitions and other stores required for the army, early began to be felt, and a series of strikes upon the Clyde brought the question to the fore. The Committee on Production, appointed by the Government in Feb. 1915, reported that one great difficulty in the way of increased production lay in the existence of certain rules and customs of the trade unions. These "trade union conditions" became of considerable importance during the war. Every trade union of any size had before the war certain regulations, some written, but mostly unwritten, under which its members were allowed to work. These regulations related mainly to the class of labour which was permitted to perform any particular job, to the length and character of apprenticeship required, the rates to be paid, and the conditions under which work was to be done. Thus, certain jobs were reserved to fully-skilled craftsmen, had to be paid at the craftsmen's rate, and might only be performed by men who had received a certain training, which in some cases occupied several years. The demand for munitions in large quantities, and the loss of many thousands of skilled men to the army, made it inevitable, in the first place, that semi-skilled and unskilled workmen should be "upgraded" on to skilled work, in order that the necessary increase in the amount of skilled work performed should take place, and secondly, that a great number of new workers should be introduced into the munitions industries, many of whom would only be able to receive a comparatively short training. The Government therefore, in March 1915, invited a number of the leading trade unions in the industries concerned with war production to the famous Treasury Conference, attended by all the unions invited with the exception of the Miners' Federation, at which it was agreed (*a*) that strikes and lock-outs in the munitions industries should cease for the period of the war, wage disputes being settled under a system of compulsory arbitration; (*b*) that the trade unions would relax for the period of the war such of their customs as were necessary for the purpose of accelerating war output, it being understood that all such customs should be restored at the end of the war, and that, where labour of a lower degree of skill (such as women's labour) was introduced on work hitherto performed by skilled men, the rate of wages previously paid should not be reduced; (*c*) that the Government would limit the profits of owners in the munitions industries. The latter clause was made a condition of coöperation by the Amalgamated Society of

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Engineers and was put into force under the Munitions of War Acts. Profits in other industries were dealt with by means of the Excess Profits Duty. The Treasury Agreements were given legislative force for the trades concerned with the supply of munitions under the Munitions of War Act of 1915. The Act reaffirmed the Treasury Agreements with regard to establishments "controlled" by the Minister of Munitions: it set up machinery for compulsory arbitration in wage disputes, limited the profits of controlled establishments to one-fifth in excess of their pre-war standard, forbade munition workers to leave their employment without permission from a munitions tribunal, ordered all customs restricting production or employment to be suspended for the period of the war only, and provided that "the relaxation of existing demarcation restrictions or admission of semi-skilled or female labour shall not affect adversely the rates customarily paid for the job." In practice, disputes arising out of the last clause claimed an enormous proportion of trade union attention during the war. In 1916 the Minister of Munitions found it necessary to take powers, in an amending Act, to fix general minimum rates for women employed in the munitions industries, but the Government was freely accused of breaking its pledges to the trade unions in the matter of wages to be paid to substituted labour, and as dilution proceeded apace during the war the controversy became more and more bitter.

The clauses in the Act dealing with restoration of the suspended customs were also the subject of dispute. These clauses merely stated that the suspension should be for the war period only, and made no explicit provision for their restoration. The trade unions contended that the Government was pledged to bringing a Bill for their restoration, and negotiations on this subject continued throughout the war period. Eventually, nearly a year after the Armistice, the Restoration of Pre-War Practices Act was passed, which provided that, where the existence of a pre-war practice could be proved, it should be incumbent upon the employer to allow its restoration.

The institution of compulsory arbitration in the munitions industries had one remarkable effect in the government of trade unions. As the trade unions concerned had practically pledged themselves not to strike for the period of the war, and as drastic penalties were provided under the Munitions Acts for any workman who struck, it followed that any strikes which did take place in the munitions industries must be unofficial, that is, conducted without authorization, or dispute pay, from trade union leaders. It was not to be expected that disputes would not arise, but these disputes fell to be conducted in the main, not by recognized trade union officials, but by unofficial committees elected from the workmen in a particular shop or factory, and known generally as Shop Stewards' or Workers' Committees. This had relation to an interesting problem of trade union organization.

Shop Stewards.—Originally, nearly all trade unions were built up of local branches, composed of all the men working at a particular trade who lived in a particular district. In the early days of machine industry, when towns and factories were comparatively small, this seemed the natural arrangement. Men working in a particular factory generally tended to be in the same residential branch, which thus achieved a trade as well as a neighbourhood unity. But as factories increased in size, and large urban aggregations became the rule, this unity disappeared. Workmen residing in a particular London suburb might be spending their working life in any one of a dozen widely separated and entirely different establishments, and might be faced with quite different industrial problems. This resulted in a stagnation of trade union branch life, which was reflected in a meagre attendance at branch meetings, and created one of the greatest problems of the trade unions. The favourite solution of the difficulty, advocated particularly by the Industrial Unionists, Guild Socialists and latterly by the Communists, was the break-up of the old residential branches, and the reformation of the trade unions in branches composed of all members who worked together in a single establishment, the several trade union branches in such establishments then to join their forces to make a single industrial unit for the whole. Certain steps in that direction had already been taken before the war. The Miners' Federation, for example, had always based its organization upon branches composed of all the men working at a single pit or group of pits, the printers' trade unions had in every printing works committees of very ancient establishment, known as chapels, and the engineering trade unions had in most cases officials, called "shop stewards," who were responsible for the inspection of the contribution cards of members at their place of work—in order to see that they were "genuine trade unionists"—and for various other minor duties. These shop stewards, both those officially recognized by the trade unions, and others unofficially appointed by the trade unionists in a particular works, enjoyed during the war a great access of importance. They included, in a majority of cases, the most active members of the trade unions, and those most imbued with the policy of "workers' control," and though general advances in wages and the broad principles of dilution and substitution were negotiated by the national bodies, all the concrete details of both the latter processes and the application of wage advances had to be dealt with on the spot, and an active man, who was not deterred by possible fines and imprisonment under the Munitions Act, could wield real power in big engineering centres. Practically all the important munitions strikes of the war period were conducted by the shop stewards, two of those which excited great public attention being the Clyde strikes of 1916, which resulted in the temporary deportation from the Clyde area of a number of the leading shop stewards, and the widespread engineering strikes of May 1917, caused by the proposal to extend dilution and substitution from the production of munitions of war to ordinary commercial work. These strikes succeeded in their object, and throughout the war dilution was confined to public work.

The shop-stewards' movement attained its greatest importance in the engineering industry, because of the existence of compulsory arbitration, the enormous increase in engineering work, and because, owing to the multiplicity of trade unions catering for skilled and unskilled engineers, common action in the localities had been hitherto difficult to secure, and the appearance of a single flexible instrument uniting all sections resulted naturally in a great increase of activity. Parallel movements did, however, exist in industries connected with the production of munitions, and in other industries such as shipbuilding, cotton and woollen textiles. The shop stewards in these industries occasionally made common cause with the engineering shop stewards on questions of policy, but except in shipbuilding they were of very much less importance. The shop-stewards' movement during the war contained a large revolutionary element which was hostile to the employing class and in many cases to official trade unionism, and aimed at securing workers' control of industry. The existence of this element led ill-informed observers to conclude that the shop stewards as a whole were a revolutionary force, and to attack them as dangerous and unpatriotic. In fact, even in the centres such as the Clyde, in which the revolutionary element was strong and vocal, and inclined to defy the executives of the trade unions on principle, there were throughout the war many shop stewards who aimed at no more than the recognized trade unions' objects of wages, hours and conditions of employment and had no concern with industrial theories. Shop stewards were in fact a recognized feature of trade unionism before the war. The Amalgamated Society of Engineers, in particular, demanded that shop stewards should be recognized as official spokesmen of the union on certain matters, and succeeded in carrying their point after lengthy negotiations. This agreement applied, of course, only to official stewards, who are now recognized by the Employers' Federation in the engineering trade as part of the official trade union machinery. At the end of the war, with the stoppage of work on munitions and the discharge of large numbers of workpeople, the importance of the unofficial element of the shop-stewards' movement declined rapidly, and public attention was therefore almost entirely diverted. The official trade unions resumed control of policy and disputes, the revolutionary elements among the shop stewards became part of the general Communist movement, and the rest returned to ordinary trade union activities, such as those laid down in the shop-stewards' agreements of 1918 and 1919. The influence of the movement on trade union government remained, however, and may be seen in various proposals for remodelling trade unions on a "workshop branch" basis.

Trade Union Action under War Conditions.—Compulsory arbitration had always been heartily disliked by the British trade union movement, and, but for the war, it is exceedingly doubtful whether it would ever have been accepted. The acceptance by the trade unions of war conditions, however, made its introduction possible, and although it did not by any means prevent the occurrence of a strike, when a dispute reached a certain point of bitterness, a large number of disputes, particularly in the munitions industries, which under other circumstances would have resulted in strikes, were settled under compulsory arbitration. The clauses, however, which enabled a dispute in a non-munitions industry to be "proclaimed" under the Munitions Act, and thereby rendered illegal, were less successful, and their unsuccess can be readily understood from a single instance—that of the South Wales mining strike of 1915.

The Miners' Federation, which had not been a party to the Treasury Agreements, had never abrogated its right to strike, and the South Wales Miners' Federation, its largest constituent, was the first body to challenge the Munitions Act. In the summer of 1915 the South Wales miners threatened to strike for the purpose of enforcing a revision of a wage agreement under which they had worked for five years, and though the dispute had been "proclaimed" under the Munitions of War Act, the strike nevertheless took place. It was clearly impossible to apply the penal clauses of the Act to a body of 200,000 miners, and after some discussion a settlement was reached which conceded to the miners the majority of their demands. Other important disputes, such as the strike of employees of the Coöperative Wholesale Society in 1918, were also "proclaimed" under the Munitions Act, but in every case the number of men who left work was sufficient to enable them to defy the proclamation.

Consideration of the miners' case leads us to the second important branch of trade union activity during the war, namely that of securing wage advances to their members. For some time this activity was practically in abeyance, unions having agreed, at the beginning of the war, to hold over their demands for an advance in their members' standard of life. Only certain sections, such as the railwaymen, to whom an advance was known to be overdue, obtained any additions to their wages during the first six months of

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the war. This, however, was partly due to the assumption that the war would be of short duration; and when it appeared that this was not to be the case, and further that food prices and employers' profits, particularly at first in the shipping trade, were rising very rapidly, the trade unions changed their policy, and by the spring of 1915 it may be said that as far as wage claims were concerned, the industrial truce had come to an end. All trade unions began to put forward claims for increased wages, these claims, for the most part, being based on the rise in the cost of living; and although in the first two years it was not invariably held to be a sufficient ground and wages rose comparatively slowly, by 1917 it was generally accepted, and arbitrators and Government tribunals were usually willing to consider claims based upon it.

Very early in the war the system of granting wage advances in the form of "war bonuses" was introduced, the railwaymen being the first to accept it. A "war bonus" was an advance explicitly granted owing to "the abnormal conditions arising out of the war," and it was argued, though not stated in any award, that "war bonuses" ought therefore to lapse automatically when these conditions were removed. The trade unions never accepted this interpretation, and both during and after the war negotiations were continually in progress for converting war bonuses into permanent wages. Certain permanent advances were in fact granted, usually in the early stages of the war, before the system of war bonuses had become general, but subsequently it became the rule for all wage advances in the majority of trades to be granted in the form of war bonuses, which amounted to anything from 20 to 40 shillings a week in the skilled trades. War bonuses were generally granted nationally to all members of the particular trade concerned, on a flat rate. This conceded an important point in trade union principle. It had always been the object of most trade unions, particularly those whose members are paid by time, to establish a national minimum wage or guaranteed rate for their trade. Before the war, *national minima*, legal or otherwise, were rare; in the better organized trades, distinct minima had been secured, but in many cases there was no standard at all, and individual wages had to be negotiated with individual employers. The war, particularly in its later stages, gave the trade unions an opportunity for standardizing wages. Actual national minima were not secured in many instances, but in a number of trades, notably in building, printing, baking, tramways, gas and electricity supply, several area rates were fixed which between them covered the whole country, and in far more the principle of national advances or war bonuses, applying equally to every worker in the industry, was secured. This was the case, for example, with all subsequent advances to miners, all advances to railwaymen, and practically all advances in the munitions industries. The volume of wage negotiations undertaken by trade unions during the war was naturally enormous, but most of it was detailed negotiation for separate trades or branches of a trade. Towards the end of the war there was a movement to consolidate all war advances in the permanent wage rates, and to establish new minima for each industry; but the trade slump which began in 1920 strengthened the resistance of the employers to the principle, and many set-backs were recorded.

From 1915 onwards the Government began to make more and more use of the trade unions both in political and industrial questions. The general course of events was for the Government to initiate a particular piece of legislation without the coöperation of the trade unions, and then to amend its administration in order to admit the trade unions as partners. Thus the recruiting of men for the army was originally entrusted entirely to the administration of the staffs of the War Office, but it was found that this led to the crippling of essential industries by the sudden withdrawal of large bodies of skilled men, and also gave rise to a great deal of industrial unrest. Accordingly, trade unionists were invited to sit on the important committees dealing with recruitment, and in most of the chief industries the Government adopted the method of discussing recruitment with the representative bodies of employers and workmen. The mines, in particular, were practically excluded from the operations of the Military Service Acts, special colliery recruiting courts, composed of representatives of miners and mine-owners, with a Government chairman, being set up under the authority of the Home Office, to deal with the recruitment of miners for the army. In the munitions industries a scheme was put into operation in 1917 under which certain trade unions catering for skilled workers were allowed to issue "trade cards" to their members protecting them from military service, but this scheme met with a great deal of opposition from other trade unions as well as from the employers, and was dropped. In addition to participating in recruiting, trade unions during the war acted as the defenders of members whom they believed to be unjustly taken into the army, and concerned themselves with other cognate questions, such as the securing of civil rights to enlisted men.

In the case of Government control of industry, the same progression is visible. The early cases of Government control were administered by civil servants, without official coöperation either by trade unions or employers' associations. Later the Government adopted the principle of consultation of the trades concerned through associations of employers, and many industries were administered under Government control by boards consisting of civil servants and representatives of commercial interests. This was the most frequent form of control; but in two important industries, cotton and woollen textiles, the trade unions were taken into partnership. The Wool Control Board was set up in the autumn of 1917, after several experiments had failed, and consisted of eleven representatives each of the employers, the trade unions, and the War Office Contracts Department. It had a free hand in organizing the civilian trade in wool and in allocating supplies of wool—bought by the Government—to the various firms. The Cotton Control Board, set up a short time previously, was composed in a somewhat similar way. It administered the Raw Cotton Order, prohibiting the purchase of cotton except under licence, restricted the amount of machinery which was allowed to run upon work other than Government orders, and when the supplies of cotton were insufficient to keep all members of the industry in employment, the Board levied the firms which were working full time in order to pay allowances to unemployed workmen, thus putting into practice a principle on which many trade unions insist, namely that each industry should provide for the maintenance of its own reserve of labour. The Food Ministry, again, when reorganized by Lord Rhondda, set up a Consumers' Advisory Council, on which the trade unions were officially represented, and Food Vigilance Committees and War Pensions Committees were among the local bodies to which they regularly sent delegates.

These experiences of partnership with the trade unions, and the existence of the control of industry propaganda, induced the Government, when in the spring of 1917 industrial relations appeared to be very much embittered, to appoint a committee to consider means of improving the relations between employers and employed. The report of this committee—known as the Whitley Report—recommended that in each of the well-organized industries joint standing industrial councils, representative of employers' associations and trade unions, should be set up to discuss all matters affecting the industry. The Government officially adopted the report (though for some considerable time it refused to set up Whitley Councils in the Civil Service, the Post Office, and other Government establishments) and between 1917 and 1919 50 or 60 such councils were set up, but they did not produce much permanent result. For trade unionism, their chief importance lies in the fact that they brought large accessions of membership to some unions (since no workman could be represented on an industrial council, save through a trade union), and that they facilitated the fixing of national and area minimum rates. They were also used by the Government as the regular channels for disseminating information and receiving advice from the trades concerned. The trade unions, however, showed no great enthusiasm, discerning in them possible taints of profit-sharing and compulsory arbitration, to both of which trade union policy is definitely opposed, and were inclined to be definitely favourable to them only in State-owned industries. So long as wages and profits continued to rise no very serious disputes occurred, but as soon as the fall began several councils were abandoned owing to disagreements on wage questions (*see* INDUSTRIAL COUNCILS).

A few months after the issue of the Whitley Report, the passage of the Corn Production Act led to a great revival of trade unionism among the agricultural labourers, who since the failure of Joseph Arch in the seventies had been almost untouched by trade unions. The Corn Production Act guaranteed a minimum price to the farm and a minimum wage to the farm-workers; and boards, representative of the employers and the three trade unions organizing farm-workers, the National Union of Agricultural Labourers, the Workers' Union and the Scottish Farm Servants' Union, were appointed to determine what the minimum should be in the different counties. The work done by these trade unions in forcing up the minimum rates and in assisting their members to claim arrears of pay due to them under the Act, brought them in a large number of new members up to the time of the repeal of the Act and the disbandment of the wages boards in the autumn of 1921. The Trade Boards Act was also drastically amended in the following year, with the result of extending legal minimum rates, fixed by tribunals representing employers and workers, to between 50 and 60 new trades and stimulating trade union organization within these trades.

The only other development of importance to the trade union movement during the war was the revision, early in 1918, of the constitution of the political Labour party, which led to an extension of the political activities of the trade unions. Under the new constitution the trade unions were, as before, the main constituents of the national Labour party, but more attention than before was given to the organization of local parties in the constituencies, and a number of trade unions took part in the formation of local Labour parties or in adding a political wing to the activities of trade councils. Nearly every trade union had by this time taken a ballot of its members enabling it to establish a fund for political action, and the results of this were seen in the increased contributions, local and national, of trade unions to the Labour party, and the number of Labour candidates, supported largely by trade union funds, who stood in the general election of 1918. No trade union which has set up a political fund has applied that fund to the assistance of any other party than the Labour party.

After the Armistice.—Up to the end of the war no further development of special importance took place. The trade unions were

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chiefly occupied with enrolling new members, negotiating wage advances, dealing with fresh proposals for the "combing-out" of industrial workers for the army, and in other activities mentioned above. With the Armistice, however, a revival took place, and every trade union formulated a programme of advance. The programmes differed in individual cases. All included shortening of hours, consolidation of war advances into permanent wages, and the establishment of national or area minimum rates; and some added nationalization with workers' control, and full maintenance, by the industry or the State, for workers out of employment. The movement for shorter hours first took shape. During the war, the working hours in many industries had been reduced, generally to 48 or 50, and researches made under Government auspices had established the fact that long hours of work did not result in greater production. The Factory Acts, however, and other legal enactments governing the hours of work remained unaltered, and there was a general demand for the enactment of a universal 48-hour minimum for all labour, when, in Jan. 1919, a series of strikes in favour of a 40- or 44-hour week broke out in many of the industrial centres. These were suppressed, but almost immediately the trade unions began to put forward their programmes, of which the most complete was that of the Miners' Federation, which included a national advance of wages, a shorter working week, and a full scheme for the nationalization of the mines and their administration under boards composed of representatives of the Miners' Federation and of the Government. On this programme a national mining strike was threatened. There was also grave unrest on the railways and in the engineering industry, and a great industrial upheaval was generally predicted. To prevent this, the Government appointed the royal commission on the coal industry (the Sankey Commission) and also called together a large national industrial conference, representative of employers' associations and trade unions, to discuss necessary changes in the laws governing industrial conditions. The Committee elected by the conference (on which the unions in the Triple Industrial Alliance refused to serve), after long discussion, agreed upon changes relative to hours, wages, and the relief of unemployment. It had been understood that proposals agreed upon by both sides of the conference would be translated into legislation, and upon this basis the discussions had been held; but when the time for legislation came, fresh difficulties were discovered, and the legislation was never introduced. Finally in 1921 both sides of the conference, finding their efforts useless, tendered their resignations. Individual reductions in the hours of labour, however, continued to take place during 1919, but these had no legislative force. The Coal Commission sat in session for a long time, taking evidence from widely differing sources, and creating a great public sensation by the appearance for the first time of trade union advocates cross-examining the leading owners of mines and mining royalties. An advance of wages and a shortening of hours was recommended and became law in the summer. On the question of nationalization the Commission was divided; the members appointed by the Miners' Federation recommending the acceptance of the miners' programme, while the mine-owners' representatives declined to accept it. The chairman's report, recommending nationalization with a measure of workers' control, but conceding only a part of the miners' demands, was presented to the Government, which after some deliberation declined to accept it. The miners thereupon threatened a strike, and brought the matter up before the meeting of the Trade Union Congress in the autumn, but failing to obtain adequate promise of support from their fellow trade unionists by March, they decided to accept the situation. The Coal Commission was the first instance of a tribunal, equally representative of employers and trade unions, being set up under Government auspices to pronounce upon a particular dispute, and considerable disappointment was expressed in trade union circles at the Government's refusal to carry out its findings. The precedent was, however, followed in the Industrial Courts Act of the same year, under which the Minister of Labour was empowered to refer any dispute to an industrial tribunal similarly constituted. This Act was used by the trade unions in several instances, notably in the case of disputes at the docks and on the tramways, to obtain a public hearing of their claims. When the trade depression came, however, the Industrial Courts Act was not used. The employers preferred to present their demands for wage reductions direct to the trade unions, and the attempts of the latter to invoke the assistance of the Act were uniformly unsuccessful. During the year the trade unions continued to press forward claims for shorter hours, wage advances, and consolidation of war wages, and in most cases met with some meed of success. The exception was a strike of policemen in London and some other large centres for an increase of wages, which was met by the immediate dismissal of all policemen on strike, the disbandment of the National Union of Police and Prison Officials, and its replacement by a Police Federation under official auspices and prescribed in an Act of Parliament. The disbanded union, however, continued to exist as a rallying ground for the dismissed policemen. This is the sole occasion in Great Britain in recent years when membership in a trade union has been made illegal.

The railway strike of the autumn, which arose out of a wage dispute, was remarkable for the extensive counter-preparations made by the Government. The Government, as well as adopting for the first time the practice of inserting advertisements of its offers and arguments in the public press—a practice which was followed by the National Union of Railwaymen—organized an extensive system of road motor transport, and arranged for the enrolment of volunteers prepared to work on the railways. These preparations were repeated on a more extended scale in the spring of 1921, when a strike of the three unions composing the Triple Alliance was feared, and the Emergency Powers Act of 1920 very considerably strengthened the hands of the executive in dealing with a strike in an "essential industry." The establishment of the principle that the Government was immediately concerned in the case of strikes in "essential industries" to see that necessary services were carried on materially affected the position of the trade unions in those industries. The railway strike ended in a compromise under which the National Union of Railwaymen accepted rates of wages which rose and fell automatically with the rise and fall in the Government figure of the cost of living, a means of adjusting wages which had already been accepted in a number of other trades (*see* STRIKES).

Early in 1920 the unparalleled shortage of working-class houses led to the remarkable development known as the Building Guild movement. This was the most direct application yet seen of the industrial theories of the Guild Socialists (*see* GUILD SOCIALISM). A Government committee had previously estimated the shortage of working-class houses at five hundred thousand, but owing to the very high cost of building and materials, the dearness of credit, and the difficulty of recalling to the building industry the many operatives who had left it in the depression prior to the war, hardly any building was in progress. Under these circumstances, led by Mr. S. C. Hobson, a Manchester Guild Socialist, the building trade unionists of Manchester formed themselves into a Building Guild, and offered to build houses for the Manchester Corporation and other local authorities in Lancashire at cost price plus a percentage to cover office expenditure, incidental charges, and the cost of maintaining every member of the Guild at full wages in sickness, bad weather, or unemployment, thus putting into practice the principle, advocated by many trade unionists, that each industry should be responsible for the full maintenance of all its workers, whether or not there was work available for them at any particular moment. No profits of any kind went to members of the Guild. The credit of the local authority was to suffice for the purchase of plant and materials, many of which were in the first instance bought with the assistance of the Coöperative Wholesale Society. The tenders of the Manchester Guild were accepted in a number of instances, though the limitation placed by the Government on the total number of Guild contracts which could be placed by local authorities considerably restricted their field, and the example of Manchester was followed by over a hundred bodies of trade unionists in various parts of the country, including London, which in the following year united to form a single National Building Guild. The Government's restriction of their work upon public contracts led the Guilds to solicit work from private companies and persons, which in a number of instances was secured. Trade Union Guild Councils, formed for the purpose of inducing other industries to take up the idea, were set up in several districts, and the furnishing trade was among the first to follow suit. The particular interest of the Building Guilds, distinguishing them from other experiments in industrial self-government by the working-classes, lies first in the absence of profits, secondly in the principle of industrial maintenance of all workers, thirdly in its limitation to trade unionists, and fourthly in the coöperation of technical as well as manual workers, representatives of architects and surveyors being given a place on the Guild committees.

With all these various developments trade unions had attained an important place in social life by the end of 1920. But in that year the trade prosperity came to an end. The trades producing for export had been gradually losing practically the whole of their European markets owing to the financial collapse of a great part of Europe, and their workmen were discharged in large numbers. This in its turn reacted upon the home market; there was a sharp fall in wholesale prices, a general and rapid decline in trade, resulting in the total unemployment of between one and two million workpeople in the summer of 1921. As soon as the trade depression became apparent, there was a general move to reduce wages. The legislation confirming war rates of wages for a time had expired during the previous year, and the way was therefore clear for immediate reductions. In many of the minor trades, where trade unionism was weak, these were enforced immediately, the widespread unemployment inclining the workers to accept any reduction rather than run the risk of losing their employment; the well-organized trades were faced during 1921 with demands for wage reductions, of which that presented to the miners was the most important.

Council of Action.—One event of this period needs describing in some detail, because it was the most successful attempt of the trade union movement to intervene in foreign politics. The events in Russia, since the revolution of 1917 and the establishment of the Bolshevik Government in Nov. of that year, had been followed with great interest by trade unionists. More from sympathy with anti-capitalist Governments in general than because any but a few of its members were in agreement with Bolshevik theories, the Labour

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movement had for long opposed Allied intervention in Russia, and isolated protests, such as that of the dock-workers who refused to load a ship with munitions intended for use against the Bolshevik Government, had been made from time to time. When in the summer of 1920 it appeared that Poland, then at war with Russia, was likely to receive active help from the French and British Governments, the trade union movement rose in protest. The members of the Parliamentary Committee of the Trade Union Congress and the Executive Committee of the Labour party formed themselves into a Council of Action, called a conference of the governing bodies of all the important trade unions, and this conference announced to the Government that a general strike would be called if Great Britain were to enter the Polish war. It was obvious that the general feeling among trade unionists was entirely in agreement with this declaration, and the protest was successful. No active assistance was given to the Polish Government. After the emergency was over, the Council of Action, despite attempts to place it on a permanent basis, gradually ceased to function. During the crisis local Councils of Action, consisting generally of the trade unions affiliated to the local Trade Councils, or Labour party, were formed in most of the large towns. These also gradually lapsed after the crisis was passed (*see* SYNDICALISM).

Post-war Problems.—The Miners' Federation, during the previous year, after the failure of an attempt to force a reduction in the selling-price of coal—the first important instance of a trade union trying to interfere with the price of its product—had accepted a settlement under which wages varied nationally with the quantity of coal produced. As a result of this settlement, during the following months the quantity of coal produced was considerably above what could be disposed of at a profit. The Government then announced the termination of their control of the coal industry which had been exercised during the war, and of the subsidy which had been previously paid. The mine-owners therefore gave notice of a series of heavy reductions in wages, varying in the different coal-fields and amounting in some cases to 40 and 50%, and when the Miners' Federation refused to accept these reductions, locked the members out. A "sympathetic" strike of the other members of the Triple Industrial Alliance was announced, and the Government made extensive preparations, including the calling up of the army reserve and the enrolment of a national Defence Force under military discipline, for coping with it; but at the last moment the sympathetic strike was cancelled. The Miners' Federation, after a long struggle, was forced to come to terms, and to submit to large reductions in wages, varying from district to district, and thus their object of securing national minimum rates for mine-workers received, for the time at least, a severe set-back. The issue of the miners' case seemed to settle the fate of other industries. Few trade unions pursued their resistance to wage reductions to the length of ceasing work; and in fact wages in all industries were considerably lowered during the year. Nor were reductions confined to cases in which the rates were a matter of mutual agreement only; the Agricultural Wages Boards, which fixed the rates for the poorly-paid agricultural industry, were swept away on the repeal of the Corn Production Acts, and an attempt was even made to abolish the Trade Boards.

The result of this was to turn the attention of the trade unions from offensive to defensive action, from advancing wages and shortening hours, to holding as much as they could of what they had already gained, particularly in the matter of shorter hours, and from enrolling thousands of new members to keeping those they already had. It was to be expected that some of these would lapse; and there was a distinct fall in membership, particularly among the unions of unskilled workers and women, towards the end of the year. But the fall was considerably less in proportion than had been experienced in any previous period of bad trade, and in the newer unions of non-manual workers, whose members were less affected by unemployment, it was comparatively slight. There was also, of course, a depletion in the large reserve funds which had been built up during the war, when unemployment benefit and strike benefit were both at their lowest level. The new activities of trade unionism, however, were not curtailed as might have been expected. Trade unions continued to find money to pay the election expenses of Labour candidates; they continued to show interest in research and education, and one of the most important schemes, that for unifying working-class education under the Trade Union Congress, was actually passed during the first year of the depression.

Organization in 1921.—British trade unionism in 1921 presented a picture which at first sight appears exceedingly confused. There were upwards of a thousand trade unions, varying in membership from a score to several hundred thousand, and organized upon all manner of different bases, from the pure craft union to the "all-grades" union enrolling everyone, skilled or unskilled, in any industry; and these unions were united in many different federations and cross-federations. Only two or three hundred of these unions were of national importance, the rest being mainly survivals from an earlier date, or local societies organizing localized industries. Even among the larger unions, however, there were important diversities of scope and structure. The largest single unit, the Miners' Federation, was industrial in its character, embracing most of the workers in or about the mines. The Miners' Federation was also the most important instance of a trade union basing its branch membership upon the place of work of its members, most other trade unions, except the postal unions, adhering to the "locality" branch. Another large trade union on an industrial basis was the National Union of Railwaymen, though in this case two other bodies of some size, the Railway Clerks' Association and the Associated Society of Locomotive Engineers and Firemen, also organized certain classes of railway employees. Other industries in which industrial unions of this kind existed were the iron and steel trades, the transport trades, other than railways, the distributive trades, the agricultural industry, and the Post Office, though in all these cases there existed rival societies of considerable importance, in some cases claiming a section of the industry, such as in the case of transport, the sailors and firemen of the merchant service, in some cases such as the Workers' Union in agriculture, ready to embrace the whole. On the other hand, the second largest group, the Workers' Union, was an "all-grades" union open to any workman of any trade, and this form of organization was to be seen, in a somewhat less all-embracing form, in the other general labour unions, which were allied with the Workers' Union in the National Federation of General Workers. The third largest group, the Amalgamated Engineering Union, had yet another basis, being formed by a fusion of kindred craft unions in the engineering trades, open to skilled engineers in all industries, and making little claim upon the unskilled workers in the engineering industry proper. The same principle was to be noticed in the chief trade union of woodmakers and in the clerks' trade union. The confusion was, however, less than would at first sight appear, owing to the existence of federation. Thus the transport trade union was united with other trade unions in the transport industry, by means of the Transport Workers' Federation, a printing federation included the various trade unions in the printing industry, the textile federation most of those in the cotton industry, an engineering and shipbuilding federation those in the engineering and shipbuilding trades, whether they catered for skilled or unskilled workers and so on. Certain bitter disputes continued to exist, of which the chief raged between the National Union of Railwaymen and the engineering and woodworking trade unions over the workers employed in railway shops; but, speaking generally, most of the trade unions concerned with a single class of workers or a single industry, whatever their private disputes, were all represented in the particular federation, and had a means of acting together in case of emergency. This applied for the most part only to the manual workers' unions. The trade unions representing professional, technical and administrative workers were only in a few cases affiliated to the manual workers' federation. They had, however, federations of their own which occasionally entered into coöperation, and individual unions had sometimes close ties with those of the manual workers.

Larger groupings also existed. Of these by far the greatest continued to be the Trade Union Congress, to which all the important trade unions of manual workers and a few of the unions of brain-workers were affiliated. In 1921 an attempt was made to provide out of the Trade Union Congress a more efficient governing machine for the trade union movement by electing its General Council from various industrial groups, instead of, as heretofore, electing it by general ballot vote of the whole Congress. The experience of the Council of Action and of the miners' strike of 1921 had convinced many of the need for a central executive and direction. Trade unions, however, are slow to surrender their individual autonomy, and little but general powers were given to the new General Council at first, though an increase in affiliation fees provided it with additional funds. It was instructed to work in coöperation with the political Labour party in order to arrange for a separation of function between the industrial and political sides of the Labour movement, and for their coöperation in policy. Such separation and coöperation were long overdue. Owing to the much greater age of the Trade Union Congress, it had formed the habit of dealing with political questions long before the Labour party was founded, and continued to do so. It thus happened that the same items, both industrial and political, would appear for discussion both at the Trade Union Congress and at the Conference of the Labour Party, and this led to a great deal of useless overlapping, even apart from cases, such as the miners' demand for nationalization, which might be considered both industrial and political. At the same time the machinery for consultation between the two bodies was very inadequate, and it often happened that they would take opposite lines of policy. The new scheme of coöperation was intended to remedy these defects. An alliance between the trade unions, the Labour party, and the working-class coöperative movement was also frequently proposed, but was never consummated except on specific occasions, though the coöperative societies frequently rendered assistance to members of trade unions in disputes. There were also other general groupings of less importance. The General Federation of Trade Unions, once regarded as a body almost coequal with the Trade Union Congress, had gradually declined in power to the position of a strike insurance society covering about one-sixth of the trade union movement. The Triple Industrial Alliance was founded in 1915 by the Miners' Federation, the National Union of Railwaymen, and the Transport Workers' Federation, avowedly for the purpose of securing united action by those three bodies on industrial questions. At the time of its formation it excited a great deal of interest, and had it ever

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succeeded in functioning effectively it would undoubtedly have wielded immense power; but owing principally to lack of coördination between its three constituents, it never took effective action upon an important question, and its last failure to act in the miners' strike of 1921 destroyed much of its prestige among the trade unions. Locally the branches of trade unions were united in Trade Councils, which in some cases were separate from and in other cases united with the local Labour party. These Trade Councils, of which there were several hundreds in the United Kingdom, varied greatly in size and importance. In large towns—where the Trade Council could often trace its history as far back as the eighteen-sixties—it sometimes wielded important industrial and political influence, while in remote places it was little more than a rallying ground for a few trade union branches to discuss matters of common interest. The Trade Councils for the most part, being composed of trade union branches with little money to spare, suffered from a lack of funds, though in times of crisis these could be partly increased by means of local levies. Their functions were not generally defined. This meant in practice that they were limited by opportunity, and might include many types of activity, from the providing of a hall for local meetings or a local Labour weekly paper, to the temporary control of the whole life of a town during a general strike.

Ireland.—Irish trade unionism, in its later stages, needs separate treatment. Originally trade unionism in Ireland was a weak copy of the British model; but in the first decade of the twentieth century, it became imbued with ideas derived from the American Industrial Workers of the World. Under the leadership of James Larkin and of Connolly (executed after the Easter Rebellion of 1916) militant industrial unionism attained to great power. Its strongest exponent was the Irish Transport and General Workers' Union, which was the leader in the Dublin strikes of 1913, and subsequently went through a period of severe repression. It survived, however, and in 1921 was by far the largest constituent element in the Irish Trade Union Congress and Labour Party. The latter body, which adopted political as well as industrial functions in 1912, acts far more as a central executive for its affiliated societies than does the British Trade Union Congress. Affiliated to it are all the important Irish trade unions, with the exception of some located in Ulster, which are kept apart from it by political and religious differences. There are also affiliated a large number of Trade Councils (including the Trade Council of Belfast), which in weakly-organized districts serve as organizing centres, workers being invited to join the Trade Council until a branch of the appropriate trade union can be founded. This is an important respect in which the Irish Trade Councils differ from those of Great Britain. The Irish movement was strongly republican in its political policy, and had close relations with Dail Eireann on the one hand, and with the Irish agricultural coöperative movement on the other. Most of the Irish industries are organized in the Irish Transport and General Workers' Union, though in certain cases British trade unions have a large Irish membership. The most important of these are the railway and postal employees (organized respectively by the National Union of Railwaymen, the Railway Clerks' Association, and the Union of Post Office Workers, though a purely Irish Postal Trade Union also exists), the engineering, shipbuilding and woodworking employees in Belfast and Dublin and some other large towns, and some women workers, mainly in the east and north, who are organized in the National Union of General Workers. There are also separate Ulster unions, principally in the textile industries, but trade unionism in Ulster, especially in Belfast, is liable to be rent asunder from time to time by political and religious upheavals.

Legal Status.—There were few changes during 1911–21 in the laws relating to trade unionism. The most important of these was the Trades Disputes Act of 1913, which partially undid the effect of the Osborne Judgment. It provided that any trade union might take a ballot of its membership on the question of establishing a fund for political purposes. If a majority of the members is in favour of its establishment, contributions for political purposes may be levied, but no member can be forced to contribute to the political fund who does not wish to do so. In cases where there is a composite subscription, covering all purposes of the trade union, any member can reclaim that part of his subscription which would be devoted to political purposes. The political fund must in all cases be separately administered from the general funds. The Trade Union Amalgamation Act, passed in 1917, removed some of the previous legal restrictions on the amalgamation of trade unions by providing that, where a ballot is taken upon the question of amalgamation, it will be sufficient if fifty per cent of the membership votes, and if of those voting a majority of twenty per cent is in favour of it. Despite this Act, a number of amalgamations have failed owing to an insufficient total of votes having been recorded, and various devices have been adopted for getting round the difficulty.

Finance.—The finance of trade unions showed little change during the decade. Most trade unions slightly raised their subscriptions during the war, in about the same proportions, so that the unions of skilled workers have still a far higher subscription and provide on the average a larger number of benefits to their members than the unions of the unskilled. Again, most trade unions built up fairly large reserve funds during the war—which were considerably depleted during 1920–1,—but here again the increase was greater in the case of the skilled unions. All trade unions made large use of the levy, which is one of the most important elements of trade union finance. It is obvious that strike and unemployment funds, particularly strike funds, cannot be put upon an actually sound basis, so that in most trade unions the method is adopted, when a particular fund seems to be in low water, or some special object demands that an immediate sum of money be available, of imposing, generally after a ballot vote, a levy upon the whole membership. Thus, a trade union may levy itself to provide assistance to a particular branch or strike, or to another trade union, or to finance the *Daily Herald*, or for any other of a variety of purposes, and the practice of imposing levies frequently renders the obligation of a member to his trade union very much greater than would appear from the subscription rates laid down in the rule book.

AUTHORITIES.—The volume of publications on British trade unionism has increased very rapidly. Official statistics are to be found in the *Labour Gazette*, published by the Ministry of Labour, in the reports of trade unionism issued by the Board of Trade (not since the war), and in the reports of the Chief Registrar of Friendly Societies. Most of the available information will be found collected in the *Labour Year Book*. For the history, organization and theories of trade unions the standard works are *The History of Trade Unionism* (new edition, 1920) and *Industrial Democracy* (new edition, 1920) by Sidney and Beatrice Webb; *Trade Unionism* by C. M. Lloyd (revised edition, 1921); and *An Introduction to Trade Unionism* (1918) by G. D. H. Cole. All these contain full bibliographies. There are also special studies of trade unionism in particular industries. Of these may be mentioned *Trade Unionism on the Railways* (1917) by G. D. H. Cole and R. P. Arnot; *Village Trade Unions* (1920) by Ernest Selley; and *Women in Trade Unions* by Barbara Drake (1920). The standard work on trade union law is *The Legal Position of Trade Unions*, by H. H. Slesser and W. Smith Clark, and a smaller work by H. H. Slesser, *The Law Relat-*

The Progress of British Trade Unionism, 1910–9.

Industry	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919
Building and Woodworking	156,985	173,182	203,773	247,685	236,524	234,000	231,000	259,000	324,000	437,000
						66,000	69,000	83,000	96,000	125,000
Mining and Quarrying	731,370	752,527	757,351	914,989	912,577	844,000	884,000	944,000	992,000	1,069,000
Metal, Engineering and Shipbuilding	370,093	414,896	479,308	538,751	557,741	641,000	699,000	849,000	952,000	1,074,000
Textiles and	380,541	437,856	479,266	518,871	498,232	449,000	457,000	543,000	616,000	706,000
Dyeing, etc.						64,000	75,000	87,000	91,000	104,000
Clothing and	67,124	74,423	91,832	105,975	102,318	65,000	51,000	78,000	120,000	156,000
Boots and Shoes						49,000	72,000	81,000	91,000	107,000
Railways	116,214	185,513	202,329	326,192	336,671	385,000	425,000	499,000	530,000	624,000
Other Transport (land and water)	129,009	328,023	312,345	374,588	379,016	304,000	313,000	326,000	376,000	528,000
Printing	74,275	77,252	76,949	84,429	92,055	98,000	99,000	113,000	143,000	192,000
Agriculture and	69,171	176,211	187,831	331,234	366,539	26,000	29,000	59,000	130,000	203,000
General Labour						523,000	589,000	815,000	1,205,000	1,491,000
Others, including Pottery, Glass and Chemical						24,000	32,000	42,000	55,000	65,000
Food, Drink, etc.	303,039	349,154	434,515	485,477	488,190	36,000	35,000	36,000	46,000	63,000
Clerks, Shop Assistants, etc.						111,000	120,000	150,000	193,000	267,000
Teachers						129,000	134,000	143,000	167,000	183,000
Public Authorities						244,000	251,000	310,000	353,000	390,000
Miscellaneous Trades						96,000	104,000	123,000	163,000	260,000
Total number of members	2,397,821	2,969,037	3,225,499	3,928,191	3,959,863	4,388,000	4,669,000	5,540,000	6,643,000	8,044,000

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ing to Trade Unions (1921). For Irish trade unionism see *The Irish Labour Movement* by W. P. Ryan (1920).

By far the most important up-to-date source of information, statistical and historical, for other countries is the *Labour International Handbook*. See also G. D. H. Cole, *The World of Labour*. For Germany see *Trade Unionism in Germany* by W. Stephen Sanders (1916). For Russia see A. Losovsky, etc., *Trade Unions in Soviet Russia* (1920). (M. I. C.)

United States

From 1898 to 1904 craft unions in the United States grew in importance, and made substantial gains by aggressive action. In 1905 with a slackening of business prosperity came a loss of faith in trade unionism as the one sure solution of the problems of the working class. The American Federation of Labor had organized the skilled trades but the unskilled had been practically neglected. The crafts seemed unable to cope with the trusts and with an open-shop campaign which drew employers together. Attempts were made to capture the American labour movement for a more radical class struggle. In 1905 the Industrial Workers of the World were organized. A movement to organize the building trades into an industrial union was resisted by the American Federation of Labor, but resulted in the establishment in 1908 of the Building Trades Department of the Federation. In 1909 the United Mine Workers announced their championship of the principle of collective ownership of the means of production. In 1911 the machinists followed. From 1903 we find increasing tendency toward concerted movements of the railway crafts. In 1908 the Railway Employees' Department was formed in the American Federation of Labor to include all the railway unions affiliated with the Federation. In 1916 the four railway brotherhoods, not affiliated with the Federation, acted together to demand the eight-hour day. In 1912 the national convention of the Federation voted down the minority report of the Committee on Education in favour of the principle of industrial unionism, 72 for and 264 against; voting strength, 5,929 for and 10,983 against. The two miners' unions voted solidly in favour of the change. Others in favour were the bakers and confectioners, iron, steel and tin workers, printing pressmen, railway carmen and journeymen tailors. In 1912 labour was weak economically but strong politically, due to its support of the Democratic party, then coming into power. Public hearings before the United States Commission on Industrial Relations in 1914 brought industrial conditions into the light of public opinion; for the first time a commission representing the Government not only pronounced the trade union movement harmless to the best interests of the country, but gave its unqualified approval to labour organization as an institution indispensable in a democracy. The return of business prosperity in 1916, coincident with the sudden decrease of immigration, gave labour a new economic advantage. In 1917 the Government asked and won coöperation of organized labour in producing military supplies. Organized labour was given recognition on Government committees, and the policy of boards which represented the Government in its relations with its employees was to recognize trade union standards of working conditions. The leadership of the American Federation of Labor was strengthened by the attitude of the Government; possibly it was weakened by the fact that the War Labor Board dealt with groups of disaffected workers in the local unions rather than with the national officers, and so made for decentralized control in the unions. After the Armistice labour was again on the defensive, and the increasing number of the unemployed were more ready than they had been to listen to the philosophy of the radical, who can always promise a steady job and a pay envelope every week in the Utopian state. The membership in the relatively conservative American Federation of Labor increased nearly threefold between 1910 and 1920. In 1910 there was a paid-up membership of 1,562,112; in 1915 1,946,347; and 1920 4,078,740. If we include also the membership of organizations suspended from the Federation, the total for 1920 was 4,509,213. Outside the Federation are the four brotherhoods of railway employees with a membership of over 400,000, the Amalgamated Clothing Workers, 200,000, the Amalgamated Textile Workers, 40,000; and other smaller independent organizations. There are five industrial departments in the American Federation of Labor—building trades, metal trades, railway employees, union label trades, and mining. The six largest of the affiliated unions are the United Mine Workers', the Carpenters' and Joiners', the Machinists', Electrical Workers', Railway Carmen, and the Ladies' Garment Workers.

The National Women's Trade Union League of America was founded in 1903 for the purpose of investigating and giving publicity to conditions of women in industry, and to undertake educational work for wage-earning women, to promote labour legislation and improved labour standards, and to aid trade unions in organizing women. The League stands also for the eight-hour day and the 44-hour week, for a living wage, and for equal pay for equal work regardless of sex. The League is indorsed by the American Federation of Labor and the Canadian Trades and Labour Congress and is represented at their conventions by fraternal delegates. It claims 600,000 trade union women, and has also a large membership of men. It publishes *Life and Labor*, and maintains a training school for organizers. Its headquarters are in Chicago.

The decade 1910–20 saw a movement develop to unionize the teachers as a trade group. The first teachers' union was organized in Chicago in 1902, following the failure of the Teachers' Federation to gain consideration from the school board. As the board insisted that it had no money to pay a "living wage," the teachers investigated city finances, and found that many wealthy corporations had been evading taxes due to the city. In the struggle to force the payment of taxes the teachers received aid from organized labour. Then, at the invitation of the Chicago Federation of Labor, the teachers affiliated with that body. In 1916 the Board of Education dismissed those teachers who had been prominent in trade union activity. In order that these teachers might be reappointed, the union withdrew from the city Federation of Labor. In 1914 the teachers of Cleveland voted to affiliate with the American Federation of Labor, but were prevented by the Board of Education. In 1916 teachers' unions in a number of cities united to form the American Federation of Teachers and affiliated with the American Federation of Labor, but forbade recourse to strikes. The official publication is the *American Teacher*. The first trade union of librarians in the United States was formed in New York City, in 1917, to demand salary increases and a regular system of promotions. In 1918 the Boston Library Employees' Union was organized and affiliated with the American Federation of Labor. Union organizers were active without success at the 1919 and 1020 conventions of the American Librarians' Association.

Trade Agreements.—The economic strength of trade unions is crystallized in trade agreements. Such expression of a joint partnership of Capital and Labour to stabilize industry on the basis of an accepted law is typical of the American labour movement. The earliest national agreement in the United States was that of the iron puddlers in 1866. A national agreement of the stove moulders established in 1891, providing for peaceful adjustment of disputes which might arise, continues in force. In 1897 a general strike in the central competitive district of the bituminous coal-mining industry led to an agreement between the operators and the United Mine Workers' Union. In 1902 the president of the union refused to join in a sympathetic strike on behalf of the anthracite strikers because such action would be disloyal to the agreement. For more than 20 years the International Typographical Union had been arbitrating disputes with the publishers of newspapers. At the convention of the National Publishers' Association in 1900, three publishers were chosen as a committee to deal with labour, to represent, however, not the whole convention, but only those employers who had favoured the measure. Contracts between individual employers and the union had been made prior to this time. This committee effected an agreement with the Typographical Union, to be in force from May 1901 to May 1902, which provided for local boards of three persons, one to represent the publisher, one the union, and the third to be chosen by these two. The board was to decide all disputes in its territory, the *status quo* to prevail until an award should be made. If either party should be dissatisfied with the decision, appeal might be taken to a national board, composed of the publishers' labour committee and the president of the Typographical Union. If they failed to agree, an impartial person was called in. A majority decision was then binding on both parties. In 1902 the agreement was renewed for a five-year period, and again in 1907, revised to

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eliminate the impartial person from the adjustment boards, and to reorganize the final arbitration board to consist of three members of the employers' committee and three from the executive council of the union. By the end of 1912 the American Newspaper Publishers' Association had in operation a total of 416 individual arbitration contracts: 217 with the Typographical Union, 108 with stenographers' unions, 47 with mailers' unions and 44 with photo-engravers' unions. A fourth national agreement, 1912–7, made local settlements compulsory, since the business of the national board had been impeded by the number of the cases. In 1917 the agreement was renewed until 1922.

In the book and job printing industry the development of central government in 1919 added new features. Coöperating to preserve industrial peace there are four groups of closed-shop employers, united in a national association, and five trade unions, centralized for concerted action in the International Allied Printing Trades Association. In Feb. 1919 representatives of both sides met to discuss coöperation. In April they agreed upon a draft of an International Joint Conference Council, international since Canadian publishing companies were included. The Council was composed of four trade unionists and eight employers; each union representative had two votes. There was no impartial member, two joint chairmen sitting together—a trade-union president and an employer. Meetings were to be held usually every other month, in different places. Resolutions were to be passed unanimously by the Council and accepted by all the organizations represented, after which they were to become law for all member shops in the United States and Canada. Enforcement was left to the executives of the individual organizations. The Council drafted an arbitration code to be used by the members. The Council itself did not settle disputes. Its work has been to give its approval to a general labour policy, expressed as "five cardinal points." It adopted for its slogan "Stabilization and Standardization." The agreement provided that wages should be reviewed semi-annually, should be based on the cost of living and the economic conditions of the industry, to provide at least a living wage; also that employers should introduce a uniform system of cost-keeping, and that voluntary agreements should take the place of strikes and lock-outs. Economic conditions in the industry and cost of living having been determined by scientific investigation, the actual fixing of wages was left to bargaining between the two parties. The unions agreed not to work for employers who did not operate their business under the standard cost-keeping clause, and the employers agreed to employ only union labour. In March 1921 employing printers not members of the Joint Conference Council formed the 48-Hour League of America and called for the abolition of the Council.

Perhaps the most remarkable change brought into any industry by trade union efforts is in the clothing industry, where "sweated" workers have been able to build up a system of industrial government respected by their employers. In Nov. 1909 discrimination against union members by employers led to a general strike of the shirt-waist makers of New York. More than 25,000 girls walked out. Other grievances were: the long overtime worked in the rush seasons, followed by long periods of unemployment; low wages, fines, and subcontracting. The employers formed themselves into a Mutual Protective Association. The police prevented picketing. This aroused public interest in favour of the strikers. The employers individually came to settlement with the girls. The workers gained better conditions, and the principle was inaugurated of adjustment of grievances between employer and representatives of the workers. During the same month, Feb. 1910, which marked the conclusion of this strike, 7,000 shirt-waist makers in Philadelphia struck for concessions similar to those secured in New York. The strike was short; the chief result was a plan for settlement of difficulties by adjustment in the shop, or by appeal to a permanent arbitration board of representatives of the union, the employer and the general public, and a promise not to discriminate against union members. The wage scale was to be fixed for each shop by a committee of that shop.

In July 1910 the cloak and suit makers struck in New York City, 45,000 strong. Their grievances were low wages, the system of subcontracting by which a few of the employees received wages from the employer directly, and engaged their own helpers, whom they "sweated" for a pittance. The strikers also demanded a 49-hour week with double pay for overtime, the installation of power sewing machines, and the closed shop. This last point was the most strongly contested by the employers. Finally a conference was held, with Louis D. Brandeis as chairman. He urged that the strikers modify their demand for the closed shop to one for the "preferential union shop." After some further dispute an agreement on this basis was signed in Sept., which also pronounced in favour of the abolition of home work and subcontracting. But the most notable feature of the agreement was the provision known as the "protocol," which established three joint boards to administer labour conditions in the future. The Board of Grievances, of two representatives from each side, was to take up differences of opinion between employers and employees, and to settle any disputes which might arise. Disputes which could not be settled in this way were to be carried to the Arbitration Board, made up of one representative from each side and an impartial member. The Board of Sanitary Control consisted of two representatives of the employers, two of the union and one for the public, this impartial member to be appointed by counsel for the two sides. This Board determined a standard of sanitation for the shops. "Health strikes" to enforce the findings of the Board were permitted in shops remaining in any condition condemned. These three boards were financed jointly by the employers and the union.

In Oct. of the same year (1910) the men's clothing workers struck in Chicago, to demand shorter hours and higher wages and some method of adjusting grievances. After 19 weeks the strikers, beaten, went back to work but the important firm of clothing manufacturers, Hart, Schaffner & Marx, made an agreement with their employees which established a permanent arbitration board of one representative from each side. There was no impartial member until one year later, when a Trade Board of 11 members was instituted to settle the minor matters which were impeding the work of the Arbitration Board. The impartial chairman of the new board also presided at the old. A third part of the machinery was composed of the individual shop committees which met with the labour managers (employers' representatives) to try to smooth out grievances before bringing them to the Trade Board. In 1913, when the agreement was renewed, provision for the preferential union shop was added.

In Jan. 1913 several trades of the ladies' garment workers struck and secured an extension of the protocol plan to cover a larger number of the trades. A strike in Boston led to its introduction there. The Joint Board of Sanitary Control was extended to cover other ladies' garment workers and also the fur workers of New York. Medical supervision features were added, with individual examinations and preventive work. Early in Jan. the men's garment workers of New York also struck. The president of the United Garment Workers' Union submitted the dispute to arbitration. Many of the members were dissatisfied, and a plan was made to put a new union leader in office at the next national election. When the convention met in 1914, many of the more aggressive delegates found themselves debarred by the committee on credentials. The insurgents retired to another building, held a rival convention and elected officers. The union membership throughout the country was divided in its allegiance to the two groups of national officers, the overall and union label shops clinging to the old leadership, but the mass of the men's and boys' clothing workers acknowledging the new, although for this they were branded as "secessionists" by the American Federation of Labor. During a strike at this time in Baltimore the cutters remained subordinate to the old leaders, the tailors were led by the new, who managed to continue the strike to victory, although without strike funds. The new leaders then organized their forces throughout the country under the new name Amalgamated Clothing Workers of America. This organization, while retaining the craft divisions, adopted industrial unionism as its working principle. The preamble stressed the aggressive character of the new union and the part it hoped to play in the "class struggle"; also the importance of education of the members.

In 1915 the new organization carried on and won two general strikes: a short one in New York, and one of four months' duration in Chicago, which cost the union over $40,000, and was finally lost through exhaustion. But the spirit of the workers was not broken. The year 1916 was marked by disputes in the clothing trades throughout the country. In New York the Manufacturers' Association abrogated the protocol in the cloak and suit trade. After a two months' lock-out and a general strike of 60,000 workers an agreement was made according to which grievances were to be adjusted by direct negotiation between union and employer. The Joint Board of Sanitary Control continued through the period of the strike. Protocols were established in the garment trades in Boston and Philadelphia. The Board of Standards of the dress and waist trade opened a test shop to time and standardize the operations.

In 1917 the Amalgamated Clothing Workers of America led other unions in establishing the 48-hour week by strikes in the different clothing centres. In 1918 they led with the 44-hour week. At the same time the industry in New York adopted an agreement for industrial government similar to that which had been introduced by Hart, Schaffner & Marx in 1910. In Feb. an impartial chairman took up his post. Studies were undertaken by both the union and the employers' association to ascertain the changes in the cost of living relative to wage increases, and an award was made of wage increases varying from 10% to 12·5%. Introduction of the 44-hour week followed in the other clothing centres. The financing of the New York strike by the union, except for contributions of $11,000, was viewed as a notable achievement for workers who until recently had been "sweated" and ill paid. Other firms in Chicago followed the example of Hart, Schaffner & Marx, and similar arbitration agreements were introduced also in the clothing centres of Baltimore, Boston, Rochester, Montreal and Toronto. An attempt of the A.C.W.A. to organize Cincinnati was as bitterly opposed by the old union as by the employers. In Rochester and Chicago, where the work is done in factories, the agreements still held in May 1921. But in New York and Boston, where most of the work is let out to contractors, the impartial machinery broke down in the autumn of 1920; it could not weather the period of industrial depression. The union in New York then went on strike to force the reinstatement of arbitration machinery. By the end of March 1921 the locals of

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the A.C.W.A. had raised $930,244.54 toward the strike fund. The arbitration plan was renewed July 1921.

In the spring of 1919 during a strike in Lawrence, Mass., the Amalgamated Textile Workers of America were organized. A resolution of the executive board in April 1920 to affiliate with the Amalgamated Clothing Workers was favourably received by the latter in their convention in May. The constitutions of the two organizations are similar. The membership of the A.T.W. in Jan. 1921 was 40,000; that of the A.C.W.A. 200,000. In 1920 the Amalgamated Clothing Workers and the Ladies' Garment Workers were drawing together and affiliation was discussed.

Shop Unions.—In recent years some employers have offered substitutes for trade agreements with organized labour. The Colorado Fuel & Iron Co. recognized committees of its employees as a part of the welfare plan of 1915. In 1918 the Standard Oil Co. introduced a system of conferences with representatives elected by the employees. Committees on health, safety, sanitation and housing were formed, and individuals might present grievances through their representatives. By the summer of 1919, 160 companies in the United States had shop committees in their plants. In some plants elaborate industrial governments have been developed; the best known are those in the Filene store in Boston and the Leitch plan named after its originator, John Leitch of Philadelphia, and modelled on the checks and balances of the U.S. Government. Some employers associate the workers with themselves by profit-sharing and bonus plans. Others offer a "forum" in which workers may meet with the managers to discuss the problems of the business. One firm expressed the hope that the purchase of stock by employees would save it from the dictatorship of absentee financial control.

In 1918 the attention of managers was called to the high cost of the labour turnover. Employment departments were instituted. In the course of placing and training the worker and securing his honest effort in production, and in organizing the working force for the safety movement, the science of personal management has been evolving. Persuasion takes the place of coercion or bargaining. The old "scientific management" introduced in 1911 by Frederick W. Taylor, an engineer connected with the Midvale and later with the Bethlehem Steel Co., looked upon the individual worker as a producing machine; effort to increase earning power was the only human reaction expected from him. The new scientific management obtains production through group action, by a general consensus of opinion in the shop. The labour problem is no longer left solely to the production engineer, who has been trained to deal with the forces of nature, but is given to a new official, a psychologist, the labour manager. The labour department is not responsible for getting out the product, but for building up a permanent and dependable labour force.

Criminal Unionists.—On Oct. 1 1910 the office of the Los Angeles *Times* was blown up and 21 people were killed. On the same night bombs were found in the homes of the publisher of the *Times* and of the secretary of the Merchants' and Manufacturers' Association. On Dec. 25 the Llewellyn Iron-Works, also at Los Angeles, were dynamited. In May 1911 William J. Burns, a detective, secured the arrest, in Indianapolis, of John McNamara, secretary of the International Association of Bridge and Structural Iron Workers, his brother James, and Ortie McManigal. The men were taken to Los Angeles, where they were found to be responsible for these and other dynamite outrages in various parts of the country. McManigal confessed to dynamite plots involving also the McNamaras and others, and the brothers pleaded guilty to blowing up the *Times* building and the iron-works. The criminals were formally repudiated by the American Federation of Labor. An investigation by a Federal grand jury of the dynamite plots led to the indictment of 54 men, many of them officers of the Bridge and Structural Iron Workers. They were tried and 38 were found guilty. Burns was arrested for kidnapping, but acquitted. In June 1916 14 business agents of the Painters' and Electrical Workers' unions of Chicago were found guilty of extortion. The evidence showed that contractors and merchants had been compelled to pay sums ranging from $50 to $200 under the threat of damage to their property. In Nov. 1920 an investigation into the high cost of building in New York City brought to light a conspiracy among dealers in material, building contractors, bankers and labour bosses to keep up the bids for construction work. The labour leader implicated and convicted was President Brindell of the Building Trades Council.

The Industrial Workers of the World, commonly spoken of as the I.W.W., were organized in June 1905 at a convention in Chicago of 203 persons, representing over 40 groups in the working classes. Among the sponsors were the leaders of the Western Federation of Miners, the remnants of the American Labor Union (made up of workers from different industries, but chiefly railwaymen), and the Socialist Trade and Labor Alliance, known to be the economic arm of the Socialist Labor party. The originators of the new association felt that a labour union based on craft autonomy, such as the American Federation of Labor, could not succeed in the struggle of the workers against capital. For success, "one big union," the industrial workers massed in a single army, was felt to be necessary. Moreover, it was thought advisable to get the working class organized beforehand and accustomed to working together in "the same groups and departments and industries that the workers would assume in the working-class administration of the Coöperative Commonwealth." The aim of the new organization, as intended by the founders, was first to provide a new central body in which the existing trade unions, consolidated into industrial unions, could be associated; and second, to organize and add to this nucleus the great mass of the unorganized, unskilled and migratory labourers. The philosophy of the movement, as expressed in the constitution adopted, was that "the working class and the employing class have nothing in common; there can be no peace so long as hunger and want are found among millions of working people and the few who make up the employing class have all the good things of life"; the wages system must be abolished, and the capitalistic form of society must become extinct. This was to be accomplished by direct action; the final solution of the class struggle would be by the "social general strike," when the toilers would "take and hold" that which they produce by their labour. "There is but one bargain that the I.W.W. will make with the employing class—complete surrender of all control of industry to the organized workers." Some of the leaders insisted that political action should be discouraged as useless. This led to the split, in 1908, between the western, or direct-action faction, known as the Chicago branch, and the parliamentarian or doctrinaire group, represented by the Socialist Trade and Labor Alliance, led by Daniel De Leon of New York, which became known as the "Detroit Branch," until in 1915 it took the name of Workers' International Industrial Union. Its official publications are *The Weekly People*, *Industrial Union News*, and *The Socialist*. The Chicago direct-action branch, exclusively claiming the name Industrial Workers of the World, was led by W. D. Haywood. After being sentenced to prison (see below) Haywood fled to Russia in April 1921, leaving the office in Chicago in charge of Roy Brown. Their organs are *One Big Union Monthly*, *New Solidarity*, both published in Chicago, and *The Industrial Worker*, Seattle. Before 1917 they published seven papers in foreign languages. After the war the organization issued 19 publications in 13 languages. The I.W.W. have amended their original constitution to omit the clause calling for political action. At its origin the I.W.W. spoke hopefully of sweeping the working class into its ranks; at the end of its first year it had a paid-up membership of 14,000; in 1907, before the split, of less than half that number; in 1912 the Chicago branch reported 18,387; in 1913 14,851; in Jan. 1917 60,000; on Oct. 1 1919 100,000. The general office had issued 500,000 membership cards to that date. One department, the Agricultural Workers' Union, reported 18,000 members enrolled between April 1915 and Nov. 1916. The turnover between 1905 and 1915 was very high, both as regards members and local unions. In 1915 7·5% of the enrolment had remained in active membership. By 1918 only one-fifth of the number of locals which had been chartered were in existence. The greatest loss was in 1907 when the Western Federation of Miners left the I.W.W. In 1911 it affiliated with the American Federation of Labor, and in 1916 became the Mine, Mill and Smelter Workers' International Union.

The I.W.W. claimed leadership in the McKees Rocks, Pa., strike in 1909, and in the "free speech fights" at Spokane, Wash., and Fresno, Cal., in 1909, San Diego, Cal., in 1910, and Everett, Wash., in 1916. In 1907 the leaders Haywood, Moyer and Pettibone were accused of the murder of the ex-governor of Idaho; they were arrested in Colorado without warrant, carried to Idaho, imprisoned and finally tried. They were acquitted. In 1912 the I.W.W. leaders helped carry on strikes at Lawrence, Mass., and at Paterson, N.J. (*see* STRIKES AND LOCK-OUTS). They were active among the lumbermen in Louisiana. In 1914 they organized the migratory labourers in the harvest-fields, lumber workers, miners and construction workers. In the spring of 1917 the lumbermen of the extreme north-west struck; soldiers rounded up the pickets and threw them into a stockade. By July 50,000 lumbermen were on strike, demanding an eight-hour day and better housing. The I.W.W. were considered responsible for trouble among the miners in Arizona in the summer of 1917 (*see* STRIKES AND LOCK-OUTS). On Sept. 5 1917 I.W.W. offices throughout the country were raided by the Department of Justice, and their property seized. A few days later most of the officials were arrested. The grand jury in Chicago indicted 166 members for conspiracy to interfere with the nation's war programme. Over 1,000 members were arrested; aliens among them were held for deportation. At the trial in Chicago in Aug. 1918 97 of the accused were industrial workers, four were journalists and organizers. Ninety-eight were pronounced guilty, and 93 were sentenced to imprisonment of from 10 days to 20 years. Haywood received 20 years' imprisonment and a fine of $10,000. He appealed, and was released on bail. The sentence was confirmed by the U.S. Supreme Court in April 1921, but, as stated, Haywood had escaped to Russia. At about the same time 46 reputed members of the I.W.W. were arrested in California under the Espionage Act. Others were added to their number. The indictment was added to six times. The defendants believed that the trial was a mere formality, and sat silent throughout the proceedings without offering a defence. They were found guilty and severe sentences were passed. Five of the defendants died in jail. In 1917 the lumber workers substituted "sabotage" for strikes. They would work for eight hours and then quit in a body. If anyone was discharged the whole crew quit. In Nov. 1917 the Construction Workers, an international union of the I.W.W., attempted to hold a convention in Omaha; all attending

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delegates were arrested and held in prison some time before they were indicted. In Dec. 1918 those who had not been released were allowed to give bond. In the winter of 1917–8 local secretaries of the I.W.W. at various places were tarred and feathered. In Tulsa, Okla., 11 members had this treatment. At Red Lodge, Mont., two members were tortured in the basement of the courthouse.

As organized in 1905 the I.W.W. had 13 industrial divisions, each composed of a group of allied industries grouped together for administrative purposes; also certain locals of mixed occupation. Boundaries of jurisdiction are by industry, not craft. The organization is centralized in a General Executive Board, with power to call strikes and a referendum on agreements between local unions and employers. All acts of the Board may be appealed to the General Convention, and decisions of the Convention are subject to a referendum of the general membership. Local matters are to be settled locally. As amended at the tenth convention, in 1916, the unit of organization became the industrial union instead of the local union; each industrial union to have its own by-laws. Five or more branches in any locality form an industrial union district council. Industrial departments are also provided for by the constitution. There is also the general recruiting union, which takes in the workers from any industry not yet sufficiently organized to have its own industrial union. The only national officers provided by the constitution are the general secretary-treasurer and a general executive board of seven members. Each industrial union has a secretary-treasurer and an executive board of five members. Only wage-earners are eligible to membership in the unions. No officer of the I.W.W. may run for political office without a referendum vote of the entire membership. Since 1919 no officer may hold his position for two consecutive years, but must return to his industrial work after one year of office.

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TRAINING CAMPS, MILITARY.—I. UNITED KINGDOM.—One of the lessons learnt from the Crimean War was the necessity for having troops of all arms quartered in close proximity to one another, and to some open area of ground where they could be trained, both separately and in combination, in military exercises. Two such training centres were then chosen, one at Aldershot in England, the other at the Curragh (Kildare) in Ireland. At these two places in 1855 arrangements were started for the construction of training camps. At Aldershot a scheme was also carried out for permanent barracks for one cavalry brigade, one infantry brigade (of three battalions) and for three batteries each of horse and field artillery. These barracks were afterwards known as Wellington Lines. Besides these permanent barracks, the scheme provided for two hutted camps, known as North and South Camps, accommodating each four battalions or their equivalent. The total accommodation, therefore, in the Aldershot of the period was one cavalry and three infantry brigades, with a proportionate number of artillery, engineers and departmental corps, about 10,000 men at most. The work begun in 1855 was finished in 1858–9.

At the Curragh the camp was designed for 10,000 men in 10 squares, each intended at first for two battalions of 500 each. The squares each consisted of a double row of huts grouped round a common parade ground, the men's quarters being at the sides in huts holding 25 men each, the officers being quartered at a third side in huts holding eight officers in each, and the fourth side of the square being taken up with regimental accessory buildings. This was the original plan, but it was very soon found that it would be better to have each square allotted to a whole battalion and to use the spare huts as married soldiers' quarters, and for increased accessory accommodation. The quartering of two regiments together in the same square, especially if these were of Irish militia, for even a short period of training, was not entirely free from disciplinary trouble.

There was a good deal of misgiving at the time as to the wisdom of providing temporary huts such as these and not permanent barracks. The embodiment of the militia, during the Crimean War, pressed for a larger amount of accommodation than the barracks existing in the country could provide, and the need of training units of troops together was also an urgent matter. Tents, no doubt, were thought of, but the view prevailed that these would be insufficient to provide shelter in the climate of the British Isles for any lengthy period. The difficulty of obtaining materials of a permanent nature, and of getting the quarters erected with sufficient rapidity, except by the use of temporary materials, were, no doubt, the military considerations which led to the decision to build huts, and these coincided with the natural desire on the part of the Treasury authorities to get the work done cheaply. At the time, it was not expected that the huts would last for more than a few years, though as a matter of fact some were in occupation 50 years afterwards.

There were other similar hutments on a small scale at Shorncliffe and Colchester, on exactly the same lines as those at the Curragh and Aldershot.

The huts themselves were built of wooden framing, resting upon dwarf walls of brick, longitudinally and transversely. They were roofed with boarding, covered with tarred felt. The walls were of wooden weather boarding painted, and the lining of the huts was plain boarding, or (in the case of officers' huts) rough canvas papered. The lighting was by windows, much smaller than would now be considered sanitary, and after dark oil lamps were used. Small stoves burning coal were used to heat the buildings, the stovepipes passing through the felted roofs. The water supply, in the case of the Curragh, and of the South Camp at Aldershot, was obtained from wells and reservoirs on War Department land. It was led to open ablution sheds, and as these were fairly near the barracks, the men had no greater difficulty than in a tented camp, in their ablutions. But anything in the shape of baths or hot water was unknown. The latrines were at first on the bucket principle, but very soon after the camps were taken into use, trough latrines with water flushing were adopted. The sewage was treated in a sewage farm at a little distance from the camp, both at Aldershot and the Curragh, the drains leading to it being brick culverts of a type now condemned.

It is of course very easy with our modern knowledge to criticize all this, but the main points of the policy were sound, viz., proximity to open manœuvre ground, and to rifle ranges, the grouping of units and the accommodation of those units in small buildings, both because a small building is more easily adapted to some other use than a large one (when change of policy necessitates reappropriation) and also because it is more easily isolated in case of fire or infectious disease. In this respect the same policy was continued in the great hutting programme of 1914–6 in England, as opposed to the American plan of having large two-storey huts containing each upwards of 100 men.

No hutted camps were built in England again until the S. African War of 1899–1902. Some demands came from S. Africa for hutting material, and huts of corrugated iron roofs and walls, lined with boarding, were accordingly designed and sent to that country. Similar huts were built at several of the new stations at home, which had come into being with the increases to the army authorized in 1899, *e.g.* Deepcut, Blackdown, Bordon, Longmoor and Ewshott in the Aldershot area, Bulford on Salisbury Plain, Kildare in Ireland, and regular summer camps such as Okehampton, Glen Imaal, Kilbride, etc.

When the World War broke out in 1914, a demand arose once more for training centres, and the problem of hutments had again to be dealt with. The types of huts adopted are described in the article BARRACKS AND HUTMENTS: it is here proposed to deal with (A) the principles on which sites were selected; (B) the system of grouping the typical designs so as to form suitable unit hutments; (C) the grouping together of various unit hutments, and (D) the accessory services incidental to such groups of hutments.

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(A) *Selection of Sites.*—During the war it was laid down by the General Staff that no sites for important training centres in Great Britain should be situated within 50 m. of the E. coast. As the whole of E. Anglia comes within this limit, this excluded a useful part of England which otherwise might have been utilized. The same objection applied to certain parts of Yorks. and Lincolnshire. It was also desirable not to choose sites near the main lines of railway leading to the principal ports, which had already important and increasing traffic, dealing with supplies and munitions. Consequently, the more westerly parts of England were mainly examined for suitable sites, the most important being in W. Yorks., Staffs. and Shropshire. There were also one or two large camps in Wales.

From the training point of view it was imperative that there should be open ground available at all times of year, for manœuvring and field works, and suitable positions for rifle ranges, for bombing practice, entrenchments and other similar instruction. From the medical point of view it was desirable that the soil should be gravel or chalk (though clay was not an insuperable objection), that there should be good drainage, and generally healthy surroundings, that the water supply should be ample and either pure or capable of being purified. From the supply point of view, besides the obvious importance of being able to issue supplies easily, it was essential that there should be ample means of communication by rail or water or both; that while the site should not be on a main line of railway so as to impede other movements, it should not be far away from existing railways. From the engineer's point of view, besides traffic facilities, it was desirable that materials should be easily procured, water abundant, labour not unreasonably difficult to obtain and supervise, and, if possible, some already established local system of waterworks, drainage works, or electrical power in which, by agreement, the camp might be a partaker.

These requisites are given in the order of importance, but in making the actual selection, perhaps less attention than was wise was paid to the third section, in some instances. Thus Salisbury Plain is an excellent training ground, but it was in the autumn of 1914 already congested with troops, and to initiate the construction of an additional large cantonment there was courting trouble.

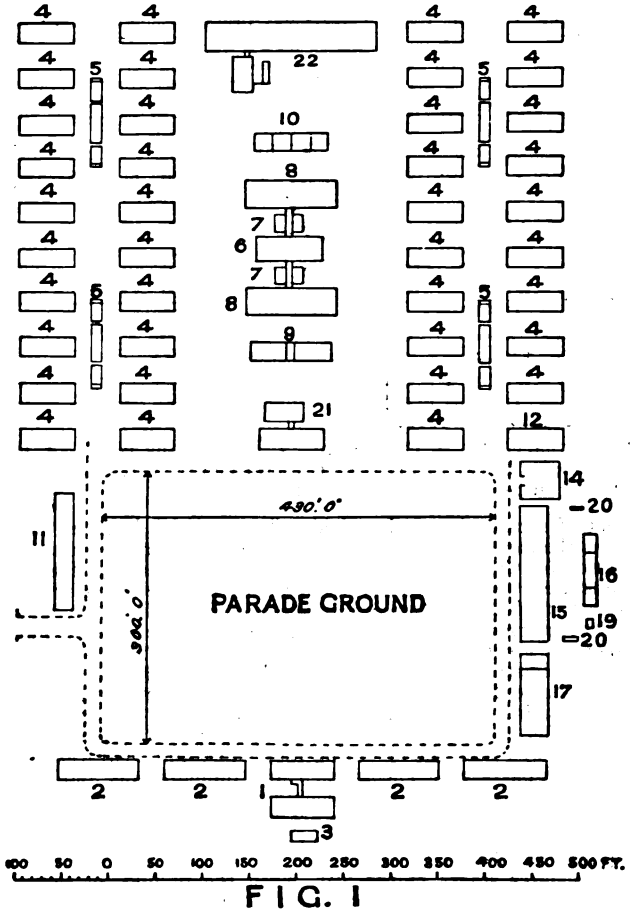

FIG. 1

The Wylye Valley near Salisbury had a number of good sites for small tented camps, and it was situated close to good training ground, besides being healthy and easily drained, but not one of these camping grounds could take more than a brigade, and consequently the two divisions which were quartered there had to be in scattered groups along a line some eight miles in extent, with great subsequent trouble in providing supplies and in administration generally. The above experience indicated that (*a*) divisional camps were the most satisfactory, if the requisite space could be found for them; (*b*) camps of two divisions were possible and good, but a larger number made the problem of administration unwieldy; (*c*) it was best not to construct the huts upon the actual training ground (as the area of such a cantonment absorbed too much of the useful training space available), but that they should be as

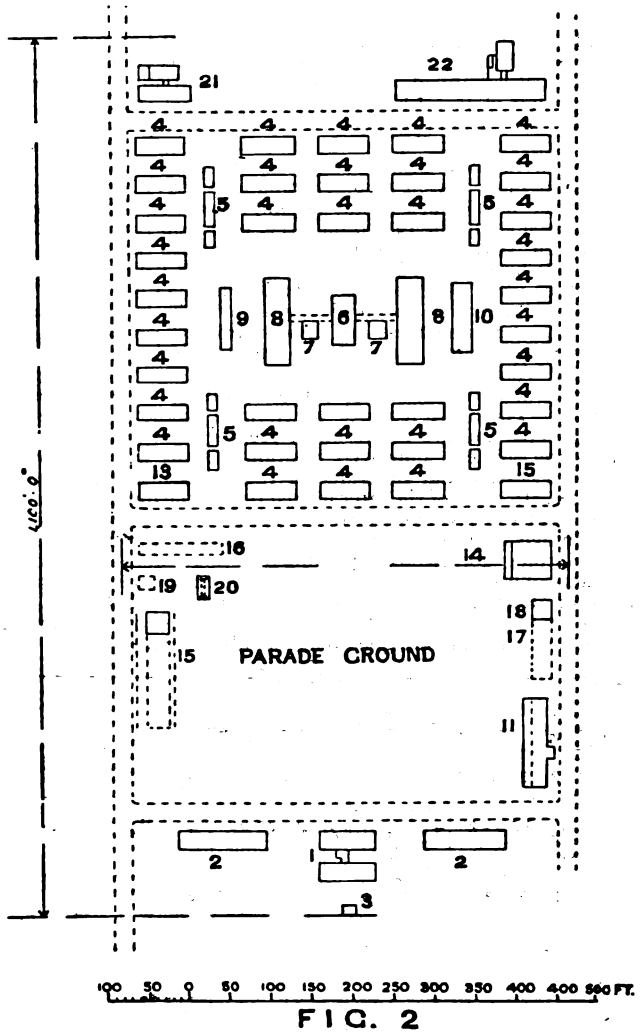

FIG. 2

1. Officers' Mess. 2. Officers' Quarters. 3. Officers' Latrines. 4. Barrack Block. 5. Ablution, Latrines and Urinals. 6. Cook-house. 7. Wash-up. 8. Dining-room. 9. Bath House. 10. Drying-room. 11. Guard House and Offices. 12. Stores. 13. Spare. 14. Coal Yard. 15. Horse Shelter. 16. Harness and Saddle Rooms and Forage Stores. 17. Vehicle Shed. 18. Mobilization Equipment Stores. 19. Dung Pit. 20. Water Trough. 21. Sergeants' Mess. 22. Regimental Institute.

near to the edge of the training land as possible, so as to minimize the time lost in marching from barracks to training ground and home. As regards engineering materials, there was little actual difficulty in obtaining what was requisite, but the presence or absence of an adjacent market made a very notable difference in the cost of the work, an important factor.

(B) *System of Grouping.*—The grouping together of huts to form a hutted camp for an infantry battalion at war strength is shown on fig. 1. To provide for such a unit, sixteen different designs of huts are needed, but the same designs grouped otherwise can be arranged for most of the similar units of other arms. It will be seen from the plan that the area occupied, 1,100 ft. by 500 ft., has on its centre line the principal buildings, viz. officers' and sergeants' messes, the shower baths, dining-rooms and cook-house, drying-room for wet clothing, and the canteens and recreation rooms; while on either side are the living huts, for officers on either side of the officers' mess and for men, two rows of huts on each side with four groups of ablution-rooms, latrines and urinals. This plan was originally designed with the view of providing at first only the huts other than living accommodation, which it was thought might be given in tents. The very short time available in 1914 between the declaration of war and the approach of winter (only three months at most) would only suffice for the messes, and dining-rooms, etc., to be built, giving a reasonable amount of

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comfort and shelter during the waking hours, while for sleeping purposes it was thought that, even in winter, tents would be sufficient, leaving the sleeping huts to be built at leisure. Had this scheme been carried out (and afterwards it was found that tents, in winter, for sleeping would not have been impracticable) it might have been quite possible to have housed with a fair amount of comfort the large armies then being raised, taking into account the limited time and materials and labour available. Unfortunately, as it turned out, this compromise was not sanctioned. The rapidity with which the first large hutted camp was erected may have raised a hope that the same rate of progress would have been maintained; but that first camp had, of course, very special advantages in that large supplies of material, especially corrugated steel sheets, were available, and labour difficulties were negligible, factors which later were not to be relied upon. Accordingly, orders were issued to construct living huts as well as the others, and the attempt to do this in the short season available was a failure. Nevertheless, in some of the first camps it was accomplished. At Belton Park at Grantham, a camp for 12,000 infantry, begun on Aug. 24 1914, was occupied on Nov. 3, less than three months from the start, a result which may be compared with the case of the Curragh in 1855–7 where three years were required for a less number of troops.

Reverting again to the typical plan, it will be seen that the officers' quarters and mess are divided from the men's huts by a small parade ground, flanked on either side by administrative buildings. Also that among the central accessory buildings are dining-rooms, baths, and drying-rooms, with a large "regimental institute." These are features which were unknown in the early hutted camps, and are the result of greater civilization and attention to the soldier's improved position. Baths are, moreover, a hygienic necessity and the value of these was insisted upon from the outset. In some of the later hutted camps the dining-rooms were omitted, but the saving effected was hardly commensurate with the disadvantages. Drying-rooms were very useful, for frequently the men's clothing got soaked by rain, but there were difficulties in the practical use of them, and they were not always repeated. Fig. 2 shows an alternative arrangement for an infantry battalion camp. Fig. 3 shows the grouping of typical huts in the case of a field artillery unit. Other units are designed on generally similar lines.

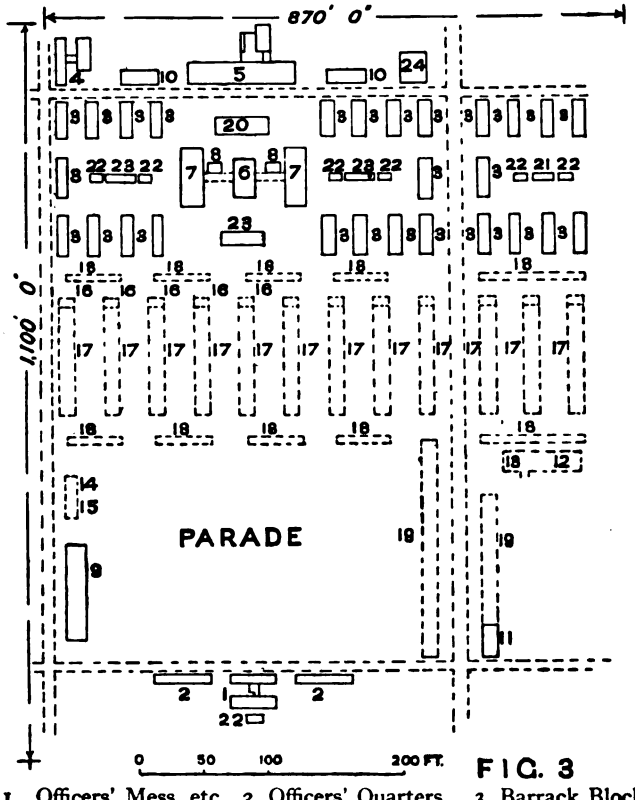

FIG. 3

1. Officers' Mess, etc. 2. Officers' Quarters. 3. Barrack Block. 4. Sergeants' Mess. 5. Regimental Institute. 6. Cook-house. 7. Dining-rooms. 8. Wash-ups. 9. Guard House and Offices. 10. Battery Stores, Brigade Bread and Meat Stores, and Spare Hut. 11. Mobilization Equipment Store. 12. Forage Barn. 13. Granary. 14. Forge. 15. Shoeing Shed. 16. Expense Forage Store. 17. Horse Shelter. 18. Harness and Saddle Rooms. 19. Vehicle Sheds. 20. Baths (32). 21. Ablution. 22. Latrines and Urinals. 23. Drying-rooms. 24. Coal Yard, Dung Pits, Water Troughs.

(C) *Grouping of Unit Hutments.*—The grouping of such unit hutments as have just been described, into a divisional camp or cantonment, can but be considered in taking an actual case, viz. that of Hipswell camp, the northerly half of the large cantonment of Catterick, near Richmond in Yorkshire. The site was not selected until Dec. 1914; some experience had, therefore, been gained in the matter of grouping. In examining this plan (fig. 4) it must be borne in mind that immediately to the S.E. of it lies another divisional camp. Thus the hospital, post-office, power station, army ordnance store sheds, banks, etc., which in the plan appear to be at one corner, are really in the centre between the two divisions. There are 12 infantry battalion hutments, marked A to L. In the actual lay-out there is some irregularity owing to the ground, no attempt being made to preserve a rigid formality of plan which would only be symmetrical on paper, but would necessitate great extra expense in foundations, etc. Yet in each case the broad principles enunciated above as to general grouping have been maintained. It will be observed that branch lines of railway approach each hutment, and each has access to a main road. The engineers and pioneers are near the outer flank of the cantonment, close to ground used for field entrenchments. Between them and the first infantry brigade (A to C) are the field artillery brigades, while the administrative troops are on the extreme N.W. flank. It may be added that the main training ground, rifle ranges, etc., lie on the W. side of the camp. The general slope of the land is from N. to S. towards the brook passing the power station and hospital.

(D) *Accessory Services.*—The accessory services are (i.) Hospital, (ii.) Roads and Railways, (iii.) Water Supply, (iv.) Lighting, (v.) Refuse Disposal and Sewage.

(i.) *Hospital.*—For a large cantonment, a hospital of 600 beds, with an isolation hospital for infectious complaints, is needed. In the theatre of war, this number was of course largely exceeded, and there the unit of each general hospital was 1,000 beds, base hospitals being frequently groups of 10 or more such units. The principles of design, however, are the same, and although in matters of construction detail there may be differences, the following general description is of universal application. Fig. 5 shows the

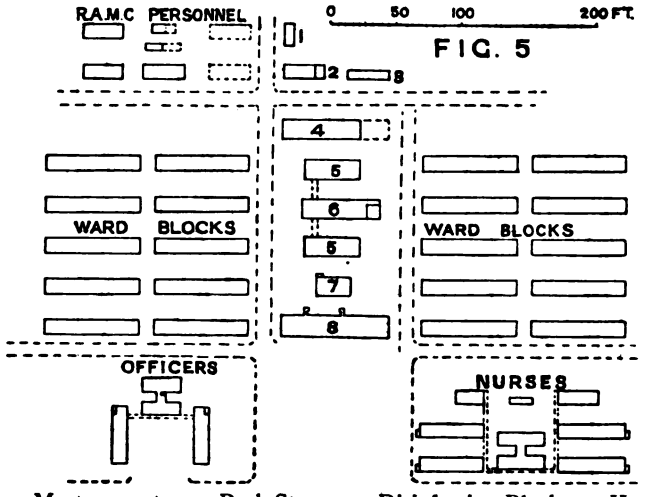

FIG. 5

1. Mortuary, etc. 2. Pack Store. 3. Disinfecting Block. 4. Hospital Supply Department. 5. Dining-room. 6. Kitchen Block. 7. Operation Block. 8. Administration Block.

lay-out of a camp hospital, considered as a type. In front on one side are the mess and officers' quarters, on the other side the accommodation for the nursing sisters. Both these are arranged so as to be separate from the hospital itself, though sufficiently near for all practical purposes. It was subsequently found desirable to surround the nurses' quarters with a high fence on the hospital side so as to ensure greater privacy. In front of the main hospital enclosure is the administration block and behind it the operation room. In some of the field hospitals this building was the centre of a series of wards radiating out from it. Groups of wards, in the type figure, are on either side, and in most hutted camps, in England, these were connected with the operating rooms and administration block by covered passages. The kitchen and dining-rooms and supply stores occupy a central position behind the operating room, and the quarters of the hospital orderlies are beyond. The isolation wards are in any convenient position not too far away from the main buildings.

At the later stages of the war, when the number of sick and wounded increased, it was found that 24 or 25 beds were too few, and much larger wards were designed, but the same general arrangement was continued.

(ii.) *Roads and Railways.*—The ordinary roads of the country where a large hutted camp is situated, will soon be found inadequate for the constant heavy traffic entailed by the occupation, and additional roads will be necessitated. This will be evident from the plan of Hipswell Camp. Consequently early steps must be taken to provide roads of the best construction, preferably concrete 20 ft.

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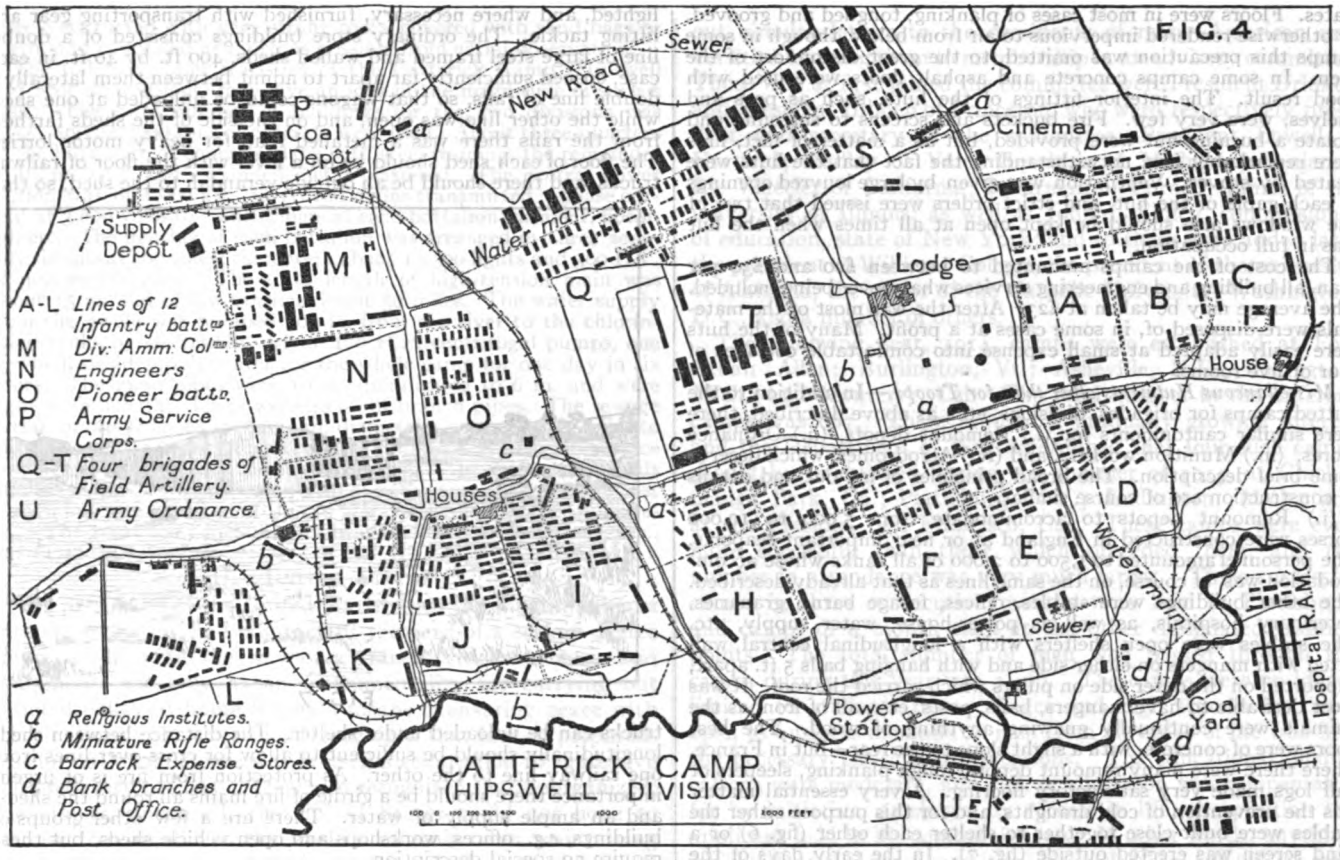
FIG. 4



to 30 ft. wide with asphalt surface. Many small bridges will have to be reconstructed. Maintenance of such roads will have to be kept in view. In each unit camp plank paths ("duck boards") will be necessary from the very first, from every hut, otherwise the whole place will become a quagmire.

Railway lines should be laid into every group of hutments (*see* plan of Hipswell Camp, fig. 4) and there should be a branch leading to a main line. The gradients should not exceed 1 in 50 and the curves 600′ radius at a minimum. The construction of these camp lines was, in some cases where the sites had been hurriedly chosen, a matter of very serious difficulty.

(iii.) *Water Supply.*—At Catterick Camp the water was obtained from the river Swale in a valley with steep banks about a mile above Richmond. It was conducted by gravity from a deep pool in the river to a pumping station where, after settling in suitable tanks, it was pumped up to two tanks holding in all one million gallons, where the water was chlorinated. From this position, which is sufficiently elevated from the general level of the cantonment to command all parts by gravity, a 10 in. main leads along the main line of railway, and branches are taken off to each unit camp. A subsidiary storage tank of 100,000 gals. at the S.E. end of the cantonment, about two and a half miles from the main tanks, provides against any inconvenience caused by a temporary breakdown.

(iv.) *Lighting.*—This subject was very carefully considered in the early days of the war and it was decided that electric light would be the safest and best, and by using aerial transmission lines supported on simple poles, it would be as inexpensive as any other form. A scale of lighting for various buildings was then carefully drawn up, upon which the whole system for any grouping of units was easily calculated. In almost every case of a large hutted camp the installation had to be provided *de novo*, for municipal supply was insufficient to enable the current to be brought from the local installation of some adjacent town. A power station was then designed at some central spot and preferably near a stream where water for boilers and for construction tanks could be easily obtained. From this central station transmission lines radiated to various hutments. Occasionally, and especially in camps (those for 1,000 men or less), gas from an adjacent town supply was used.

(v.) *Refuse Disposal and Sewage.*—This subject presented difficulty owing to faulty selection of sites in some cases. For comparatively small camps the removal of solid matter was possible by cartage and incineration; there being several patterns of destructor in the market, it was only a question of erecting one or more in suitable places, and arranging for a regular system of conservancy. But with large bodies of men, 20,000 and upwards, this became very difficult, and in the larger cantonments a regular system of water-borne sewage was adopted. Here, again, coöperation with local bodies was tried as far as possible, but generally the task was too great for town sewers (*e.g.* at Ripon, a town of 9,000 pop., the addition of 42,000 men and 10,000 horses was far too great for the efficient use of the town sewers, and a separate purification plant had to be devised for the camp with an elaborate network of sewers). The sewerage system for the Hipswell Camp is indicated on the plan (fig. 4), as far as the hospital, beyond which point the main sewer is joined by the sewer from the other division (Scotton) and together the main sewer, now 18″ in diameter, proceeds some two miles to the disposal works.

In any case some disposal works are necessary in every camp for the treatment of liquid sullage from lavatories, kitchens, etc. This sullage water is often very foul and had to be carefully filtered—either in primary and secondary contact filter beds, or according to some other recognized method of sanitary engineering.

Other refuse from the camps can be dealt with by some simple form of refuse destructor.

Organization of Constructing Hutted Camps.—The system of organization in America is that each department of engineering has a separate and independent charge, one department doing all the surveys, another the building, another the water supply, and so on. In England the system was that, while the War Office technical staff supplied the type plans, the authorized rules for quantities of water, electric light, etc., the general approval of the order of urgency and of lay-out, and the selection of the contractor who executed the work, the whole of the local work was entrusted to an experienced senior Engineer officer. He had sub-departments under him for roads, railways, water, electricity, sewage, but he was entirely responsible for coördinating their work and for the local application of materials. The actual execution was almost invariably in the hands of a large firm of contractors who worked on a system of cost plus percentage (which has certain defects but which can be worked well on a competitive system). The superintending officer had authority to give instructions to the contractor, and was responsible for the supervision of his work and for regular and periodical payment. The system worked well and expeditiously.

As regards materials, although some of the earlier camps had their walls built of corrugated steel on wooden framing, this material was rapidly exhausted, and the subsequent substitution of timber boarding caused such a famine of all sorts of scantlings and planks that every effort was made to use some other method. Light steel framing filled in with concrete vertical slabs was used with success, and framework with expanded metal plastered over was also used. Both these methods had the advantage of giving employment to such trades as bricklayers and plasterers, and thus not being so entirely dependent on carpenters.

Roofs were for the most part covered with one or another of the many waterproof felts in the market. In some cases corrugated steel sheets were used and a few hutted hospitals were roofed with

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slates. Floors were in most cases of planking, tongued and grooved, or otherwise rendered impervious to air from below, though in some camps this precaution was omitted, to the great discomfort of the men. In some camps concrete and asphalt floors were used with good result. The interior fittings of the huts, such as pegs and shelves, were very few. Fire buckets and screens to surround and isolate a burning hut were provided, but as a matter of fact, fires were remarkably few, notwithstanding the fact that the huts were heated by stoves. Ventilation was given by large louvred openings in each gable of the hut, and strict orders were issued that two of the windows also should be kept open at all times when the hut was in full occupation.

The cost of the camps amounted to between £20 and £30 per man, all building and engineering services whatsoever being included. The average may be taken at £23. After the war most of the materials were disposed of, in some cases at a profit. Many of the huts were easily adapted at small expense into comfortable cottages of four or five rooms.

Miscellaneous Hutments other than for Troops.—In addition to the hutted camps for brigades, divisions, etc., as above described, there were similar cantonments for (i.) Remount depots, (ii.) Ordnance stores, (iii.) Munition workers, and (iv.) Aerodromes, which deserve some brief description. The broad principles of lay-out and details of construction are of course similar.

(i.) Remount depots to accommodate from 5,000 to 10,000 horses were constructed in England at or near important seaports. The personnel amounted to 1,500 to 2,000 of all ranks whose accommodation was, of course, on the same lines as that already described. The other buildings were stables, offices, forage barns, granaries, veterinary hospitals, as well as power-house, water supply, etc. The stables were open shelters with a longitudinal central wall fitted with mangers on either side and with hanging bails 5 ft. apart, supported on the outer side on pillars which carried the roof. It was most desirable to have mangers, bails, posts, etc., all of iron, as the animals were continually gnawing anything of wood. The best floors were of concrete, with a slight slope to the rear—but in France, where there were many remount depots, rough planking, sleepers or half logs made very satisfactory flooring. A very essential matter was the prevention of cold draughts, and for this purpose either the stables were built close together to shelter each other (fig. 6) or a wind screen was erected outside (fig. 7). In the early days of the

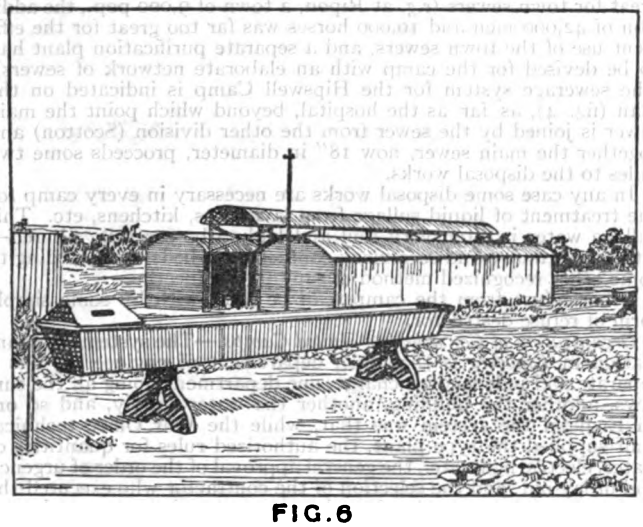

FIG. 6

war the S. African plan of having about an acre of land fenced in round each group of stables for 50 horses, was tried, but it was found that in the moist climate of the British Isles the ground soon became a quagmire, and the area required was enormous. Later, therefore, the stables were built in parallel lines near one another, a better arrangement for administration and good enough for exercising the animals. The veterinary stables were on much the same principle as the ordinary ones, but there were some loose boxes provided with slings for special cases. A horse bath, *i.e.* a narrow concrete tank with a sudden drop under water at the entering side and a ramp out on the far side, was a most useful adjunct in the veterinary lines, and indispensable in the case of skin complaints.

(ii.) *Ordnance Store Depots* were numerous on lines of communication in France, and in connexion with munition collecting centres in England. The largest of these was at Didcot, close to a railway junction. The depot was divided into two main sections, one for ammunition, the other for ordinary stores. The former had to be at some distance from other buildings, was fenced in and guarded by sentries, and the interior space was divided up so that certain buildings were allotted to different classes of ammunition (shells, small arms, cartridges, etc.) under magazine regulations. The buildings were of a fairly substantial character, well ventilated and lighted, and where necessary, furnished with transporting gear and lifting tackle. The ordinary store buildings consisted of a double line of large steel framed and walled sheds, 400 ft. by 40 ft. in each case, spaced sufficiently far apart to admit between them laterally a double line of rails, so that wagons could be unloaded at one shed, while the other line was open, and on the side of the sheds farthest from the rails there was a metalled road for heavy motor lorries. The floor of each shed should be on a level with the floor of railway trucks, and there should be an outside verandah to the shed, so that

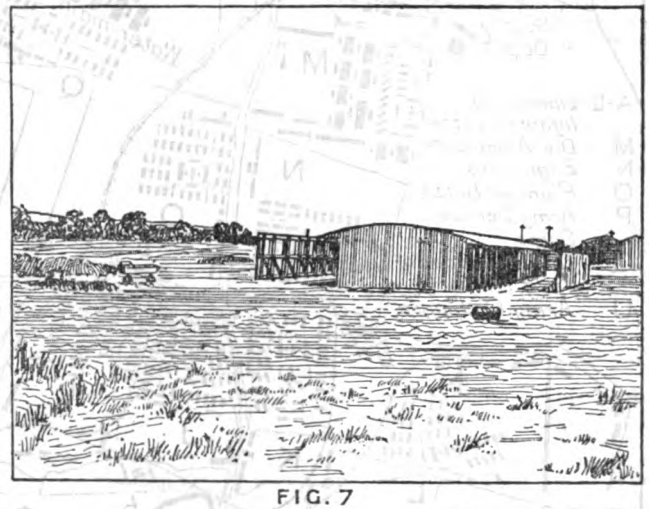

FIG. 7

trucks can be unloaded under shelter. The distance between sheds longitudinally should be sufficient to allow for cross-over lines from one railway line to the other. As protection from fire is of urgent importance there should be a girdle of fire mains all round the sheds, and an ample supply of water. There are a few other groups of buildings, *e.g.* offices, workshops and open vehicle sheds, but these require no special description.

(iii.) *Hutments for Munition Workers.*—For male workmen and employees the general lines of provision are the same as for soldiers, but with the coming of women into the field of labour, special provision was needed. One of the best arranged works had its women's colony situated on attractive and healthy ground about two miles from the works, the workers being sent to and fro by a light railway, and the special provision at the actual works being limited to dining-rooms and lavatories. At the colony headquarters the huts, which were made as attractive as possible with furniture well chosen, with flower beds and grass lawns surrounding them, consisted of two main groups, viz. the dormitories and the recreation huts. The former were double-storied wooden huts, about 25 ft. span, with a central passage, from which opened on either side little cubicles, about 8 ft. square, the partitions being about 7 ft. high. At the end of the central corridor were the lavatories and baths. Outside were water-closets. The number of women in each block was about 60. The recreation blocks consisted of dining rooms and kitchens in one block and a recreation and games room in the other, where also were the rooms of the lady superintendent.

(iv.) *Aerodromes.*—The accommodation for officers and men corresponded to that of infantry. The aerodrome sheds were sited at the end of the landing ground, a certain portion near the sheds being paved with concrete, asphalt or, in some cases in France, with rough planking. At first, the doors of the aeroplane sheds opened at the sides of the shed, a structural defect which became more accentuated as the demand for wider opening became greater. A fresh design of aeroplane shed, therefore, which gave doors at each end of a large shed, the span in some cases being as much as 100 ft., and the height of the shed 30 ft. to 35 ft., was made out, and all the later aeroplane sheds were built accordingly. Behind the aeroplane sheds were small workshops for minor repairs, and a cellar for the boilers required to heat the piping for maintaining a temperature in winter suitable for the various aeroplanes. Adjacent to the great sheds, but on the other side of a metalled road (for motor lorries) were workshops, lorry sheds, stores for spare parts, ordinary store houses, and power plant. Of these the only special one was for doping aeroplane wings, the poisonous fumes from which necessitated very special ventilation by means of fans. All the above were required in ordinary cases, but special designs had to be made in certain aerodromes used for experimental or other purposes; these however need not be detailed here.

Generally speaking it may be said that the requirements of aviation gave rise to a number of new constructive problems in connexion with hutting, but none of these proved to be insurmountable.

Although the arrangements in the theatre of war followed the above in general design, there were obvious local modifications. In the case of ammunition dumps, for instance, the buildings contained limited quantities of different classes of ammunition, and

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were constructed with very strong roofs, covered with sand bags or earth, and concealed as much as possible from aerial observation.

The following brief statistics of the Catterick Camp (Hipswell and Scotton divisions) may give an idea of the magnitude of such a task:—The total number of buildings for the two divisions was 2,700, and 240,000 tons of concrete were used. About three-quarters of the huts were of concrete slabs with steel framing, the remainder of frame work and expanded metal plastered. The central power station was of 1,000 kw. Overhead mains transmitted 3-phase current at 3,000 volts to transformers at each battalion hutment, hospital, etc. The lighting of each battalion was arranged in three separate circuits at 200 volts; there were about 12,500 lights and 300 H.P. of motors installed. The total length of high-tension main was about 15 m. and of low-tension circuit 50 miles. The water supply from the Swale was pumped 400 ft. from the river to the chlorinating tanks by electrically driven 120 H.P. centrifugal pumps, one of which could supply water for the whole camp for one day in six hours. The main pipes were 10 in. diminishing to 6 in. and were eight m. in length. There were 40 m. of branch pipes. The sewage outfall drains from 18 in. to 24 in. diameter were taken six miles to the treatment works. There was a complete system of surface drainage independent of the sewage system. The main camp roads totalled 22 m. and there were 70 m. of pathways. The average cost of each hut was £200 and of this 40% was for labour and 60% material. The total cost, including railways, electric installations, etc., was £1,250,000. (G. K. S. M.)

II. United States

The presidents of the United States since Washington, almost without exception, had pointed out the need of a certain degree of preparedness in the way of a trained citizenry, arms and equipment, not only as an instrumentality for carrying out national policy at home but as a means of ensuring peace with other nations. Most of them recognized that lack of preparedness for national defence was in itself a temptation to aggressive and predatory nations. They also recognized that unorganized, unequipped, untrained, the United States could not hope to exercise that weight in the world's councils or in maintaining peace and international fair dealing, to which its position and importance entitled it. American politicians had often deliberately misled the people as to what could be done. The result was that, at the time when a world crisis was approaching which was in the end certain to involve the people of the United States, they were, in everything which related to preparedness for defence or to playing their part in the struggle for civilization, asleep. Lord Roberts had already sounded the clear note of warning to England, Kitchener had planned organized defences for the British colonies, but America, warlike yet unmilitary, was doing nothing to prepare for the storm. Impelled by an appreciation of the utter unpreparedness of the United States to meet promptly any military emergency arising from conflict with a first-class Power and by the general lack, not only of knowledge but of interest in the question of national preparedness on the part of the general public, and realizing that such interest could best be built up through the youth of the country, Maj.-Gen. Leonard Wood took up in 1913, as chief of staff of the army, with the Secretary of War, Lindley M. Garrison, the project of establishing certain training camps for duly qualified youth, and obtained his approval. This was the beginning of the Plattsburg idea. It was pushed forward by Gen. Wood in the following three years.

The 1913 camps were held at Gettysburg, Pa., and Monterey, Cal., and were made up principally of college students. The total number in camps was 244. They were known as Students' Military Instruction Camps. The young men who came were an unusually intelligent and earnest lot. Those at Gettysburg formed a permanent organization, which became known as the National Reserve Corps and had for its purpose the building up of a corps of reserve officers. The shield of the corps bore the words "Ready–Organized–Prepared" and its motto was "Striving for Peace but Ready for War." The results at Gettysburg and Monterey were such that these first camps attracted immediate and favourable recognition, and were the seeds from which sprang the Plattsburg camps. The question then presented itself, "Why should not the college and high-school students receive a training for national defence and learn that equality of privilege implies equality of obligation?" President Drinker of Lehigh University and Gen. Wood sent out circular letters to the presidents of many American universities, inviting them to membership in an advisory committee. Those who at first joined the committee were President Drinker, and President Hibben of Princeton, who were respectively president and secretary of the committee; President Lowell of Harvard; Hadley of Yale; Hutchins of Michigan; Benjamin Ide Wheeler of California; Schurman of Cornell; James of the university of Illinois; as well as John J. Finley, commissioner of education, state of New York; and to these were added later the president of Williams College, the president of the university of Alabama, the rector of the Catholic University, Washington, D.C., and a number of others.

The following year, 1914, camps were established at Fort Ethan Allen; Burlington, Vt.; Asheville, N.C.; Ludington, Mich.; and Monterey, Cal. The total number in the different camps was 667. These aroused a gradually growing interest and the Department of War determined that four such camps should be established during the summer of 1915, at Chickamauga Park, Ga.; Plattsburg, N.Y.; Ludington, Mich.; and at the Presidio, San Francisco, Cal. These camps were even more successful than those which preceded them, and the number in attendance was very much larger. Three successful camps in three consecutive months were held at Plattsburg, and camps of a month each at the other designated training points. The total number of men who passed through the camps during this year was 3,406. The camps were no longer limited to students from colleges and high schools but were open to business men and to men from all walks of life who had the necessary physical qualifications. The educational qualifications were moderate, and lack of education was compensated for by initiative, as shown by success in life, the position the applicant held in his community, etc.; in other words, anything which showed sound qualities of leadership. Interest grew apace. There were recruiting committees at the various universities. The World War had broken out, and to all who looked ahead it was evident that America would sooner or later be drawn into the struggle. In 1916 over 16,000 men were passed through the camps. The Advisory Committee and the Students' Recruiting Committees of the various universities were influencing the general public, and the Military Training Association of the United States was formed for the purpose of increasing the attendance. As Plattsburg was the largest training centre, the camps, wherever held, began to be called "Plattsburg Camps," the idea of this intensive training being spoken of as the "Plattsburg Idea."

In 1917, applicants for the camps numbered about 130,000, and had the United States not gone into the war in the spring, well over 100,000 men would have been trained in these volunteer training camps. The men who came to these camps were from every walk of life: bishops, priests, clergymen, rabbis, men from the labour unions, farmers, policemen from neighbouring cities, business and professional men, youths from the colleges.

The outbreak of the World War in 1914 stimulated interest in the training. It must be remembered that the second series of camps, those of 1914, were coming to a close just before the war began. During the winters of 1915–6 and 1916–7 courses were opened in Boston, New York, Providence, Detroit, Pittsburg, Philadelphia and other cities for the instruction and examination of applicants for reserve commissions, and through them were developed a large number of officers who played an important, indeed a vital, part in the training of the great war levies. Speaking of these camps, the chief of staff of the army, in his Annual Report for 1915, said:—

"The military camps of instruction for students of educational institutions which were held in 1913 and 1914 have been continued this year. As there were no funds available to meet any expenses incident to the establishment of these camps, it was necessary to have them at military posts where the ordinary utilities of the post could be used, or, if at a place other than a military post, the citizens had to incur the necessary expenses in constructing the camps. . . . The reports show that the results have fully justified the establishment of these camps. In addition to camps for students, camps have been authorized at Plattsburg, N.Y., Fort Sheridan, Ill., and San Francisco, Cal., for business men whose interest in the prepared-

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ness of the country for defense prompted them to request that opportunity be given them to prepare themselves so as to perform more efficiently their duties in case the country should unfortunately be involved in war. . . . Aside from the military instructions given these students and business men, I feel that the interest in preparedness which leads these men not only to give their time to the Government, but to incur the expenses of buying uniforms and paying for transportation to the camps, is of great value to the country and should be encouraged by the war department. These camps have passed the experimental stage and there can hardly be any question as to the advisability of continuing them and extending them where the conditions of service of regular troops are such as to permit the department to send troops and instructors to the camps. Men with means probably do not object to paying the necessary funds to get the military training which the Government expects to use in case of need. This, however, does not make it right. Men who are not so fortunately fixed financially should be permitted to show their patriotism and interest in preparing the country for war. If these camps are of value, which undoubtedly they are, and are to be continued, certain necessary expenses of the men willing to give their time should be met by the Government."

In 1916 a series of four camps, each for a month, was held at Plattsburg, N.Y., a camp of one month's duration for boys at Fort Terry, N.Y., and a series of six camps of two weeks' intensive training at Wadsworth, N.Y., for the police of New York City; and a series of three camps, each for a month, at Oglethorpe, Ga.

When the United States entered the World War these hastily but intensively trained enthusiastic men were invaluable. They furnished the nucleus of civilian officers with which to begin the great work of developing 200,000 officers, and added a valuable and indispensable force to the scanty number of regular officers and national guard officers available for the training of the men. In the spring of 1917 the Federal Government took over the whole task and established a series of camps for the training of officers for the war. Under authority of Section 54, National Defense Act 1916, the Secretary of War directed the establishment of 16 Citizens' Training Camps throughout the United States at the following points:—

Name	For Candidates from
Plattsburg Barracks, N.Y. (1)	Long I., New York City and adjacent territory.
Plattsburg Barracks, N.Y. (2)	Long I., New York City and adjacent territory.
Madison Barracks. N.Y.	Balance of State of New York and part of Pennsylvania.
Fort Niagara, N. Y.	Balance of Pennsylvania.
Fort Myer, Va.	New Jersey, Delaware, Maryland, District of Columbia and Virginia.
Fort Oglethorpe, Ga.	N. Carolina, S. Carolina and Tennessee.
Fort McPherson, Ga.	Georgia, Alabama and Florida.
Ft. Benjamin Harrison, Ind. (1)	Ohio and W. Virginia.
Ft. Benjamin Harrison, Ind. (2)	Indiana and Kentucky.
Fort Sheridan, Ill. (1)	Illinois.
Fort Sheridan, Ill. (2)	Michigan and Wisconsin.
Ft. Logan H. Roots, Ark.	Arkansas, Mississippi and Louisiana.
Fort Snelling, Minn.	Minnesota, Iowa, N. Dakota, S. Dakota and Nebraska.
Fort Riley, Kans.	Missouri, Kansas and Colorado.
Leon Springs, Tex.	Oklahoma and Texas.
Presidio of San Francisco, Cal.	Montana, Idaho, Washington, Oregon, California, Nevada, Utah, Wyoming, Arizona and New Mexico.

The training camps for officers were ordered to be ready for the reception of reserve officers about May 8, for candidates for commission May 14, and the course of instruction was to begin on May 15, 1917. Minimum age for attendance was 20 years and 9 months; maximum age 44 years. In addition to the foregoing, General Order 119, War Department 1917, established a training camp at Fort Winfield Scott, Cal., for the training of members of the Coast Artillery section of the Officers' Reserve Corps residing within the territorial limits of the Western Department, and a similar camp at Fort Monroe, Va., for the balance of the Coast Artillery Reserve Corps officers. These training camps began operation on Sept. 22 1917. A medical officers' training camp was also established in 1917 at Camp Greenleaf, Fort Oglethorpe, Ga. Other camps for officers were established at the headquarters of the various divisions, the courses being essentially the same as those at the former officers' camps. The period allotted for the development of an officer at the Government training camps was three months. The work was intensive and hard. It was an attempt, in the rush and confusion of war, to produce officers in the minimum period of time. The purpose was to turn out the largest possible number of platoon leaders and a limited number of company commanders and officers of field grade. The same general plan was carried out at the training camps for officers in the Quartermaster Corps, Medical Corps and other staff corps. The courses involved much hard work and were necessarily defective in some particulars, but they served to turn out many tens of thousands of officers with elementary training which was later supplemented by their work with the divisional organizations to which they were assigned.

Theodore Roosevelt gave the full support of his great prestige and influence in the upbuilding of the camps and never lost an opportunity to impress upon the public their importance and to push forward their development. Men too numerous to mention, men who are leaders in every walk of life, coöperated to the limit of their ability in the upbuilding of these camps and in waking the country to an appreciation of the gravity of the situation and the need of preparation. The camps were a great force in firing the public conscience and rousing the people to a realization of their obligation to prepare the country for defence and to do their part in the great struggle then threatening the world. (L. Wo.)

TRANSJORDANIA, Emirate of, sometimes called Kerak, a dominion extending some 200 m. S. from the Yarmuk and from the Jordan eastwards to the desert. It comprises Gilead, Amman, Moab and part of Edom of the Old Testament, and El Belqa, the southern portion of the former Turkish *vilayet* of Damascus. After forming the independent kingdom of Ghassan under a succession of Arab dynasties from A.D. 165 onwards it was conquered by the Moslems during the joint reigns of Amr IV. and Jabala V. and VI. in 637, and under the name of Kerak became one of the six kingdoms into which Syria was divided under the khalifs of Bagdad and the Seljuk Turks. As the Emirate of Kerak it was a separate State during the Middle Ages and again became an independent principality in 1920 with its capital at Amman (pop. 2,300). The other principal towns are Kerak (pop. 2,500), Madeba (pop. 2,000), Es Salt (pop. 8,000), Ma'an (pop. 3,000), Jerash (pop. 1,500). Its inhabitants possibly number 180,000, varying according to the season and the movements of the nomads; they are partly settled Arabs—many of whom are Christians—with some colonies of Circassian Moslems and a number of nomads. It contains many interesting classical and mediaeval ruins. The physical features, flora and fauna are similar to those of southern Syria.

During the Crusades Kerak (*see* 15.753) was the capital of the great fief of the Oultrejourdain and, of its Christian lords, the most notable were Philip de Milly (1161–8), formerly lord of Nablus (1142–61), who surrendered the fief in order to join the Templars, subsequently becoming their Grand Master, and Reginald de Chatillon (1177–87), a former Prince of Antioch (1153–60), who was beheaded by Saladin after the battle of Hattin (1187). Saladin's brother El Adil ("saphadin") took Kerak in 1188 and was its emir until he became Sultan of Egypt (1200). His grandson En Nasr Da'ud, after being deposed from the throne of Damascus (1229), reigned in Kerak for 20 years and recaptured Jerusalem from the Christians in 1239. When the Ayyubid dynasty was overthrown in Egypt, his nephew El Mugith, a prisoner of the new Sultan Aibek, was released by his gaolers in Shobek and placed on the throne of Kerak (1250). He was deposed in 1262 (and later strangled) by Sultan Baibars of Egypt whose own son was glad to find a throne at Kerak after losing that of Egypt (1279). Berekeh's brother Ma'sud, who succeeded him in Kerak, was in turn deposed (1286) and another fugitive Sultan of Egypt, En Nasr, reigned in Kerak (1294–9) until his restoration to power in

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Cairo, only to return to Kerak (1308–10) after a fresh deposition while awaiting a second and final restoration. For many years Kerak, which was the treasure-city of the Mameluke sultans in 1355, slipped out of history, and during much of the Ottoman period (1517–1918) enjoyed an uneasy if obscure independence, only coming under direct Turkish civil administration after the construction of the Hejaz railway.

Kerak was captured by the Emir Faisal on April 7 1918. General Allenby's troops operated in Transjordania in the spring of 1918 and the retreating Turkish garrison of Ma'an, forming part of the IV. Army, surrendered to Gen. Chaytor with the Australian Light Horse at Qastal on Sept. 29 1918 which marked the end of the Ottoman period. Transjordania formed part of the Emir Faisal's dominions, even after he lost Damascus, until the spring of 1921, when it was transferred to his brother the Emir 'Abdalla. (H. P.-G.)

TRANSPORT.—Among new economic conceptions resulting from 20th-century progress, the rise of a definite "science and art" of Transport is of outstanding interest.

The Function of Transport.—The function of transport may be described as the transference of persons and things, as and when required by mankind, from one part of the earth to another in a minimum of time and at a minimum of cost, these two factors being closely connected with each other. The axiom of political economy that exchange enables wealth which would otherwise remain unutilized to be used to the best advantage implies *displacement*. Such displacement or transportation is an essential characteristic of that form of exchange which we recognize under the name of commerce, and hence the history of commerce is to a great extent the history of the development of transport. The transport problem is an ever-recurring one which can never be finally disposed of. Only in recent years have its complexities been systematically studied, although the problem must have arisen when the first man had any belongings to move.

The factors governing the development of transport are intrinsic and extrinsic, the former including the nature and quantity of matter to be conveyed, the distance and character of the earth's surface between the two points of carriage, and the apparatus available for bringing the movement into effect. These intrinsic factors are governed and often impeded by certain extrinsic factors, which are mainly political, economic, strategic, and, lastly, the ever-existing element of human nature.

During recent years the importance of efficient transport to civilization has been more and more realized by the leading men in the world of commerce and politics; various schemes have been formulated and put into operation with a view to removing obstructions, and in order that a more comprehensive grasp of the whole subject might be obtained. These include the formation of schools of economics at the universities and elsewhere, which treat the subject as a branch deserving accurate study and scientific inquiry. A definite advance has also been signalized by the formation in the United Kingdom of a Ministry of Transport and of an Institute of Transport; also by the publication of various journals which deal exclusively with the subject.

Those who are intimately connected with the present-day efforts towards a solution of the problem are forced to realize the all-embracing scope of the subject and the difficulties attending its every phase. On the latter aspect of the problem it is interesting to note that as transport becomes more completely organized, it more surely provokes increasing controversy.

Many obstacles have already to a great extent been overcome, and those dealing with the nature of the commodities carried may be instanced as an example. The difficulties attending upon the bulk, fragility, delicacy, and the preservation of certain commodities which in early times formed an unsurmountable obstacle to their carriage, have been solved, and as a result, an increasing traffic in these commodities has taken place. This in turn increased the demand for these commodities, the wants of man having become less elemental and more artificial as the world has become more civilized. Of the extrinsic factors affecting the development of transportation we may instance the colonizers of the Early and Middle Ages, the growth of overseas trade dating from the 12th century, the wonderful impulse given by the "Industrial Revolution" of modern times, and, lastly, military exigencies in war-time.

Generally speaking, the development of transport brings about a tendency to a surplus of wealth. Unless a country produces a surplus of wealth it is unable to reduce poverty to a minimum or to insure that all its inhabitants have a sufficiency of food, clothing and warmth, without which contentment is an impossibility. The cheapening of transport reduces the cost of the necessities of life and thus enables a person to live at a higher standard than would be possible if the whole of his earnings were taken up in obtaining the bare necessities of life. The prosperity of most modern countries has directly followed the improvement of their transport system. Instances of this may be quoted in the case of Great Britain, with its internal system of railways and its vast organized overseas communication of shipping; of America, France and Germany, with their railways and internal waterways. On the other hand, China may be quoted as a country with vast resources and possibilities, but which for the want of transport facilities is not yet developed in proportion to her territory or population. It would not be too much to say that the development of the wealth of any country in the world has been brought about from time immemorial chiefly by the improvement in its transport system. The development of transport acts upon, and in its turn is influenced by, the progress of mankind in the continuance and improvement of the civilization of the world. It affects and promotes the intercourse between different peoples and continents, and it creates opportunities for employing the forces of Nature for the use of mankind by the advancement of science.

In general terms, modern-day transport may be classified into human, animal, and mechanical. In its various forms the latter is carried on by land, road, sea, river, canal, inland water, railway, air and aerial ropeways: these in turn are actuated by the motive powers of gravity, steam, electricity, combustion engines, wind, and water. All these motive powers originate in some form or another in the use and application of the stored-up energy of the elements, and the object of mankind has always been to use these elements to give the best results with a minimum of cost. The progress of mankind has probably lain in this direction more than in any other, and advancement has been made during the past century which would before that period have seemed impossible of attainment.

The History of Transport.—At different periods of their existence the various communities of the world have passed through somewhat similar stages of transport development. We read that canals were constructed in Egypt 3000 B.C., that the Phoenicians crossed the inland seas in ships propelled by oar and wind and carrying 500 men, and that King Solomon drew a portion of his revenue from the caravans which journeyed through his territory. We learn that Babylonian caravans travelled into Phoenicia, Arabia, Syria, and Persia, and that the Egyptians sold chariots in neighbouring countries at an equivalent value of £50, while chariots are first noted in the annals of Britain in 300 B.C. The Greeks, before 1000 B.C., were constructing roads, and providing their harbours with walls and jetties, whereas roads, as such, were practically unknown in Britain nine centuries later.

The first mode of transport undoubtedly was the carrying of commodities on the human form. This mode is still exclusively used among the primitive tribes and to a certain extent even among the most civilized nations. Primitive man, however, early realized the value of waterways as a means of transport, and at first utilized a raft of tree trunks lashed together, a cumbersome method, both in preparation and in use. This raft he guided by means of a stick or branch, the forerunner of our punt pole. He also discovered that skins would float, and, by supporting the skin of an ox or a horse with a light wicker frame, he produced the coracle, a boat which he could propel on the water and carry on his back overland. Later, two or more skins were sewn together to form the shell of the boat, the seams being "caulked" with a resinous substance. The coracle is still in use on certain of the western rivers of Britain. It was an easy stage to build up the raft into a sort of box by using planks for the sides, the planks being sewn together. Here we have the origin of our present-day flat-bottomed boats. Yet again, by the use of

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fire, early man made a primitive boat by hollowing out the trunk of a tree, which, being shaped as experience has taught, formed the first point in the evolution of the ship. To harness the wind was a further stage, and the gaining of the art of navigation furthered the development of the sailing vessel.

On land, the animals natural to a country—the horse, the camel, the ass—have been employed as beasts of burden from early days. Chariots were in existence thousands of years before the Christian era, but the absence of good roads resulted in a very slow development of land transport.

Coming to Britain in the Middle Ages, we find water transport as the most important means of conveying goods; what little transport was effected on land was by means of pack-horses. Travellers and traders combined in armed companies for protection against marauding bands, and we see long lines of laden horses slowly progressing over tracks so narrow that the animals could seldom pass two abreast. The rolling of a log is supposed to have inspired the idea of the early waggon for transporting materials, and in the 16th century a heavy waggon with broad wheels on a rotating axle, and fixed front wheels, came into use. Its sphere of action was limited to local markets. Such organization as there was lay in the hands of the lord of the manor, who could call upon his tenants for the services of a specified number of waggons and waggoners. Better roads were required. Although the Romans, with their knowledge gained from the Etruscans, did construct many and great roads, organized road-making was practically non-existent from their time until the 16th century, when counties were made responsible for the upkeep of bridges, and parishes were ordered to appoint two road surveyors, who were assisted by compulsory labour. Passenger carriages came into vogue in 1550, but, being springless, had little pretension to comfort.

In 1634 the Sedan chair came into use, and in the same year the first hackney carriages were licensed. In 1650 waggons completed the journey from London to Dover in three or four days. About the same time, springless stagecoaches carrying passengers inside at a charge of five m. for 1s., and luggage at the back, were introduced. By reason of the condition of the roads their rate of travel was only four to five m. an hour; they seldom travelled in winter. In 1658 a coach made the journey from London to Edinburgh at a cost of £4 per passenger, and was more than a fortnight on the way. The post-chaise system was now established. Wealthy people were able to hire horses for their carriages in relays at the various inns, or both the chaise and the horses. A journey from London to Scotland in this manner cost at least £30.

At the beginning of the 18th century, waggons were journeying with goods from London to Bristol, and we read that in 1776 waggons travelled from London to Edinburgh and back in six weeks with a load of four tons, whereas a sailing vessel made a similar journey in the same time, carrying some 200 tons and requiring only four times as many men as a waggon. In 1763 a monthly coach service between the same two towns was instituted, completing the journey in 14 days, and about the same time services to Bath, York, Glasgow, Exeter, and other towns were inaugurated. Coaches with springs appear to have been in use by 1760. Particular attention was now being paid to roads. The famous road engineers, Telford, Macadam and Metcalfe, were at work, and in the 14 years following 1760 some 450 Acts of Parliament authorizing road construction and tolls were passed. The experimental mail coaches of 1784 gave an impetus to road transport. Their speed of six m. per hour was soon increased to 12. Outside passengers were charged about 5d. a m., and those inside, 3d.

Canals had long existed in Holland, and were introduced into France in the 17th century, but although two canals were constructed in Britain by the Romans, one of which, the Fosse Dyke, is still in use, it was not until the 18th century that canal development began in this country. The first important canal was constructed from Worsley to Manchester, at the instance of the Duke of Bridgwater, and was opened for traffic in 1761. It was found that the cost of transport by canal was about one-quarter of that for carriage by pack-horse or waggon for the same distance, and the price of coal in Manchester was immediately reduced by 50 per cent. In 1772 passenger boats, charging 1s. for 20 m., were established on the canal. In 1777 the Grand Trunk Canal, between the Mersey and the Trent, 96 m. in length, was completed, and in 70 years 3,000 m. of canals were constructed in the British Isles by the Companies of Proprietors. Since 1830, with the exception of the Manchester Ship Canal, there has been but little expansion of Britain's canal system. So far as England and Wales are concerned, practically all the canals were constructed by private enterprise without any State financial assistance, but this does not apply to Ireland or Scotland.

Towards the end of the 18th century, experiments with steam-driven vessels were in progress, and in 1788 a small steam-boat was tried in Scotland. Trains hauled by horses over parallel logs of wood had been in use for colliery purposes in the 17th century. Later, the wood was covered with metal plates, and in 1767, cast-iron rails were brought into use.

The coming of the 19th century was heralded by the authorization by Parliament in 1801 of the first public railway—from Croydon to the Thames. Traders paid tolls to the company for the privilege of horse-hauling their own waggons over the line. In 1804 Trevithick's locomotive hauled 70 passengers and 10 tons of goods near Merthyr Tydvil, but the first use of locomotives on public railways was on the Stockton and Darlington line (now part of the North Eastern railway), which was opened in 1825. The first train carried 500 passengers and made the journey of 8¼ m. in 65 minutes. For some years, steam traction was employed for the haulage of goods and mineral traffic only, passengers being conveyed in horse-drawn coaches. The company soon learned that it was impracticable to allow individuals to run their own waggons at will over the line, and as a solution the system of company-owned traction and waggons developed. In 1829 George Stephenson made certain the future of railways by producing his famous "Rocket" type of engine, which attained a speed of 29 m. an hour at its trials. By 1840 there was a regular service between London and Birmingham, the journey occupying from 5 to 6 hours, and Glasgow was brought within a 24-hours' journey. There was also a quarter-hourly service between London and Greenwich. In 1845 over 1,200 railway bills were presented to Parliament, but only a tenth of them received sanction.

Similar progress was made with steamships. In 1807 the "Clermont," constructed by Robert Fulton, began to ply on the Hudson river between New York and Albany. In 1818 the "Rob Roy," a wooden paddle-steamer, travelled from Dover to Calais, and in 1819 the "Savannah," a sailing vessel with auxiliary steam and removable paddles, crossed the Atlantic from Savannah to Liverpool in 25 days. In 1838 two vessels crossed the Atlantic under steam-power only, and the screw propeller, which was invented in 1836, was used on ocean-going craft in 1850.

In 1820 was started the Paris cabriolet, which word was later contracted to "cab," and the "Dandy-horse," the forerunner of the bicycle, and in 1829 the first omnibus made its appearance on the streets of London.

The advent of the "Industrial Revolution" saw in Britain a number of self-contained communities, each more or less dependent on its own resources for necessary commodities, and a transport system which has been described as probably the worst in Europe. The means of transport were limited to river transport, supplemented by teams of pack-horses and waggons, and, in mining districts, by horse tramways. The comparatively bad condition of the roads, and the small amount that could be carried, made conveyance by horse and waggon slow and costly, while transportation by river had only a limited sphere, and even then it was unreliable.

The application of steam as the motive power of machinery cheapened and speeded up production, but labour, iron for the machinery itself, and coal as fuel, were needed. There followed a rapid development of the British coal industry, not only where there were river and sea facilities, but far inland. The iron industry moved its base northward, and there was a speedy growth of large factory areas, with increasing numbers of workers. The workers required food and domestic supplies, the factories required raw materials and coal, and these must needs be obtained from other areas. Improvements in the iron industry gave better and cheaper agricultural implements, and a development in agriculture gave greater supplies of produce ready for moving to the industrial areas. Industry had now reached a stage where production had outstripped its necessary adjunct, transport, and there was a crying need for more efficient and economical methods of transport. For this, capital was necessary, and the increasing wealth which accompanied the industrial development provided it. At first, canals, and, later, railways, played their part in providing the factory districts with raw materials, fuel, and food, and, in addition, along with steam-boats, made possible the distribution of the manufactured articles to an ever-widening range of markets.

Modern Development.—The modern development of transport may be said to date from the "Industrial Revolution," and from that time it has been generally recognized that, where advantages have been granted by the State to various forms of carriers, the rates of charges and the provisions for the safety of the public should be controlled to a certain extent by the State. This has been chiefly in evidence in the case of the railways, which were given compulsory powers by legislation for the acquisition of land and other advantages. In other words, it has been recognized that, as the carriers existed to a large extent for the benefit of the public, it was necessary that individuals should be compelled to sacrifice their private interests for the good of the public generally. On the other hand, it has also been recognized that, the carriers having been given these advantages, the State should protect the public in certain respects.

In Great Britain practically the whole of the transport undertakings have been initiated and carried on by private enterprise, the primary object of the companies from their point of view being the earning of money. For this reason the various companies have of necessity vied with each other in making as much money as possible, and one of the most obvious ways of doing this was by increasing the amount of traffic carried. Induce-

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ments were therefore held out of giving facilities to traders in various ways, the chief of which has been the cheapening of the rates. This, however, has taken place as a rule only when there has been competition, and the rate-cutting between the railways at certain periods has reached such a stage that it is very doubtful whether the companies have benefited by it or not. In the case of the railways, which are at the present time the most important of the overland carrying factors of Great Britain, the return on the capital expended has not been very great.

From time to time there have been amalgamations of the railways to a limited degree, and these as a rule have benefited both the railway companies and the public by cheapening the cost of working the undertakings.

A brief summary of each system of transport, with its influence as a factor of transportation, is given below.

Railways.—The evolution of the railway and the invention of the locomotive, with its successful application to railway traction in 1804, inaugurated a new system of transport. Designed primarily to reduce the cost of transport of coal by road and to compete successfully with transport by canal, railways have developed from the isolated small sections in various parts of Great Britain to be at the moment the predominating factor in the world's transport. Indeed the mileage of railway in a country may safely be taken as a criterion of its industrial development.

Railways spread rapidly in Great Britain after their inception, and numerous companies promoted the new mode of transport.

The carriage of coal and other minerals proving immediately successful, the transport of the travelling public became naturally the next development. The first passenger coaches consisted of open trucks with neither roof nor seats, but the discomfort of these led to the evolution of covered coaches, which were provided for 1st- and 2nd-class passengers only. The 3rd-class coach was still roofless, but fitted with benches. The luxurious coaches of to-day, with facilities for dining, sleeping, and, in some cases, baths, are material proofs of the great progress made in this branch of transport.

Locomotives and freight rolling-stock have also developed in accordance with the requirements of the age. Waggons constructed to carry 120 tons and locomotives weighing 244 tons are in use on two or three railways in the United States; but the waggon commonly used has a capacity of only 50 short tons, while the usual weight of locomotives is between 175 and 220 short tons.

The electrification of railways is the latest stage of their development. Applied to the transport of the masses of people congregated in large cities, it has gone far to solve one of the most difficult problems of the present day.

For long-distance travel, electricity has now passed the experimental stage, and no doubt the progress of time will see the displacement of steam by electricity as the motive power for all railways.

Water Transport.—The development of this system has been chiefly confined to sea-borne transport. Although a steamer was first used on a canal, the Forth and Clyde, in 1802, it soon reached salt water, and the s.s. "Comet," built on the Clyde in 1812, marked the commencement of the ocean steamer transport era.

The first form of propulsion, viz. by paddles, was superseded by the screw propeller, which has been found more efficient and suitable for rough waters. Improvements were also effected in the engine room. Simple and compound engines were successfully followed by triple and quadruple expansion engines. These in turn gave way to the steam turbine. Coal is being displaced by oil fuel for steam raising, and we have also the internal combustion engine.

Other important features of development are refrigeration and wireless telegraphy. The former has increased the availability of the food supplies of the world.

In this sea-borne system of transport, competition has resulted in rate-cutting wars, which have not been so evident in the other systems. In cargo rates and passenger fares, competition has at times been very keen, and quotations have reached figures far below an economic level, as for instance at the time when passengers were carried from Liverpool to New York for £2.

Mechanical Road Transport.—This form of transport, although generally believed to be an invention of recent years, was also inaugurated at the beginning of the 19th century, but development was hampered by the excessive road tolls and statutory restrictions, an example being the British regulation which required a man with a red flag to precede every mechanically propelled vehicle. These restrictions operated until 1896, when greater liberty was afforded by the Locomotives on Highways Act of that year. Further freedom has been given by the Motor Car Order, 1904, and the utility of this system has now been fully established.

The earlier types of mechanical road vehicles were steam propelled, but the invention of the internal combustion engine and its application to road transport, associated with rubber-tired wheels, created a revolution, and is responsible for the rapid development of the last generation. Mechanical road transport commenced and operated solely as a passenger transport system until recent years, but in conjunction with the general improvement of roads it has, for distances up to 75–100 m., developed into a form of freight transport in competition with railways, except in the case of long-distance mineral traffic.

Passenger road transport is generally provided by petrol-propelled vehicles, and examples of these are found in high-powered private motor-cars and in public motor-buses carrying 54 passengers.

In the transport of merchandise by road, all three types—petrol, steam and electric vehicles—are used, their respective spheres being dependent upon distance, nature of traffic, regularity of service, etc.

In the development of mechanical road transport may be included the improvements effected in tram-car services. The horse vehicle has been displaced by the electric vehicle, obtaining power through overhead or underground conductors, and this form of transport has contributed very largely to the expansion of the areas of large cities.

Aerial Transport.—This system commenced with the 20th century, but so rapid has its progress been, principally through military stimulus, that by 1921 its success was assured.

The development of the internal combustion engine provided the means of securing adequate power with a minimum of weight which had long been sought in connexion with aerial navigation. France, Great Britain, and the United States joined in the development and while the first decade of aerial navigation was a period of experiment, transport by heavier-than-air machines was sufficiently advanced to be put to practical use at the commencement of the World War in 1914. The potentialities of aircraft in warfare were immediately manifest, with the result that the progress achieved in the development of the air machine was infinitely greater than would otherwise have been the case. This applied equally to the airship or lighter-than-air machine. The internal combustion engine converted the ordinary balloon into a dirigible, and this development continued until the cessation of hostilities in 1918.

Economic Effects.—The consequences of the development of the various systems of transport upon nations and peoples are incalculable. The growth and consolidation of the British Empire may well be attributed to the fact that during the greater part of the 19th century the initiation and supply of transport was provided by Great Britain. She became the carrier of almost all the world's traffic, which, of course, involved the maintenance of the freedom of the seas.

In the United States it is not too much to say that the rapid development of its transport system has enabled the growth of the whole country to develop simultaneously and thus evolve a "United" States instead of a second "divided" Europe.

Viewed from a different angle, we find the conclusions of those political economists who advance the argument that over-population would inevitably lead to starvation have been negatived by the development of transport which, coupled with the use of modern methods of refrigeration, has increased the availability of the world's harvests. The periodical famines in those countries where transport in its modern developments is practically unknown is direct evidence on this point.

The mobility of labour, the importance of which can hardly be exaggerated, had also been increased by transport development to an enormous degree. Its effect on the social condition of mankind is clearly demonstrated when it is observed that, where transport is developed most highly, there also is the social standard highest.

Military and naval operations have been considerably influenced by modern transport. At the battle of Waterloo about 75,000 men were engaged on each side. One hundred years later in the World War 50 million men were engaged in the armed forces of the combatants from start to finish. New railways and roads for mechanical road transport made possible the movements of armies, guns, munitions and necessary supplies. The heavy guns were moved by rail or mechanical road transport, and as if to emphasize the part which transport took in the war, the negotiations for the Armistice were conducted in a railway carriage.

On the naval side, steamer transport was the forerunner of the modern battleship. It was many years after the building of the first steamship when sailing ships of war were discarded, and practically all developments in ocean transport have been adapted to the needs of the navy.

During this wonderful development the Governments of the world generally took little interest in transport beyond enacting restrictive legislation. Prussia was the one exception; for almost from the commencement of railways in that country, the State took an active part in their construction and operation, and

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after the Franco-Prussian War of 1870–1 adopted the policy of acquiring all the German lines. This was entirely for military reasons, and was accomplished in two decades. There was also Government coöperation in the United States. Various states assisted the railways by land grants and other subsidies, while the Union Pacific—the first American transcontinental railway—was made possible by financial aid from the Federal Government.

The World War of 1914–8 was destined to have far-reaching influences on transport. Until then, except for the fixing of rates and for the ensuring of public safety, the British Government did not interfere with the working of the railways. At the outbreak of the war, however, it became apparent that it would be necessary for the Government to take control of the whole of the British railways, and, as a direct result of former amalgamations, this was done with admirable results. Rolling-stock was pooled, engines being loaned where necessary. The success which followed justified the action taken, and valuable lessons were learned which have proved of great assistance in the consideration of the direction of future development. Similar action was taken in the United States.

The early part of the 20th century was marked by a tendency towards large combinations of capital and labour, one acting and reacting upon the other. This movement, perhaps first developed in the United States as to capital and in Great Britain as to labour, has been gradually increasing, and the state of affairs is now such as to render difficult the existence of any small concern, either of capital or labour, which is not protected by some form of combination with other similar bodies. With other concerns, transport has been largely affected by the Trust movement, and to this cause the Railways Bill of 1921 which amalgamated the railways of Great Britain into four groups was largely due. This arrangement in reality has been a development of the Trust movement.

If modern transport is to develop on economic lines and properly fulfil its functions, the tendency of the future will be toward the standardization of the various forms of transport all over the world. The lessons of the war have emphasized this very strongly, and though the progress may be slow, the future prosperity of the world largely depends upon its being brought into effect.

Operation Principles.—Transport operation deals with the actual movement of passengers and goods, and the methods of operation are dictated by the requirements of both classes of traffic. Any passenger service must be so designed as to satisfy public requirements in respect of safety, convenient times of departure and arrival, connexions for through services, speed, and comfort. Attention must be given in the first instance to what are the main channels of traffic, and these are dictated by the requirements of both commerce and pleasure—in other words, " necessary " and " luxury " travelling.

With goods traffic the conditions are different. One essential difference between passenger and goods traffic is that whilst passenger traffic must conform in some measure to the requirements of the public, goods traffic can, generally speaking, be run more or less at the transport company's convenience, attention being paid at the same time to the needs of the commercial community. The question of safety is not so important here, as evidenced by the more lax regulations governing goods traffic, as compared with passenger traffic, both on land and sea. In the United States, however, safety laws apply to freight trains and passenger trains alike. (*See* RAILWAYS: *United States.*)

Recent developments in block and automatic signalling have made railway operation—where automatic train-stops are in use—as safe as is humanly possible, while shipping is now controlled by adequate safety regulations. If safety in the air were assured, such means of transport would compete more severely with rail and sea services; already the safety and comfort of road transport have opposed to the railways a keen rival.

Another factor in transport operation is speed. In all forms of transport, other things being equal, the demand is for the quickest route.

As to goods traffic in particular, it is probable that the tramp steamer will continue to carry commodities which do not require quick delivery, and the " slow " as distinct from the " fast " goods train will always have its particular use, while a future generation will doubtless use aircraft for the conveyance of goods where the quickest delivery is the main consideration. The speed and convenience of road transport is attracting a considerable volume of traffic formerly borne by rail.

High speed is one of the primary considerations in all forms of transport. The aeroplane attains a speed of 100 m. per hour, the express train 60 m. per hour, the liner 24 knots, and while road motor vehicles can attain the speed of railway trains, other considerations limit their speed on public highways. One of the reasons why canals have fallen almost into disuse in England is that barge traffic is exceedingly slow. In France, the serious competition of the railways was recognized a generation ago, and although the canals were then equipped to furnish efficient service, and steam and motor traffic has to a large extent superseded the slow horse-drawn barge system which in England is still very general, the average speed seldom exceeds four or five m. an hour.

The methods of loading of ordinary goods traffic vary. A well-equipped goods depot has various mechanical appliances for lifting and loading goods on to waggons, but a considerable amount of waggon-loading is still performed by hand. Small parcels require a large amount of manual labour. Oil-loading in bulk is on the other hand a mechanical process. Then again different classes of goods require different vehicles, such as refrigerator vans for meat, fruit and other perishable commodities, vans for explosives, and mineral waggons. Ships, too, are adapted for carrying special classes of goods; grain ships, meat ships, oil tankers, as their names imply, are constructed for conveying particular commodities.

In the United Kingdom goods waggons have a limited loading capacity of ten to twenty tons, with mineral waggons up to forty tons, although two or three railways of the United States use a 120-ton coal waggon. It is obvious that the work involved in loading a goods train is far greater owing to break of bulk than that involved in placing the same load in the hold of a ship.

A very large tanker, for example, can load or discharge about 11,000 tons of oil in 12 hours. Loading the same quantity for conveyance by rail is a much longer process, as at present each oil tank waggon has a limited capacity of about 10 tons. The question of transport in bulk by ships applies not only to oil but to every class of commodity. Docks and harbours are generally well-equipped with cranes and warehouses, and with special appliances such as grain elevators and oil pumps.

Much time and labour are expended at transhipping points. Goods are brought to ports by rail for shipment, and the accumulation of cargo for any particular vessel usually commences long before the vessel's arrival. This predicates the necessity for goods warehouses and sheds, so that commodities are properly protected against pilferage, wind and weather, while awaiting shipment. When the vessel arrives, there must be adequate facilities for removing and dispatching her inward cargo before the outward freight is dealt with. Rail facilities on the quayside, as at Manchester, Southampton, and all modern ports, obviously make the process of transhipment much simpler than as at some of the older docks, where, when goods are taken from the ship's hold, they must first be loaded on road vehicles, and thus dispatched to the rail terminus.

The transhipment difficulty is also to be met where through-running facilities for trains do not exist, due to break of gauge, for example. This difficulty has been very acutely felt on the mainland of Australia, where the states have varying gauges, so that inter-state traffic involves transfer or change at several of the boundaries. The importance of the subject has resulted in the appointment in 1920 by the Australian Government of a commission to report on the possible unification of the railway gauge throughout Australia.

The most usual method of local collection and distribution of goods from a dock, station, or goods depot is by means of motor

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lorries. These have largely superseded horse traffic. In Great Britain, the railway companies perform a certain amount of carting, but many private traders have their own collection and delivery vans, and special carrier companies also assist in this very essential service. The use of motor vehicles for the local conveyance of goods has been so far extended that regular goods and passenger services now operate over long distances throughout the country. For the transport of perishable goods the motor lorry is particularly well suited. It has the advantage of offering door-to-door facilities with one handling at each end. The publication of the first "road Bradshaw" in Great Britain is an indication of the extent to which road traffic now operates.

The haulage of empty stock from one point to another is clearly necessary whenever a centre receives more or fewer waggons with loads than it requires for its own outward traffic. Very few centres receive the same number of loaded waggons as they require for forwarding goods. There must therefore always be a considerable movement of empty waggons. Statistics published by the Ministry of Transport in England show that in that country, at the commencement of 1921, about 30% of waggon mileage was "empty" running. Similar conditions prevailed in the United States. A large proportion of "empty" running is in connexion with mineral traffic. A mining area offers a considerable volume of outward traffic, with very little inward. Occasionally, however, loads can be obtained in both directions. A good example is seen in the case of iron-ore carried from Tyne dock to Consett for use at the iron-works there. The waggons are then used to convey coal from the collieries in the neighbourhood of the iron-works to Tyne dock for shipment. But this case is exceptional. The number of mineral waggons which run empty, or the ineffective dead load, can be reduced by the introduction of higher capacity waggons with a larger proportion of live to dead load.

This question of "empty" running is of equal importance in connexion with shipping. A well-organized shipping company will have its agencies so well distributed to secure return cargoes that loss through running ships in ballast is reduced to a minimum.

One great difference exists between the operation of railways and that of all other forms of transport. Railways operate on their own tracks, property which they must maintain and which has to be adequately staffed and attended. Ships have the advantage of the trackless ocean; aeroplanes and airships, infinite space; road vehicles, the public highway. Canals in Great Britain are different again; the waterways themselves are as a rule owned by various authorities, but the barges and other canal craft are usually owned by separate transport companies and private traders.

It is thus apparent that a railway undertaking must have proportionately a much larger operating staff than any other transport service. This introduces the question of management. The combination of the several factors of transport efficiency is the key to efficiency in operation. For the efficient handling and use of these factors an executive management is required, a management that should not only have full knowledge of the agencies, means and methods required for the particular type of transport operation with which it is concerned, but should also possess ability for the correlation and control of the many resources at its command. Indeed, the whole system of operation depends upon the body of management.

As to what is the best organization for management of a railway there are such wide differences of opinion that it is not possible to suggest that any given or particular plan is the correct one. In England at the head of a railway organization are the directors, presided over by their chairman, who are responsible to the shareholders for the efficient conduct of the undertaking. All questions of policy are settled by the Board of Directors, and the administrative staff, which is controlled by the general manager, who is directly responsible to the Board of Directors, is responsible for the actual carrying out of the work. The general manager cannot actually attend to all the details of operation of a railway: he can however see that the policy of the directors is carried out by the various heads of the departments. The chief executive officers are the chief engineer, mechanical engineer, traffic and goods managers, secretary, legal adviser, and accountant. In America, where one company is responsible for perhaps 5,000 m. of permanent way, the "divisional organization," which decentralizes the management, is more extensively resorted to than in other countries, having less track mileage.

A comprehensive view of the whole system is necessary to any manager or body of managers. The American railways recognized at an early stage that they could obtain a proper survey of the working of the whole system only by the collection and collation of statistics relating to every branch and section of the industry, and the Interstate Commerce Commission in a recent report stated that the successful operation of American railways is highly dependent upon statistics. The value of statistics is now better appreciated in England than formerly, and statistics relating to railway operation, on the general lines of those in use on the North Eastern railway for many years past, are now officially collected and issued. These have the effect of reflecting the operating efficiency of the various lines. They enable a number of units of efficiency to be arrived at, as, for example, the ton mileage, the train mileage, the waggon mileage, the average waggon load, the net ton miles of freight moved per hour, the percentage of time a locomotive spends in effective work, the proportion of standing and running time, and the proportion of time a waggon is moving. The ultimate object of statistics is to enable railways by comparison to find out the weak points and thus to be operated in the most economical and efficient manner.

As regards shipping, the Board of Directors is again responsible to the shareholders, but the managing staff is much smaller in proportion than in the case of railways. Each department has, however, its executive head, viz. marine superintendent, superintending engineer, freight superintendent, victualling superintendent, etc. The operating staff is also much smaller than is the case with railways, and the larger part of a ship's crew is engaged temporarily for a voyage, and when a vessel returns to a home port and the crew is discharged, only a nucleus staff remains. Then again, most shipping companies send their vessels for overhaul to shipbuilders and only carry out minor repairs themselves, unlike the railways, who do most of the repairs to their stock in their own shops.

Economics of Transportation.—The business of transport, whether by land or water or air, is subject, like any other industry, to those economic laws which govern the production, distribution and consumption of the commodities and services required for the satisfaction of the needs of humanity. From the economic standpoint, therefore, it is essential that the cost of the "production and distribution" of transport services and the price at which these services are placed at the disposal of the consumer shall be so related as to yield a reasonable margin of profit to the undertakings concerned. Where transport services are provided and operated by private enterprise, the applicability of this principle is naturally more obvious than in those instances where the enterprise is undertaken by a municipality or State: but even in this latter case the assumption should be that the benefits derived directly or indirectly by the community concerned are sufficiently great to warrant the expenditure which the provision of the service involves.

Railways.—In their efforts to attract traffic, railways have to compete not only with other railways but also with transport services carried on by road, river and canal. In certain circumstances an additional element of competition is to be found in coastwise shipping, and the competitive influence of air transport agencies still remains to be measured. Railway undertakings differ from road service undertakings in that the former ordinarily bear the whole cost of constructing and maintaining the "way" upon which the traffic is carried, whilst the cost of roadways is usually borne, wholly or in part, out of public funds. In the case of inland waterway services also, the expenditure on "way and works" is frequently defrayed out of State resources in countries other than Great Britain; but against this advantage must be set the slowness of inland water transport and the much greater vehicular capacity which railways can offer. The competition of coastwise shipping on the other hand is frequently severe, the cost of carriage by sea being relatively low, whilst in the conveyance of non-perishable goods, rapidity of service may be a matter of little moment.

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In the promotion of any new railway the selection of the route to be followed is of the first importance. Upon this depends the expenditure involved in overcoming the physical difficulties to be encountered in the course of construction, and the location of the line should be such as to secure the maximum amount of traffic available. The cost of future operation also depends, in great measure, upon the route adopted.

By the exercise of engineering skill and experience, the total mileage of track may be reduced, and difficult gradients and curves may be avoided, and by these means the subsequent cost of haulage is obviously affected. At the same time savings may be effected in capital expenditure on earthworks, tunnels, bridges and other special works of a costly character.

The location of the line and of the stations, goods depots and sidings in relation to the centres of population, trade and industry, determines to a great extent the amount of traffic and consequently the earnings which will be secured; and the number and position of these stations, etc., will in turn affect both the capital cost of the undertaking and the annual expenditure involved for staff and maintenance. Moreover, as distance is one of the prime factors to be considered in the fixing of rates and fares, it is manifestly desirable that, *ceteris paribus*, the route selected to connect the various traffic points to be reached should be as short as possible. This principle is obviously of particular importance in competitive areas.

In determining the location of the line the question of curvature and gradients calls for special attention. Curves are introduced with a view to avoiding undue expenditure on special works, such as tunnels, bridges, embankments and cuttings, but as a set-off against this, if the curves are anything but flat ones (*i.e.* curves of large radius), there is the resultant increase of wear and tear upon the rails and rolling-stock and increase in the mileage of track, whilst reductions of speed and a greater consumption of fuel may also be involved.

The influence of gradients upon working costs is still more marked. Where they are numerous and severe it may be necessary to employ engines of a heavier and less economical type, with the result that when running on the level sections or on the down-grades there is an appreciable waste of power, whilst the use of brakes is accompanied by an increase of the wear and tear of the rolling-stock of permanent way. In extreme cases it is usually necessary to employ additional ("banking") engines on the up-grades. In some instances the length and weight of trains have to be reduced and the cost of working the line is thus inevitably increased.

In considering the "earnings" of railway companies, or the "price" at which they place their services at the disposal of the consumer, it must be remembered that the undertakings themselves, being quasi-monopolistic in character, are usually subject to regulations imposed by the State. Consequently, in railway working, the economic tendencies which usually determine the price of commodities or services do not operate with entire freedom. At the same time even railway rates and charges, as a whole, must bear some relation to the cost of production.

Railway expenditure, apart from taxes, falls under two main heads: (*a*) working expenses, which include salaries and wages, maintenance and renewal of way and works and of rolling-stock, and also fuel and stores; and (*b*) fixed charges, including interest on capital and also rentals and other similar charges.

The aggregate earnings or gross receipts of a railway undertaking which is run on a purely commercial basis must be sufficient to cover both the working expenses and the fixed charges. The success of the undertaking depends ultimately upon the amount of the gross receipts and upon the proportion of this amount which is absorbed in the payment of working expenses. The volume of the traffic is therefore a matter of fundamental moment. If it be small and incapable of further development, and if the working expenses are already at the minimum compatible with efficiency of service, it may be necessary to charge high rates in order to cover both working expenses and the fixed charges. An increase of rates, to be effective, must, however, be such as to produce an amount which will more than compensate for the loss of traffic which such an increase tends to produce. Successful railway transportation therefore rests upon the following factors: (*a*) economy in the cost of construction and other items by which the magnitude of the fixed charges is determined, requiring engineering skill; (*b*) the maximum development of the traffic available, requiring business capacity; and (*c*) economy in working expenses, which is a matter for a railway expert.

In the fixing of freight charges, account is taken not only of the weight and bulk of the goods conveyed and of the distance for which they are carried, but also of terminal services, such as the loading and unloading of waggons. This charge varies in accordance with the services rendered and the class of goods dealt with. It is also irrespective of the distance the goods are carried. The maximum rates chargeable for goods traffic are fixed by Statute, but on British railways these rates are not necessarily the same in every case. This is not due to any ascertainment of the cost of "production" per unit of service in each case, but to a consideration of the general circumstances of each line concerned. The amount of the fixed charges being known, the density and regularity of the traffic is taken into account. Where the traffic is dense and regular and where fuel is obtainable at a comparatively low cost, there is obviously some ground for establishing lower maxima than would be appropriate for lines in agricultural areas having a light or intermittent traffic. Nevertheless, such differentiation is less common abroad than it is in the United Kingdom.

Service charges and mileage rates differ also according to the varying values of the commodities carried, the differences being determined by an elaborate system of classification. It is extremely difficult to say what proportion of the fixed charges or working expenses of a railway is attributable to the handling of a particular quantity of any particular kind of traffic, because a large part of such expenditures is "joint costs." Consequently railway charges are based very largely upon the consideration of the value of the commodities offered for conveyance. On general economic principles the amount which any commodity can pay for carriage to the market for which it is intended depends upon the amount by which its value in the market exceeds that which it possessed at the point of despatch. The difference between the value of a commodity at the point of despatch and its value in the market is naturally greater in the case of a costly article, and it therefore can bear a higher actual charge without sensibly diminishing the percentage available for profit. The apparently heavy charge payable for the transport of a valuable commodity may increase the cost of that commodity by only a small percentage, whilst in the case of merchandise of low value a similar charge would add a large percentage to the cost of the goods and possibly render them unmarketable. Thus the traffic is usually made to pay "what it will bear" and so long as the aggregate return to the undertaking is adequate, the railway manager is content to carry much traffic at rates which are below the average. This he can usually afford to do, not only because he obtains super-average rates for higher-grade traffic, but also because the additional expenditure incurred by the company in carrying a given quantity of additional traffic is rarely proportionate to the volume of such additional traffic. In the majority of cases the acceptance of additional traffic is accompanied by little addition to the fixed charges which have to be met, and can usually be handled without any proportionate increase in working expenses.

With regard to distance, the rates per mile quoted for freight traffic usually decrease as the distance to be covered increases, for although the cost per ton-mile (or per passenger-mile) for journeys of varying lengths can hardly be gauged with accuracy, it is recognized that long-distance freights are more profitable. Apart from the fact that a long-distance journey may be regarded as having a "wholesale" as distinct from a "retail" character, it enables the railway undertaking to make a fuller use of its plant, whilst the amount of terminal and other work involved is not affected by the greater distance for which the goods are conveyed.

In British practice, railway passenger fares are of three kinds: (*a*) ordinary fares at scheduled rates, (*b*) season-ticket rates, and (*c*) special fares.

Ordinary passenger fares were originally fixed in a somewhat empirical fashion, being arrived at by under-cutting the rates quoted by the other passenger transport agencies which were in operation prior to the advent of the railway era. Nevertheless, the rates which were thus fixed proved to be remunerative without being immoderately so, and it is no doubt because of this that they have usually been recognized as reasonable by the travelling public and the companies concerned.

Similarly, the differentiation which exists between the fares charged to first-class and third-class passengers rests upon an arbitrary basis and is not measured by the actual difference in the cost of the accommodation and haulage. Arbitrary, however, as the method of fixing passenger fares has been, it is the general experience of railway companies that passenger traffic is, on the whole, less remunerative than freight traffic.

Season-ticket traffic being chiefly confined to large urban areas involves heavy expenditure on the construction of lines and stations in districts where the value of land and property is naturally greatest, and where competitive influences are strongest. Another characteristic of season-ticket traffic is that the bulk of it has to be carried within the limits of the morning and evening rush-hour periods, and to meet the requirements of these "peak" hour periods (where trains can get full loads in one direction only), it is necessary to provide a large quantity of rolling-stock which must perforce remain idle during the slack hours of the business day. Against this must be set the fact that the traffic is regular and provides full train-loads with a minimum attention on the part of the station staffs. On the whole, however, the question whether season-ticket traffic is remunerative is debatable, whilst with regard to the low rates chargeable under the system of "workmen's fares" it may safely be said that political and not economic considerations have been the principal determining factor.

"Special" passenger fares are mainly confined to holiday and pleasure traffic. This traffic is naturally mobile and tends to pass readily from one line to another according as the advantages offered by each to the passenger vary in attractiveness. Consequently the traffic is usually secured by purely competitive methods, *e.g.* by advertisement and by the quotation of special fares. The cost of working pleasure traffic is high in proportion to the revenue earned, but good train-loadings are usually obtained, and as much of the traffic is genuinely "additional" it is doubtless a source of appreciable profit.

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Apart from the charges for freight and passenger transport to which reference has been made above, railways commonly quote "special rates" for goods traffic which has to be obtained by active competition with other transport agencies. These special rates represent departures from the ordinary schedule, and in Great Britain and the United States a great part of the total weight of goods conveyed by rail is charged for on the special-rate system.

The institution of these rates may in certain cases be due to the presence of waterway or other railway competition. The cost of transport by waterway is normally low and the competition for the carriage of goods of low intrinsic value is therefore severe; and where the competition arises from the presence of another railway, the competing line which possesses the shortest route naturally has an advantage over its competitor. In other cases the competitive influence may be exerted by a road motor service; but from whatever source it springs the question whether the quotation of special railway rates as a means of securing the traffic is justified is one which can only be determined by a consideration of the particular circumstances of each case.

Water Transport.—The expenses of transportation by water, like those of rail transport, fall under two main heads: (*a*) the fixed charges, which do not vary very much with fluctuations of traffic; and (*b*) the working expenses, including the costs involved in the actual movement of goods and passengers, the terminal charges which depend upon the volume of the traffic and not upon the distances for which it is conveyed, and lastly, the general expenses which vary very little with increase or diminution of business. As in railway management, the gross receipts must be sufficient to cover both the fixed charges and the working expenses, and provide a reasonable return upon the capital invested.

With regard to fixed and general charges, water transport services differ somewhat from railways. In the case of transport by sea, there are no considerable general charges for maintenance of way nor any fixed charges consequent upon the construction of such way. Construction is limited to wharves, docks and vessels with this equipment, and can be proportioned more or less directly to the amount of traffic to be carried. There is therefore less likelihood of excess in cost of construction and less necessity to accept additional items of traffic at less than average rates merely in order to make a fuller use of the plant provided.

In the case of canals, or of other waterways on the adaptation of which considerable sums have been invested, the conditions with regard to fixed and general charges obviously present a closer resemblance to those which obtain on railways.

The ownership of wharves on inland waterways is ordinarily distinct from that of the vessels which use them; and wharf charges should be such as to yield in the aggregate a normal return on the capital invested in the purchase of land and in the work of construction, *i.e.* the equivalent of a fair rent for the land occupied, plus a reasonable rate of interest on construction cost.

In water transport competitive influences operate more freely than on railways, and, in the case of ocean services, the choice of route is determined mainly by physical and economic considerations. *Ceteris paribus*, the choice is determined by the location of the centres to be served, and the route taken will follow the shortest lines between them.

In the case of inland navigation the course of a river will itself determine the route to be taken, whilst in the location of a canal the principles which operate are similar to those which determine the location of railroads.

Transport on natural waterways, and especially by sea, is less monopolistic in character than railway transport, the "sea road" being open to all competitors; and at terminals also such water transport is more subject to competitive forces then is usually the case with railways.

With regard to rates for freight, the general principle is that, on the whole, these rates should bear some resemblance to the cost of carriage, whilst with regard to particular articles discrimination may be made according to their character and value. There is, however, one case in which rates for water transport may be far below cost, namely, in those cases where certain goods may be used as ballast. On a particular route, for example, the demand for cargo space for shipments in one direction may be considerable, whilst in the other direction the demand may be very much weaker. In such a case cargoes may be accepted for the return journey at very low rates, apart from the fact that they may prove useful as ballast.

Road Transport.—The principal factor in the modern development of road transport is the advent of the mechanically propelled vehicle, the use of which is rapidly extending. In road motor services, as in the case of other transport agencies, the question of return on capital expenditure is important. The amounts expended upon the purchase of vehicles and upon the purchase of land and the erection of garages (where these are not rented) must be taken into account. Where land and garages are rented, the annual charges thus created must be covered by the gross receipts. Depreciation, repairs and renewals, fuel, and wages must also be provided for.

The responsibility of road motor undertakings for a proportion of the cost of maintaining the roadways which they use is now coming to be recognized, but they still escape the heavy capital expenditure such as the provision of railway way and works involves. In the case of these road undertakings, therefore, the fixed charges are of less importance, and such capital charges as they do incur (*e.g.* in the purchase of vehicles or in the provision of garage accommodation) can be more easily proportioned to the amount of traffic.

The gross receipts, and therefore the rates for freight and passengers, must be such as to cover both the fixed charges and working expenses, and must therefore bear some relation to the costs involved; but in the stage through which road motor transport is now passing there can be no doubt that, in the fixing of rates, the necessity for competing with railway services (especially for short-distance traffic) and with other road motor services is a governing factor.

Air Transport.—The possibilities of transport by air remain to be revealed, but it is significant that, already, regular mail and passenger services have been instituted and that, to a limited extent, the aeroplane is being utilized for the carriage of goods in small parcels. The general economic principles governing this form of transport are similar to those which operate with regard to those other transport agencies which use a way provided by nature and escape the construction and maintenance charges which the provision of an artificial permanent way would involve.

Ownership and Control.—The question whether the ownership and/or control of transport undertakings should be vested in the State, in municipal bodies, or should be in private hands, was in 1921 still the subject of considerable controversy. In some countries State ownership and, with it, State control of railways are accomplished facts, and even the working of the lines is undertaken by the State. In other cases, State ownership is accompanied by a strict control whilst the actual working of the lines is leased to private companies. In yet other instances State control goes hand in hand with private ownership and management, whilst in some cases (as in the United Kingdom prior to the war, and in the United States) railways are privately owned and managed, and are subject only to State "regulation," particularly in respect of matters concerning public safety and the like.

Many tramways are municipally owned and worked, being subject to State regulation in respect of public safety, whilst in the case of water transport State interference is usually limited to the grant of subsidies, coupled with a relative measure of control and with regulations for safety. In most cases, however, transport by sea is subject to safety regulations alone.

The advocates of private enterprise contend that the economic development and operation of transport is best achieved when public interference is absent or is limited to such matters as concern the public safety. They urge that, as public ownership or control involves official management, the great incentive to make a profit—which is the mainspring of private enterprise and stimulates efficiency—is removed. They urge that in the absence of this spur to efficiency, management tends to become slack and wasteful, that the element of political pressure is present, and that the vigorous enterprise which is essential to development and progress is seldom forthcoming. Experience has shown that these contentions are very largely correct.

On the other hand, the advocates of State ownership and control contend that as transport services possess the character of public utilities, they are proper subjects for public ownership and control, that they should be operated in the public interest alone, and that any profits which may result from such operation should properly accrue to the State or to the municipality as the case may be. They argue also that by the centralization of management of which public ownership and control admit, large economies in administrative and overhead charges can be effected, and that the wasteful competition and duplication of services can be avoided.

In weighing up the contentions of these two factions, it should be borne in mind that, whereas private ownership must of necessity be worked on an economic basis in order to exist at all, in the case of State ownership it is impossible to say definitely whether a service is being worked efficiently or economically.

Government Regulation.—The extent and nature of the regulation of transport by Government has varied very considerably at various times and in different countries. Where, as in many countries, the railways and canals have been built or acquired, and similarly the roads, to a varying extent, built and maintained, by the State, the extent of Governmental regulation is naturally great. In other cases—notably in Great Britain and

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the United States—transport has been traditionally regarded as a matter for private enterprise and initiative, and only such measure of control provided as might be necessary in the interests of public safety and general national policy. The present tendency has in all cases been towards a greater measure of control of transport services by the State, due to the increasing realization of the importance of transport in the economic life of a nation.

As regards roads and rivers—the latter having formed the principal channel of communication for many centuries, the State exercised but little control in Great Britain. Roads were regarded essentially as of local interest, the local authorities or private individuals being responsible for such construction and maintenance work as was undertaken. During the eighteenth century considerable improvement of the road system in many parts of England was made by the Turnpike Trusts set up by Private Acts of Parliament, and subsequently by the work of Macadam and Telford. In 1835 the Highways Act abolished the compulsory Statute labour on roads and empowered each parish to levy a rate for road maintenance, and in 1888 the care of the main roads outside urban areas was transferred to the County Councils. During the whole period the general policy adopted had been that of adapting traffic to road conditions rather than vice versa, with consequent restriction of weight of load, and stipulations as to breadth of wheels, and the fixing of conditions for the licensing of public vehicles; but a great step forward, mainly due to the extended use of mechanical road transport, has been the passing of the Roads Act of 1920, which initiated a Road Fund financed by the excise duties on mechanically propelled vehicles, from which grants can be made by the State for the construction, maintenance and improvement of roads, and which provided also for a greater measure of control over vehicular traffic.

As regards rivers, State action was mainly directed to the prevention of obstructions and abuses; and when authorizing the construction of canals—which during the latter part of the 18th and the beginning of the 19th century became the system of transport on which Industrial England mainly depended—these private undertakings, as later in the case of railways, were given compulsory powers to acquire land, and in return Parliament laid down the maximum charges which they might levy. In spite of the variety in the gauge and depth of the different canals, the canal system developed into a virtual private monopoly earning at one time very large profits, and the charges gave rise to much discontent among traders.

The railways suffered from this discontent, not only in the early stages of their development, but for many years afterwards, since the principal care of Parliament for a long time was to avoid the creating of another monopoly. It was at first thought that competition would be assured by the different carriers owning their locomotives and waggons, the railway companies owning only the lines. This was soon found to be impracticable, and reliance was then placed in competition between different undertakings; and it was many years before it was realized to be in the interest of the State that the various companies should work together.

Hitherto Government control in England has been mainly restricted to matters concerning the safety of the public and railway-workers, and to the charges made by the railway companies for the carriage of passengers and goods. The supervisory authority was placed by Parliament with the Board of Trade, a separate railway department being formed subsequently in the Board to deal with all railway matters. Officers of this department inspected all lines before they were opened for traffic, being given power to delay the opening where necessary, and were required to inquire into the causes of all accidents. They had no power to order work to be carried out in any special way, but if their requirements or recommendations were not given effect to, they had the power of refusing to sanction the use of the lines for passenger traffic for which fares were charged. In the case of goods lines and alterations to existing lines, the interests of the public were protected by the fact that if an accident occurred and the Board of Trade regulations had not been complied with, juries would deal very severely with the offenders. In practice, wherever railways have been constructed or operated, the Board of Trade regulations have always been complied with.

The Board of Trade was empowered to act as conciliator to settle, amicably if possible, differences between individuals and the railway companies, and, with a view to giving traders a specially qualified tribunal for complaints against the companies, the Railway and Canal Commission was set up in 1888.

The outbreak of war in Aug. 1914 brought about a remarkable extension in the control of transport service by Government. In Great Britain the Government at once took possession of the railways under the Regulation of the Forces Act, 1871, and during the whole period of the war these were worked on behalf of the Government by the Railway Executive Committee, a standing body formed from among general managers of the principal railway companies. Certain canals were taken over by the Canal Control Committee, and during the period of the war the greater part of the shipping was worked under the direction of the Ministry of Shipping. In 1919 further progress in control was made by the Ministry of Transport Act. This Act brought into being the Ministry of Transport, and placed under the minister the existing powers (with certain exceptions) of other Government departments in relation to railways, light railways, [6] tramways, canals, waterways and inland navigations, roads, bridges and ferries, and vehicles and traffic thereon, harbours, docks and piers. By this Act the minister was charged with the initiation and formulation of a policy for dealing with transportation, and in order to allow time for this and to permit of development in the meantime, he was authorized to retain for a period of two years control of those undertakings which were already in Government possession, and if necessary to take possession similarly of any other undertakings. Very wide powers were given to the minister in regard to these undertakings. He might give directions as to the rates and fares to be charged, and the salaries and wages of employees were under his control. He might order the working or discontinuance of working of an undertaking, or any part thereof, and take steps to see that alterations and improvements were carried out and coöperative working effected which would result in greater efficiency or more economical working. The minister was also empowered to establish and work, directly or indirectly, transport services by land or water. During the period of two years it was thought that the undertakings would be able to make considerable progress, as these powers would enable the minister to authorize the companies to carry out alterations and improvements and to acquire land without the delay and expense involved by the ordinary procedure.

In addition to the above temporary powers, the minister was authorized to make grants and loans for the construction, improvement or maintenance of the various classes of transport services and for the promotion of such services by existing companies, and he was also given powers in regard to the classification of roads, the through running of tramcars, omnibus routes, and the purchase of privately owned railway waggons.

The British Ministry of Transport was formed in Aug. 1919, Sir Eric Geddes being the first minister. It comprised departments dealing with civil engineering, mechanical engineering, development, traffic, finance and statistics, public safety, roads, secretarial and legal. A separate branch was formed to deal with Irish transport questions. In July 1920, the ministry issued a memorandum containing proposals for the future organization of transport undertakings in Great Britain. These provided for the grouping of existing railway companies into seven groups, each of these groups being under the control of a Board of Management composed of representatives of the shareholders and employees; for the fixing of rates to a certain standard revenue, a proportion of any surplus being allocated to a development fund to assist backward districts to develop light railways and other appropriate purposes; for the setting up of permanent machinery for settling railway wages and working

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conditions. It was also stated in this memorandum that it was intended to confer powers upon the State in relation to the railways (*a*) for the protection of the public, (*b*) for the economical working of the railway systems of the country, and (*c*) to safeguard national interests.

These proposals led to considerable criticism, and as a result of discussion with the railway companies, trading interests, and trades unions concerned, various alterations were agreed upon and embodied in the Railways bill introduced by the Government in the House of Commons in May 1921. This bill was designed to sweep up masses of legislation which had accumulated in the years since railways were first sanctioned by Parliament, and to simplify the relations between the State, the railway companies and the users.

The bill provided for the grouping of railways in four groups, which grouping was to take effect on Jan. 1 1923, and also for a variation of the grouping, provided that the Minister of Transport was satisfied that the variation was not incompatible with the efficient and economic working of the railway system of the country: the machinery by which the amalgamation of the companies in each group was to be effected was laid down in detail, and the scheme when agreed upon by the companies had to be submitted to the Amalgamation Tribunal established by the bill. If the companies were unable to agree upon a scheme, one would be settled by the Tribunal. The Board of Management of each group would be elected by the shareholders, but the proposal that the employees should be represented was abandoned. Elaborate machinery was provided for the fixing and periodical review of rates and fares. It was proposed to set up for this purpose a new court, called the Railway Rates Tribunal and consisting of three members, one a lawyer, one a commercial expert, and one a railway expert. An entirely new system was to be adopted, and the fixed charges would be actual and not maximum charges, that is to say, that except in certain specified cases the railway companies would not be at liberty to charge for any traffic a rate other than that fixed. The proposal to set up a development fund was abandoned, and in order that the railway companies might have every incentive to efficient and economical management, the bill provided that in the event of a company earning a surplus above the standard revenue, 20% of such surplus should go to the company and 80% to the trading community in the shape of reduction of rates.

It was proposed that the Minister of Transport should have power to require any two or more railway companies to conform gradually to measures of general standardization of ways, plant and equipment (including methods of electrical operation, type, frequency and pressure of current), and to adopt schemes for coöperative working or common use of rolling-stock, workshops, manufactories, plant, and other facilities; also, the railway companies might be required, on a proper complaint being made, to afford reasonable services, facilities and conveniences, and the machinery for obtaining authority to construct a light railway was simplified.

In other countries the war has similarly brought about a greater measure of Governmental control. In the United States the railways were taken over by the Government in Jan. 1918, and worked by a director-general of railroads until March 1 1920, when they were handed back to their owners. In the meantime the Transportation Act had been passed, of which the two cardinal features were:—(*a*) the continuance of private ownership and operation as a national policy, and (*b*) the recognition of public interest and duty in respect to the adequacy and efficiency of transportation facilities. The powers and responsibilities of the Interstate Commerce Commissioners have been largely increased by this Act, particularly in relation to the settlement of rates, the economical provision of adequate facilities, the regulation of operation of the railways in times of emergency, and the certification of loans to transport undertakings to enable them to render effective service during the period of transition which followed immediately upon the termination of Federal control.

In Germany the pre-war individual State administrations have been replaced by a central commonwealth administration under a Ministry of Transport established in 1919; and in most other European countries there has been considerable strengthening of the departments dealing with transportation, due to the increasing appreciation of the importance of this factor in the economic life of the State.

International Aspect.—A further question needs consideration, *i.e.* the international aspect of an effective international transport council. Roads, waterways and railroads originally were built for communication between neighbouring towns or districts, and to serve the needs of traffic within each nation, and not as routes from one State to another. Apart from custom and policy, to which must be attributed in earlier times the relatively small amount of commerce between the various European countries, there were great difficulties arising from customs dues, physical obstacles, differences in gauge and plant, and in loading regulations. These difficulties had such serious results that as the need for the interchange of goods became appreciated, endeavours were made to overcome them at various international conventions. Of these, the best known is the Berne Convention, formulated in 1893 as a result of arrangements initiated at a conference of representatives of various Governments held at Berne in 1878. This convention, which has been embodied in the laws of the adhering States, settled many difficulties. It abolished customs dues in intermediate countries on through traffic, specified the rights, liabilities and responsibilities of shipper, carrier and railway company, and provided for the establishment of a permanent association to facilitate settlements between the railways governed by the Convention and for the diffusion among them of information relating to the matters covered by the Convention. Further agreements have been subsequently reached on other important matters, but the need of a fresh and thorough review of the subject from all points of view became increasingly apparent during the first decade of this century. Very little was, however, done until the peace negotiations at Paris in 1919. A strong commission of experts of the Allies was formed to advise on questions concerning transit which arose during the negotiations; and the Covenant of the League of Nations included a declaration that members of the League will make provision to secure and maintain freedom of communications and of transit for the commerce of all members of the League. The expert commission in question continued to work until March 1920, when it was taken over by the Council of the League of Nations and instructed to arrange the Conference on Communications and Transit, which was held at Barcelona in March and April 1921, under the presidency of M. Gabriel Hanotaux. One of the results of this conference, which may have very far-reaching importance, was the creation of a permanent international body, to be known as the Technical and Advisory Commission, to watch the international traffic situation. The Commission will consist of sixteen members and will function as part of the League of Nations organization at Geneva. It will meet at frequent intervals and will arrange for a full assembly of all the members of the Conference or for regional conferences as circumstances may require. It will have duties of advice, initiation and administration, and will also serve as a council of conciliation in the event of a dispute on a traffic question between signatories of the Barcelona Convention. The latter function may lead to the gradual creation of a recognized and authoritative body of international law on traffic questions, which will prove a considerable advance on existing conditions. The Commission will have, as a basis for its decisions, conventions and recommendations agreed upon at the Barcelona Conference, which, however, require to be ratified by the several Governments. The more important of these deal with freedom of transit, waterways of international interest, and international railways. The convention on freedom of transit lays it down that the parties shall facilitate the free transit of persons, goods, vessels, coaching and goods stock or other means of transport by the routes most convenient for international transit. No distinction whatever is to be made as to the nationality of persons, the flag flown by vessels, the origin, points of departure, entry, exit, destination, or the owner-

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ship of the goods; no special transit dues are to be levied beyond what is necessary to defray the cost of actual services rendered, and they are to involve no discriminations as regards nationality or ownership. It is expected that many States will act on the recommendations, which declare that the Powers represented at the Barcelona Conference recognize that "any one of these States is entitled on the railways under the sovereignty or authority of any other State to all reasonable facilities for promoting and encouraging the flow of international traffic to and from its territory," and proceed to lay down detailed regulations for the application of these principles. (A. GI.)

TRANSVAAL (*see* 27.186), since 1910 a province of the Union of South Africa. At the 1911 census the inhabitants numbered 1,686,212, compared with 1,269,951 in 1904, an increase of 32·78%. Whites numbered 420,562 (as against 297,277 in 1904), coloured 1,265,650. Women outnumbered men, the proportion being for all races 89·71 males to 100 females. Of the whites 92·55% and of the coloured 24·30% were returned as Christians. Asiatics numbered 11,072 (9,018 males); of these 10,048 were British Indians, 3,065 having been born in the Transvaal.

In 1918 the whites numbered 499,347, of whom 303,050 lived in urban areas. At the 1921 census the total white pop. was 543,481 (males 284,952, females 258,529). Thus between 1904 and 1921 the whites had almost doubled in number, the increase being principally due to the development of the gold and coal mines. The growth of the white population gave the Transvaal at the 1920 election 13 more seats in the Union Parliament than the province had in 1910.

The chief towns are Johannesburg (total pop. 1911, 237,104, whites only, 1918, 137,166) and Pretoria (total pop. 1911, 57,674, whites only, 1918, 41,690). Besides Johannesburg there were on the Witwatersrand the municipalities of Krugersdorp, Germiston, Boksburg, Benoni, Roodepoort and Brakpan (the last named the centre of the Far East Rand, being created a munic pality in 1919), approximately half the inhabitants of the province being concentrated on the Rand.

The chief executive officer is styled administrator, and provincial government is in the hands of a provincial council, the system being the same for all the provinces of the Union (for particulars *see* CAPE PROVINCE). In the five years 1913–4 to 1917–8 the revenue collected for provincial purposes rose from £602,000 to £815,000, native pass fees providing half or more of the receipts. The Union subsidy in the same period rose from £620,000 to £695,000. The two main heads of expenditure were education and roads, bridges, works. The sum spent on education was £665,000 in 1913–4 and £1,143,000 in 1917–8. In 1920 there were 1,040 State schools with 109,700 scholars. There were also 389 State-aided native schools with 26,900 scholars. There was keen controversy over the language question in the schools for white children. By an ordinance of 1911, which came into operation on Jan. 1 1912, instruction up to standard IV. was to be in and through the "home language of the child"; a second medium might then be used if the parents so desired. This arrangement ended an attempt to enforce bi-lingualism and worked very fairly. In other respects the Transvaal was noted for its many educational experiments.

Gold mining retained its position as the chief industry, the Transvaal producing nearly half the world's output. There was a notable increase in the output of coal, and with the provision of railway communication to the Messina mines (situated in the extreme N. by the Limpopo) the production of copper ore rapidly increased. The output of tin from the Bushveld was also noteworthy. Manufacturing industries were developed on the Rand. The province retained its importance as a stock-raising country, and there was a marked increase in the cultivation of maize and tobacco (for statistics *see* SOUTH AFRICA).

Politics and parties in South Africa cut across provincial boundaries, and the history of the Transvaal since 1910 is part of that of the Union. The province presented in its social life many extremes, the conservatism of the back-veld Boer contrasting strongly with the progressive and democratic spirit of the dwellers on the Rand. But both these elements had their counterparts in other provinces. Party feeling was, however, more strongly expressed in the Transvaal than elsewhere, and this led to the introduction of politics into the provincial council, in which, at the election of 1914, the Labour party gained a majority of one. This election followed a great industrial upheaval on the Rand, leading to serious riots and bloodshed. The white workmen on the Rand formed the main strength of the Labour party, though it had also a considerable following in Durban and Cape Town.

A considerable number of Boers in the western Transvaal took part in the rebellion of 1914, but the influence of Generals Botha and Smuts kept many Boers loyal to the British connexion, as was shown at subsequent general elections. At the 1920 election the Nationalists, or Separatist party, gained 13, and at the 1921 election 15 out of the 49 Transvaal seats—how evenly the Dutch vote was divided was shown by the narrow majorities obtained in 1921 in the rural areas, while in two constituencies the voting resulted in a tie. The 1920 election had been notable for the success of Labour candidates on the Rand; the election of 1921 saw the Labour representation of the province reduced from 12 to 5 members. Labour organizations were not confined to the whites, but extended to the natives, who showed unexpected powers of combination and arranged strikes on customary European lines. But neither this industrial movement among the natives, nor their demands for political rights, was confined to the Transvaal.

The first administrator was Mr. Johann F. B. Rissik (Minister of Lands and of Native Affairs in the Transvaal as a self-governing colony). He was reappointed for a second term but resigned in 1917 to become a member of the Railways and Harbour Board of the Union, being succeeded as administrator by Mr. A. G. Robertson, who had represented Wakkerstroom in the provincial council. (F. R. C.)

TREE, SIR HERBERT BEERBOHM (1853–1917), English actor and manager (*see* 27.234), died in London July 2 1917. The chief Shakespearean productions of his later years were *Macbeth* in 1911 and *Othello* in 1912. In 1912 he also produced Louis N. Parker's *Drake* and in 1913 his biblical play *Joseph and his Brethren*. In 1914 he produced Mr. Bernard Shaw's *Pygmalion*. During the World War he was active in propaganda work, organizing lectures at His Majesty's theatre and speaking himself frequently in America during his theatrical tours. He published a volume of *Thoughts and Afterthoughts* (1913) and other occasional papers. His sudden death, after a comparatively slight operation, at the age of 63, was felt as a great loss to the contemporary English stage.

See *Herbert Beerbohm Tree: some Memories of him*, collected by Max Beerbohm (1920).

TRENCH, FREDERICK HERBERT (1865–), British poet and playwright, was born at Avoncore, co. Cork, Nov. 12 1865. Educated at Haileybury and Keble College, Oxford, he was elected a fellow of All Souls' College, and in 1891, after some years spent in travelling, was appointed an examiner in the Board of Education. This appointment he gave up in 1908 in order to devote himself to literary work. In 1908 he also became director of the Haymarket theatre, London, and during a short tenure of this position he staged *King Lear* and Maeterlinck's *Blue Bird*. During the World War he worked in Florence for the establishment of a better understanding between Great Britain and Italy. From his school days he had been a writer of verse, and his first volume of poems, *Deirdre Wedded*, appeared in 1901. It was followed by further poems, notably "Apollo and the Seaman," included in *New Poems* (1907), and *Lyrics and Narrative Poems* (1911). Among his later publications were an *Ode from Italy in Time of War* (1915); *Poems with Fables in Prose* (1917); and a poetic play *Napoleon* (1918), which was produced in London by the Stage Society in 1919.

TRENCHARD, SIR HUGH MONTAGUE, BART. (1873–), British air marshal, was born Feb. 3 1873 and joined the army in 1893. He served through the S. African War, was dangerously wounded, and was promoted brevet major. He was then for seven years with the W. African Frontier Force and during that time took part in three campaigns, receiving the D.S.O. in 1906. After returning home in 1910 he joined the Royal Flying Corps and he became assistant commandant at Upavon in 1912. On the outbreak of war in 1914 he was at first left in charge of the central depot at Farnborough, but before the end of the year he was summoned to the front and he shortly afterwards became head of the military wing of the air forces under Sir J. French; this appointment he filled with signal success for nearly three years. He was promoted brevet

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lieutenant-colonel and brevet colonel in 1915, and advanced to the rank of major-general at the beginning of 1917. On the formation of the Air Ministry at the end of that year he was brought home to become chief of the staff, but he resigned the position in the following April; he was however a few weeks later given command of the "Independent Force," which carried out extensive raids into German territory during the closing months of the struggle. He had been made a K.C.B. in 1918, and on the final distribution of honours for the war he was given a baronetcy and received a grant of £10,000. He was gazetted air vice-marshal on the introduction of the new designations of rank in the air service, and in 1919 he was promoted air marshal and became chief of the air staff.

TRENCH FEVER.—Early during the World War, in 1915, it was noticed that a large number of soldiers in France and Flanders were falling victim to a disease the nature of which was not clearly understood. It was an infectious disease because men were affected who shared the same tents, huts or billets. It bore some resemblance to rheumatism in that pain in muscles and bones was a prominent symptom. It was also rather like influenza except for an absence of nasal catarrh.

The disease at first was given many names. Thus cases were called "P.U.O.," an army term meaning "pyrexia of uncertain origin." They were also called "rheumatism" and "influenza" and "myelitis" and "lumbago." If the cases were seen at a late date when palpitation and breathlessness had become prominent, they were often called "cardiac neurasthenia" or "disordered action of the heart" ("D.A.H.").

Soon, however, it was felt that these diagnoses were inaccurate and a serious attempt was made to study the disease. The earliest contributions to its literature were made by Dr. J. W. McNee, and others who worked with him. Afterwards several Trench Fever Committees were formed by the British medical authorities. One of these worked in connexion with the American Red Cross; another, known as the "War Office Trench Fever Committee," had a hospital in Hampstead. This Committee was presided over by Sir David Bruce; the director of its research work was Col. William Byam. Both Committees infected volunteers and the conclusions reached, though they differed on points of detail, were substantially the same.

Trench fever is a louse-borne disease. The lice do not become infectious at once after feeding on a trench-fever patient; there is a latent period of some 8–12 days before they are dangerous to other people. Thereafter the excreta of the lice, rather than their bites, are infective. If these infective excreta be rubbed into a scratch or scarification trench fever develops in about eight days. The importance of this discovery about the excreta lies in the fact that persons may contract the condition who have never had lice upon them. The excreta is a dry powder, easily blown about, and so apt to reach the clothes. It remains infective for long periods and even when exposed to sunlight. Water on the other hand seems to diminish its infectivity quickly.

The blood of trench-fever patients is infective to other patients when injected into their veins. Thus the parasite circulates in the blood. The parasite is also in the louse excreta. It has not, however, so far been positively identified, though there is a certain amount of evidence, that it is one of the so-called Rickettsia bodies. In this connexion the names of Dr. G. A. Arkwright and Prof. A. W. Bacot must be mentioned.

The disease is protean in its manifestations. A proportion of the cases begin suddenly with great muscular weakness and exhaustion, headache, furred tongue and blood-shot eyes. Other cases come on gradually, the above symptoms increasing daily in intensity. The patient feels very ill and usually develops a temperature-rise to 102°F. or 103°F. Various types of temperature have been described. In some instances there is but one wave lasting two or three days; in other instances a "saddle-back" curve is shown, the temperature falling slightly and then rising again. Some patients relapse definitely on the fifth day, others about the eleventh day. Others again relapse at irregular intervals for long periods, each relapse giving a "spike" of temperature of short duration.

In a few cases there is no rise of temperature. Thus three volunteers were infected with the same batch of louse excreta. All of the three developed symptoms of trench fever but in one instance the temperature remained normal. Yet lice, subsequently fed on this patient, were able to transmit the disease to other volunteers all of whom developed rises of temperature. (For similar disease-carrying by body-lice *see* TYPHUS FEVER.)

The skin pains of trench fever are characteristic. They do not as a rule appear until a few days after the onset. They are of a boring, gnawing character and may be so violent that the patient cannot even bear the weight of the bed clothes. Again they may be very slight or absent.

The diagnosis is easy in early cases but the disease tends to run a very chronic course. In one case a patient labelled as a "neurasthenic" was found to infect lice four years after his initial attack. A percentage of patients become chronic invalids, others develop symptoms of functional heart trouble, others have nervous symptoms. It is probable that all these patients remain infected. The most reliable signs on which a diagnosis can be founded in the chronic stage are: (1) the patient's history, especially the state of his health before and after the initial attack; (2) the nature of his relapses; (3) the tenderness commonly met with on gently pinching the skin of the front of the leg (over the tibiae); (4) the presence of heart or nervous complications, *e.g.* breathlessness on exertion, pain, palpitation, gross tremor, etc.

The treatment is very unsatisfactory. At present no drug is known which will end the condition as quinine will end malaria. Thus it is necessary to attempt to build up the patient's strength against his infection. He should if possible lead an open-air life, he should have exercise, good plain food and cheerful surroundings. Some authorities lay stress on the value of thyroid, gr. 2 daily, in these cases. Others believe in iron tonics. Recent observations have suggested that the muscular weakness which follows the disease prevents the proper opening of the chest in respiration and so interferes with the suction action of the opening chest on the great veins. On this account the wearing of an abdominal belt has been recommended. It causes the patient to breathe with his chest and so tends to the restoration of thoracic movement. The disease is very disabling and its marked tendency to relapse makes it very distressing to the victim, who can never count on his health. Change of weather and wet weather seem specially to conduce to relapses.

(R. M. WI.)

TRENCH ORDNANCE.—The need of some form of easily transportable weapon for bombarding an enemy's works or his men from trenches immediately facing them, instead of from a distant artillery position, has made itself felt throughout the history of siege warfare. The use, in the trenches, of small mortars (known as "cohorns," from the Dutch engineer Coehoorn who designed them) was habitual in the sieges of the 18th century, and the great Carnot early in the 19th century proposed their use on a very large scale for the purpose of attacking personnel protected from direct fire by breastworks. The production of rifled ordnance, and the consequent modifications in siege methods, led to the disappearance of these cohorns. Nevertheless the need of a trench-mortar was felt in both of the two great sieges of modern times—Vicksburg and Port Arthur—in which before the World War, trench fighting was close and prolonged. In these cases mortars of wood and hoop-iron, strong enough to bear the strain of throwing small bombs a short distance, were improvised by the troops themselves. After the experience of Port Arthur, however, European designers took up the question, and several types were worked out, of which three, the Belgian Aasen, the German official "Military Engineering Committee's" design, and the Krupp, initiated progress along three different lines which were followed up in the World War. The first named, which was used in action even before the World War—at the siege of Adrianople, 1913—was the prototype of the light trench-mortars; the second, with few important modifications, remained in service throughout the World War, and represents the adaptation of standard artillery ideas and elements to the new problem, while the third introduced the principle of the "stick-bomb," fired from a small-bore high-pressure cannon. The Aasen, besides opening the series of light trench-mortars, introduced the principle, opposite to that of the Krupp, of low pressure.

The history of trench-mortars in the World War is a record, first of a continually increasing demand which the supply authorities in the various belligerent countries could not meet; then of a period, coinciding with the full development of position-warfare methods of tactics, in which well-designed weapons with ample ammunition supply played an increasingly important part; and lastly of a period in which, under pressure of new tactical needs, the "trench" mortar strives to become a gun of

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"accompaniment." The tactical employment of trench ordnance, whether in its designed rôle or as accompanying artillery, is dealt with under ARTILLERY: the present article is concerned with the weapons themselves.

The German trench-mortars—handled not by artillerymen but by engineers in their capacity as the technicians of the siege trenches—were used with great effect in the attack of certain of the Liége forts, and a little later at Maubeuge and Antwerp. In this they were carrying out the special duties for which they were designed, and at that stage of the war it was not foreseen that weapons of this class would be required for the equipment of a trench-front hundreds of miles in length. Consequently very few were available when the western front became stabilized, and the demand was made simultaneously from all quarters for some short-range trench weapon capable of curved fire, by which alone the covered enemy could be attacked from covered positions. For the time being, it was impossible for any belligerent to do more than provide stop-gaps in the form either of mechanical throwers (*see* BOMBTHROWERS) or small mortars mounted on wooden beds, which were in fact either artillery shell sawn off at the neck and bored with a vent or else cohorn and other mortars of the smooth-bore era, unearthed from arsenals or museums. But while the troops made shift with these, inventors and designers were producing experimental models which, when approved, were brought out in enormous numbers, with little difficulty from the point of view of manufacture since the designs were deliberately kept simple so as to be serviceable in the roughest conditions.

Setting aside, for the present direct-fire trench-guns, of which various types came into use for combating machine-gun emplacements, and, later, tanks—trench ordnance for curved fire is classified either according to weight, as light, medium or heavy, or according to the principle of design, as high-pressure or low-pressure. The latter basis of classification is taken here; and it is desirable at once to indicate the specific differences which mark off trench ordnance from normal artillery weapons, applying equally to high-pressure and to low-pressure types.

The most important difference is in *range*. Although by the end of the World War some remarkable results had been obtained by progressive experiments in the direction of increased range, the trench-mortar remained essentially a weapon of less than 2,000 yd. effective range. In the earlier models—save a few—the limit was about 500 yd., while many were incapable of exceeding 250. Even this last range sufficed in some cases, owing to the short distances separating the opposed front lines, and during the period of position-warfare most of the work of light and medium trench-mortars was done at ranges of 400 to 600 yards. The main motive for increasing range was not the desire to reach a more distant target from the front line, but the desire to emplace the trench-mortar at such a distance behind one's own front-line troops that premature explosions—specially liable to occur with improvised ordnance and ammunition—would not affect them. An almost equally cogent motive was the desire to avoid drawing the enemy's reprisal-fire, time after time, upon the same body of friendly infantry. Another motive was the desirability of withdrawing the trench-mortar itself from the effects of fire directed upon the front line, and preventing too close observation of its position by the enemy.

The next point is *weight*. For use in or near the front trenches the trench-mortar must be portable, either as a single unit (as in the case of light mortars) or in parts which severally do not exceed certain limits fixed by experience, either in point of weight or in point of dimensions. For the heavier trench-mortars, having greater range, the limits imposed on those which have to be taken close up to the front line are somewhat relaxed; indeed, the very heaviest, used only in very favourable conditions, is designed for a concrete bed and light-railway transport.

A third point is *simplicity*, or better, in the French phrase, "rusticity." The trench-mortar is by hypothesis subjected to the worst conditions of exposure and handling. From birth it lacks the mechanical finish of standard artillery; it is required in great numbers at a time when all engineering shops for high-class ordnance works are fully occupied and take the pick of the available metal. Then, on service, it is handled in the main by a hastily trained personnel, not all of whom possess the gunner's respect for his gun or the mechanic's pride in his machine. Moreover, the medium and heavy models are in most cases taken down and assembled frequently, and the parts are transported by hand through winding, muddy trenches, or across broken country in the dark. Save perhaps a detachable sight (which is carried by a non-commissioned officer or gunlayer), none of the customary adjuncts of modern ordnance is admissible.

Lastly, the *ammunition*, even of rifled trench-mortars, differs considerably from that of standard artillery. In most cases its design is special to the particular design of mortar, and there is no interchangeability such as that of 6-in. gun and howitzer ammunition. But in all cases, not being exposed to the bore pressures which standard artillery ammunition must endure, it has much thinner walls and a far greater explosive content.

These specific differences will be best realized by comparing a standard heavy trench-mortar with a heavy howitzer of the ordinary kind. The trench-mortar here taken is the Batignolle 24-mm. used by the French, British and Italian armies; the howitzer the German 21-cm., 1910 model, with a somewhat thick-walled shell.

	Shell	Weight of gun exclusive of mounting	Propellant Charge	Bursting Charge	% of Burster to weight of filled shell	Range in Metres
	kgm.	kgm.	grm.	kgm.	%	
Trench-mortar	89	220	720	45	56	1,040
Howitzer	83	2,625	3,200	8	9·7	9,100

Here the trench-mortar shows roughly one-fifth the propellant charge and one-ninth the range, but one-twelfth the weight of gun and six times the shell "efficiency" of the howitzer.

All trench-mortars fire at super-angles; that is, they use elevations of about 47° for their longest range and highest elevations up to 75° or more for the shorter ranges. This enables them to be used from deep and narrow trenches.

The design may now be considered under the three headings of high-pressure smooth-bore, low-pressure smooth-bore, and rifled.

I.—*High-Pressure Smooth-Bore Trench-Mortars.*

The prototype is the Krupp bomb-gun of 1912. This, and all the types presently to be described have "stick-bombs." The stick-bomb is a large-bodied explosive container sometimes spherical ("football" bomb), as in the case of the Krupp and the British 2-in. T.M., sometimes formed to overcome air resistance, as in the Dumézil types. In either case, attached to the base of the projectile is a rod which fits closely into the bore of the mortar—like the rod of a rifle-grenade—and may or may not be fitted with a gas-check disc at its end. The gun itself is either a solidly forged small cannon or a long stout tube, trunnioned at its breech end, and its mounting is supported on a wooden bed. It is fired either by friction tube or percussion lock like an ordinary piece of ordnance, or by the primitive device of lighting a length of match placed in a vent or touchhole. As the base or gas-check of the rod is in contact with the bag containing the propellant charge, the pressures developed in the bore are comparable to those in a regular howitzer, and it is necessary not only for the gun to be stout but for the seating of the rod in the bomb base to be solid and cup-shaped, lest (as sometimes happened) the shock of discharge should drive the rod into the bomb before the inertia of the latter has been overcome. All stick-bombs, owing to the air-drag of the stick, and in the Dumézils and some others to the steadying effect of external vanes, fly nose first, and can be used with ordinary percussion or instantaneous fuzes provided the arming resistance of these is adjusted. Of this class, the most widely used was the Dumézil, designed by General Dumézil, in substantially its final form, as early as June 1915, and subsequently used by the French, Italian, Russian (in a modified form) and American armies, though declined by the British. The "Dumézil No. 2," here described was the standard medium trench-mortar of the French army throughout the last three years of the war. It is simple and easily transported and assembled by unskilled personnel.

The *mortar* (fig. 1) is a stout cannon of forged steel (1) with simple vent-firing and rear trunnions. The maximum pressure with the heaviest bomb is 16 tons to the sq. in. The trunnions (2) are massive and bored through transversely to take a carrying bar or

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axle. It rests, when assembled for firing, in trunnion seatings formed in the inner parts of two cheek-pieces (4), which are heavy castings with accurately fitting inner faces. The foreparts of these are moulded upward to form elevating arcs forming a collar (3) on

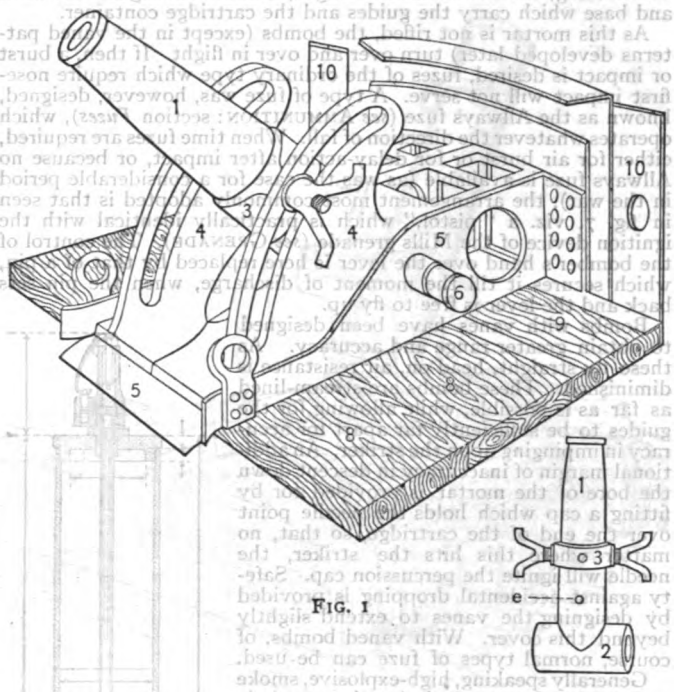

FIG. 1

the gun slide, the gun being secured at the desired angle of elevation by screwing home the clamping screws. The cheeks (4) carrying the gun rest in a trough (5), attached to the back of which is a curved plate. This curved plate butts against a similar curved plate (10), which is jammed firmly against the back wall of the trench or emplacement. The mortar can thus be laid for direction by sliding the back-plate of the trough (5) along this back-plate (10).

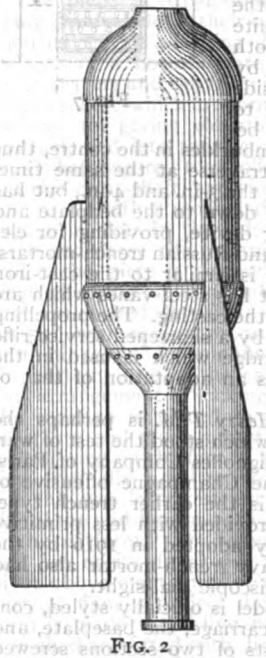

FIG. 2

The bed, in which the system rests without being attached, consists of three planks (8, 8, 9). The system may be moved without being taken down, by means of wooden truck wheels attached to the axle (6) which is passed through to the sides of the trough, the cheeks and the bored trunnion. These accessories were, however, not much used in practice, as only 4 to 5 minutes are required to bring up and reassemble parts in a new position. Various methods of indirect laying for line were employed, as well as direct laying by periscope (excluding axle and wheels). The weights of the various parts are as follows:—mortar, trunnions and elevating collar 165 lb.; two cheek pieces, 143½ lb. each; trough 132 lb.; wall back-plate 106 lb.; three planks 128 lb. Total weight in action 818 lb.

The stick-bombs vary in weight from 35 lb. (burster 13½ lb.) to 99 lb. (burster 50¾ lb.). The earlier types, as in the 99-lb. bomb of fig. 2, had three vanes; later, as in the 40-lb. bomb of fig. 3, six were fitted. Some types had considerably more elongated bodies than those illustrated. With a charge of 4 oz., the 35-lb. bomb ranges to 715 yd. at an angle of elevation of 45°, the muzzle velocity being 263 f.s., and with a charge of 4½ oz. a 68-lb. bomb, m.v. 220 f.s., ranges at the same angle of elevation to 490 yards. (C. F. A.)

II.—*Low-Pressure Smooth-Bore Trench-Mortars.*

Trench-mortars of this class are characterized by the fact that the pressure of the propellant gas is reduced by being allowed to expand into an "expansion chamber" of one form or another before beginning to take effect on the projectile. This device enables a thin-walled gun-tube to be used (instead of a true cannon such as the Dumézil above described) with considerable saving of weight. In some types, the firing of the charge was arranged to take place in a separate chamber which communicated by a chan. the expansion chamber, *i.e.* the breech portion of the gun- which the projectile is seated. Such were the Aasen, the S. Armstrong, which was employed as a naval "bombthrower' ORDNANCE: section *Naval*), and the Temple. The last-named distinguished by possessing a silencer attachment, which was considered by some authorities as a desirable addition in the period of short ranges and very advanced emplacements.

Of more importance in the history of the World War are those types in which the strong-walled "combustion chamber" does not form a separate component, but is included either in the base of the gun-tube (as in the Batignolles type) or the base of the shell (as in the Stokes). In both of these, the "expansion chamber" is formed automatically by the fact that only certain projections from the shell-base, and not the base itself, rest on the bottom of the bore or chamber-shoulders when in the loaded position.

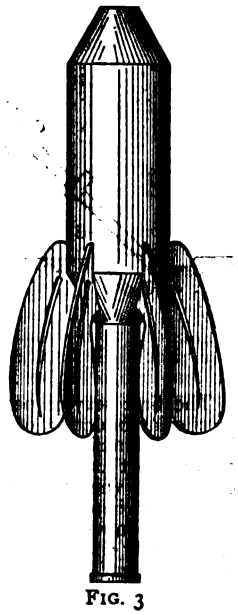

FIG. 3

The principal representatives of the class are the French Batignolles heavy trench-mortar, used also by the British, Italians and Americans, and copied, with modifications, in certain German patterns, and the British light Stokes mortar, which, with its derivative the medium Stokes-Newton, were used by the British and American armies. The *Stokes Mortar*, invented by Sir Wilfred Stokes early in 1915, was considerably improved in the course of the war as the result of experience with the weapon itself and with trench-mortars generally. It was first used in battle at Loos, Sept. 25 1915, when a few 4-in. tubes on bipod mountings, with straw-board-bodied shell, improvised at short notice, were employed for firing smoke shell; but by the battle of the Somme (July 1 1916) both 3-in. and 4-in. mortars (the latter specialized for gas and smoke projectiles) had been issued in large numbers. Thereafter, to the last phase of the war, in which its lightness enabled it to do useful service as an "accompanying" piece, it satisfied all expectations. Each British infantry brigade of 4 or 3 battalions included a battery of 3-in. Stokes. Their principal characteristic was *automatic ignition*.

Although it is believed that the first record of automatic ignition in trench-mortars, where the projectile carried its own propelling charge and igniter attached to the base of the bomb, existed in an early patent taken out in Germany by Messrs. Krupp, no practical use seems to have been made of this, and the first application of the theory of dropping a bomb of this nature down the bore of a mortar, so as to fire the charge and eject the bomb upon impact with the base, was that put forward by Sir Wilfred Stokes. The bomb in its first service form (fig. 4) had a container screwed on to the base, and this took a 12-bore sporting cartridge, the percussion cap of which, after the bomb had slid rapidly down the bore, impinged upon a striker fixed in the base of the mortar. In the 6-in. medium mortar (Stokes-Newton), developed later in the war, the principle of the fixed striker was adhered to, but both the mounting and the projectile differed entirely in design.

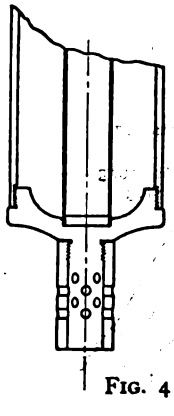

FIG. 4

The barrel of the 3-in. Stokes mortar (fig. 5) consists of a light seamless steel tube (A) drawn down at the base end, which is bumped into a semicircular form having a slight projection in the centre of the axis of the bore. This projection is drilled and threaded to take the striker (H), which, when screwed home, projects into the bore; the size of the combustion chamber is regulated by the extent to which the striker protrudes into the barrel or bore of the mortar. A cap (G) is screwed over the outside of the projection to take the set-back of firing. This cap, which is made of steel, rests in a small depression in the base-plate (C), which is fixed in the ground approximately facing the objective, and at a convenient angle, and has several such depressions placed in an arc to provide for changes of direction. The thin tube or barrel of the mortar has a smooth bore; it is supported above the centre of gravity by a pair of folding legs (B), between the apex of which (when open) and the barrel are the elevating and traverse gears, the latter being attached to the barrel by means of a steel band (*see* fig. 6).

There is no attempt to take up or absorb mechanically the set-back on firing, or the recoil, as the low combustion pressure renders this unnecessary at the ranges used.

As already noted, the 3-in. Stokes was in the British service set apart for the firing of high-explosive bombs (although smoke-pro-

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ducing bombs were added later), while the 4-in. mortar was reserved for gas, smoke and incendiary projectiles. The weight of the 3-in. bomb was given at 10 lb., and of the 4-in. at 25 pounds. The design of the mortar, as between the two types, was only varied in so far as the difference in size rendered this necessary, and the same is substantially true of the design of the bomb. Steel is used in the 3-in. and both steel and cast iron bodies in the 4-inch.

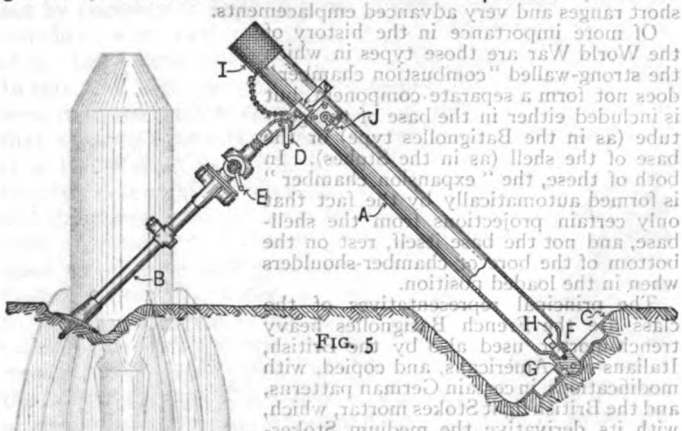

FIG. 5

The first service patterns of bomb, and all subsequent ones up to the introduction of the vaned bomb in the last days of the war, have a cylindrical body, which is provided with 2 bands or "guides" as far apart as the wall of the bomb permits, preferably one at each end of this (fig. 7). The object of these guides is to ensure that the percussion cap falls accurately upon the striker after the bomb has travelled down the inside of barrel. The guides also eliminate friction during the descent of the bomb; windage has to be allowed for (*i.e.* sufficient space to permit the air compressed by the bomb in its descent to escape between the guides and the wall of the barrel). The windage provides an escape for the surplus air and ensures that the acceleration due to gravitation will drive the percussion cap with sufficient force on to the striker to cause ignition. In the 3-in. and 4-in. service designs the working chamber pressure is limited to 2 tons per square inch. At this pressure a range of 1,250 yd. is obtainable with the cylindrical bomb, when using the full propelling charge. This charge is obtained by placing rings of cordite round the exterior of the cartridge container, the container being perforated with a number of small holes, through which the gas from the cartridge escapes into the chamber, thus igniting the cordite rings in passing.

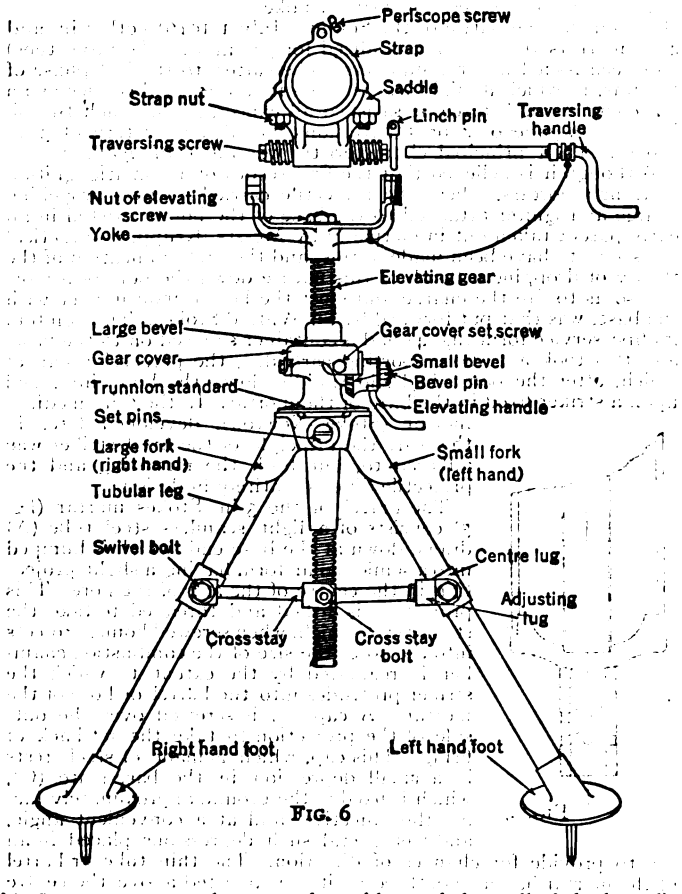

FIG. 6

The steel bomb is made up of ordinary commercial lap-welded steel tubing, cut to the desired length, and of the forged steel head and base which carry the guides and the cartridge container.

As this mortar is not rifled, the bombs (except in the vaned patterns developed later) turn over and over in flight. If then, a burst or impact is desired, fuzes of the ordinary type which require nose-first impact will not serve. A type of fuze was, however, designed, known as the Allways fuze (*see* AMMUNITION: section *Fuzes*), which operates whatever the direction of fall. When time fuzes are required, either for air burst or for delay-action after impact, or because no Allways fuze is available (as was the case for a considerable period in the war), the arrangement most commonly adopted is that seen in fig. 7, viz. a "pistol," which is practically identical with the ignition device of the Mills grenade (*see* GRENADE). The control of the bomber's hand over the lever is here replaced by that of a pin, which secures it till the moment of discharge, when the pin sets back and the lever is free to fly up.

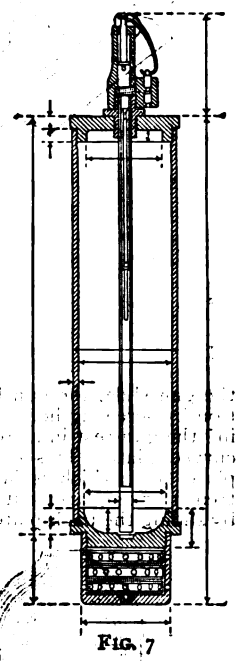
FIG. 7

Bombs with vanes have been designed to obtain greater range and accuracy. As these fly straight, head on, air resistance is diminished. These bombs are stream-lined as far as is possible, while allowing for the guides to be sufficiently far apart for accuracy in impinging upon the striker. An additional margin of inaccuracy in descent down the bore of the mortar is provided for by fitting a cap which holds the needle point over the end of the cartridge, so that, no matter where this hits the striker, the needle will ignite the percussion cap. Safety against accidental dropping is provided by designing the vanes to extend slightly beyond this cover. With vaned bombs, of course, normal types of fuze can be used.

Generally speaking, high-explosive, smoke and gas bombs are all designed to explode upon impact, while incendiary bombs are designed to function in the air as nearly over the objective as possible.

The *Stokes-Newton 6-in. T.M.* is similar, so far as the barrel is concerned, to the Stokes 3-in. and 4-in. A much stronger bedplate, however, is required owing to the increased weight of the projectile and the greater range, and the mounting is quite unlike that of the smaller weapons. Both direction and stability are obtained by means of lugs set radially round the outside of barrel, about midway, and attached to rings in the bedplate. These lugs can be lengthened or shortened by means of turnbuckles in the centre, thus obtaining elevation or depression and traverse at the same time. This method is slower than that used in the 3-in. and 4-in., but has the advantage of tying the mortar well down to the bedplate and ensuring stability. A somewhat similar device, providing for elevation only, is found in certain German and Russian trench-mortars.

The projectile of the Stokes-Newton is similar to the cast-iron vaned bomb of the smaller weapons. It has steel vanes which are placed in the mould and become part of the casting. The propelling charge is guncotton, and this is ignited by a shortened service rifle cartridge, instead of the 12-bore cartridge which is used in the Stokes cylindrical bomb. This bomb is an adaptation of that of the French 240-mm. described below.

The *Batignolles 240-mm. (9·45-in.) Heavy T.M.* is perhaps the most elaborate of those trench-mortars which stood the test of war. It was brought out in 1915 by the Batignolles Company of Paris, and first used in a great battle in the Champagne offensive of Sept. 25 1915. The model described is the earlier trench type. Later, the piece was lengthened and provided with less primitive firing arrangements. The model finally adopted in 1916 by the British War Office as the standard heavy trench-mortar also had different firing arrangements and a periscopic dial-sight.

The *240 court de tranchée*, as this model is officially styled, consists of four main parts, the piece, the carriage, the baseplate, and the platform (fig. 8). The *piece* consists of two sections screwed together; the lower section, which has very thick walls, contains the chamber proper, in which the propellant charge is housed, and (in this model) an aerial vent to take the 12-secs. length of Bickford fuze which communicates the flame from the gunner's portfire to the powder primer of the charge. The upper or front end of the chamber is not "choked" but on the contrary opened out so as not to impede the rush of gas into the broader "expansion chamber," or lower part of the thin-walled tube. This thin-walled tube contains the vaned bomb (fig. 9), which unlike those previously described in connexion with the Dumézil trench-mortar, has its four vanes exactly in prolongation of the body. This arrangement not only enables the whole of the projectile to enter the bore, but ensures

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the maintenance of a free expansion chamber as the tips of the vanes, and not the base of the bomb, rest on the curved shoulders of the chamber proper. The bomb is of steel, thin-walled, and its body is built up from three pieces by autogenous welding, the cruciform vanes being secured to the body in the same way after being riveted

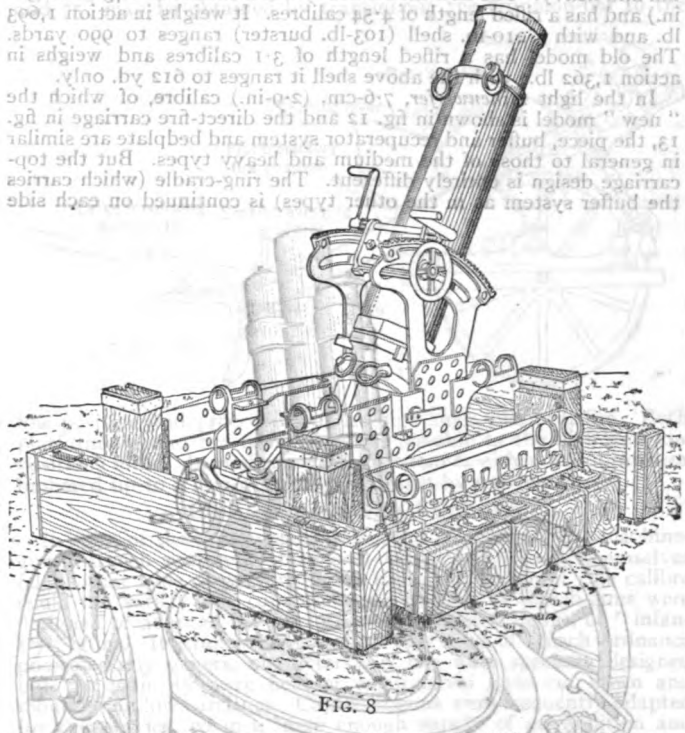

FIG. 8

to each other. A delay-action fuze only is used. With this, the powerful bomb, weighing 192 lb., of which 101 lb. are high explosives, will demolish thirty linear feet of trench work, break down all but heavily protected dugouts, and make a crater in compact clayey earth 10 ft. deep and 30 ft. across.

The piece is rear-trunnioned, the trunnions being firmly held in their seatings in the base of the carriage by a locking device. The carriage consists of a bottom-plate which contains the pivot-seating and the trunnion-seatings, and two side-brackets which are formed at their top edges as arcs for giving elevation. These arcs are toothed, and into them gear small pinions on a cross-shaft secured to a collar on the piece. Below this cross-shaft, and similarly secured to the collar, is another cross-shaft, the ends of which engage in slots in the side brackets of the carriage and carry the clamping arrangements by which the piece is secured rigidly to the carriage when the arc-and-pinion gear have brought it to the desired elevation. The elevation limits are 54° (with certain precautions 45°) for maximum range, 75° for minimum. On its underside the bottom-plate of the carriage has an ingenious arrangement of locking sectors which, when the carriage is placed over the pivot on the baseplate and given a partial turn, engage in a locking-ring on the face of the baseplate. (The ring originally admitted of all-round traverse, but this was later restricted to one of 18° each side of the mid-line, so as to avoid slantwise strain on the platform.) The baseplate is almost square and has on its upper side the locking-ring and pivot above mentioned. From its underside six vertical flanges project downwards. The platform is made up of five heavy square baulks, iron-shod and fitted with distance pieces so that, as they lie in position in the shallow, levelled pit, the four inner flanges of the baseplate can enter between them, while the two outer flanges fit over the outer baulks. Latches on both ends of each baulk engage with projecting tongues on the baseplate. Thus baseplate and baulks together form a steady unit in firing. The unit is further steadied against the horizontal component of the thrust by being wedged, back and front, against end-boards placed against the walls of the pit. The piece is laid for direction by an auxiliary aiming point, any suitable dial-sight being adaptable to the mounting-means of one or another form of dial-sight, a clamp on the bottom-plate of the carriage binding the latter in the desired position of traverse.

FIG. 9

All the parts are equipped with sockets for lighting-ha... except the piece itself which is carried by two staves passed ... the two parts of carrying rings seen in the drawing. But mov... in the trenches is as a rule by means of iron barrows pushed by ... One barrow takes the mortar upright, another the carriage, a th... the baseplate and accessories, while the baulks and end-boards a... carried by hand.

The weights of the short 240-mm. are as follows: mortar 485 lb., carriage 425 lb., baseplate 510 lb., platform baulks 132 lb. each. Total weight in action (exclusive of wedges, steadying pickets, etc.) 2,080 lb. The loaded weight of the heaviest barrow (baseplate, etc.) is 943 lb. The maximum range of the 192-lb. bomb with a propellant charge of 1 lb. 9½ oz., is 1,125 yd. at 45° elevation and 1,045 at 55° 30′. The maximum pressure in the bore is slightly less than 1 ton per sq. in. (150 kgm. per sq. cm.). The lengthened 240-mm. (breech-loading and percussion-fired) ranged with a 179-lb. bomb to 2,265 yd. (m.v. 476 f.s., maximum pressure 3,700 lb. per sq. in.), using a charge of 2 lb. 13 oz., but it required a heavier and more elaborate platform. A still more powerful weapon of the same class was the 340-mm. (13·4-in.), which required a concrete bed and a light-railway track for supply. This carried a 430-lb. shell (high explosive burster 205½ lb.) to a distance of 2,250 yards.

Pneumatic guns, as possessing a high-pressure reservoir and a low-pressure gun chamber, should also be included amongst the low-pressure class of trench ordnance. Owing to their silence and invisibility in action, they possessed marked advantages over the earlier forms of trench-mortar using explosive propellants. But their low power, their complication and liability to get out of order, and as regards some models, their entire dependence on a special form of supply (air or carbon-dioxide bottles) disappointed expectation; and of many ingenious designs put forward in the different belligerent countries, one only was consistently employed in the field. This was the French Brandt, classed as a light trench-mortar, which could obtain its pressure either from a bottle or from a motor-car pump. Its first model, which had a tripod mounting, weighed 48½ lb. for the gun, 35½ lb. for the tripod, and 70½ lb. for the box of accessories and pumps. A later model, firing to a fixed angle only, was much lighter. It threw a 1½-lb. bomb, or rather grenade, very accurately to a distance of 250 yd. but, although much greater ranges were obtainable, the accuracy fell off rapidly beyond that figure. (C. F. A.)

III.—*Rifled Trench-Mortars.*

The Germans were the first to produce an officially designed model of trench-mortar (*Minenwerfer*), and these weapons were used in the earliest sieges of the war. Although this gave German designers a long start in the competition, it did not save the German army from passing through the same phase of crude improvisations, which the French and British armies had to traverse. Bored-out shell mounted on blocks, old bronze siege mortars, experimental pneumatic mortars, and various smooth-bore types all figured in the armament of the German trenches for the first years of the war, and it is not till 1916 that the standard types are found in very large numbers. Thereafter, with the sole exception of a *minenwerfer* copied in principle from the Batignolles 240-mm., the standard types alone were used for general battle and trench service. The older types, so far as they survived, were practically reserved for throwing gas-bombs and other special projectiles. All the standard types of light, medium and heavy *minenwerfer* are rifled, and are derived from the pre-war service weapon. Modifications during the war were few, and did not affect the main elements of the design. They were principally two—the lengthening of the barrel in all three classes, and the adaptation of the light type to a direct-fire carriage, which enabled it to be used with conspicuous success as an "accompanying gun" in the semi-open warfare of 1918. The models selected for description here are the original model of "medium," the new or 1916 model of "heavy" and the light type with and without direct-fire carriage. Rifled trench-mortars were not used in any of the Entente armies.

The characteristic of the German rifled trench-mortar in all forms is that, unlike the stick-bomb weapons and the low-pressure weapons which are radical departures from ordinary artillery practice, they are designed essentially as siege howitzers of reduced weight and power. Recoil-gear is provided, but of a simpler kind than the intricate combinations of elements necessary in a howitzer of high velocity and recoil energy; similarly, to ease the strain of discharge, by reducing the power necessary to propel the projectile, the driving band of the shell is "engraved" in advance. But the arrangement of piece, cradle and buffer, and the form of the shell, is in accordance with the conventional artillery practice.

The "*old*" *model medium trench-mortar* (fig. 10) is a short, thin-walled howitzer of 17-cm. (6·69-in.) calibre, rifled with 6 shallow grooves of uniform twist, 1 turn in 26½ calibres. The length of the rifling is 3·3 calibres. It is muzzle-loading and has percussion-firing gear placed axially on the breech. It is mounted in a ring-cradle which carries, above and below, a combined buffer and spring recuperator of simple type. The piece slides back and forth in the cradle and has the pistons attached to horns above and below the breech. The cradle is centre-trunnioned and the trunnions rest in seatings in a top-carriage of the usual form. The left trunnion car-

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ries an elevating arc actuated by a worm-shaft and handwheel on the carriage. This trunnion also carries a panoramic sight (not shown in the illustration), mounted so as to slide on an arc which renders its position independent of the gun elevation. The baseplate, which is of steel, has longitudinal and transverse spades or flanges to enable the mounting firmly to be bedded on the ground.

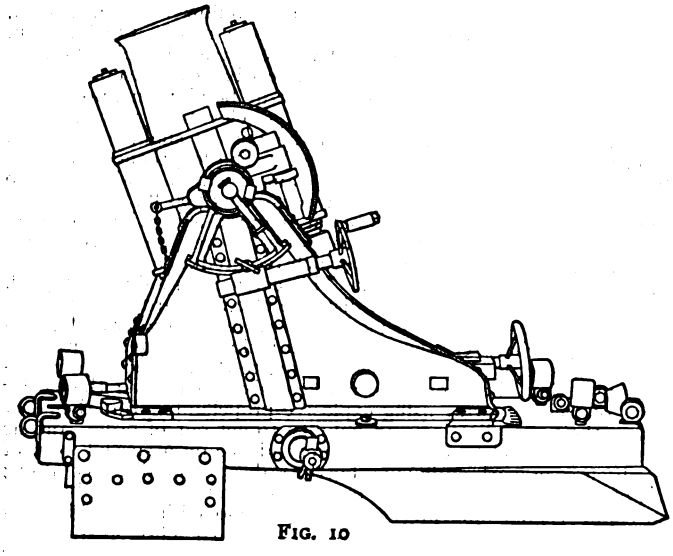

FIG. 10

In the forepart, the baseplate has a vertical pivot and in the rear part an arc, which enables the top carriage to be traversed 12½° either way from the centre line by means of the handwheel seen in the illustration. As in all German rifled trench-mortars care is taken to house in gearing and mechanism so as to keep out mud and dirt. The weight of the whole system in action is 1,064 lb. and the maximum range, with a 109-lb. shell (burster 24½ lb.), is 980 yards. For transport, wooden wheels are fitted to axles on the bedplate and a handspike with a socket formed at the back of the same. The "new" model of medium *minenwerfer* is slightly longer (3·8 calibres rifled length), weighs 1,232 lb. in action, and ranges to 1,250 yd. with the same shell.

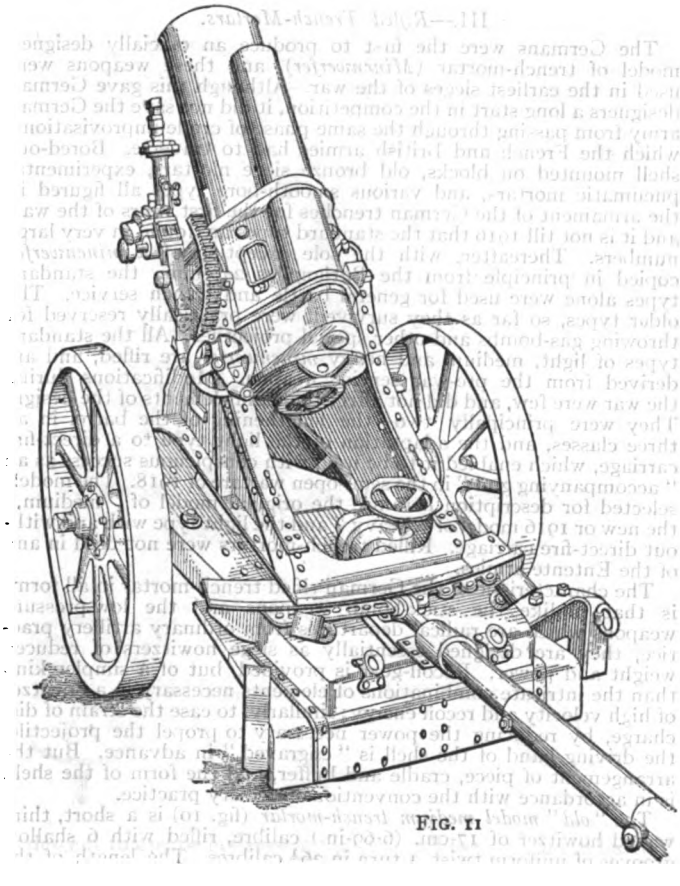

FIG. 11

The heavy *minenwerfer, new model*, shown in fig. 11, is similar in all essentials of design to the above, but like other new models longer than the original model of its class. The details, such as the sight and the traversing gear seen in the illustration, and the elevating gear, etc., seen in fig. 10, are common to old and new models of medium and heavy. The new model heavy has a calibre of 245 mm. (9·8 in.) and has a rifled length of 4·54 calibres. It weighs in action 1,693 lb. and with a 210-lb. shell (103-lb. burster) ranges to 990 yards. The old model has a rifled length of 3·1 calibres and weighs in action 1,362 lb.; with the above shell it ranges to 612 yd. only.

In the light *minenwerfer*, 7·6-cm. (2·9-in.) calibre, of which the "new" model is shown in fig. 12 and the direct-fire carriage in fig. 13, the piece, buffer and recuperator system and bedplate are similar in general to those of the medium and heavy types. But the top-carriage design is entirely different. The ring-cradle (which carries the buffer system as in the other types) is continued on each side

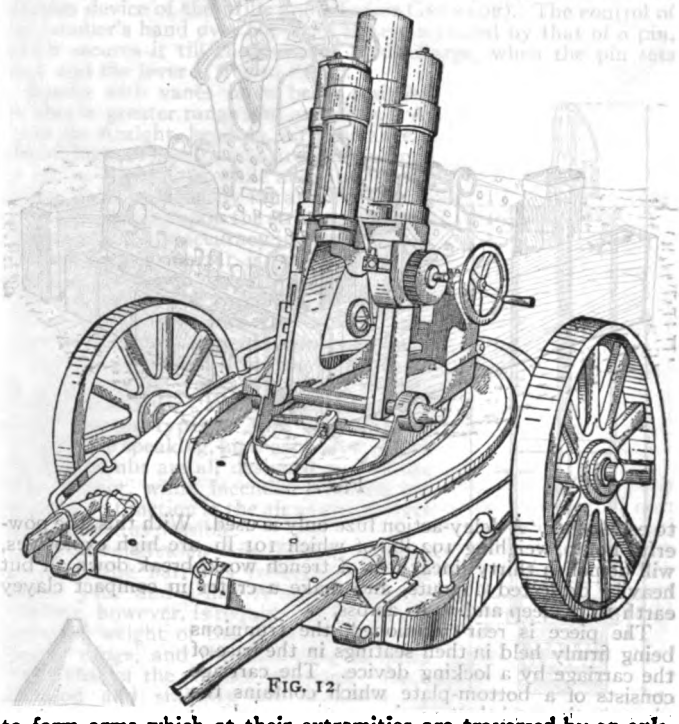

FIG. 12

to form arms which at their extremities are traversed by an axle, or through trunnion-bar, a few inches above the baseplate level. This bar rests in seatings in a very small intermediate carriage which traverses (through a circle) round a pivot in the bedplate. In the forepart of this intermediate carriage is another cross-axle which at its middle is formed as a socket, taking the foot of a stout elevating screw. This elevating screw (which is cased in leather to protect it from dirt) is clearly seen in fig. 13. It supports the weight of the cradle and piece, to which it is jointed, and elevation is given by screwing up or down.

The weight in action of this model is 312 lb., the rifled length of bore 5·2 calibres, and the high-explosive shell weighs only 9 lb., and, comparing these proportions to those of the heavy and medium shell, it is not surprising to find that it ranges to 1,422 yards. The "old" model was somewhat shorter and lighter, and ranged to 1,150 yd. with the 9-lb. shell.

The light *minenwerfer*, which is also known as the "Ehrhardt," was a very successful weapon, and every German infantry battalion had by 1917 a "light *minenwerfer* section," consisting of 4 of these pieces and a number of the "*granatwerfer*" described under BOMB-THROWERS.

In 1918, in preparation for the expected resumption of "open" warfare, the Germans on the western front adapted the light *minenwerfer* for service as a direct-fire short-range gun of accompaniment for use against undisclosed machine-gun nests and other defences that might be met with in the course of a deep advance. For this purpose the bedplate, already provided with axles, was fitted with higher (29-in.) wheels, and a trail with trail spade was bolted to the small intermediate carriage described above. This trail is peculiarly arranged in the forepart. The cross-axle, or through trunnion-bar, which, in the trench-service mounting, connects the ends of the cradle arms to the intermediate carriage, is, in the direct-fire mounting, connected to a framework in the trail which can be raised or lowered, thus enabling the cradle and mortar, always supported in front by the elevating screw, to assume either the horizontal or slightly elevated position with trunnion-bar high, or the quasi-vertical loading position (shown by dotted lines) with the trunnion-bar low.

The motion of the framework in question is about a transverse axis contained in the trail and is controlled by a shifting level.

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Traversing is still about the pivot in the bedplate, and is managed by moving the point of the trail (by means of a small lever) along the broad arc-shaped spade member. The limits of this traverse, viz. with spade bedded, are 11·8° either way from the middle-line. The maximum range with the 9-lb. shell in the direct-fire position high-trunnioned (elevation 38°) is 995 yd., but all angles between 34° and 75° may be obtained by transferring the trunnion-bar to the

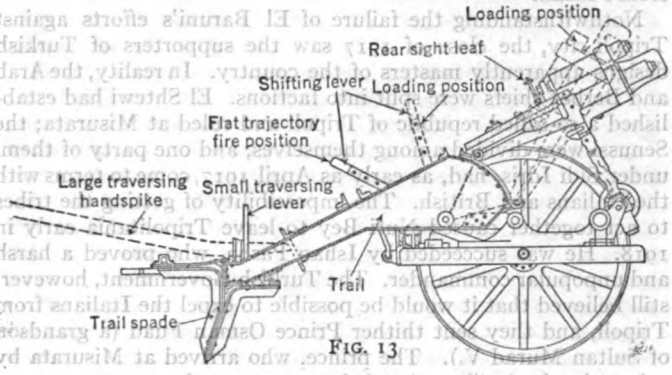

FIG. 13

low position and proceeding as its high-angle platform fire. Both platform-fire and fire from wheels is possible in the high and low positions alike. In movement, the system is either man-drawn or limbered up to a two-wheeled cart drawn by one horse.

IV.—*Direct-Fire Trench Ordnance*

In spite of the great defensive powers revealed by the machine-gun in trench warfare, certain local-defence needs made themselves felt in that type of warfare which the machine-gun of rifle calibre could not satisfy. In consequence, a variety of trench-guns were designed or adapted for emplacing as "forward" guns, or "infantry" guns. It cannot be said that this class of trench ordnance possesses any generic characters. A few were specially designed but the majority were field or small naval guns cut down and mounted on low carriages. Captured guns were frequently adapted for this service, when a large enough supply of ammunition and pieces was available, and also hooded quick-firing guns of the 57-mm. class taken from fortress armaments, in which formerly they had figured largely as a standard close-defence armament. Later on, these forward guns were sometimes made mobile again for use as guns of accompaniment. None of these converted types, however, need be dealt with here, and it will suffice to mention more particularly the 37-mm. gun (of French origin, but used also by other armies), not so much because it is representative of a class—which is too miscellaneous for any member of it to be regarded as such—as because it was used on a large scale in the war. It is a direct-fire quick-firing weapon, short in barrel length, mounted on a low-wheeled carriage and provided, as is a field gun, with a shield. It was laid over open sights and fired small, high-explosive shells with percussion fuzes similar to those of the "pompom," which were effective against machine-guns, etc., under light cover. The dimensions and weights of the Russian model of the 37-mm. (which is provided with the recoil-absorbing rubber discs commonly found in Russian designs) are as follows:—calibre 37 mm.; weight of the system in action 396 lb.; of the gun, breech and lock alone 86½ lb.; and of the pointed shell with base-fuze and burster 1·1 lb.; m.v. 1,450 f.s.; max. range on the sights 3,500 yards.

In their later evolution, many of these miscellaneous trench-guns became anti-tank guns. (C. F. A.)

TREVELYAN, SIR GEORGE OTTO, 2ND BART. (1838–), English author and statesman (*see* 27.255), who received the O.M. in 1911, published in 1912 the first volume of his work *George III. and Charles Fox*, and the second in 1914.

His eldest son, CHARLES PHILIPS TREVELYAN (b. 1870), resigned his post at the Board of Education in 1914 as a protest against the policy which involved Great Britain in the war. He lost his seat in Parliament at the general election of 1918.

His third son, GEORGE MACAULAY TREVELYAN (b. 1876), was during the World War commandant of the first British ambulance unit on the Italian front, and received in 1915 the Italian silver medal for valour. He published *Garibaldi and the Making of Italy* (1911); *Life of John Bright* (1913); *Clio, a Muse, and other Essays* (1913); *Scenes from Italy's War* (1919). He married in 1904 Janet Penrose, elder daughter of Mrs. Humphry Ward. She published in 1920 *A Short History of the Italian People.*

TRIPOLI (*see* 27.288).—As the result of the war of 1911–2 between Italy and Turkey, the vilayet of Tripoli, together with that of Bengazi (Cyrenaica), passed from Ottoman to Italian rule. The newly acquired territories were jointly styled Italiana, but Tripolitania and Cyrenaica were organized as tinct entities with separate administrations and governors.

History.—The war of 1911–2 (*see* ITALO-TURKISH WAR) ended without any formal acknowledgment of Italian sovereignty by the Porte. At an early period of the conflict, on Nov. 11 1911, when the Italians held little more than the town of Tripoli, a royal decree declared that both vilayets were placed "under the full and complete sovereignty of the kingdom of Italy." This was a political move, confirmed (in Feb. 1912) by the Italian Parliament, taken to make plain Italy's intentions to Germany and Austria, her partners in the Triple Alliance (*see* AFRICA: *History*). When, in view of the situation in the Balkans, the Turkish Government opened peace negotiations neither Tripoli nor Cyrenaica had been conquered, and the negotiators came to an unsatisfactory "face-saving" arrangement. By an agreement signed at Lausanne on Oct. 15 the Ottoman Government bound itself to issue, within three days, a *firman* renouncing Turkish sovereignty; the form used made the Sultan declare "I concede to you (the inhabitants of Tripoli and Cyrenaica) full and complete autonomy." But at the same time the Sultan was to nominate not only an official to protect Ottoman interests but a religious chief, while the Sultan's name, as Caliph, was to continue to be pronounced in public prayer by the Moslems.

The formal treaty of peace signed at Lausanne three days later (Oct. 18 1912) made no mention of the Italian annexation, but provided for the evacuation of the vilayets by Turkey. France was the first Power formally to recognize the new position created; by a declaration signed at Paris on Oct. 28 the two Governments agreed not to put any obstacles in the way of measures which they should judge opportune in Libya and Morocco respectively. This was in fulfilment of a Franco-Italian agreement reached in 1902, an agreement in which Great Britain acquiesced.

In Tripolitania the article of the Treaty of Lausanne requiring the immediate recall of the Turkish troops was carried out. Neshat Pasha and his force of 2,500 regulars embarked for Constantinople, while the garrisons in the interior, largely composed of natives (Arabs and Berbers), disbanded, or joined the Turks and Senussites in Cyrenaica. The Italians then took in hand the pacification of the interior. The tribes of the Jefera (coast zone) submitted with little difficulty, but there was stout opposition from the Berbers of the adjacent hill region. Suleiman el Baruni, the powerful Berber chief of the Jebel Nefusa, was the principal opponent of the Italians. He had represented Tripoli in the Turkish Parliament, had been created a pasha, was an ardent supporter of the Pan-Islamic movement, and now set up a kingdom in the hills. After having maintained his independence for the greater part of 1913 Suleiman was beaten. He fled to Europe—to reappear at a more convenient season. The occupation of the rest of the province by the Italians presented little difficulty. Murzuk, the capital of Fezzan, was entered unopposed on March 3 1914 by a column under Col. Miani. With the occupation of the oasis and town of Ghat by Col. Giannini on Aug. 12 following, every place of importance in the province was garrisoned by the Italians. In these operations, besides battalions from Italy, troops from Eritrea and native partisans (Arab and Berber) were employed.

Meanwhile, as soon as the coast region had been pacified, the Italians set to work with great energy to improve harbours, make roads, build railways, found schools, open hospitals, organize sanitary and police services and encourage agriculture and trade. By the middle of 1915, when the work had to be abandoned temporarily, a good deal had been accomplished. National feeling had been highly gratified by the acquisition of what was looked upon as the "natural heritage" of Italy, and money and men were forthcoming for the task of regeneration. Many Italians were anxious to settle in the country as agriculturists—but this movement the administration wisely discouraged. Towards the Arabs and Berbers a policy of trust and confidence was adopted, a policy which might have succeeded but for the situation in Cyrenaica. In that province the Treaty of Lausanne had not brought about peace, and Turkish troops aided

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the Senussites to continue the conflict (*see* SENUSSI). At the beginning of 1914 the Italians held in Cyrenaica only a strip along the coast. The Senussites were masters in the interior, and thus in a position powerfully to influence the tribes of Tripolitania. Many of the Fezzani were of the Senussi fraternity.

Such was the position when in Aug. 1914 the World War began, Italy however at that time remaining neutral. Towards the end of the next month (Sept. 1914) the Fezzani—instigated by emissaries from the Senussi Sheikh—suddenly rose in revolt and attacked several small garrisons between Murzuk and the coast. By the end of Nov. the rising had assumed large proportion. The Italian Government then ordered that Fezzan should be evacuated, and Col. Miani and his troops fought their way back to the coast. As soon as the Italians had left Murzuk Mahommed el 'Abid, a brother of the Senussi Sheikh, took over control there and declared himself governor of Fezzan. Miani's withdrawal from Fezzan left the Italian garrison at Ghat—600 m. from the coast—isolated, while the garrison of Ghadames, farther N., was also in danger. Both places adjoined the French frontier, and at the invitation of the French Government the garrison of Ghat marched across the desert to Fort Flattere (a distance of 200 m.), while that of Ghadames withdrew into the Tunisian Sahara. General Tassoni, then governor of Tripoli, whose forces were increased by 6,500 fresh troops, directed the reoccupation of both oases. After hard fighting Col. Giannini retook Ghat on Feb. 18 1915, and shortly afterwards Ghadames was also regarrisoned. But on the eastern side of Tripoli fortune went against the Italians. In an engagement with the rebels between Sokna and the coast on April 29, the Libyan auxiliaries of the Italians went over to the enemy on the field of battle, and the Italian and Eritrean troops were only saved from complete disaster by a skilful retreat to the coast. Turkish, German and Senussi propaganda was very active throughout Tripolitania, and the Italian declaration of war upon Austria (May 23 1915) was the signal for a general rising. In these circumstances the Italians decided to abandon the interior. The withdrawal of the garrisons was not effected without serious losses. In June the troops at 'Aziziya, 40 m. S. of Tripoli city, closely besieged and having exhausted their food, broke out and attempted to reach the coast. Nearly all were killed. The last place evacuated was Ghadames, the garrison on July 19 again crossing into Tunisia. The only places retained by the Italians were the seaports of Tripoli and Homs (Khoms). In this month (on July 15) Gen. Ameglio, governor of Cyrenaica, was also named governor of Tripoli, for the better conduct of the defensive operations. The hostile forces which gathered in the neighbourhood of Tripoli city in the summer of 1915 were beaten back.

The success of the revolt induced the Turkish and German agents in the country, of whom there were a considerable number, to endeavour to bring about revolts in Tunisia and Algeria also. In Algeria they failed, but in the Tunisian Sahara some tribes, aided by forces from Fezzan led by Turkish officers, attacked the French outposts. Sharp fighting in Sept. and Oct. 1915 ended in the reëstablishment of order along the frontier by the French forces. At this time, however, the chief effort of the Turks was in Cyrenaica, where Sidi Ahmad, the Senussi Sheikh, was induced to invade Egypt. The only development of note in Tripolitania until after the defeat of Sidi Ahmad by the British was the reoccupation of the seaport of Zuara by the Italians in Aug. 1916.

In Sept. 1916 Suleiman el Baruni reappeared. He landed at Misurata on the 25th of that month accompanied by German and Turkish officers and in possession of a *firman* from the Sultan, appointing him governor-general of the vilayets of Tripoli, Tunis and Algiers.[1] He was joined at Misurata by Ramadhan el Shtewi, the most powerful local chieftain, an ambitious man who proved a doubtful ally and whose real aim was independence of all other parties. He now, however, helped El Baruni, as did also Nuri Bey. Together they organized a fighting force of 6,000 to 7,000 men, with which all through 1917 El Baruni harassed the Italians, whom he boasted he would drive into the sea. Though he was defeated in four separate engagements the Italians could not follow up their successes. While this fighting was going on Sidi Ahmad's expulsion from Egypt weakened Senussi prestige in Tripoli, and in the summer of 1917 the pro-Turkish party in Fezzan expelled Sidi Ahmad's brother Mahommed el 'Abid from Fezzan.

Nothwithstanding the failure of El Baruni's efforts against Tripoli city, the close of 1917 saw the supporters of Turkish designs apparently masters of the country. In reality, the Arab and Berber chiefs were split into factions. El Shtewi had established a so-called republic of Tripoli and ruled at Misurata; the Senussi were divided among themselves, and one party of them, under Sidi Idris, had, as early as April 1917, come to terms with the Italians and British. The impossibility of getting the tribes to act together caused Nuri Bey to leave Tripolitania early in 1918. He was succeeded by Ishaq Pasha, who proved a harsh and unpopular commander. The Turkish Government, however, still believed that it would be possible to expel the Italians from Tripoli, and they sent thither Prince Osman Fuad (a grandson of Sultan Murad V.). The prince, who arrived at Misurata by submarine in April 1918, tried to compose the quarrels among the tribes, but did not succeed. The tribes were as jealous one of another as were the Highland clans in the "45," and powerful chiefs exercised independent authority, El Baruni and El Shtewi being the most important. They combined on occasion, and on occasion quarrelled. Such was the position when the World War ended in Nov. 1918.

The task of pacifying the country and restoring Italian authority was more difficult in Tripoli than in Cyrenaica. Sidi Ahmad had fled and Sidi Idris having consolidated his authority over the Senussi fraternity, it was possible to make with him an arrangement which bound the tribes of Cyrenaica. In Tripoli there were a dozen or more chieftains with whom to deal, and the Italians were not prepared to undertake extensive military operations. They extended their direct authority along the coast and entered into negotiations with El Baruni and the chiefs of other tribes. The result was seen in the issue of a royal decree in June 1919 in which natives of Tripoli were given "complete local citizenship," and in the creation of an elective assembly to deal with legislation and direct taxation. The immediately effective part of the decree was that the country should be governed as far as possible through native chiefs, to whom were attached political officers. El Shtewi was the last chief to agree to this arrangement; he became *mutessarif* of Misurata. As token of reëstablished amity the Italian flag was rehoisted at the *ksar* of 'Aziziya on June 12 1919. In Aug. Sig. Vittorio Menzinger was appointed governor of Tripoli to carry out the new policy of ruling through a local Parliament, but the chiefs cared little for such an assembly, being more concerned in consolidating their own authority. El Shtewi, particularly, gave much trouble, and in the first half of 1920 he seized and detained for weeks the commander of the troops at Homs and other Italian officers and men. He aroused the hostility of Ahmad Murad, the chief of the Tarhuna tribe, and in the fighting which followed the Italians did not interfere. A new governor, Sig. Luigi Mercatelli, was sent out in July 1920, and gradually the situation improved. The complete accord reached in Cyrenaica with the Senussi (Nov. 1920) had a tranquillizing effect. As marking the period of calm which then prevailed, the young Crown Prince Humbert in Sept. 1921 visited Tripoli and Bengazi, receiving assurances of loyalty from many chiefs.

In Sept. 1919 an agreement was reached with France rectifying the Tripolitan-Tunisian frontier, which was made to sweep in a semi-circle from the coast, so as to leave to Tripoli the direct routes between Ghat, Ghadames and Tunis. Italy also obtained economic concessions in Tunisia and an agreement as to a common railway policy (*see* AFRICA: *History*).

Economic Conditions, etc.—The number of inhabitants is unknown; for Tripolitania and Cyrenaica combined it may reach 4,000,000. Tripoli city had (1920) a pop. of about 73,000, and Bengazi 35,000. Europeans, mainly Italians and Maltese, number some 10,000. Most of the country is desert and there are no

[1] To soothe his wounded feelings Sidi Ahmad was in Nov. 1916 given by the Turks the title of "Viceroy of Africa."

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perennial rivers, but there are numerous fertile oases and grazing grounds. The chief crop is barley; the date palm, the olive and the fig tree flourish. There are large supplies of esparto grass, and saffron and henna are grown. The people possess large numbers of cattle, sheep and goats, and camels, and there are good possibilities of developing the country's pastoral resources. Salt is the only mineral exploited. There are valuable sponge "fisheries" valued roughly at £50,000 yearly.

Both pastoral and agricultural development depend largely on irrigation works. As it is, neglect of cultivation (caused by constant tribal wars, overtaxation and the stoppage of the slave trade) has notably enlarged the desert area; this is obviously the case in Fezzan, where much might still be done to reclaim lands recently fertile. There is little prospect of any great revival of the trade between the central Sudan and Tripoli and Bengazi—ostrich feathers, ivory, and embroidered leather goods are, however, still brought across the Sahara by camel caravans.

The value of exports (Tripoli and Cyrenaica combined) was £213,000 in 1914, sunk to £93,000 in 1916, and had risen to £300,000 in 1918. The chief exports were skins, henna, ostrich feathers and sponges.

The figures of imports in these war years bore little relation to normal trading, imports being largely for Government services. The imports in 1914 were valued at £1,638,000, in 1918 at £3,039,000. Since 1912 the bulk of the trade has been with Italy. Colonial revenue, some £600,000 in 1914, was estimated at £1,000,000 in 1920–1. Expenses considerably exceed revenue; in 1914 the budget was balanced at £2,835,000, in 1920–1 at £5,080,000. Large sums were spent on public works, still larger sums on defence, military expenditure in 1920–1 being put at £1,650,000. In that year 1,030 officers and 25,000 men were stationed in Tripoli (16,000 being Italians). In Cyrenaica there were 540 officers and 17,000 men (6,800 Italians). The non-white troops are principally Abyssinians from Eritrea.

In 1920 there were 157 m. of railway; the principal lines were along the coast westward from Tripoli city to Zuara and southward from Tripoli by 'Aziziya to beyond Gharian. Submarine cables were laid in 1912 between Syracuse and Tripoli and Bengazi; several wireless stations were also erected. Shipping is mainly in Italian hands.

See *A Handbook of Libya*, a British Admiralty publication (1920), and *Italian Libya* (1920), a British Foreign Office handbook, with bibliography; the *Rivista Coloniale* of Rome, and the *Bolletino* of the Italian Geographical Society. (F. R. C.)

TROTSKY, LEV (1877–), Russian Communist leader, of Jewish origin, originally named Leiba Bronstein and often described as Leon Trotsky, was born in 1877, near Elisavetgrad, in the province of Kherson, S. Russia. He studied in a public school at Odessa and afterwards in the university there. He soon joined the left wing of the Social-Democratic party, took part in students' disorders, and was expelled from the university. In 1898 he was arrested for his activity as a member of the "League of Workmen of South Russia," and three years later he was deported to Ust-Kut, on the Lena river, in Siberia. He arrived at the place of his exile at the beginning of 1902, but immediately escaped, and made his way to Geneva, where he took a prominent part in the work of the Russian Social-Democratic group. He collaborated in the *Iskra*, a paper which was founded in 1901 by Lenin, Plekhanov, Martov and others. A follower of the extreme Marxian doctrine, and an irreconcilable enemy of the Liberals, Trotsky tried to create a unified Socialist party in Russia, and he spent his time till the revolution of 1905 in constant travels to and from Russia. At that time he was already well known in Russian revolutionary circles. The events of the revolution of 1905 found him in Russia, where he was publishing the paper *Borba* ("The Struggle"). He took a leading part in the direction of the revolutionary movement, and was one of the organizers of the "Soviet of Workmen of Petrograd"; he became a member of the executive committee and later on vice-president of that body. He was arrested on Dec. 5 1905, with other members of the Soviet, by order of Count Witte's Government. After a year of solitary confinement, he was tried and condemned to perpetual deportation to Siberia. At the beginning of 1907 he arrived at Obdorsk, on the shore of the Arctic Ocean, but he escaped again, took residence at Vienna, and became a constant contributor to the *Arbeiterzeitung*. In 1907 he was present at the International Socialist Conference at Stuttgart, and in 1910 at that of Copenhagen. In 1910 he attended the Pan-Slavonic Congress at Sofia, where amid general consternation he delivered a vehement speech against the union of the Slavonic nations. In 1912 he was one of the organizers of the secret conference held at Troppau by the Russian revolutionary organizations abroad.

At the beginning of the World War, Trotsky as a Russian subject was obliged to leave Vienna, and he established himself first at Zurich and later in Paris, where he collaborated in the Russian paper *Golos* (afterwards *Nashe Slovo*). He strongly criticized the Socialist parties of Germany and of the Entente Powers for supporting their Governments in the war and voting for the war credits. He was one of the organizers of the Zimmerwald Conference, but, together with Lenin, he refused to sign the Zimmerwald manifesto, which he considered to be too moderate. In Sept. 1916 the publication of *Nashe Slovo* was suspended by order of the French Government, in consequence of a rebellion among the Russian troops at Marseilles, which was traced to the anti-militarist propaganda of that paper. Trotsky was arrested and ordered to leave France. Switzerland refused to receive him, and he was deported to Spain, but he was arrested again by the Spanish Government almost on the day of his arrival at Madrid. At the beginning of 1917 he sailed for the United States and took part in New York City in the publication of the Russian paper *Novy Mir*.

After the revolution of March 1917 Trotsky immediately started for Russia, but was arrested by order of the British Government and interned in a prisoners' camp at Halifax. He was released by a special intercession of Milyukov, who was at that time Russian Minister for Foreign Affairs. He arrived in Russia in May, and developed the greatest activity in Petrograd as one of the leading members of the Bolshevist party. He was one of the organizers of the Bolshevist rising on July 16 and 17, and was arrested at the beginning of Aug. for "organizing and participating in armed rebellion," but soon released by order of Kerensky. On Oct. 8 he was elected president of the Petrograd Soviet, and after the Oct. revolution he took the portfolio of Foreign Affairs and later that of War in the Council of the Commissaries of the People. He took a leading part in the political activity of the Soviet Government, representing the extreme left wing of the Communist party, and, as such, often opposed the more moderate programme of Lenin. He signed the peace of Brest Litovsk, and, in spite of his former anti-militarist declarations, became the organizer and the commander-in-chief of the Red Army. He introduced again an "iron discipline," more relentless than that practised under the Tsarist régime; deserters and disobedient soldiers were shot; a system of extensive espionage kept officers and men in constant terror; mercenary corps of Letts, Chinese, Kirghizes and Buriats were formed for the purpose of coercing and destroying the Russian elements. Particular attention was paid to the formation of specially trained detachments of cadets, devoted to the Communist régime and ready to serve it on every occasion, like the Janissaries of old Turkey. Trotsky and his friends did not shrink before a plan of a general militarization of industry. In a speech delivered at a meeting of the Third Conference of the Soviets in Moscow, he said: "All artisans will be sent into the works and transferred from one place to another, according to the indication of the Government. We will have no pity for the peasants; we will make labour armies of them, with military discipline and Communists as their chiefs. These armies will go forth among the peasants to gather corn, meat, and fish that the work of the workmen may be assured." A Moscow wireless reported that in another speech (*The Times*, March 4 1920) he declared that "The First Army of Labour so far includes 240,000 Red Army men, 7,000 civilians and employees, 7,000 military horses and 156,000 private horses." In a review of the First Army of Labour he wrote: "The Red Army detachments make a formidable labour force, certainly more efficient than, for example, those civilian detachments mobilized for the clearing of snow. The military detachments have all the advantages of proper organiza-

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tion and the precise order of stern discipline. The fundamental condition of the productivity of Labour Red Army men, and of workmen in the Soviet economy in general, is the arousing of the spirit of emulation. The organization of this spirit is the most important problem of economic reconstruction, and without this subjective force nothing will help, neither peat, nor coal, nor petrol, nor the removal of the blockade. It is necessary to take all measures to foster the feeling of labour conscience, both in the coöperative institutions and in the individual." At a congress of the Soviets at Moscow a resolution was passed on April 4 in favour of his proposal that labour should be organized on the principle of military conscription and obligatory work; also that the inspection of labour should be confided to special inspectors, instead of local Soviets.

Within the Soviet Government organization, as it still held power in 1921, Trotsky, Dzerjinsky and Bukharin were the leaders of the extreme left of the Communist party, and, as such, had repeatedly opposed Lenin when the latter was inclined to conciliatory measures; but the outside world generally associated the names of Lenin and Trotsky together as the embodiments of Russian Bolshevist rule. (P. Vi.)

TSCHAIKOVSKY, NICHOLAS VASILIEVICH (1850–), Russian revolutionary politician, was born in 1850, at Viatka. He spent the first part of his life on his mother's estate, and studied at a public school at Viatka and later on in St. Petersburg. In 1868 he entered the St. Petersburg University and got his degree in chemistry in 1872. He took part in the "Narodniki" (populist) movement, and became one of its leaders, working for the creation of a system of societies for self-education. These societies organized lectures and provided their members with cheap and well-selected books. They had a considerable influence on the moral and political development of a whole generation of the Russian "intelligentsia."

But under the political régime of Russia in the 'seventies no public body or society could act freely if its activity was not fully approved by the Government. Every kind of repression was used against the promoters of the "narodniki" movement; and Tschaikovsky was twice arrested. Under these conditions the new party soon lost its educational character and became a revolutionary and terrorist association. Tschaikovsky did not approve of this new tendency and joined the social-religious group, which received the name of "God-men" because its members tried to find in themselves a reflection of God.

In 1874 Tschaikovsky left Russia, and a year later he went to the United States with a small party of men and women who shared his political views and religious feelings. They founded a communistic settlement at "Cedar Vale," near Wichita, in the state of Kansas, and tried to work out their new religious and social teaching. The experiment proved a failure. After two years of hard experience, Tschaikovsky and his friends were obliged to recognize that mankind was not yet ready for the communistic life which they believed to be an imminent development of the future. They regarded communistic life as senseless without a constant feeling of the presence of God in the case of each member of the community, and this essential condition could not be achieved. Therefore they returned to the "old world of antagonism." The awakening was especially hard for Tschaikovsky, who not only found it necessary to reconstruct his conception of the world, but had a family to keep and no means of livelihood. He worked for some time as an ordinary workman in a shipbuilding yard and in a sugar factory near Philadelphia. His health broke down and with his family he joined the religious community of the Shakers, where he remained for a year.

In 1879 he returned to Europe, and in 1880 took up his residence in England, renewing his active participation in the Russian revolutionary organizations abroad; he was a member of the "Red Cross of the Narodnaia Volia," and organized the supply of revolutionary literature to Russia. During the first Russian revolution of 1905–6 he made a tour of America, lecturing on the subject and collecting funds for the struggle against the Imperial régime. In 1907 he returned to Russia. There he was arrested on a charge of conspiracy against the Government and spent 11 months in the St. Peter and St. Paul Fortress at St. Petersburg. He was released on bail, £5,000 having been collected by his friends, chiefly in England and America. In 1910 he was brought to trial and discharged for lack of proof. He remained in Russia and took a great interest in the work of coöperative organizations.

During the World War he was very active under the flag of the Russian Red Cross, supplying food to the population of the fighting area. After the revolution of 1917, he was elected member of the Council of Soldiers, Workmen and Peasants, formed at Petrograd, where he used his influence to fight the Bolshevist propaganda. He was also elected member of the Constituent Assembly. After the Bolshevist revolution, as a member of the "Committee for the Salvation of the Motherland and of the Revolution," and of the "Committee for the Defence of the Constituent Assembly," he helped to organize the struggle against the Bolshevists.

In 1918 he was one of the founders of the "Union of the reconstruction of Russia," an anti-Bolshevist organization of the left parties of Moscow. He was also elected member of the Ufa Directorate. On his way to Siberia, he came to Viatka, where he took the lead in an insurrection against the Bolshevists and entered into negotiations with the Allied force at Archangel. He took part in the *coup d'état* of Aug. 2 at Archangel and became president of the Supreme Administrative Board of the North Region. After the break-up of a conspiracy of monarchist officers, he organized the Provisional Government of the North Region under his own leadership. Tschaikovsky was sent by his Government to Paris, where he represented the interests of the North Region before the Peace Conference. He was a member of the "Russian Political Delegation" in Paris till its dissolution in Feb. 1921. (P. Vi.)

TUBERCULOSIS (*see* 27.354*).—Since the *bacillus tuberculosis* was discovered by Koch in 1882, the various forms of disease caused by its invasion have been in the forefront of medical research. The disease is known to have existed amongst the earliest civilizations. Bony tuberculous lesions have been described in Egyptian mummies, and in the Nubian collection of bones in the Royal College of Surgeons, London, are two specimens, respectively of the dates of about 3,000 and 2,000 B.C., presenting all the characteristics of tuberculous disease of the spine. Tuberculous disease of the lungs is known to have existed in very early times. The old Greek Hippocrates (born 460 B.C.) first applied the term "phthisis," and a description of its clinical manifestations may be found in his writings and those of Celsus, Aretaeus and Galen. Before the discovery of the bacillus its effects in different parts of the body were classified as distinct diseases, receiving different names:—"consumption" or phthisis for pulmonary tuberculosis, struma or scrofula for bone or gland tuberculosis, lupus for tuberculosis of the skin, and *tabes mesenterica* of the intestinal glands.

Pathology.—Affected tissues invaded by the tubercle bacillus undergo typical changes, become inflamed, break down and perish. By the irritation which the bacilli excite, epitheloid cells are proliferated from the normal cells of the tissues, forming a tubercle, in which is usually present a "giant" cell surrounded by smaller epitheloid cells encompassed by a zone of leucocytes. Scattered amongst these cells tubercle bacilli may be found. Later the tubercles undergo degenerative changes (caseation) proceeding further to abscess formation. Repair may take place by cicatricial formation of fibrous tissue, these fibrous nodules sometimes undergoing calcareous degeneration. Bayle, in the latter part of the 18th century, first described the tubercular nodule, and its distributions in other organs than the lungs.

One organ or part of the patient attacked is generally the seat of these tubercular nodules, some of which may become confluent, but the disease may take the form of an acute specific fever, clinically somewhat resembling typhoid fever, with widespread dissemination of the infection. In this form the disease is so severe and rapid, that many of the tubercles have not time to get beyond the initial stages of their development

** These figures indicate the volume and page number of the previous article.*

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before death occurs. Such a manifestation is termed acute miliary tuberculosis. The intra-cellular or extra-cellular toxins produced by the tubercle bacillus in the course of its development are the cause of many of the pathological features associated with the disease the bacillus produces.

The tubercle bacillus is a minute rod-like, often slightly curved, organism, 1·5μ – 3·5μ in length and 0·3μ in breadth. It may stain uniformly or present a beaded appearance, the unstained beads being regarded by Koch as spores. Metchnikoff advanced the view that the bacillus as ordinarily met with is but a stage in the developmental cycle of a filamentous fungus. The organism is regarded by many as a member of the streptothrix group belonging to the hyphomycetes or mould fungi. It stains with difficulty but retains its stain, once received, with remarkable tenacity, resisting decolorization by strong acids and hence called acid-fast.

Exposed to direct sunlight or ultra-violet radiation it is rapidly slain but is of retentive vitality under certain conditions. Dr. Stenhouse Williams has shown that it remains viable and virulent in cow-dung on pasture land for at least five months, and in dung stored in the dark for twelve months, a discovery of great importance and significance in veterinary practice. It retains its virulence and capacity for development for six weeks or longer in decomposing sputum and for six months in dried sputum. The thermal death point varies between 65°C. and 90°C. and Swithinbank has shown that it will survive a temperature of −186°C. for 42 days.

Certain antiseptics are fatal to the tubercle bacillus, 5% carbolic acid will slay it in less than a minute, and endeavours have been made to destroy the organism in living tissues by the administration of drugs, but hitherto without demonstrable success. Methylene-blue and certain copper salts injected into guinea-pigs infected with tuberculosis, can be demonstrated in their tubercle bacilli, and a fascinating, but hitherto unfruitful line of chemotherapeutic research has thus been opened up, aiming at the destruction of the tubercle bacilli while parasitic in their host.

The tubercle bacillus is widely parasitic through the animal world, but different animals show widely varying degrees of susceptibility. Generally, domesticated animals are more liable to infection than wild, and captive wild animals than those in their natural state. Domestic cattle are particularly prone.

Much controversy has arisen as to the communicability of tuberculosis from animals to man. After Koch had thrown doubt on its probability at the British Congress on Tuberculosis in 1901, the British Government appointed a Royal Commission to enquire into the relationship of human and animal tuberculosis. In the second interim report of the Commission, issued in 1907, the conclusions arrived at were: "That there seems to be no valid reason for doubting the opinion, never seriously doubted before 1901, that human and bovine bacilli belong to the same family. On this view, the answer to the question—Can the bovine bacillus affect man?—is obviously in the affirmative. The same answer must also be given to those who hold the theory that human and bovine tubercle bacilli are different in kind, since the 'bovine kind' are readily to be found as the causal agents of many fatal cases of human tuberculosis." In later years the investigation has been further pursued. Pulmonary tuberculosis is rarely bovine in origin, and non-pulmonary tuberculosis does not appear to be so commonly bovine as previously supposed, the latest researches (up to 1921) in England going to show that probably approximately some 30% of cases of non-pulmonary tuberculosis are of bovine and 70% of human origin. While cows are the commonest domesticated animals infected, tuberculosis occurs in pigs, less commonly in dogs, cats, and but rarely in horses and sheep. Tuberculosis in rats has been demonstrated. In domestic fowls another variety of the tubercle bacillus, the avian, is found. Even reptiles, fishes and invertebrate creatures such as worms may be infected. While bovine bacilli are capable of infecting the human subject, especially in childhood, avian bacilli are of little human pathogenic significance.

In the evolution of pulmonary tuberculosis, human or, very rarely, bovine bacilli may be detected in the sputum, and usually are demonstrable in tuberculous pus derived from any focus. The bacilli may also sometimes be found in the blood or stools of infected subjects.

Channels of Infection.—Congenital origin, though rare, has been proved to exist. By Cobbett it has been regarded as commoner than usually supposed. Tubercle may be introduced by direct inoculation. Much more commonly the infection is produced by inhalation of dried sputum as dust into the lungs, or by the ingestion of tuberculous material into the alimentary canal. Cornet has estimated that as many as 7,200,000,000 bacilli may be expectorated by a consumptive patient in the course of a day, and it requires little consideration to show what a ready means is thus presented of infection. Recognition of this fact is of importance in prophylaxis. The vehicle of infection by ingestion is commonly tuberculous milk or butter. The portal of entry, carious teeth, tonsils or some portion of the intestine. Fatal bovine infection, though rare in adults, is not uncommon in children. Dr. Cobbett has calculated that about one-third of all fatal cases of tuberculosis in children under five is attributable to a bovine source, a matter of great importance to farming interests and preventive medicine. There is reason to believe that the relative incidence of bovine or human infection may vary according to locality. Thus in Scotland, bovine infection is probably relatively commoner than in England.

Contagiousness of Tuberculosis.—Tuberculosis is not contagious in the sense that such diseases as measles and other of the exanthemata are. The danger of infection of healthy subjects where reasonable precautions are taken, as in institutions for the tuberculous, is extremely remote. But under conditions due to overcrowding, bad hygiene, imperfect nutrition, when lowered resistance is encountered, where massive doses of bacilli are absorbed and contact is intimate and prolonged, the danger of infection is very real. The vexed question of marital or conjugal tuberculosis has been much discussed of late and should not be neglected.

Predisposing Causes of Infection.—In discussing infection, attention should be drawn to the "soil" of the patient as well as to the "seed" sown. There is variation in both individual and racial susceptibility. Thus the Irish are said to be relatively susceptible, the Jews immune. "It has been learned of late years that the number of individuals who can be shown by radiography, tuberculin tests, and autopsy findings to have some focus of tuberculosis is enormously in excess of those who are usually classed as tuberculous" (Bushnell). Tuberculous infection amongst civilized communities is well-nigh universal. The tubercle bacillus may remain latent in the individual for indefinite periods, may rapidly and in varying degrees give rise to local lesions or generalized dissemination. Its innocuousness depends both on the good health of the individual attacked, his immunity inherited or acquired, and the absence of conditions calculated to break down that immunity. Amongst the more important factors likely to facilitate morbid infection are heredity, a constitutional liability to the disease, general debility due to various circumstances; poverty and its associated conditions; overcrowding, insanitary surroundings, bad hygiene, insufficient or unsuitable food, exposure, trauma, alcoholic excess, insanity, syphilis and other diseases; unfavourable climatic influences, occupations, etc. Dr. Browning has shown that the common age-period of phthisis may vary in different localities. Thus, it is earlier in the Shetland Is. than in London. The age of maximum mortality appears to be increasing. In the middle of the 19th century it was 25 to 35 years; in 1921 it was 45 to 55 in males, 35 to 45 in females.

Control and Eradication of Tuberculosis.—With the discovery of the causal factor of this disease and an ever-extending acquaintance with the conditions favouring its pathogenicity, it became possible to initiate, investigate and undertake scientific methods for its control and eradication. The problem, however, is of infinite complexity. Up to 1921, no certain method of immunization against infection had actually been discovered, and no specific treatment comparable to that employed in dealing with syphilis had been devised. Till the uninfected population can be safely immunized against tuberculosis and the infected population cured by specific measures, the laborious and often complicated methods now employed, constantly improved and elaborated, will constitute both our means of prophylaxis and of attempted cure. Tuberculosis is protean in its manifestations and the methods directed against the disease are of corresponding variety. Certain general principles in treatment may, however, be laid down. These comprise the adoption of all those measures calculated to increase the patient's power of resistance and preserve and restore the part or parts attacked. Life in the open air under suitable climatic and

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good hygienic conditions, with ample and easily assimilated food, rest while the disease is acute, absence of worry or fatigue, graduated exercise later, and education in the mode of life to be followed are details of first importance. Drugs are chiefly of value in the treatment of symptoms and complications. The introduction of tuberculin by Koch raised vast hopes which have not been fulfilled. Numerous varieties of tuberculin have since been manufactured and employed which still fall short of the anticipations of their originators. Sir Almroth Wright placed tuberculin therapy on a more scientific basis: his opsonic theory giving promise of a means of scientific administration and control. In 1887 Sir Robert Philip introduced the scheme known as the Edinburgh system for the coördination of efforts, applicable to all phases of the tuberculosis problem. It has the tuberculosis dispensary as the centre of its activities, with trained physicians and nurses for educating, treating and directing the patient, examination of contacts, distribution of patients requiring institutional care to the tuberculosis hospital or sanatorium where advanced cases can be segregated, and early cases receive curative treatment. Later, facilities are given for continued aftercare or treatment and training in a farm colony. The scheme is a practical and comprehensive one and has been the pioneer of other analogous efforts elsewhere. The value of this coördination of methods cannot be sufficiently emphasized.

Marcus Paterson by graduated exercise has shown how much may be safely and advantageously done by auto-inoculation of the patient by his own tuberculin. Varrier-Jones at Papworth has demonstrated the value of the tuberculous colony with facilities for treatment of pulmonary tubercle in all stages of the disease, and where prolonged segregation in village settlements is encouraged under reasonable conditions. The patient is trained and his labour subsidized. The value of rest in the treatment of all forms of acute tuberculous disease has inspired surgical interference for securing more complete rest to the diseased and damaged lung in the hope of procuring cure. Forlanini demonstrated the feasibility of introducing by injection gas into the chest to secure the collapse and rest of a tuberculous lung. This manœuvre, introduced into Great Britain by Lillingston and others, has proved of considerable value in carefully selected cases. This method of treatment is known as the induction of artificial pneumothorax and has proved of dramatic value in the treatment of many patients who were in an apparently hopeless condition.

In non-pulmonary conditions such as tuberculous disease of the bones, joints and glands, for long the condition was regarded as a local disease, comparable to a malignant tumour. This "tuberculome" conception, aided by the discovery of anaesthetics and antiseptics led often to extensive operations being undertaken with a view to the extirpation of infected tissues. The results in the more severe conditions were frequently unsatisfactory, the mortality both direct and indirect high, deplorable orthopaedic results frequent, sinus formation and subsequent secondary infection common. The present trend of surgical opinion is avoidance where possible of severe radical measures and the adoption of conservative treatment. While the disease is acute the patient is kept at rest, the part affected immobilized, orthopaedic measures are employed to prevent or correct the severe deformities which are frequent in tuberculous lesions of the bones and joints, tuberculous abscesses are evacuated, preferably by aspiration. Later, when ambulatory treatment is permissible the lesions are suitably immobilized in appropriate splints. Institutions for these cases should be specially designed and staffed and situated in suitable localities at the seaside or in the country. Auxiliary methods of treatment such as heliotherapy (sun treatment), X-ray treatment, etc., play an important part. As treatment is necessarily lengthy it should be associated with education for children, technical training for adolescents, and occupation for adults. In this way the monotony of long enforced recumbency is relieved and the *moral* of the patient preserved. The value and low mortality of such treatment may be illustrated by Table 1. showing the results achieved at the Treloar Cripples' Hospital, at Alton.

TABLE 1. *Analysis of results of treatment of patients suffering from surgical tuberculosis at the Lord Mayor Treloar Cripples' Hospital, Alton, Hants., from the opening of the Hospital in Sept. 1908 to Jan. 31 1921.*

Lesion	No. admitted	No. discharged	Disease arrested	Improved	Unimproved	Removed or Transferred	Died	Average length of stay in days
Spine . . .	920	810	674	22	24	68	27	503·2
Hip . . .	880	768	710	18	2	25	13	413·1
Knee . . .	333	304	282	7	—	11	7	334·7
Other . . .	354	315	265	16	5	19	9	259·8
	2487	2197	1931	63	31	123	56	382·5

During the decade 1910–20 greatly increased public interest was manifested in serious and organized endeavours to deal with the tuberculosis problem. In England and Wales prior to the passing of the National Insurance Act, 1911, it was competent to sanitary authorities, under the powers of section 131 of the Public Health Act, 1875, to provide dispensaries and residential institutions for the treatment of persons suffering from tuberculosis, and some authorities had initiated a campaign of prevention and treatment. At the beginning of 1912, 1,500 beds in institutions had thus been provided by British sanitary authorities for treatment of tuberculosis; 57 sanitary authorities also had contracted for use of beds in private sanatoria; 30 tuberculosis dispensaries had been established by local authorities; and 50 by voluntary effort. The need for a national campaign assisted by contributions from the British Exchequer became evident. This need was recognized by the National Insurance Act, 1911, which included provision for "sanatorium benefit" of insured persons. Under this Act and the Finance Act, 1911, a capital sum of £1,500,000 was made available in the United Kingdom for the treatment of tuberculosis. After the passing of the National Insurance Act a departmental committee on tuberculosis was appointed to report upon the consideration of the problem in its preventive, curative and other aspects. The recommendations of this committee had an important influence on subsequent policy. Compulsory notification of pulmonary tuberculosis was enforced in 1912, and of all forms the following year. In July 1912 domiciliary treatment of insured patients suffering from tuberculosis was approved by the Local Government Board. Schemes for the institutional treatment of tuberculosis became gradually formulated. The extent to which official schemes had been brought into operation in England and Wales may be gathered from the following figures. On April 1 1921, the number of approved dispensaries was 411; officers and assistant officers for tuberculosis, 341; residential institutions, 418; the number of beds available in these institutions was 17,352; the total gross maintenance cost of tuberculosis schemes for 1919–20 was £1,953,992. The amount of Government grant for 1919–20 was £619,941. All this was accomplished notwithstanding the severe setback to anti-tuberculosis endeavour which was an inseparable effect of the World War.

On July 1 1919 the powers of the Local Government Board in relation to the tuberculosis schemes of local public-health authorities and of the Insurance Commissioners in relation to the administration by the Insurance Committees of the sanatorium benefit of insured persons under the National Insurance Act 1911 devolved upon the Minister of Health, and one central department was made responsible for the guidance and supervision of the work of the two classes of local bodies principally concerned (apart from Poor Law authorities) in the conduct of measures for the prevention and treatment of tuberculosis. The National Health Insurance Act, 1920, was further designed to simplify administration by providing for the discontinuance of sanatorium benefit within 12 months of the passing of the Act, and insurance patients needing institutional treatment for tuberculosis may obtain it at the hands of the local authorities under the schemes undertaken for the provision of such treatment for the population generally of their respective areas. This transfer of authority came into force on May 1 1921. The Tuberculosis Act 1921 carried this legislation a step further by enabling local authorities to provide approved schemes for the treatment of all patients suffering from all forms of tuberculosis, and on their failing to do so empowered the Ministry of Health to deal with the matter, debiting the cost to the authorities concerned.

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TABLE 2. *Mortality in England and Wales from Tuberculosis (all forms) per Million Pop. 1912–4, 1917, and 1918.*

	Males			Females			Persons		
	1912 to 1914	1917 (Civilians only)	1918 (Civilians only)	1912 to 1914	1917	1918	1912 to 1914	1917 (Civilians only)	1918 (Civilians only)
All crude ages standardized	{ 1,569 / 1,546	2,072 / 2,334	2,153 / 2,518	1,167 / 1,168	1,303 / 1,314	1,373 / 1,378	1,361 / 1,347	1,624 / 1,801	1,694 / 1,924
0	2,063	1,915	1,741	1,701	1,631	1,417	1,883	1,774	1,580
5	566	662	632	572	694	682	569	678	657
10	442	573	611	685	892	920	564	733	766
15	927	?	?	1,214	1,719	1,789	1,071	?	?
20	1,478	?	?	1,326	1,643	1,888	1,398	?	?
25	1,774	?	?	1,369	1,489	1,723	1,561	?	?
35	2,233	?	?	1,405	1,523	1,613	1,804	?	?
15–45	1,681	3,240	3,681	1,342	1,570	1,733	1,505	2,104	2,328
45	2,437	2,590	2,592	1,208	1,249	1,321	1,798	1,892	1,924
55	2,283	2,316	2,192	1,004	1,018	1,050	1,608	1,649	1,604
65	1,421	1,540	1,484	767	798	1,057	1,129		
						791	1,057	1,129	1,102
75	649	649	740	496	490	464	558	554	574
85 and upwards	260	527	295	246	218	233	251	328	255

Provisional death-rate per million living from (i.) all causes 1920 12,360
(ii.) all forms of tuberculosis 1920 1,128

In April 1919 an important inter-departmental committee was appointed jointly by the Local Government Board and Ministry of Pensions, "to consider and report upon the immediate practical steps which should be taken for the provision of residential treatment for discharged soldiers and sailors suffering from tuberculosis and for their reintroduction into employment, especially on the land." The report of the committee laid stress on the fact that "the problem of the tuberculous ex-soldier or sailor is only one aspect of the national problem of dealing with tuberculosis," and considered that "the best interests, both of the country and of the ex-service man, will be served first by making the best possible use of all existing means of treatment, and then by expanding, improving, and increasing these means as rapidly as possible." It reported that existing accommodation was most seriously inadequate in quantity, and advocated in addition to the development of schemes for the institutional treatment of tuberculosis, provision of facilities for the training, both occupational and vocational, of sanatorium patients in suitable industrial and other occupations, and also for their permanent settlement, after training, in village communities where they could earn a livelihood under sheltered conditions. Owing to considerations of economy, the recommendations of this committee as to developments on the lines of training colonies, village and industrial settlements, were temporarily hampered, but doubtless are destined to fructify as economic conditions improve. Valuable information as to the development of Public Health schemes for the treatment of tuberculosis is in the annual reports of the Chief Medical Officer of the Ministry of Health and other Government publications.

While the above records official encouragement and exhortation in the measures calculated to assist in the eradication and treatment of tuberculosis, tribute should be paid to philanthropic and other agencies which have been at work, and which have afforded valuable information on the lines on which policy should be directed. By progressive legislation voluntary work has tended to become more and more subsidized by the state. An instance of such combined activity on a large scale is afforded by the King Edward VII. Welsh National Memorial Association, which was founded in 1910 for the prevention and eradication of tuberculosis and other diseases in Wales. For the furtherance of this aim Wales (with Monmouthshire) is divided into 14 dispensary areas with a tuberculosis physician having a central dispensary in each area. In each area there are a number of visiting stations at which patients are seen and examined at frequent intervals. There were 90 of such visiting stations in 1921. In addition, hospital beds and sanatoria are provided for the treatment of all forms of tuberculosis. From its inception up to 1921 the association's officers had examined 76,500 patients. Of these 7,800 were treated at sanatoria and 14,200 at its hospitals.

TABLE 3. *Notification of Tuberculosis in England and Wales (from the 1920 Report of the chief medical officer of the Ministry of Health, Cmd. 1397).*

	Pulmonary		Non-pulmonary		Total—All forms	
	Notifications	Cases	Notifications	Cases	Notifications	Cases
1913	91,866	80,788	38,583	36,351	130,449	177,139
1914	86,081	76,109	25,237	23,388	111,318	99,497
1915	73,359	68,309	22,573	22,283	95,932	90,592
1916	75,796	68,109	24,521	22,799	100,317	90,908
1917	76,183	68,801	22,514	20,884	98,697	89,685
1918	79,025	71,631	20,215	18,942	99,240	90,573
1919	67,123	61,154	17,775	16,357	84,898	77,616
1920	63,732	57,844	16,694	15,488	80,426	73,332

TABLE 4. *Mortality from Tuberculosis (England and Wales).*

	Deaths from Pulmonary Tuberculosis			Deaths from other forms of Tuberculosis		
	Males	Females	Total			Total
1911	21,985	17,247	39,232			13,888
1912	21,568	16,[illegible]	[illegible]			11,968
1913	21,934	[illegible]	[illegible]	6,623	5,798	12,421
1914	[illegible]	[illegible]	[illegible]	6,264	5,397	11,661
1915	[illegible]	[illegible]	41,676	6,715	5,904	12,619
1916	23,238	18,307	41,545	6,488	5,825	12,313
1917	23,670	19,443	43,113	6,689	6,132	12,821
1918	24,756	21,321	46,077	6,271	5,725	11,996
1919	19,581	17,081	36,662	4,969	4,681	9,650
1920	18,184	15,285	33,469	4,734	4,342	9,076

Tables 2 (by courtesy of the Ministry of Health), 3 and 4 give details as to the incidence of tuberculosis in Great Britain. Commenting on these tables, Sir George Newman remarks on the considerable decline in the number of new cases, of both pulmonary and non-pulmonary tuberculosis in 1919; in 1920 there were 3,310 fewer new cases of pulmonary tuberculosis than in 1919. Regarding Table 3 he states that the causes of increase of tuberculosis mortality during the war are generally ascribed to underfeeding or lack of particular varieties of food materials, greater industrial employment of women (often in unfavourable conditions and under much stress and strain), exposure and fatigue, and the great outbreak of influenza. Similar increases were observed in other countries, both neutral and those directly engaged in the war. It is significant that the increase during the war was particularly great in lunatic asylums and among women aged 20–25 years—many of whom were employed in munition works. Sir George Newman further adds: "The past history of the decline of tuberculosis is full of instruction as to the future." He suggests that we should (i) fortify the powers of resistance of the individual to disease; (ii) prevent the spread of infection; (iii) undertake all the general health reform which is necessary; (iv) educate and lastly—we must revise and apply in a proper and effectual way *the particular methods* with which we have made a substantial beginning—notification, domiciliary and dispensary treatment, the sanatorium, the training colony, the village settlement and the proper means of after-care. The local administration of these matters should be unified under the local authority and its medical officer of health.

REFERENCES.—Sir R. D. Powell and P. H. Hartley, *Diseases of the Lungs and Pleurae* (6th ed., 1921); Sir W. Osler, *Principles, Practice of Medicine* (9th ed., 1920); Sir T. Clifford Allbutt, *System of Medicine* (1905–11); G. E. Bushnell, *Epidemiology of Tuberculosis* (1920); Louis Cobbett, *Causes of Tuberculosis* (Public Health Series, 1913); a series of international studies by many authors, *The Control and Eradication of Tuberculosis* (1911); various official publications from the Ministry of Health and elsewhere.

(H. J. G.)

UNITED STATES

An extraordinary decline in the mortality from tuberculosis in the United States decreased the rate for the whole country from 202 per 100,000 inhabitants in 1900 to 160 in 1910, 21% less, and to 114 in 1920, 29% less than in 1910 and 43·5% less than in 1900. In New York City the decline was even more notable, the rate being 280 for 1900, 210 for 1910 and 126 for 1920; this was a fall of 25% between 1900 and 1910, 40% be-

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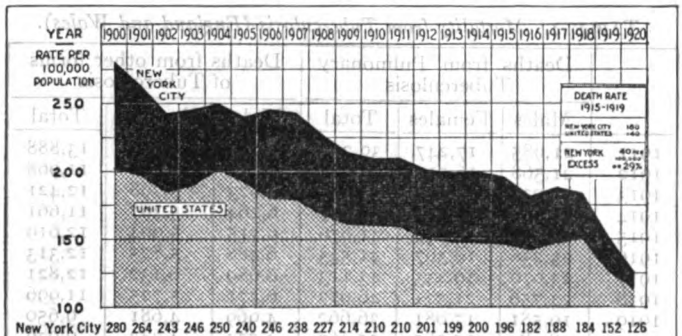
tween 1910 and 1920 and 55% between 1900 and 1920. In 1900 the New York City rate was 29% in excess of the rate for the United States; in 1910 it was 24% higher; but by 1920 conditions had so improved that it was only 9% higher. The chance of dying from tuberculosis in New York City in 1920 was about one-third that in 1900 and a little more than half that in 1910. Such a remarkable improvement in so crowded a city is unparalleled in the history of tuberculosis.

During the decade 1910–20 the fall in the death-rate was by no means uniform. Between 1912 and 1915 the mortality from tuberculosis throughout the country was almost stationary (150 in 1912 and 146 in 1915), while between 1916 and 1918, the period of the World War and the epidemic of influenza, the rate rose from 142 to 150. Virtually the same conditions obtained in New York City (201 in 1912, 196 in 1915, 182 in 1916 and 188 in 1917). The greatest decline was after 1918: from 184 in 1918 to 126 in 1920 for New York City and, during the same period, from 150 to 114 for the United States.

TUBERCULOSIS* DEATH-RATE OF NEW YORK CITY AND OF THE UNITED STATES† 1900 TO 1920



* All forms of tuberculosis. † U.S. Registration area which in 1920 included 82% of the population or 87,486,713 inhabitants.

G. J. DROLET, Statistician
New York Tuberculosis Association.

The registration of deaths became more exact and complete. A consideration of the conditions described on page 358 of Vol. XXVII. as being widespread late in the 19th century shows how much registration had been needed. Registration, the creation of state, not Federal, legislation was provided for only gradually by the necessary state laws. In 1910 the Registration Area of the United States covered 58·3% of the population; by 1920 nearly three-fourths of the states, with about 80% of the population of the country. The fact, therefore, that the tuberculosis death-rate shows a marked decline at the same time that the reporting of deaths has come under better control accentuates the great improvement. As has always been the case, pulmonary tuberculosis accounts for about seven-eighths of the deaths from tuberculosis of all forms. In 1920 the rate (pulmonary tuberculosis) for large cities ranged from 54 per 100,000 for Portland, Oregon, to 281 for Denver, to which city many tuberculosis patients have resorted. Chicago's rate was 83 and Philadelphia's 121; Boston's was 126, the same as that of New York City.

The decline in mortality was due to many factors, which in 1921 could not be formulated and estimated. The influenza epidemic played its part, but in a manner not definitely understood. The great wave of this disease swept the country in the autumn of 1918. It is significant that for the first time on record there was in that year a marked autumnal increase of tuberculosis deaths above the normal. For example, in Oct. 1917, the deaths from tuberculosis in New York State were 1,089, a rate of 122·2. This was an average incidence which had been maintained for years. In Oct. 1918, the month of the influenza epidemic, 1,520 deaths from tuberculosis were reported—an increase of about 50%. Oct. 1919 showed only 813 deaths, and Oct. 1920 726 deaths. It is conceivable that influenza carried off thousands of consumptives who would have contributed to the tuberculosis mortality later; and, that these potential deaths for later years, thus compressed into 1918, reduced the rate during the succeeding years. Nevertheless, influenza can have been only one of several or many factors. Economic and social movements played their part. It seems certain that tuberculosis to no small extent has yielded to the remarkable organized efforts directed against it in the United States.

The keynote of the American struggle against the disease has been organization. Founded in 1904, the National Tuberculosis Association developed into probably the most effective public health body in the United States. With its subsidiary state and local societies it reaches into every hamlet. Few men and women, interested actively in tuberculosis, are working otherwise than in connexion with the National Association. Perhaps its greatest achievement is that it calls the attention of a vast proportion of the population to tuberculosis and educates them in it through its unique way of raising funds to carry on its work. Every year, during the month of Dec. its subsidiary societies sell, at one cent each, stamps called Christmas seals, which may be used (not as postage) to fasten and embellish envelopes. Their sale in 1921 had reached the enormous yearly total of more than 500,000,000 and yielded more than $4,000,000 for the work of the Association.

Treatment.—The elements of the routine treatment of tuberculosis changed but little during 1910–20, but therapeutic resources expanded greatly. In 1920 there were more than 600 sanatoria for the treatment of pulmonary tuberculosis in the United States. These were maintained by states, cities, counties, private individuals and corporations, and by endowments. Under N.Y. State law every county must erect and maintain an institution for the care of its tuberculous population. Some trade unions and fraternal organizations established sanatoria for their members. The Metropolitan Life Insurance Co. of New York built for its employees one of the best sanatoria in the country. The trend away from sanatorium treatment which is to be observed on the continent of Europe has not been manifest in the United States. Artificial pneumothorax is the only surgical measure which has gained anything like a vogue: American observers are unanimous as to its usefulness in selected cases. Heliotherapy and phototherapy for surgical tuberculosis were used, but only sporadically, and very few reports as to their results appeared in American medical literature. Chemotherapy was under extensive experimentation at the Phipps Institute in Philadelphia and at the University of Chicago: results have not warranted its application to human tuberculosis. Tuberculin treatment is practised with more discrimination than formerly.

The decade was notable for the use and development of the X-ray in the diagnosis of pulmonary tuberculosis. As an aid to diagnosis it became indispensable in routine tuberculosis practice. It is the better American opinion that the roentgenologist must work hand in hand with the practitioner and that good diagnostic judgment is attained only by the proper analysis and evaluation of information yielded by physical examination, laboratory procedures and X-ray observation together: no single one of these will alone suffice in routine diagnosis. Diagnosis of tuberculosis by tuberculin was practically abandoned, few cases having proved amenable to this method.

The practitioner of 1920 regarded tuberculosis from a point of view quite different from that of 1910. The relatively recent disclosure that tuberculosis exists as a latent infection in almost all people and that infection confers a measure of specific immunity to reinfection gave rise to the almost necessary presumption that adult pulmonary tuberculosis develops from infection acquired in childhood and that the adult is insusceptible to exposure to infection from without. By 1915 this opinion had become almost a dogma. But during 1918–20 opinion became less positive; an increasing number of studies by American authorities showed that conditions are only relative. Although early infection and immunity therefrom are conceded, it is maintained that infection is capable of complete healing and that immunity may greatly diminish or even disappear; and that, therefore, there is every likelihood that reinfections—and active disease from them—are possible at any period of life.

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The study of tuberculosis and medical education in connexion with it received a great impetus from several directions. The Phipps Institute at Philadelphia was established at the opening of the decade; a tuberculosis research laboratory at Johns Hopkins University in 1916; and one in connexion with the National Jewish Hospital for Consumptives at Denver in 1918. Edward L. Trudeau, the recognized pioneer and leader of tuberculosis activities in the United States, died in 1915. During the last year of his life there was planned the Trudeau School of Tuberculosis, the first of its kind, to give systematic instruction to physicians. This held its first session at Saranac Lake, N.Y., in 1916, and was so successful that several others were established in other parts of the country. As a memorial to Trudeau, funds were raised to establish the Edward L. Trudeau Foundation, which aims to carry on research work and the Trudeau School and assist in the administration of the Trudeau Sanatorium. In 1916 *The American Review of Tuberculosis*, a monthly scientific periodical, was founded by the National Tuberculosis Association. It was in 1921 the only tuberculosis journal in the United States and had done much to stimulate the study and investigation of the subject.

Perhaps the most significant and unique achievement of the period was the Framingham (Mass.) Health and Tuberculosis Demonstration. Supported by the Metropolitan Life Insurance Company and the National Tuberculosis Association, this agency undertook a tuberculosis survey of a community of 15,000 people, to extend through six years. The work began in 1916. By 1920 the greater part of the population had been studied in its medical, economic and sociological relations. The survey established many facts, which seemed likely to serve as important data upon which future campaigns against tuberculosis might be based. Between 1916 and 1920 the tuberculosis death-rate of the community fell from 121·5 to 64·5 per 100,000. At the same time it was shown that the ratio of active cases to deaths was 9 or 10 to 1, instead of 3 to 1, the ratio which records of the community had previously shown. The survey supplied standards of diagnosis and treatment, of case detection, of school, factory and home control, of necessary expenditures against tuberculosis, etc., which promised to be of service not only to the whole nation but to the world at large.

(A. K. K.)

TUNISIA (*see* 27.393).—The pop., according to the 1911 census, consisted of 1,739,744 natives; 11,300 Maltese and 50,477 Jews. There are but few Arabs, the majority of the population being Arabic-speaking Mussulman Berbers. The chief feature of the European population is the presence of large numbers of Italians, who compete with the French in influence, and who have certain privileges with regard to language and education. According to the 1921 census the European pop. amounted to 156,125, of whom 54,477 were French, 84,819 Italian, and 13,509 Maltese. These figures show an increase of 8,000 in the French inhabitants since the census of 1911, and augur well for the further development of French immigration to the protectorate.

Since 1905 Tunis has had a Consulting Conference formed by 45 French members chosen by universal suffrage, and 16 natives, one of whom is Jewish, nominated from among the notables by the Government. This body expresses its views on all financial matters of interest to Tunis, whenever any fresh reforms place further burdens on the country.

The country is essentially agricultural, and cereals are raised on a large scale. In 1919, 514,861 hectares were under wheat, and produced 1,450,000 quintals. Vines are grown intensively over 23,246 hectares, and in 1919, 444,157 hectolitres of wine were produced. Olive trees cover a section of the country, and produced 191,836 quintals in 1919. The export of olives has a promising future. Fishing and the sponge industry occupy quite a number of the population. Iron and zinc are another resource, 360,453 tons of iron were extracted in 1919, their value being 14,500,000 francs. The chief mineral wealth of the protectorate lies in the immense phosphate deposits, which are worked on a big scale. In 1919, 815,385 tons were extracted, of a value of 36,692,325 francs; this is a considerable drop, for in 1915 the tonnage figure was 1,075,214 tons. There are valuable quarries and mineral springs. General trade in 1919 amounted to 487,789,000 francs, of which 285,761,000 francs represented imports. The share of France in the imports was 92,309,893 and of Great Britain 67,106,084 francs. Of the exports France absorbed 129,932,000, and Great Britain 15,670,000. In 1918 the total general trade amounted to 436,990,000 francs, 207,442,000 francs of which were imports. In the last normal year before the World War, the figure was 322,918,000, of which 144,256,000 francs were imports.

TUPPER, SIR CHARLES, BART. (1821–1915), Canadian statesman (*see* 27.410), died Oct. 30 1915.

TURBINES, STEAM (*see* 25.823 and 842).—The progress of the steam turbine during 1910–21 was very marked both as regards size and efficiency. The pure Curtis type, in which velocity compounding exists at every pressure stage, has been abandoned, except possibly for very small powers, and the design of impulse turbines now follows generally along the lines first laid down by Rateau, and developed principally by Rateau and Zoelly. A single Curtis wheel is frequently used to absorb the velocity due to the expansion of the steam in the first stage, as this practice permits of a greater heat drop in that stage, so that the pressure and superheat are considerably reduced before the steam is admitted to the body of the turbine. Velocity compounding is recognized as less efficient than the abstraction of the energy of the steam by single impulse blading, but the practical advantage of obtaining a large heat drop in the first stage is often considered to outweigh a slight loss of efficiency. The typical impulse turbine of to-day consists of a horizontal shaft carrying a number of disc wheels, each furnished with a single row of blades around its circumference, and running in its own separate compartment. The diaphragms which separate the compartments contain nozzles which are so proportioned that the steam expanding in them from the pressure which exists in one compartment to that in the next acquires just the velocity which can be efficiently absorbed by the wheel in the second compartment. The description later of a modern impulse turbine will make clear its construction and principles of action.

The reaction machine still maintains its position as regards efficiency and, like the impulse machine, is employed for very large powers. In modern machines, although the thermodynamic principles are identical with those of the earlier machines, there has been a considerable change in details of construction. The modern reaction turbine is frequently fitted with a velocity compounded impulse wheel, upon which the steam acts before passing to the reaction blading, the reason for this being the advantage of reducing the temperature and pressure of the steam before it is admitted to the body casing. It is not unusual to design the impulse wheel so that it absorbs about one quarter of the available energy of the steam, with the result that the drum may be materially shortened, the number of rows of reaction blading greatly reduced, and the cost of the turbine lessened. Other features which are typical of modern reaction machines are the great care taken to eliminate causes of distortion in the casing, by avoiding ports and irregularities of the metal. The casing is always made as symmetrical as possible.

The Reaction Steam Turbine.—Enormous progress has been made with the reaction turbine invented by Sir Charles Parsons, both as regards size and efficiency, and corresponding mechanical developments have taken place in the design. Land turbines of more than about 10,000 K.W. capacity are usually constructed in two or more parts, each part being a complete turbine, but utilizing only a portion of the total pressure drop of the steam. Sometimes the parts are placed side by side, each driving an independent electric generator, but otherwise they are arranged in tandem on a continuation of the same shaft.

This latter arrangement is illustrated in fig. 1, which shows a section through a large modern two-cylinder machine constructed by Messrs. C. A. Parsons & Co. Ltd. The steam passes from left to right through the blading of the high-pressure cylinder, and is then conducted by means of the circular external pipe to the centre of the low-pressure cylinder. Here it divides, flowing axially in each direction through the blading to the exhaust branches whence it passes to the condenser beneath. The low-pressure cylinder is built on the " double flow " principle in order to avoid the excessive length of blades and size of exhaust branch which would otherwise be required. In turbines of the reaction type there is a difference of pressure between the two sides of every row of blades, and there is thus a corresponding tendency for the steam to leak past the row without passing through the blading. This leakage was a source of considerable inefficiency, and to minimize it, the custom was to employ the smallest practicable radial clearance between the tips of the blading and the opposing surface of the drum or casing. These fine clearances were a source of weakness, as in the event of a slight distortion of the parts by straining or uneven heating, or in case of vibration occurring, there was always a chance of contact occurring, and the danger of this resulting in a stripping of the blades. In order to avoid the fine radial clearances with their attendant danger, Messrs. Parsons introduced the system of end-tightened blading, which now represents their standard practice for the high-pressure end of the turbine where the density of the steam makes fine clearances essential. This is illustrated in fig. 2.

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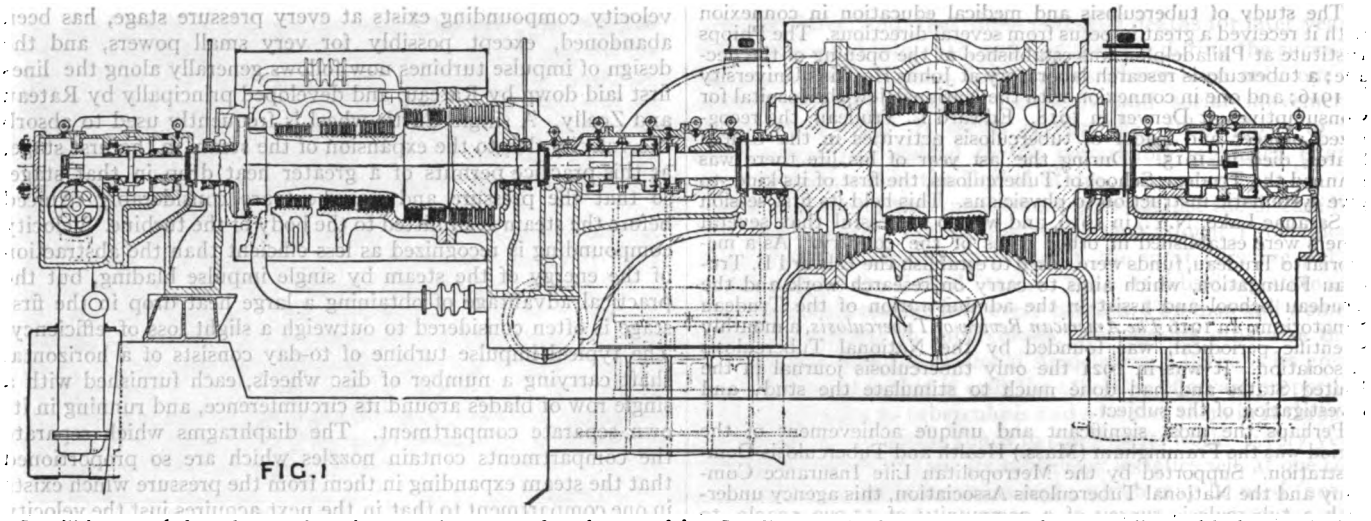

FIG. 1

It will be noted that the spacing pieces at the roots of each row of blades project above the surfaces of the rotor and cylinder, as the case may be, and form a continuous barrier. There is a thin brass shrouding strip rivetted to the free ends of the blades, which projects over the side of the blades and is almost in contact with the barrier of the next row. The space between the projecting edge of the shrouding strip and the adjacent barrier forms the actual working clearance which can be adjusted to any desired amount while the machine is running. The radial clearances between the shrouding and the surfaces of the rotor and casing are never less than $\frac{3}{16}$ in., so that contact is out of the question. Considerably greater economy is said to be obtainable with this type of blading.

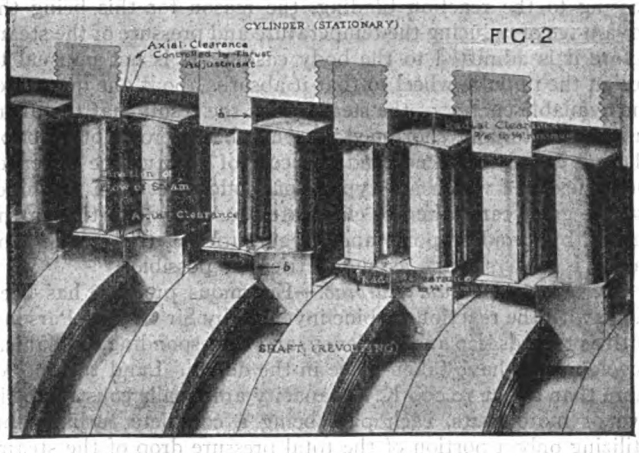

FIG. 2

The modern type of blading is illustrated in fig. 3. The blades, made of drawn brass strip, are assembled in units, complete with spacing pieces and shrouding. The blades and spacing pieces are brazed solidly together at the roots, and circumferential serrations are then cut in the solid part as shown.

The following table gives the results actually obtained with certain large turbo alternators of the Parsons Company:—

Installation	Chicago	Carville	Lots Road	Dunstan
Date of test	Nov. 1918	Nov. 1919	June 1916	Mar. 1921
K.W. Economical rating	20,000	10,000	15,000	12,000
K.W. Output	21,227	9,991	15,047	11,967
Speed, r.p.m.	750	2,442	1,000	2,400
Gauge pressure at stop valve, lb.	202·4	251	176·5	175·7
Temperature at stop valve, deg. F.	548·7	687	524·3	607·1
Superheat, deg. F.	159·8	281	146·1	229·2
Vacuum, ins. Hg.	1·13	0·96	0·97	1·02
Heat drop, B.Th.U. per lb.	408	459·4	402·8	421·2
Steam consump. per K.W.H.	10·84	10·04	11·82	10·80
Efficiency ratio	77·4	73·98	71·80	75·20
Thermodynamic efficiency	25·31	25·7	23·35	24·70
Length of time turbine had been working	5 years.	2½ years.	3 years.	4 years.

In all cases the instruments used were calibrated before and after the tests, and the steam consumption was obtained by weighing the condensate, so that a very high degree of accuracy was obtained. The tests go to show, incidentally, that reaction machines do not fall off in efficiency after several years' operation under commercial conditions of service.

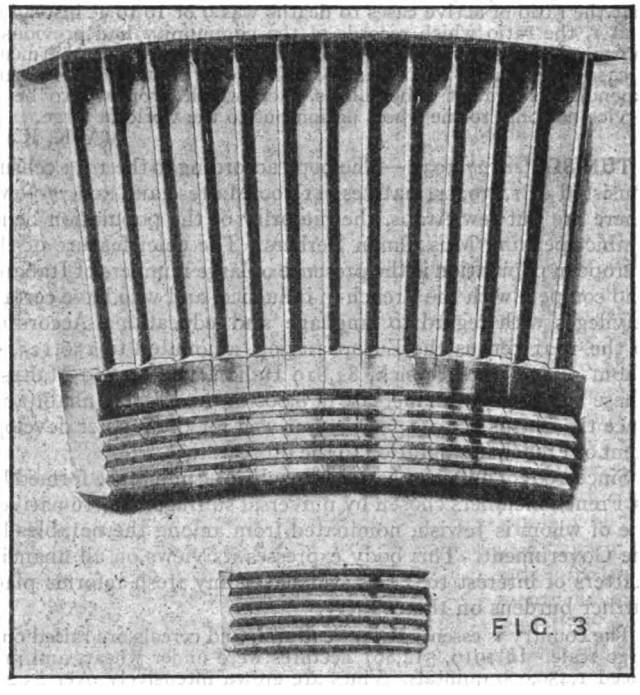

FIG. 3

The Impulse Steam Turbine.—The Rateau steam turbine is a typical modern multistage impulse turbine. Fig. 4 shows a longitudinal section through a machine of this type constructed in 1919 by the Metropolitan Vickers Electrical Co. for the Dalmarnock power station, the machine in question having a maximum continuous rating of 18,750 K.W. at a speed of 1,500 revs. per minute. The shaft carries altogether 15 wheels keyed upon it, each wheel running in a separate compartment. The diaphragms dividing the compartments from each other are fitted with nozzles, in which the steam undergoes successive partial expansions in its progress through the turbine, and from which it emerges with a velocity due to the drop in pressure which it has undergone. This velocity is abstracted by the action of the blading which the steam enters after issuing from each set of nozzles, the steam being brought more or less to rest and the energy due to its partial expansion appearing as useful mechanical work on the shaft.

In all large machines of this type, especially when they are working with a high vacuum, the volume of the steam at the low-pressure end becomes so great that the length of the turbine blades at this part tends to become excessive. In the machine in question a part of the steam, after having passed through 10 wheels, being then at a pressure of about 4 lb. abs. is passed out of the casing and used to heat the boiler feed water, the feed heater for this purpose being shown in section in the illustration. This practice diminishes,

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to a certain extent, the volume of the steam which passes through the remaining wheels, but in the machine illustrated, the makers have employed a special device to permit a reduction of the length of the last row of blades. The steam which enters the last wheel but one, is divided into two parts, that which acts on the outer annulus of the blade ring passing away directly to the condenser, and only that which acts on the inner annulus being afterwards conducted to the final wheel. The blading on the last wheel therefore only deals with about half the weight of steam which passes through the preceding wheel, and it can handle this amount at a very reduced pressure.

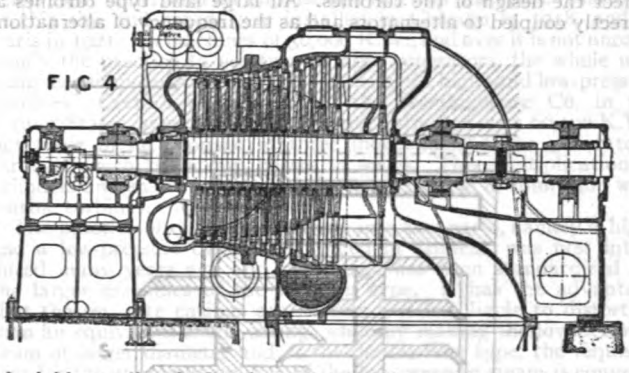


FIG. 4

A rigid coupling is fitted to connect the turbine shaft with the shaft of the alternator, and the turbine shaft is located axially by means of an adjustable thrust block of the Michell type which takes care of any unbalanced end pressure along the shaft.

The mean diameter of the blading of this machine is 84 in. and the length of the last row of blades is 24 inches. The mean circumferential velocity of the blading is 550 ft. per second, the tip velocity of the longest blades being 708 ft. per second. The turbine is designed to work with a stop-valve pressure of 250 lb. per sq. in., a temperature of 650° F. and a vacuum of 0·9 in. of mercury, thus having an available heat drop of 455·2 B.Th.U. per lb. of steam. Under these conditions the guaranteed steam consumpion is 10·2 lb. per K.W.H., this figure being the same for both 15,000-K.W. and 18,750-K.W. load.

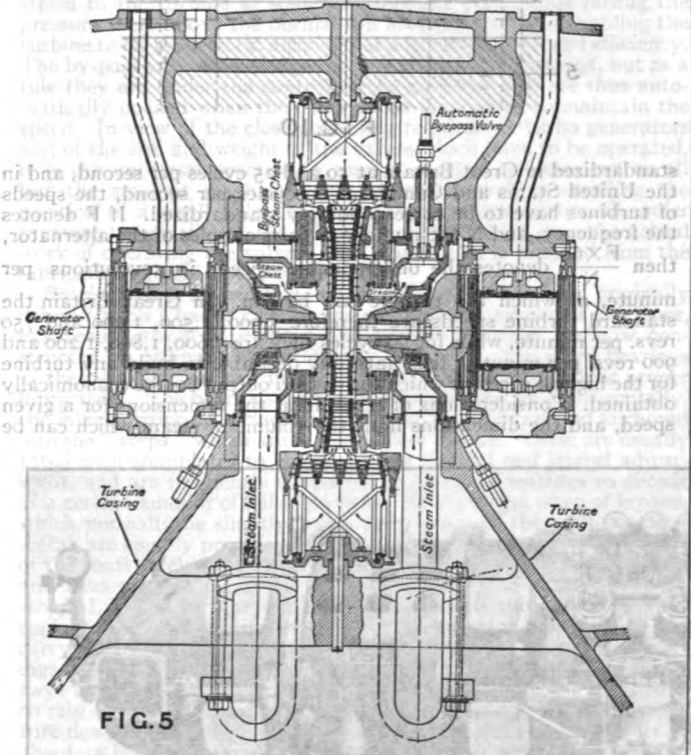
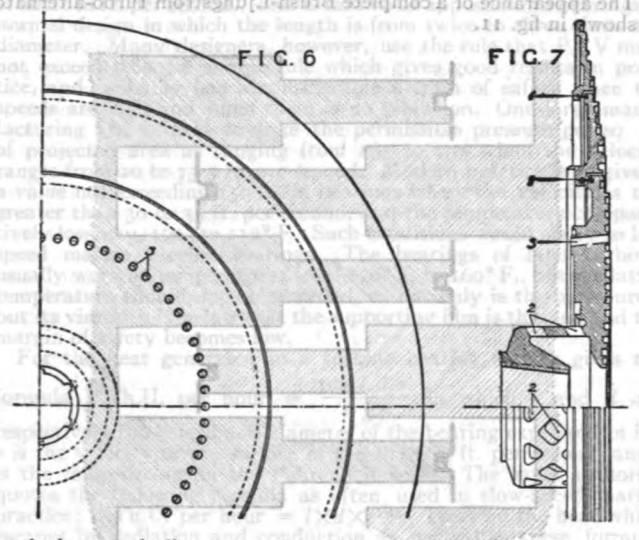


FIG. 5

The Ljungstrom Steam Turbine.—In the early days of the reaction turbine, a number of machines were built by the Hon. C. A. Parsons in which the steam passed radially outwards between two discs carrying rings of blades projecting axially from their opposed faces, one disc being stationary and the other driving the shaft of an electric generator. Mechanical difficulties were experienced, principally due to the distortion of the discs by uneven heating, and the design was soon completely abandoned in favour of the axial flow type. In the year 1910 Messrs. Birger and Frederic Ljungstrom of Stockholm built an entirely new type of radial flow reaction machine which was conspicuous not only for its mechanical merits but for its great efficiency. The Ljungstrom turbine is now being developed in sizes up to 30,000 K.W. capacity, and is manufactured in Great Britain by the Brush Electrical Engineering Co. and in the United States by the General Electric Company. The steam is admitted between two discs and in its passage from their center to their circumference it passes through concentric blading rings mounted alternately on the faces of the discs. The discs revolve at equal speeds in opposite directions, so that the relative blade speed is twice as great as in an ordinary machine of the same



revolutions and diameter, with the consequence that for equal efficiency the number of blade rings is only one quarter as great. Each disc is fastened to the end of a separate alternator shaft, and as the turbine comes up to speed, the alternators come automatically into synchronism and operate in parallel so that they act virtually as a single machine.

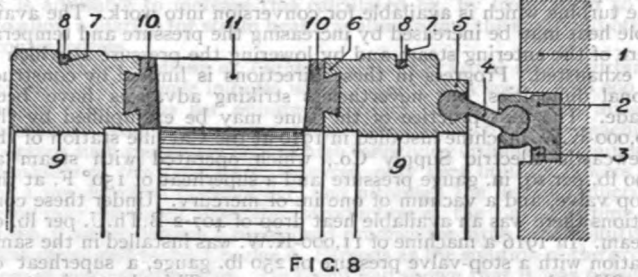


FIG. 8

The mechanical construction of the Ljungstrom turbine is unique. Fig. 5 shows a section through a machine to develop 5,000 K.W. at 3,000 revs. per minute, the illustration including the two ends of the alternator shafts, upon which the turbine discs are mounted. The construction will be better understood by reference to figs. 6–10 which show the most important details to a larger scale. The steam enters the turbine through the branched pipe shown in fig. 5 and thence passes to the centre of each disc through the holes marked 2 in figs. 6 and 7, which illustrate the disc alone. It will be seen that the face of the disc contains a number of circumferential grooves. Each groove carries a blade ring, shown to a larger scale in fig. 8, in which 1 represents the disc; 2 a seating ring; 3 a caulking strip; 4 an expansion ring; 5 and 6 rolling edges; 7 steam packing strips; 8 caulking strips; 9 strengthening ring; 10 dovetail profile ring; 11 the blade itself. These blade rings are interleaved as they project alternately from the discs, and steam leakage is checked by the thin fins 7. The blades are made from drawn steel strip and are welded solidly into the strengthening rings 10.

The conical steel expansion ring, 4, is a particularly important feature of the blading system, and similar rings will be seen at 1 in fig. 7, where they serve to connect the three parts of which the disc is composed. The ring of holes shown at 3 in fig. 7 is to admit the extra steam necessary for overload conditions, the inner rings of blading being then short circuited. The pressure of steam in the blading naturally tends to thrust the discs apart. It is therefore balanced by an arrangement of "dummies," or labyrinth discs, as shown in fig. 5. A detail of the labyrinth, to a larger scale, is given in fig. 9. To prevent the high-pressure steam leaking along the shafts, these are fitted with labyrinth packings, a portion of one of these packings being illustrated in fig. 10. The whole packing consists of a number of rings keyed alternately to the shaft and to the housing and having deep grooves turned circumferentially in the

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sides. The rings interleave in the manner shown, the edges of the grooves being bent down so as practically to make contact with the walls of the grooves in the adjacent rings. An extremely effective and compact labyrinth is thus formed.

The efficiency of the Ljungstrom turbine is remarkably high for machines of moderate capacity. Independent tests of a 1,500-K.W. machine, after 15 months' service, have shown a steam consumption of 11·95 lb. per K.W.H., with steam at 208 lb. per sq. in. abs. and 569° F. temperature, and a vacuum of 1·29 in. Hg. The no-load consumption of the same machine was only 1340 lb. per hour, or 7·5% of the full-load consumption.

The appearance of a complete Brush-Ljungstrom turbo-alternator is shown in fig. 11.

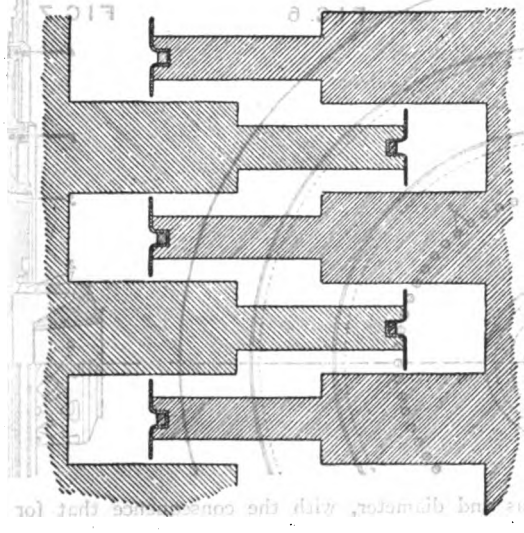

FIG. 9

Steam Conditions in Turbines.—The steam consumption of a turbine depends not only upon the excellence of its mechanical design but upon the amount of heat in every pound of steam delivered to the turbine which is available for conversion into work. The available heat may be increased by increasing the pressure and temperature of the entering steam and by lowering the pressure at which it is exhausted. Progress in these directions is limited by constructional difficulties, but nevertheless striking advances have been made. The best practice of the time may be exemplified by the 10,000-K.W. machine installed in 1910 at the Carville station of the Newcastle Electric Supply Co., which operated with steam at 190 lb. per sq. in. gauge pressure and a superheat of 150° F. at the stop valve, and a vacuum of one in. of mercury. Under these conditions there was an available heat drop of 407·2 B.Th.U. per lb. of steam. In 1916 a machine of 11,000-K.W. was installed in the same station with a stop-valve pressure of 250 lb. gauge, a superheat of 244° F. and a vacuum of one in. of mercury. This change in steam conditions increased the heat drop to 450·2 B.Th.U. per lb. of steam. In 1921, a machine having an economical rating of 25,000 K.W., installed at Manchester, utilized a stop-valve pressure of 350 lb. gauge, a superheat of 264° F. and a vacuum of 0·9 in. of mercury, thus working with an available heat drop of 484·7 B.Th.U. per lb. of steam. It may be taken that modern practice sanctions steam pressures up to 350 lb. per sq. in., temperatures up to 700° F. and vacua as high as 29·1 in., with the barometer at 30 inches. No commercial reciprocating engine could work under such steam conditions with anything like the efficiency a turbine would show in similar circumstances.

Speeds of Turbines.—The principal use of steam turbines on land being to drive electric generators, the speed at which these can be run controls to a large extent the speeds for which turbines can be designed. Continuous current turbo generators are comparatively small in size and few in numbers, and as these are almost exclusively driven through reduction gearing on account of the difficulties of commutation at high speeds, their characteristics do not materially affect the design of the turbines. All large land type turbines are directly coupled to alternators and as the frequency of alternation is

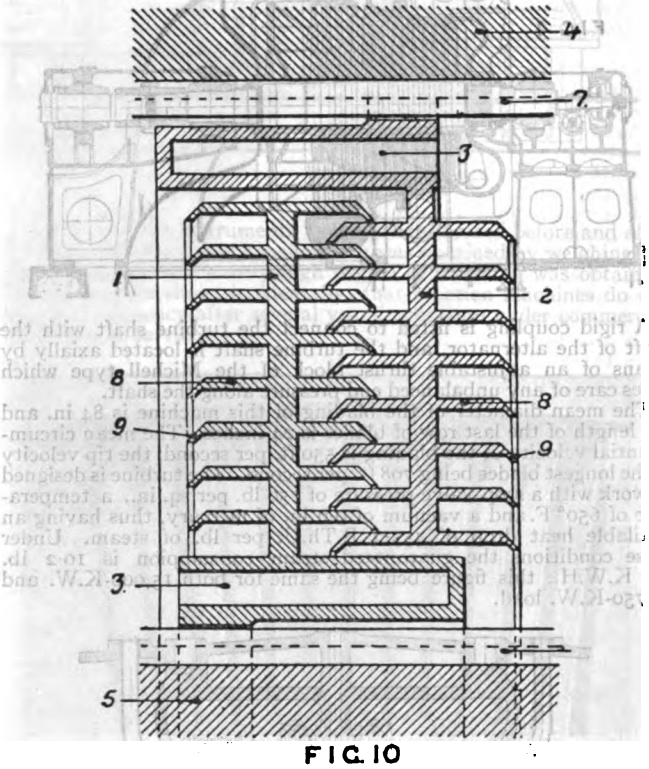

FIG. 10

standardized in Great Britain at 50 and 25 cycles per second, and in the United States and Canada at 60 cycles per second, the speeds of turbines have to be correspondingly standardized. If F denotes the frequency, and N the number of pairs of poles of the alternator, then $\frac{F \times 60}{N}$ denotes the only possible speed, in revolutions per minute, at which the turbine can be run. In Great Britain the standard turbine speeds are therefore 3,000, 1,500, 1,000 and 750 revs. per minute, while for 60 cycles they are 3,600, 1,800, 1,200 and 900 revs. per minute. It is naturally desirable to build any turbine for the highest speed at which the desired output can be economically obtained. Considerations of stress limit the dimensions for a given speed, and the dimensions limit the volume of steam which can be

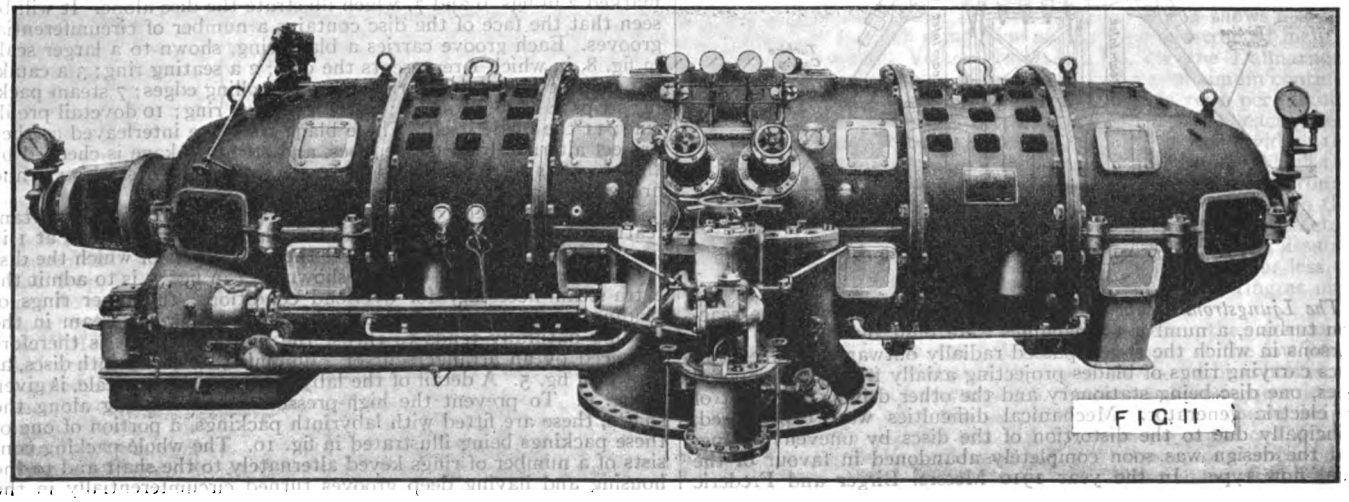

FIG. 11

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efficiently utilized, so that in practice a fairly definite limit of power corresponding to each speed is obtained.

Turbo alternators have been satisfactorily built, having a maximum continuous rating of over 6,000 K.W. at 3,600 revs., the limit of economical rating for this speed being at the present time about 5,000 K.W. At 3,000 revs. per minute the maximum continuous rating is about 13,750K.W., the economical output being 12,500 K.W., the machine built in 1921 for the Liverpool corporation being of this size. There are several turbines with a maximum continuous rating of 30,000 K.W. running at 1,800 revs. per minute, and at 1,500 revs. per minute, a continuous rating of 35,000 K.W. appears to be about the present limit, both for impulse and reaction machines. Machines of this size and speed were installed in Chicago in 1918, and in Paris in 1921. In machines of 30,000 K.W., and over it is not uncommonly the practice to use two or more generators, the whole unit really consisting of mechanically independent high- and low-pressure turbines. Certain units built by the Westinghouse Co. in the United States have a maximum rated output of even 60,000 K.W., but these in fact consist of three independent turbo generators, through which the steam passes in series. This multiplication of cylinders and shafts is of course the usual custom in connexion with marine turbines.

The practice of dividing a turbine into two parts, namely a high- and a low-pressure cylinder arranged in tandem, was first introduced many years ago and the design has been standardized for the larger machines of the reaction type. It has the advantage that the separate casings are shorter and less liable to distortion than an equivalent single casing, while by making the low-pressure drum of larger diameter and of the double flow type, the requisite area for the enormous volume of the low-pressure steam is conveniently provided for. The importance of this will be realized from the fact that in a modern turbine the ratio of expansion of the steam may be over 800·1. Fig. 1 shows a section through a two-cylinder tandem turbine as constructed by the Parsons Co., and fig. 12 illustrates the appearance of a two-cylinder side by side arrangement as used with gearing for marine purposes.

Governing of Steam Turbines.—The speed regulation of turbines is effected by a centrifugal governor driven by worm gearing from the main shaft, which acts in the case of all reaction machines by controlling the pressure at which steam is admitted to the casing. In machines constructed either wholly or partially on the impulse principle, the governor may open up successively extra nozzles or groups of nozzles as the load increases. Loads in excess of the maximum economical load are sometimes provided for by admitting steam to the turbine at some intermediate point, thus raising the pressure there above the normal full load pressure and enabling the turbine to do more work, although at a somewhat reduced efficiency. The by-pass valves for this purpose may be hand operated, but as a rule they are under the control of the governor and are thus automatically opened when the extra steam is required to maintain the speed. In view of the close governing required on turbo generators and of the size and weight of the valves which have to be operated, it is the universal practice to employ a relay arrangement on all but the smallest machines, the governor merely controlling the position of a small balanced piston valve which admits oil under pressure to one side or the other of a piston which does the actual work of operating the valves. The pressure oil is supplied from the lubrication system of the turbine.

Bearings and Lubrication.—The old sleeve bearing, originally devised by Sir Charles Parsons and employed on his earlier machines, has been entirely superseded and turbine bearings are now constructed on ordinary lines, differing only from slow-speed bearings in their proportions and in the provision necessary for their proper lubrication. The bearings are made in two halves, split horizontally, the interior working surfaces being of white metal cast and anchored into the "steps" which are of cast iron or bronze. These are usually fitted with shimplates to provide a fine vertical and lateral adjustment, and are frequently supported in spherical seatings to permit of a certain amount of self-alignment. Safety strips, often of bronze, which normally lie slightly below the surface of the white bearing metal, are usually provided. These are intended to carry the weight of the shaft safely in the event of the white metal being melted out, and thus prevent injury to the blading until the machine can be stopped. In all turbine bearings the important thing is to insure a copious supply of lubricating oil, not so much for lubrication as to carry off the heat generated by friction and to maintain the bearings at a reasonable working temperature. Water-cooled bearings have been used by some makers, but the most approved practice is to rely on the flow of oil through the bearing to keep its temperature down. Oil is usually delivered to the bearings at a pressure of about 15 lb. per sq. in., a gauge being provided on each bearing to indicate whether the pressure is being maintained. On modern turbines an automatic device operated by the oil pressure is fitted, which shuts the machine down in case of any failure of the oil supply.

Bearings up to 8-in. diameter are usually bored larger than the shaft to the extent of about 0·004 in. for every in. of shaft diameter. In larger bearings the clearance is proportionately less. This somewhat large clearance enables the heat to be carried away by the continuous wash of fresh cool oil. The shaft, when running, is kept out of metallic contact with the bearing by a thin film of oil continually dragged underneath it by its rotation. It is this film which supports the shaft, and the pressure of the latter on the bearing must therefore not be greater than the film can stand. Theory and experiment both indicate that the greater the surface velocity of the shaft, the more effectively is the film established, and the greater therefore the permissible load on the bearing. But the fact that bearings have to start from rest, when the film is imperfect, imposes a practical limit to the load which can be imposed.

A formula connecting permissible pressure with velocity, given by Mr. F. H. Clough, is $P = 17\sqrt{V}$, in which P denotes the pressure in pounds per sq. in. of projected area, and V = velocity of surface of shaft in ft. per second. This is said to be applicable to bearings of normal design in which the length is from twice to three times the diameter. Many designers, however, use the rule that $P \times V$ must not exceed 5,600, a simple rule which gives good results in practice, and probably has a considerable margin of safety when the speeds are high and when there is no vibration. One large manufacturing firm is said to take the permissible pressure per sq. in. of projected area as ranging from 167 to 235 when the velocity ranges from 20 to 73·5 ft. per second. Modern practice is to give P a value not exceeding 150 lb. in bearings where the velocity is not greater than 30 to 35 ft. per second, and the temperature comparatively low, say, 100° to 110° F. Such conditions would apply to low speed marine turbine bearings. The bearings of land turbines usually work at temperatures from 120° F. to 160° F., but the latter temperature should not be exceeded, as not only is the oil injured, but its viscosity is so low that the supporting film is thinned and the margin of safety becomes low.

For the heat generated in a turbine bearing Stoney gives the formula B.Th.U. per hour $= \frac{190\, l.\, d.\, v}{t.\, 32}$ in which l and d are respectively the length and diameter of the bearing expressed in in., v is the velocity of the surface of the shaft in ft. per second, and t is the temperature on the Fahrenheit scale. The same authority quotes the following formula as often used in slow-speed marine practice: B.Th.U. per hour $= l \times d \times v^{1\cdot 28}$. Treating the heat which escapes by radiation and conduction as negligible, these formulæ give the heat which has to be carried away by the oil and extracted by the oil cooler. This heat of course is the equivalent of the work lost by friction in the bearing. The increase of temperature of the oil passing through the bearing should not exceed 10° to 20° F., and if the specific heat of oil be taken at 0·31 the minimum quantity of oil required for each bearing may be readily calculated. In practice it is advisable to increase this calculated fig. by from 30 to 50%, to allow a margin for steam heat travelling along the shaft and other contingencies.

Mechanical Gearing of Turbines.—The De Laval steam turbine, consisting of a single impulse wheel running at a speed of 30,000 to 10,000 revolutions per minute according to the size, has always contained reduction gearing as an integral part of the machine because such speeds are far too high for driving ordinary machinery. Turbines of this type have, however, only been built for powers up to a few hundred horse-power, and although the use of reduction gear may be dated from the introduction of the Laval turbine in 1886, it never became a recognized practice for large powers until it was developed by Sir Charles A. Parsons as the solution of the problem of marine propulsion. De Laval had shown that it was possible to transmit power satisfactorily through mechanical gearing running with a circumferential velocity of over 100 ft. per second. The gears he used were of the double helical type with a spiral angle of 45 degrees. The reduction ratio was usually about 10:1, and the pitch of the teeth varied from 0·15 in. to 0·26 in., according to the power of the turbine. The De Laval gear embodied all the features which have been found necessary to the successful performance of modern gears transmitting several thousand horse-power through a single pinion. The double helical form of tooth of comparatively fine pitch has been retained, as this design eliminated end thrust and insured silent running by reason of the number of teeth simultaneously in contact. Ample lubrication of the teeth by means of oil jets was also employed by De Laval, who succeeded in producing durable and satisfactory gears which had an efficiency of about 97 per cent. These gears are used up to about 600 H.P. which is the commercial limit of the type of turbine for which they are designed.

Steam turbines of any type, designed with due regard to efficiency and cost of manufacture, require to run at a far higher speed of revolution than is practicable for screw propellers, especially when the latter are employed to drive ships of moderate speed. The coupling of a turbine, therefore, directly to a propeller shaft involves a compromise in design, in which the speed is greater than desirable for the propeller yet so low as to require the turbine to be of greater size and weight and of lower efficiency than it would otherwise be. In the case of high-speed vessels direct coupling afforded a commercially acceptable solution of the problem of turbine propulsion, and for vessels of eighteen knots speed and over, such as warships, passenger liners and cross-channel boats, the direct coupled turbine soon became the recognized driving power. But ordinary cargo vessels and tramp steamers, with an average speed of 10 or 12 knots, were outside the practical field of the steam turbine until speed reduction gearing was available to couple a high-speed turbine with

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a slow moving propeller. It was really the problem of the slow speed ship which brought about the development of marine turbine gearing, and now that the mechanical difficulties have been overcome, the direct coupled marine turbine is likely to be largely displaced by the geared turbine in all classes of vessels.

The first example of marine turbine reduction gearing appears to have been in 1897, in connexion with a twin screw launch, in which the Parsons Marine Steam Turbine Co. fitted a 10-H.P. turbine driving the two shafts by means of helical gearing having a speed ratio of 14:1. The result appears to have been entirely satisfactory. Other experiments followed, and in 1909, the "Vespasian," a cargo vessel of 4,350 tons displacement, was fitted with geared turbines driving a single propeller. This vessel had previously been equipped with triple expansion reciprocating engines of the usual type, and before these were removed they were put into perfect order, and very careful tests were made to determine the efficiency and performance of the vessel. The geared turbines drove the same shaft and propeller as the engines had done and were supplied with steam from the same boilers. The power developed was about 1,000 H.P. and the shaft ran at 70 revs. per minute, the gear reduction ratio being 19·9:1. The installation of the turbines resulted in an increase of about one knot in speed for the same coal consumption, and the results of the trials were highly satisfactory in every respect, and convincing as to the advantages of geared turbines over reciprocating engines. After the "Vespasian" had run 18,000 m. in regular service, the pinion was examined and found to be in perfect condition, the wear not exceeding 0·002 inches. (See *Trans. I.N.A.* 1910 and 1911.)

The success of the "Vespasian" led to rapid developments. In 1910 the British Admiralty adopted gearing, the torpedo boats "Badger" and "Beaver" being the first warships to be equipped with geared turbines. In these vessels each L.P. turbine drove its shaft directly, but the H.P. and cruising turbines were geared to a forward extension of the turbine spindles. At full load about 3,000 H.P. were transmitted through each set of gearing. Six years later complete gear drives had become the standard practice for British war vessels of all types and by 1920 some 652 gears, transmitting an aggregate of 7,280,000 shaft H.P., were fitted, or on order for the royal navy (Tostevin, *Trans. I.N.A.* 1920).

The appended particulars of H.M. battle cruiser "Hood," of 144,000 shaft H.P., which was completed in 1920, will indicate the development of gearing for turbines and will at the same time indicate the proportions which have been adopted.

Gearing of H.M.S. "Hood."

Horse-power of H.P. turbine	17,500
Horse-power of L.P. turbine	18,500
Revs. per minute H.P. turbine	1,497
Revs. per minute L.P. turbine	1,098
Revs. per minute propellers	210
Diameter of pitch circle, in H.P. pinion	20·174
Diameter of pitch circle, in L.P. pinion	27·51
Diameter of pitch circle, in gear wheel	143·787
Number of teeth H.P. pinion	55
Number of teeth L.P. pinion	75
Number of teeth gear wheel	392
Circular pitch, in.	1·1533
Normal pitch, in.	0·9985
Helical angle of teeth	29°57′
Effective width of pinion face, in.	73·25
Number of teeth engaging	36·6
Total length of tooth contact, in H.P. pinion	128·8
Total length of tooth contact, in L.P. pinion	132·9
Load in lb. per in. on total Width of tooth face (=P) } H.P.	965
Load in lb. per in. on total Width of tooth face (=P) } L.P.	1030
Value of K in formula $P=K\sqrt{P.D.}$ } H.P.	215
Value of K in formula $P=K\sqrt{P.D.}$ } L.P.	196
Velocity of pitch line ft. per second	132

The earliest practice with regard to marine gearing was to use a helical angle of 23° in conjunction with a normal pitch of 0·75 inches. Subsequently a helical angle of 45° which had been found successful in the De Laval gears was adopted with the idea of securing quieter running, but modern practice favours an angle of about 30°, as teeth cut at this angle will run silently, while their less inclination to the axis of the shaft results in increased efficiency and greater effective strength. The usual angle of obliquity is 14½°, and the normal pitch except for the very largest gears is nearly always 0·583 inches. The permissible pressure in lb. per in. of axial length of the pinion is determined by the formula $P=K\sqrt{D}$ in which D is the pitch diameter of the pinion in in. and K is a constant which has a value usually between the limits of 160 and 230. This formula represents the practice of the Parsons Co., who have a preponderating experience on these gears. There is reason for believing, however, that the pressure might be made more directly proportional to the pitch diameter. A circumferential velocity of 150 ft. per second on the pitch line has been successfully employed, and it is possible that this might be exceeded with safety.

For turbine gearing the British Admiralty specify that the pinion shall be made of oil-hardened nickel steel, containing not less than 3·5% of nickel and from 0·30 to 0·35% of carbon, with an ultimate tensile strength of 40 to 45 tons. The gear wheels are to be of steel of 31 to 35 tons ultimate tensile strength with 26% elongation in two inches.

It is essential that the teeth of turbine gearing shall be very effectively lubricated, and to insure this, oil under a pressure of from 5 to 10 lb. per sq. in. issues in jets which flood the teeth immediately before they come into engagement. A further point of primary importance is that the fitting and alignment of the gears must be as perfect as possible and great care must be taken to maintain and insure these conditions. In America the practice has been adopted of carrying the pinion on a floating frame with the object of permitting a certain amount of self-alignment, but the required correction is of such a very small order of magnitude that the advantages of the system are doubted by many engineers.

Gearing of British naval turbines is exclusively of the single reduction type, but double reduction gearing has been largely introduced into cargo vessels during recent years, with the object of efficiently using turbine machinery for ships of comparatively low speed without involving too large a reduction ratio for a single pair of gears. The general design follows—*mutatis mutandis*—that of single reduction gear.

Numerous tests have been carried out to determine the mechanical efficiency of gears of the kind described. The mechanical efficiency of a single reduction gear at full load should be over 98%, and 98·5% has been recorded. With double reduction gear the efficiency is about 97·0%. These figures include bearing friction. No method of obtaining speed reduction by hydraulic or electrical methods has yet been devised which will approach the efficiency obtainable with mechanical gearing.

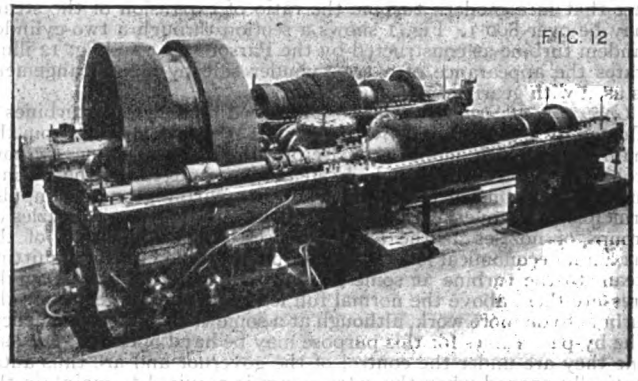
FIG. 12

Fig. 12 gives a good idea of the shafts of the Cunard liner "Transylvania," built by Scotts Shipbuilding & Engineering Co. Ltd. An exactly similar set of machinery was fitted to drive the other shaft. The "Transylvania" was the first Atlantic liner to be fitted with geared turbines. The vessel had a length of 548 ft. and a gross tonnage of 14,500. Each set of turbines and gearing was designed to develop and transmit 5,500 shaft H.P. and they drove the vessel at 16·75 knots. The turbines ran at 1,500 revs. per minute and drove the propellers at 120 revs. per minute, the ratio of the gearing being therefore 12·5:1. In the illustration the pinion in the foreground is driven by the high-pressure turbine, the steam from which operates the low-pressure turbine on the other side of the gear wheel. The astern turbine, consisting of an impulse wheel followed by a comparatively few rows of reaction blading, is seen on the forward end of the low-pressure turbine. The size of the machinery is indicated by the fact that the gear wheel is 10 ft. in diameter and 5 ft. wide.

Theory of the Steam Turbine

Throughout the ensuing section, heat is expressed in foot pound centigrade units, and the symbols employed have the following meanings:—

H	=Total heat in one lb. of steam.
H_w	=Total heat in one lb. of steam at the supersaturation limit or Wilson line.
H_s	=Total heat in one lb. of steam at the saturation line.
V	=Volume of one lb. of steam in cub. ft.
V_w	=Volume of one lb. of steam in cub. ft. at the Wilson line.
V_s	=Volume of one lb. of steam in cub. ft. at the saturation line.
$V\phi$	=Volume of one lb. of steam in cub. ft. after an isentropic expansion.
p	=Absolute pressure in lb. per sq. in.
t_s	=Saturation temperature (centigrade).
ϵ	=Efficiency ratio.
η	=Hydraulic efficiency.
u	=Thermodynamic head expended in isentropic expansion.
U	=Thermodynamic head expended in a practicable expansion.
γ	=Index for adiabatic expansion.
λ	=Index for an expansion at constant efficiency.

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w = Flow of steam in lb. per second.
ν = Number of pressure stages in an ideal turbine.
n = Number of pressure stages in a practicable turbine.
h' = Blade height of an ideal turbine, in in.
h = Blade height of a practicable turbine in in.
$\bar{d}$ = Mean diameter in in. of a row of blades.
D = Drum diameter of a reaction turbine.
J = Joules equivalent.
$K = \Sigma\left(\frac{\bar{d}}{100}\right)^2\left(\frac{\text{RPM}}{100}\right)^2$ moving rows only being included in the summation.

From the standpoint of hydraulics there is a somewhat close analogy between a steam turbine and one operated by water. An essential feature in both cases is that the potential energy which a fluid possesses in virtue of its pressure is utilized to maintain a flow through a set of nozzles or guide vanes. In the ideal case of frictionless flow the energy possessed by unit mass of the fluid is the same whether it be at rest in the reservoir or whether it forms part of the jet and has accordingly a kinetic energy due to its velocity. The theoretical velocity of efflux of a gas can accordingly be determined by equating the kinetic energy to the work which the same mass of fluid could perform were it allowed to expand, behind the piston of an ideal engine, from the pressure of the reservoir down to that of the receiver into which the discharge takes place. In thus expanding behind a piston, W, the theoretical work done per lb. of the fluid is given by the equation

$$W = 144\frac{\gamma}{\gamma-1}p_0 V_0\left[1-\left(\frac{p_1}{p_0}\right)^{\frac{\gamma-1}{\gamma}}\right]$$

where W denotes the work in foot pounds, p_0 and p_1 the initial and final pressures, respectively, expressed in lb. per sq. in., while V_0 represents the original volume of the fluid in cub. ft. at pressure p_0 and γ is the index of adiabatic expansion, on the assumption that the relationship between the volume and the pressure during such an expansion can be represented by the formula

$$p^{\frac{1}{\gamma}}V = \text{constant}.$$

By the principle already stated, the theoretical velocity of efflux will be obtained by writing

$$\frac{v^2}{2g} = W = 144\frac{\gamma}{\gamma-1}p_0 V_0\left[1-\left(\frac{p_1}{p_0}\right)^{\frac{\gamma-1}{\gamma}}\right] \qquad (1)$$

From this expression it appears that as p_1 becomes smaller and smaller v becomes greater and greater. When, however, the velocity of efflux becomes equal to the velocity of sound in the escaping fluid, any further reduction in p_1 occasions no increase in the weight discharged from the nozzle per second. This follows because the velocity at which any impulse is transmitted through a medium is the same as that of sound in the medium. Hence, if, starting from an equality of pressure in reservoir and receiver, the receiver pressure is progressively reduced, "news" of each successive reduction is transmitted back along the jet into the reservoir at the speed of sound, and as a consequence the pressure gradients there undergo a readjustment and the flow into the nozzle is increased. Once, however, the speed of issue exceeds that of sound, no "news" as to any further reduction in the external pressure can reach the interior of the reservoir. The pressure gradients therein consequently remain unaltered, and the weight of fluid fed to nozzle per second remains unchanged. This reasoning, which originated with Osborne Reynolds, applies to all cases of the efflux of fluids, although in the case of a liquid such as water it has no practical significance, as the head necessary to generate a velocity equal to that of sound in water would be many miles in height.

In the case of superheated or supersaturated steam, the speed of sound is attained when the ratio of the lower pressure p_1 to the upper pressure p_0 is equal to 0·5457. No further reduction of the lower pressure will increase the weight of steam flowing per second, but final velocities of efflux greatly exceeding the velocity of sound can be attained by making use of a nozzle converging first to the throat and then slowly diverging again. The theoretical velocities under such conditions can be calculated from equation (1).

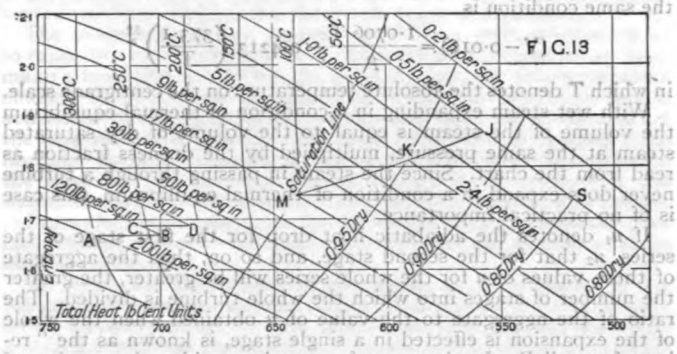
In practice the actual velocity of efflux is less than the theoretical on account of losses due to nozzle friction. The maximum weight which can be discharged per second from a convergent-divergent nozzle is fixed by the area of the throat. In the case of steam, for each sq. in. of throat area the maximum weight which can be passed per second is

$$w_{max} = 0{\cdot}3155\sqrt{\left(\frac{p_0}{V_0}\right)}$$

where p_0 denotes the absolute pressure of supply in lb. per sq. in. and V_0 the corresponding specific volume of the steam in cub. ft. per lb. This equation holds whether the steam is superheated or wet.

In equation (1) above, the work due from one lb. weight of steam under pressure p_0 is expressed in ft. lb., but in steam turbine practice it is generally more conveniently expressed in heat units, and the convenience is the greater because the equation $p^{\gamma}V = \text{constant}$, is an inexact representation of the relationship between pressure and volume in the adiabatic expansion of steam. By working in heat units this difficulty is avoided.

If lb.-centigrade heat units be adopted, the theoretical velocity of efflux is given by the relation $v = 300{\cdot}2\sqrt{u}$ where u denotes the adiabatic heat drop and is conveniently measured from a Mollier chart, of which many have been published. A diagrammatic chart of this kind is reproduced in fig. 13, in which the ordinates represent



entropy, and the abscissæ are total heats of steam (*see* 25.827). The curves drawn on the chart represent lines of constant pressure, constant temperature or constant wetness. The use of the chart is best illustrated by an example. To find the velocity of efflux from a nozzle supplied with steam at an absolute pressure of 200 lb. per sq. in. and at a temperature of 300° C., which is discharging into a receiver maintained at an absolute pressure of 120 lb. per sq. in., the point A is marked on the chart at a position corresponding to the initial conditions and a straight line is drawn horizontally (*i.e.* with constant entropy) to cut the 120-lb. pressure line at B. The length AB, as measured by the scale of total heats, represents 30·6 lb. centigrade heat units. The theoretical velocity is therefore $300{\cdot}2\sqrt{30{\cdot}6} = 1{,}660$ ft. per second nearly.

Owing to nozzle friction the actual velocity will be less than this figure, which has accordingly to be multiplied by a coefficient, the value of which is commonly taken to be 0·95 or 0·96. With convergent-divergent nozzles the loss is much greater. The function of the moving wheel of an impulse turbine is to convert the kinetic energy of the jet into useful work on the shaft. The method of drawing a velocity diagram and estimating therefrom the probable efficiency of conversion is explained in the earlier article on STEAM ENGINE (25.843). With impulse steam turbines a stage efficiency of about 0·80 can be realized if the blade velocity be sufficiently high. To obtain such an efficiency the ratio of blade speed to steam speed should be about 0·47. For commercial reasons this figure is seldom obtained, but if δ represents the actual ratio of blade speed to steam speed, and δ_1 the ratio corresponding to maximum efficiency η_1, then the efficiency η corresponding to δ can be obtained from the equation

$$\eta = \eta_1\left[\frac{2\delta}{\delta_1} - \frac{\delta^2}{\delta_1{}^2}\right].$$

A steam impulse turbine generally consists of a series of elementary turbines or stages arranged in succession on the same shaft. Suppose the first of the series has unit efficiency and expands the steam from a pressure of say 200 lb. per sq. in. and a temperature of 300° C. to a pressure of 120 lb. per sq. inch. Then, as shown above, in the absence of frictional losses, the state of the steam as delivered to the next elementary turbine would be represented by the point B on the chart, fig. 13, where the pressure is 120 lb. per sq. in. and the total heat 698·2 lb. centigrade heat units. The whole of the 30·6 units due in an adiabatic expansion from the initial conditions to a final pressure of 120 lb. per sq. in., would in the assumed case of a perfect turbine be converted into useful work on the shaft. In practice, however, only a part of this adiabatic heat drop will be usefully converted, the remainder being wasted in friction and added as heat to the steam, before it is delivered to the next elementary turbine, or stage. If the efficiency of conversion is 0·7, the heat which would be added to the steam in the above example will be $0{\cdot}3 \times 30{\cdot}6$, or 9·18 lb. centigrade units, thus making the total heat of the steam on delivery to the second stage $698{\cdot}2 + 9{\cdot}18 = 707{\cdot}4$ nearly. This gives point C on the chart.

If it be assumed that the second stage expands the steam down to 80 lb. per sq. in., the adiabatic heat drop will be found as before by drawing a horizontal line from C to cut the curve for 80-lb. pressure at D. The length of this line as measured on the scale of total heats is 22·8 lb. centigrade heat units. If, as before, we assume that but 0·7 of this is converted into useful work, the remainder being added to the steam as heat, the total heat of the steam as delivered to the third stage will be $707{\cdot}4 + 0{\cdot}7 \times 22{\cdot}8 = 691{\cdot}5$ heat units, giving

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us the point E on the chart as representing the condition of the steam as supplied to the third stage. Proceeding in this way, a series of "state points" can be marked on the chart, each of which represents the condition of the steam as supplied to the next elementary turbine of the series.

So long as the steam is superheated or supersaturated its volume can be determined, when the pressure and total heat are known, by Callendar's equation

$$V = 2{\cdot}2436\,\frac{H-464}{p} + 0{\cdot}0123.$$

The relation between the volume, pressure and temperature under the same condition is

$$(V-0{\cdot}016) = \frac{1{\cdot}0706\,T}{p} - 0{\cdot}4213\left(\frac{373{\cdot}1}{T}\right)^{\frac{10}{3}}$$

in which T denotes the absolute temperature on the centigrade scale.

With wet steam expanding in a condition of thermal equilibrium the volume of the steam is equal to the volume of dry saturated steam at the same pressure, multiplied by the dryness fraction as read from the chart. Since the steam in passing through a turbine never does expand in a condition of thermal equilibrium, this case is of no practical importance.

If u_1 denotes the adiabatic heat drop for the first stage of the series, u_2 that for the second stage, and so on, then the aggregate of these values of u for the whole series will be greater, the greater the number of stages into which the whole turbine is divided. The ratio of the aggregate to the value of u obtained when the whole of the expansion is effected in a single stage, is known as the "reheat factor" R. In the case of a reaction turbine the number of stages is so great that the expansion may, for practical purposes, be considered as effected continuously instead of in a series of steps. In this case the reheat factor for superheated or supersaturated steam can be read off from the diagram fig. 14, which is reproduced from Martin's *New Theory of the Steam Turbine*.

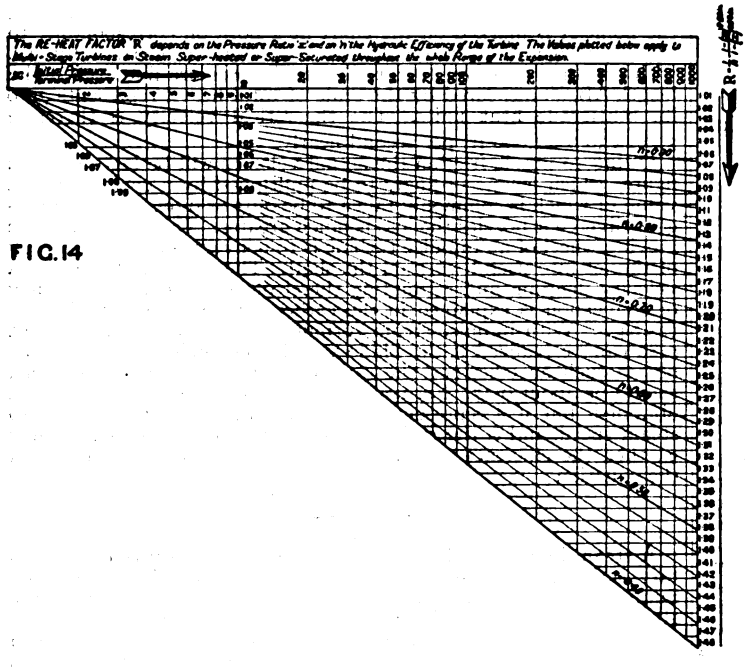

FIG. 14

The "efficiency ratio" of a turbine is denoted by ϵ, and is defined as the ratio which the useful work W actually done by the steam bears to that which would be performed by a turbine of unit efficiency, so that $W = \epsilon u$. The hydraulic efficiency, denoted by η, is defined as the ratio of the work done to the total effective thermodynamic head, which head, as pointed out above, is always greater than u in the case of a multistage turbine, as it is the sum of the values of u for each stage. We thus have

$$W = \eta U = \eta R u, \text{ so that } R = \frac{\epsilon}{\eta}.$$

The hydraulic efficiency η of a turbine is a much more fundamental property than the efficiency ratio ϵ, and remains unaltered whatever the number of elementary turbines or stages, into which the whole turbine is divided, or whatever be the total ratio of expansion. In the ideal limiting case in which the expansion is carried down to zero pressure the efficiency ratio is always unity, whatever the hydraulic efficiency may be.

Where the heat drop per stage of a turbine is small, it cannot be measured with accuracy from a chart but must be calculated from formulas or derived from steam tables, of which Callendar's are the most reliable and self-consistent, and accord best with the most trustworthy experimental data. Callendar's formula for the adiabatic expansion of superheated or supersaturated steam is

$$p^{-\frac{13}{3}}\,T = \text{constant}$$

where T denotes the absolute temperature.

In a continuous expansion of superheated or supersaturated steam effected with a hydraulic efficiency η, the relation between volume and pressure during the expansion is represented accurately by the expression

$$p^{\frac{1}{\lambda}}\left(V-0{\cdot}016\,\frac{\lambda}{1{\cdot}3}\right) = \text{constant} \qquad (2)$$

$$\text{where } \frac{1}{\lambda} = 1-0{\cdot}230773.$$

A closely approximate expression has been given by Callendar in the form

$$(H-464)\,p^{-\frac{3}{13}\eta} = \text{constant} \qquad (3).$$

In practice $\frac{\lambda}{1{\cdot}3}$ in equation (2) may be taken as unity without involving serious error; and since, along the saturation line, the relation between pressure and volume is represented very approximately by the equation

$$0{\cdot}9406\log p + \log(V-0{\cdot}016) = 2{\cdot}5252,$$

the point at which the saturation line is crossed in a continuous expansion, effected with an efficiency η, can be found approximately by combining this equation with (2), which gives:

$$\frac{1}{\lambda}\log p + \log(V-0{\cdot}016) = \frac{1}{\lambda}\log p_0 + \log(V_0-0{\cdot}016).$$

The pressure thus obtained can be plotted on the steam chart as at M (fig. 13). A single additional point representing the state of the steam at some intermediate pressure gives the "condition line" in the superheated field with sufficient accuracy as the curvature of this line is always very slight. The condition line for wet steam expanding in thermal equilibrium is best obtained from the chart. To this end a horizontal line is drawn from M to cut the exhaust pressure line at S. The length MS then represents, on the scale of total heats, the adiabatic heat drop for an expansion from M in a condition of thermal equilibrium. Denoting this by u_0 the corresponding useful work done is ϵu_0 and the heat wasted in friction is $(1-\epsilon)u_0$.

If we add this wasted energy to the total heat corresponding to the point S we get J as the state point representing the condition of the steam as finally discharged. A similar procedure gives us the state point K at some intermediate pressure, and the three points M, K, J suffice to fix with practical accuracy the condition line for wet steam expanding from M to S in thermal equilibrium.

From a condition line the total heat of the steam corresponding to any pressure can be read off, and the corresponding volume then obtained as already described. The condition line for steam expanding beyond the saturation line in a condition of thermal equilibrium, has, as already mentioned, no practical significance in steam turbine work. Once the saturation line is passed the expansion never proceeds in thermal equilibrium. This discovery renders obsolete the theory of the steam turbine working with non-superheated steam, as understood up to the end of 1912, at which time attention was directed anew to certain remarkable anomalies observed in experiments on the discharge of non-superheated steam from nozzles. Numerous careful experiments had shown that the weight discharged was often in excess of what the then accepted theory declared to be possible. In discussing these results in *Engineering*, Jan. 10 1913, Martin pointed out that the experiments of Aitken and Wilson on the sudden expansion of dust free vapour afforded conclusive evidence that in expanding through a nozzle, the steam must be in the supersaturated condition and not in thermal equilibrium, so that the accepted theory was based on a fundamental error. Stodola succeeded in confirming this conclusion by direct experiment. He studied, under very strong illumination, the appearance of jets of steam discharged from a nozzle and found that the steam exhibited no signs of condensation occurring until the pressure had been reduced far below the saturation point. Finally, in 1915, Callendar, in a paper published in the Proceedings of the Inst. Mech. Engineers, gave an exhaustive study of the whole question and showed that the anomalies observed in nozzle experiments entirely disappeared if the steam were considered to remain in a supersaturated condition up to a point beyond the throat of the nozzles. Moreover, under such an assumption, the computed frictional losses became in good accord with those observed in experiments with air. There is however, of course, a point beyond which steam cannot be expanded without condensation occurring. From experiments of C. T. R. Wilson, H. M. Martin calculated the following table giving the properties of steam at the supersaturation limit, or the "Wilson line" as he called it ("A New Theory of the Steam Turbine," *Engineering* 1913):—

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TABLE 1. *Properties of Steam at the Wilson Line.*

Temperature at Wilson Point.	Pressure at Wilson Point.	Volume at Wilson Point.	Total Heat at Wilson Point.	Equilibrium Temperature.	Equilibrium Volume.	Entropy at Wilson Point.
t_w	p_w	V_w	H_w	t_s	yV_s	γ_w
deg. C.	lb. per sq. in.	cub. ft. per lb.	F.P.C.	deg. C.	cub. ft. per lb.	
0	0·9888	295·30	593·79	38·52	325·85	1·9098
10	1·739	173·33	598·28	49·41	191·50	1·8641
20	2·935	106·11	602·64	60·33	116·91	1·8220
30	4·764	67·339	606·85	71·19	74·218	1·7825
40	7·478	44·091	610·90	82·13	48·474	1·7476
50	11·39	29·732	614·75	93·00	32·666	1·7141
60	16·86	20·566	618·36	103·89	22·575	1·6830
70	24·36	14·531	621·70	114·80	15·957	1·6537
80	34·41	10·506	624·56	125·66	11·537	1·6261
90	47·60	7·720	627·47	136·57	8·638	1·5998
100	64·64	5·778	630·01	147·48	6·353	1·5748
110	86·28	4·389	632·10	158·40	4·832	1·5508
120	113·37	3·376	633·89	169·48	3·713	1·5278

Along the Wilson line the relation between pressure and volume is given with considerable accuracy by the equation

$$0{\cdot}9401 \log p_1 + \log (V - 0{\cdot}016) = 2{\cdot}4651.$$

At the supersaturation limit moisture is formed and settles out in the form of minute droplets.

To proportion rationally the blading of a steam turbine it is necessary to know the relationship between the pressure and the volume, or between the pressure and the total heat of the steam during the expansion. The discovery that wet steam does not expand through a turbine in a condition of thermal equilibrium, whilst affording an explanation of certain anomalies experienced in practice, has raised new difficulties, since we are no longer in a position to determine with certainty the volume of wet steam at different points of the expansion. So long as the expansion is not carried beyond the supersaturation limit, or the "Wilson line," the behaviour of the steam is in accord with the equations given above. At the supersaturation limit, however, an overdue change abruptly occurs, and it is a matter of general experience that when a condition of unstable equilibrium is suddenly upset the subsequent phenomena are commonly incalculable. In such cases there is frequently found to be a period of transition during which "repeat" experiments fail to give consistent results. Once, however, the transition is fairly effected, a new steady state is generally established. In the case of steam, this steady state appears to be obtained if the expansion is continued considerably beyond the supersaturation limit. In this steady state, such evidence as is available goes to show that the water of condensation which remains suspended in the steam in the form of minute droplets, has a temperature approximating to that of saturated steam of the same pressure, whilst the gaseous portion of the steam has a temperature corresponding to that of steam just on the point of condensing at the supersaturation limit. The dryness fraction of the exhaust steam from a turbine is therefore given approximately by the relation

$$y = \frac{H_s - t_s}{H_w - t_s}$$

where H_s denotes the total heat in one lb. of the exhaust steam, t_s the temperature corresponding to saturation at the same pressure while H_w is the total heat of one lb. of dry steam at the exhaust pressure but at the limit of supersaturation, as given in table 1 above for various pressures. The volume V_s of the exhaust steam is equal to yV_w where V_w is taken from a table similar to table 1.

In general, engineers express exhaust pressures as so many in. of mercury. The standard barometric height is taken as 30 in. of mercury, and a vacuum of 29 in. of mercury, corresponds therefore to an absolute pressure of one in. of mercury, or 0·491 lbs. per sq. inch. Values of H_w, V_w, and t_w for different vacua are tabulated below:—

TABLE 2.

Vacuum (in. of mercury).	t_w (°C).	H_w lb. centigrade units.	V_w cub. ft. per lb.
29	−11·37	588·59	569·3
28	− 0·15	593·67	296·3
27	+ 6·98	596·92	202·5
26	+12·21	599·22	154·5

It will be seen that the determination of V_s depends upon a knowledge of H_s, whilst $H_s = H_1$—indicated work done.

The indicated work done in the expansion of wet steam can only (as matters stand to-day) be found as the result of experience with actual turbines, and our knowledge is accordingly empirical in character. If we take steam expanding from the saturation line to ordinary exhaust pressures, the following rule for the effective thermodynamic head U, engendered is in good accord with experience $U_s = \psi u_s$. Where u_s denotes the adiabatic heat drop, assuming the expansion from the initial to the final pressure to be effected under condition of thermal equilibrium, whilst

$$\psi = 1{\cdot}1070 + 0{\cdot}02212 \frac{x}{100} - \eta\left(0{\cdot}1638 + 0{\cdot}0286 \frac{x}{100}\right).$$

In this expression x denotes the ratio of the initial pressure to the exhaust pressure and η is the hydraulic efficiency, which is taken to be the same as if the turbine were operated with steam in a superheated condition throughout the whole range of expansion.

The coefficients in this formula for ψ have been selected so as to make the indicated work done the same as if computed by Baumann's empirical rule (*Inst. E. E.* 1921), but the relatively small amount of work done by expansion below the saturation line is attributed to the effective thermodynamic head being less than if the expansion had been effected under conditions of thermal equilibrium. Baumann's empirical rule on the other hand assumes that the efficiency decreases by 1% for every 1% of moisture in the steam, the latter being assumed to expand in thermal equilibrium.

From the above expression for U_s we can find H_s from the general relation $H_s = H_1 - \eta U$; and from this we can calculate V_s as already explained.

To determine the volume of the steam at other points of the expansion it is perhaps sufficient in the present state of our knowledge to use an interpolation formula which shall give correctly the initial and final volumes at the saturation line and at the exhaust, and which shall also give correctly the work done between these two limits. No doubt there is force in the argument that as we know accurately the relation between the volume and the pressure of the steam in expanding down to the Wilson line, it would be more logical not to make use of an interpolation formula until the necessity actually arose by this line being crossed, but in the present state of our knowledge the simpler procedure seems adequate for practical needs. It is certainly nearer the truth than the assumption hitherto adopted, that the steam expands in thermal equilibrium.

Callendar has devised a very simple and easily applied interpolation formula which satisfies the required conditions. It may be written as

$$\log (H - C) = \log A + n \log p.$$

The value of the constants are determined by writing

$$\frac{H_1 - C}{H_2 - C} = \frac{p_1 V_1}{p_2 V_2} = \left(\frac{p_1}{p_2}\right)^n.$$

In practice it is seldom necessary to determine either A or n, whilst C is most easily obtained by writing

$$H_1 - C = \frac{(H_1 - H_2)\ p_1 V_1}{p_1 V_1 - p_2 V_2}.$$

The use of the formula will be made clearer by taking a practical example. Thus, suppose dry saturated steam at a pressure of 20 lb. per sq. in. to be expanded down to a vacuum of 29 in. with an hydraulic efficiency of 0·7. (This efficiency is low for a modern turbine but the method is of course applicable whatever the value of η.) Then from Callendar's steam tables it will be found that $H_1 = 642{\cdot}82$ centigrade heat units; $V_1 = 20{\cdot}08$ cub. ft. per lb., whilst $u_s = 125{\cdot}46$ units. In this case $\frac{x}{100} = \frac{20}{49{\cdot}1} = 0{\cdot}4075$, so that $\psi = 0{\cdot}9932$ and $U_s = 124{\cdot}61$ centigrade heat units. The "indicated" work done is therefore $0{\cdot}7 \times 124{\cdot}61 = 87{\cdot}23$ and hence $H_s = H_2 = H_1 - 87{\cdot}23 = 555{\cdot}59$. The dryness fraction at exhaust is therefore given by $y = \frac{555{\cdot}59 - 26{\cdot}09}{588{\cdot}59 - 26{\cdot}09} = 0{\cdot}9413$, so that $V_s = yV_w = 0{\cdot}9413 \times 569{\cdot}3 = 535{\cdot}9$ cub. ft. per lb.

Had the steam expanded in thermal equilibrium and an equal amount of work been taken out of it, its volume on exhaust would have been 594·4 cub. ft. per lb. Hence at high vacua the volume of steam to be provided for at exhaust is some 10% less than on the old theory in which it was assumed to expand in thermal equilibrium.

The requisite data for constituting Callendar's interpolation formula are now available. Thus we have $p_1 V_1 = 401{\cdot}6$; $p_2 V_2 = 263{\cdot}1$; whilst $H_1 - H_2 = 87{\cdot}23$. Hence

$$H_1 - C = \frac{401{\cdot}6 \times 87{\cdot}23}{38{\cdot}5} = 253{\cdot}0.$$

Thus $C = 389{\cdot}8$ and $H_2 - C = 165{\cdot}8$.

We therefore get $\log (H_1 - C) - \log (H_2 - C) = 0{\cdot}1835$

and $\log p_1 - \log p_2 = 1{\cdot}6099$.

We divide each of these differences by 10 (say) and can then calculate corresponding values of $\log (H - C)$ and $\log p$ by repeated subtraction of these dividends, giving the figures tabulated in columns 2 and 3 in table 3 below. To determine corresponding values of $\log V$ we proceed in an exactly similar manner, determining the difference between $\log V_1$ and $\log V_2$ and repeatedly adding one

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tenth of this difference until the value of log V_2 is obtained. This latter procedure is based upon the general relation

$$H_1 - H = \eta U,$$

so that

$$-dH = \eta dU = \frac{144}{J}\eta V dp$$

and thus

$$V = \frac{J}{144}\eta\frac{dH}{dp}.$$

But on differentiating Callendar's relationship above, we get

$$\frac{dH}{dp} = \mu\left(\frac{H-C}{p}\right)$$

which gives us

$$V = \frac{J}{144\eta} - \mu\frac{H-C}{p}.$$

Since by hypothesis η is constant we may write this as

$$\sigma \log V = \log (H-C) - \log p.$$

But log p is a linear function of log $(H-C)$ and therefore so also is log V. It may be noted that log V is accordingly also a linear function of log p, so that this interpolation formula gives between p and V a relationship of the type pV^{λ} = constant. But the value of the integral of Vdp is adjusted so as to bring the total work done into accord with the data. The formulas for V and $H-C$ are, in short, empirical interpolation formulas and must be regarded as such. They are not absolutely consistent with each other but the discrepancy is small enough to be negligible in practice.

TABLE 3.

Section.	log $(H-C)$	log p	log V	log $\frac{H-C}{\eta}$	$\frac{H-C}{\eta}$	U	V
A	2·40310	1·30100	1·30280	2·55800	361·4	0	20·08
B	2·38475	1·14001	1·44543	2·53965	346·5	14·9	27·89
C	2·36640	0·97902	1·58806	2·52130	332·1	29·3	38·74
D	2·34805	0·81803	1·73069	2·50295	318·4	43·0	53·79
E	2·32970	0·65704	1·87332	2·48460	305·2	56·2	74·70
F	2·31135	0·49605	2·01595	2·46625	292·6	68·8	103·8
G	2·29300	0·33506	2·15858	2·44790	280·5	80·9	144·1
H	2·27465	0·17407	2·30121	2·42955	268·9	92·5	200·1
I	2·25630	0·01308	2·44384	2·41120	257·8	103·6	277·8
J	2·23795	1·85209	2·58647	2·39285	247·1	114·3	385·9
K	2·21960	1·69110	2·72910	2·37450	236·8	124·6	535·9

To avoid an accumulation of errors and to facilitate checking, the values of the intermediate logarithms in the above table are tabulated to five figures but only four of these are significant. When the additions and subtractions are accurately carried out the values in the last line of the table must be the values at the exhaust with which the calculation was started. The convenience of this check is so great that it is advisable (even at the expense of the slight inaccuracies involved) to use this type of interpolation formula even in the case of steam superheated throughout its expansion, although in this case exact relationships between the different functions can be stated.

Knowing U, the general characteristics of a turbine intended to operate with a given hydraulic efficiency can be very readily determined.

Thus if we define K as

$$K = \Sigma\left(\frac{d}{10}\right)^2\left(\frac{\text{R.P.M.}}{100}\right)^2$$

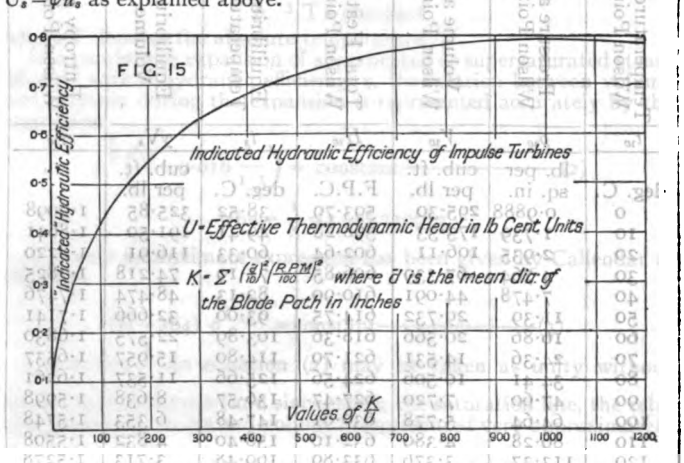
where d denotes the mean diameter in in. of a moving row of blades, and the summation includes the moving rows only, the efficiency of the turbine is a function of $\frac{K}{U}$, as will be readily understood from the obvious consideration that K is proportional to the mean square of the blade speed, whilst U is proportional to the mean square of the steam speed. If the hydraulic efficiency be plotted against $\frac{K}{U}$ the resultant curve is an ellipse, but this ellipse is not symmetrical about the axis along which $\frac{K}{U}$ is measured. The equation to this ellipse is

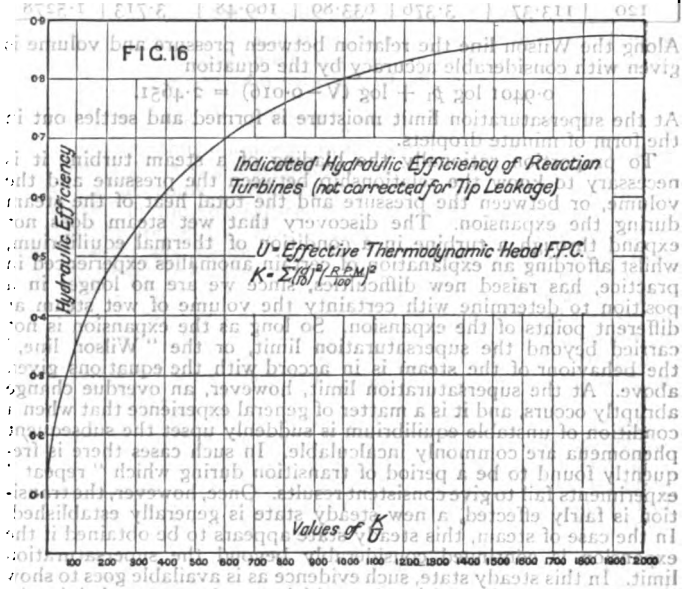
$$\left(\frac{\eta}{\eta_1} + \frac{K}{U}\frac{U_1}{K_1}\right)^2 = 4\frac{K}{U}\frac{U_1}{K_1}$$

where η_1 denotes the maximum value of η, and $\frac{K_1}{U_1}$ is the corresponding value of $\frac{K}{U}$.

The relation between η and $\frac{K}{U}$, as determined by the collation of actual test figures is given in figures 15 and 16. In both cases the expansion is assumed to be continuous in character instead of being effected in finite steps, a circumstance which slightly lowers the apparent hydraulic efficiency of the impulse machine, but the error is small and moreover cancels out when the curve is used for purposes of design.

When the steam is initially superheated the value of U to be used in the formula is given by $U = U^1 + U_s$ where U^1 represents the thermodynamic head expended down to the saturation line and $U_s = \psi u_s$ as explained above.





Suppose that an impulse turbine which is to operate with dry saturated steam supplied at a pressure of 20 lb. absolute and exhausted at a vacuum of 29 in. mercury is to run at a speed of 1,500 revs. per minute, the mean diameter of all the blade rows being $44\frac{7}{8}$ in. whilst the designed hydraulic efficiency is 0·7. Then from fig. 15 it will be seen that $\frac{K}{U} = 436$. Hence as from table 3 the total thermodynamic head is 124·6, the value of K must be $124{\cdot}6 \times 436 = 54{,}330$.

But if ν be the number of stages

$$K = \nu\left(\frac{44{\cdot}875}{10}\right)^2\left(\frac{1500}{100}\right)^2$$

whence $\nu = 12$, so that a turbine of 12 stages with wheels of $44\frac{7}{8}$ in. mean diameter will give the required efficiency. If ν does not turn out to be an even number, it can be made so by suitably adjusting the value of d. Intermediate values of ν are directly proportional to the corresponding values of U and a series of such values calculated with an ordinary 10-in. slide rule, which is amply accurate for the purpose, are as follows:—

Section	A	B	C	D	E	F
U	0	14·9	29·3	43·0	56·2	68·8
ν	0	1·435	2·82	4·14	5·41	6·63
log p	1·3010	1·1400	0·9790	0·8180	0·6570	0·4961
Section	G	H	I	J	K	...
U	80·9	92·5	103,6	114·3	124·6	...
ν	7·79	8·91	9·98	11·01	12·0	...
log p	0·3351	0·1741	0·0131	−0·1479	−0·3089	...

The values of ν are fractional, but they are used merely for curve plotting, the values of the different functions corresponding to integral values of ν being read from the curves. Thus in fig. 17 log p has been plotted against ν and it should be noted that the curve is by no means represented by a straight line. Since ν is proportional

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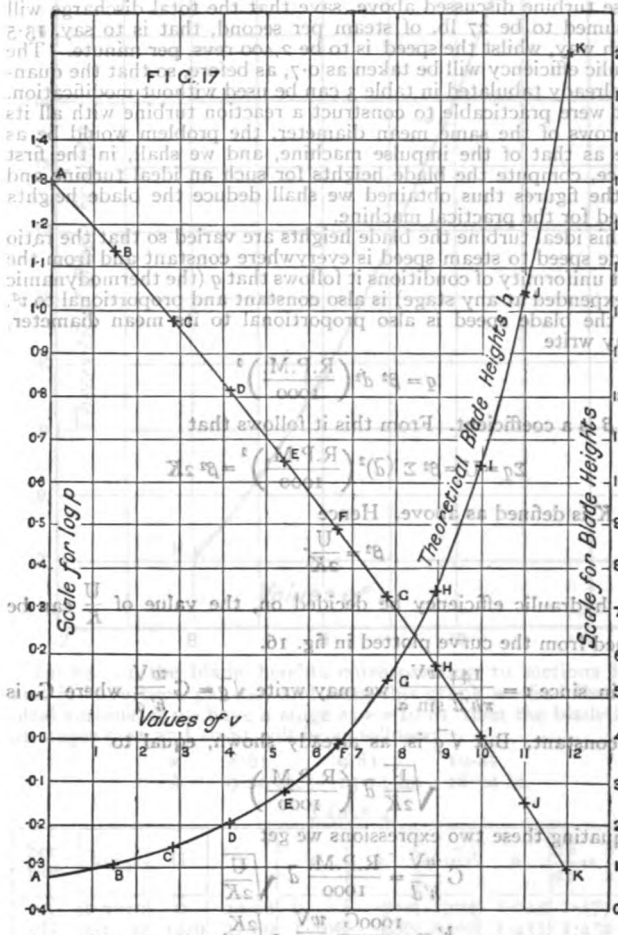
to K it follows that if in any turbine log p when plotted against K gives a straight line, that turbine, whether of the impulse or reaction type, cannot be designed to operate with uniform efficiency. In the diagram fig. 17 the values of log p represent the pressure of the steam after discharge from the preceding stage, stage No. 1 being thus conceived as being preceded by an imaginary stage No. 0. A corresponding plot of the volume would, however, give not the volume at discharge from the guide blades, but this volume as increased by the heat generated in the passage of the steam through the moving buckets. All stages being similar, the effective thermodynamic head at each stage is the same. But the apparent thermodynamic head, obtained by dividing the total thermodynamic head U by the number of stages, is somewhat greater than the adiabatic heat drop at each stage.



According to what has been stated above, the velocity of discharge from the guide blades of a stage is commonly taken as $v=300{\cdot}2\times0{\cdot}95\sqrt{u}$ where u is the adiabatic heat drop. The weight W discharged per second per sq. ft. of guide blade area is

$$W=\frac{v}{V\phi}=\frac{300{\cdot}2\times0{\cdot}95\sqrt{u}}{V\phi}$$

where $V\phi$ represents the volume of the steam after an adiabatic expansion between the pressure above and below the stage. Instead of calculating these values it is more convenient to utilize the known values of U and V and to correct the above formula by using an appropriate coefficient ψ. As there are 12 stages in the present case we get $\frac{U}{12}=\frac{124{\cdot}6}{12}=10{\cdot}38=q$, and the above equation may therefore be written

$$W=f\frac{300{\cdot}2\times0{\cdot}95\sqrt{10{\cdot}38}}{V}.$$

An interpolation formula for f which is applicable for the ordinary range of turbine efficiencies and for convergent guide blades is $f=1+0{\cdot}13\,(1-\eta)\sqrt{x-1}$ where x denotes the ratio of the pressure above and below the stage. The coefficient f is readily evaluated by the ordinary slide rule with quite sufficient accuracy.

In the case under consideration we note from the curve fig. 17, that when $v=1$, log $p=1{\cdot}197$ so that $x=1{\cdot}27$ and f is therefore $1{\cdot}023$.

The area available for flow through a row of guide blades is $\frac{\pi\, h'\, \bar{d}\, \sin\alpha}{144}$ where h' denotes the blade height in in., and α is the "effective" angle of discharge, allowing if necessary for the fact that the blades are of finite thickness. Hence if w be the weight of steam flowing through the turbine per second

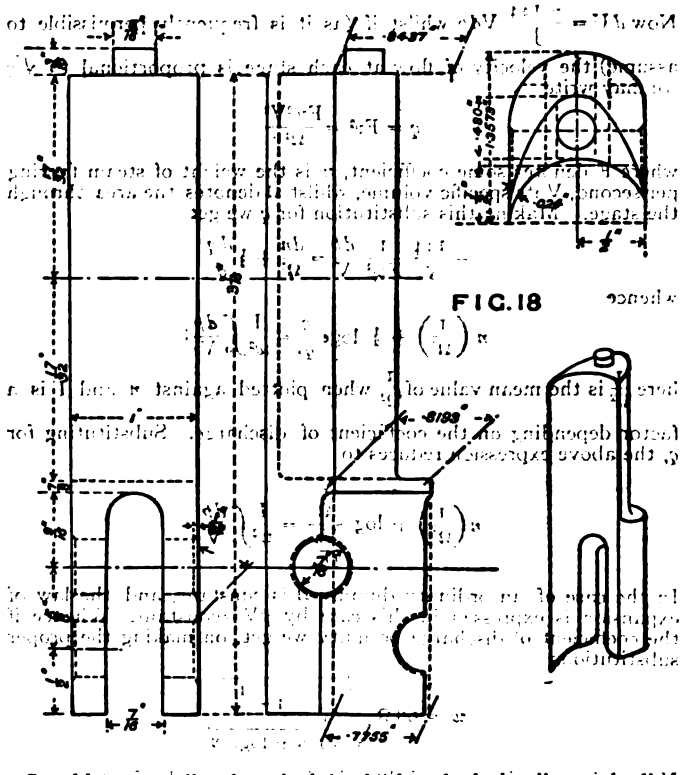
$$h'=\frac{wV}{6223\,f'\,\bar{d}\,\sin\alpha\sqrt{q}}.$$

Taking $\sin\alpha=0{\cdot}30$, $\bar{d}=44\frac{3}{4}$, $q=10{\cdot}38$ and $w=10{\cdot}3$ lb. per second, this expression reduces to $h'=\cdot03732V$. Values of h' thus calculated for the values of V given in table 3 are plotted in fig. 17 and from the curve thus obtained we read off the theoretical blade heights at the different stages. These are:—

Stage No.	1	2	3	4	5	6
Theor. blade height in in.	0·94	1·18	1·51	1·95	2·48	3·24
Stage No.	7	8	9	10	11	12
Theor. blade height in in.	4·30	5·65	7·69	10·48	14·40	20·0

In practice the nearest even dimensions will be substituted for the calculated heights. The calculated heights for the last three stages are inconveniently long, but they can all be reduced to say 9 in. by suitably increasing the effective angles of discharge. Some builders moreover increase the pressure drop at the exhaust end, and would accordingly combine stages 11 and 12 into one. These expedients decrease the efficiency but are cheaper than the alternative of constructing the low-pressure end on the double flow principle.

The high-pressure end of a turbine can be proportioned in a manner exactly similar to that described, but as the steam there is commonly superheated, the problem is correspondingly simplified and need not therefore be discussed here. It is, however, usually necessary to construct some of the high pressure stages as partial admission stages and it is also a common practice to have a large pressure drop at the first stage with the object (at some sacrifice of efficiency) of making a large initial reduction in the temperature and pressure of the steam, so that the high pressures and temperatures are confined to the nozzle-boxes of the first stage. To the same end a velocity compounded wheel is frequently used in the first stage. The general theory of these wheels is described in Prof. Ewing's article (*see* 25.844), but it may be observed that in practice it has been found necessary to adopt empirical methods of designing such wheels. If designed as pure impulse wheels operated with a fluid which is "freely deviated" the results are very disappointing. One rule which has been used is to assume that only 85% of the total heat drop of the stage is utilized in the nozzles, and of the residue that 5% is utilized in each of the three sets of blading. The wheel therefore works to some extent as a reaction turbine.



Speaking generally, the principle of "free deviation" as embodied in some water wheel designs is inadmissible in steam turbine practice, in which the moving blades should be just sufficiently long to avoid "spilling" of the steam delivered to them from the guide blades. As to the exact form of the moving blades, this does not appear to be of primary importance within reasonable limits, as;

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although the practice of different makers varies considerably, all impulse turbines exhibit much the same efficiency under corresponding conditions. Typical Rateau blading is illustrated in fig. 18. The discharge angle is commonly about 30° save at the last row of blading where it is increased to 35°.

As regards nozzle and guide blade efficiencies, generally, reliable experimental data are still lacking. It has been assumed that the efficiency of convergent guide blades is a maximum when the speed of efflux is equal to the velocity of sound, and though this is not improbable from *a priori* considerations no conclusive evidence in support of the view has yet been forthcoming, and turbines which attempt to embody this theory have not shown the slightest superiority over competing designs. A great drawback to high steam speeds is the liability to excessive wear of the blading, and in this respect reaction blading has a great advantage over impulse blading in addition to the higher inherent efficiency of the former. This higher inherent efficiency depends upon the fact that the overall efficiency of a steam turbine depends upon its stage efficiency, a stage being defined as the section of a turbine comprised between two successive heat drops. In the case of impulse turbines for each successive heat drop, frictional losses are experienced in two elements, namely, the nozzles or guide blades and the moving buckets, whereas in a reaction turbine at each heat drop there is loss in one row of blading only.

The Design of Reaction Turbines.—The proportioning of a compound reaction turbine is a somewhat intricate problem, and as a preliminary it will be convenient to discuss the flow of steam through a series of openings or stages. At each of these a certain thermodynamic head q is expended, and this is not, in general, the same for each stage. If however U denote the total thermodynamic head expended in forcing the steam through n stages we have

$$\Sigma_1^n q = U = \int_0^n \frac{dU}{dn} dn.$$

Now Laplace's theorem in the calculus of finite differences may be written

$$\Sigma_1 q = \int_0 q\, dn + \frac{q-q_0}{2} + \frac{1}{12}(\Delta q - \Delta q_0) - \frac{1}{24}(\Delta^2 q - \Delta^2 q_0) + \&c.$$

If we neglect the terms comprising the differences we get

$$\Sigma_1 q = U = \int_0 q\, dn + \frac{q-q_0}{2},$$

so that

$$\frac{dU}{dn} = q + \tfrac{1}{2}\frac{dq}{dn}.$$

Now $dU = \frac{-144}{J} V dp$ whilst if (as it is frequently permissible to assume) the velocity of flow at each stage is proportional to $\sqrt{q}$ we may write

$$q = Fv^2 = \frac{Fw^2V^2}{\Omega^2}$$

where F denotes some coefficient, w is the weight of steam flowing per second, V its specific volume, whilst Ω denotes the area through the stage. Making this substitution for q we get

$$-\frac{144}{J}\frac{1}{Fw^2}\frac{dp}{V} = \frac{dn}{\Omega^2} + \tfrac{1}{2}\frac{dq}{q}$$

whence

$$n\left(\frac{1}{\Omega^2}\right) + \tfrac{1}{2}\log_e\frac{q}{q_0} = \frac{I}{w^2}\int_0 \frac{dp}{V};$$

here $\frac{1}{\Omega^2}$ is the mean value of $\frac{1}{\Omega^2}$ when plotted against n and I is a factor depending on the coefficient of discharge. Substituting for q, the above expression reduces to

$$n\left(\frac{1}{\Omega^2}\right) + \log\frac{\frac{V}{\Omega}}{\frac{V_0}{\Omega_0}} = \frac{I}{w^2}\int_0 \frac{dp}{V}.$$

In the case of an ordinary dummy Ω is constant, and the law of expansion is expressed in this case by pV = constant. Whence if the coefficient of discharge be unity we get, on making the proper substitutions

$$w = 68\,\Omega\sqrt{\frac{p_0}{V_0}\frac{1-\frac{1}{x^2}}{n+\log_e x}}.$$

Here x denotes the ratio of the initial pressure to the final pressure. The logarithmic term becomes of great importance when n is small and renders the formula reliable under very extreme conditions.

Suppose it is desired to replace n openings in which the area is varied in direct proportion to the volume of the steam, by n openings all of equal area, the weight of steam passed per second, and the total pressure difference remaining constant. If we neglect the small change such a substitution will make in the value of $\int\frac{dp}{V}$ and assume that the velocity of discharge at each stage is still proportioned to $\sqrt{q}$ we get

$$\Omega^2 = \frac{n + \log_e\frac{\Omega_n}{\Omega_0}}{n}\left(\frac{1}{\Omega^2}\right) \qquad (4).$$

Use will be made of this formula in proportioning the blading of a reaction turbine.

Let it be required to proportion the blading for a double flow reaction machine, the conditions being similar to those assumed for the impulse turbine discussed above, save that the total discharge will be assumed to be 27 lb. of steam per second, that is to say, 13·5 lb. each way, whilst the speed is to be 2,400 revs. per minute. The hydraulic efficiency will be taken as 0·7, as before, so that the quantities already tabulated in table 3 can be used without modification.

If it were practicable to construct a reaction turbine with all its blade rows of the same mean diameter, the problem would be as simple as that of the impulse machine, and we shall, in the first instance, compute the blade heights for such an ideal turbine and from the figures thus obtained we shall deduce the blade heights required for the practical machine.

In this ideal turbine the blade heights are varied so that the ratio of blade speed to steam speed is everywhere constant and from the perfect uniformity of conditions it follows that q (the thermodynamic head expended at any stage) is also constant and proportional to v^2. Since the blade speed is also proportional to its mean diameter, we may write

$$q = \beta^2 d^2\left(\frac{\text{R.P.M.}}{1000}\right)^2$$

where β is a coefficient. From this it follows that

$$\Sigma q = U = \beta^2\,\Sigma\,(\bar{d})^2\left(\frac{\text{R.P.M.}}{1000}\right)^2 = \beta^2 2K$$

where K is defined as above. Hence

$$\beta^2 = \frac{U}{2K}.$$

If the hydraulic efficiency be decided on, the value of $\frac{U}{K}$ can be obtained from the curve plotted in fig. 16.

Again since $v = \frac{144\,wV}{\pi h'\bar{d}\sin\alpha}$ we may write $\sqrt{q} = G\frac{wV}{h'\bar{d}}$ where G is some constant. But $\sqrt{q}$ is, as already shown, equal to

$$\sqrt{\frac{U}{2K}}\,\bar{d}\left(\frac{\text{R.P.M.}}{1000}\right)$$

and equating these two expressions we get

$$G\frac{wV}{h'\bar{d}} = \frac{\text{R.P.M.}}{1000}\,\bar{d}\sqrt{\frac{U}{2K}}$$

or

$$h' = \frac{1000G}{\text{R.P.M.}}\frac{wV}{\bar{d}^2}\sqrt{\frac{2K}{U}}.$$

The value of G must be determined experimentally, and from careful tests it appears that for normal Parsons blades h' may be written as,

$$h' = \frac{616}{\text{R.P.M.}}\frac{wV}{\bar{d}^2}\sqrt{\frac{K}{U}} \qquad (5).$$

It may be added, however, that the value of the coefficient is not quite independent of the efficiency, and whilst the value 616 is appropriate to an efficiency of 0·7 it increases to 678 for an efficiency of 85%.

For a reaction turbine having an hydraulic efficiency of 0·7 it will be seen from the efficiency curve that $\frac{K}{U}$ has the value 600, and if $\bar{d}$ be taken as 49 in. we get for the total number of rows (fixed and moving) corresponding to the expenditure of a thermodynamic head U, the expression

$$\nu = \frac{2K}{\bar{d}^2}\times\left(\frac{1000}{\text{R.P.M.}}\right)^2 = \frac{1200\,U}{\bar{d}^2}\left(\frac{1000}{\text{R.P.M.}}\right)^2 = 0{\cdot}08677\,U.$$

Taking the values of U from table 3 the corresponding values of ν are entered in the fifth column of table 4. Taking the steam passed as 13·5 lb. per second each way, we get for h' the expression

$$h' = \frac{616}{2400}\times\frac{13{\cdot}5}{49^2}\sqrt{600}\times\nu = .03535\,\nu.$$

From this the values of h' given in the sixth column of table 4 have been deduced.

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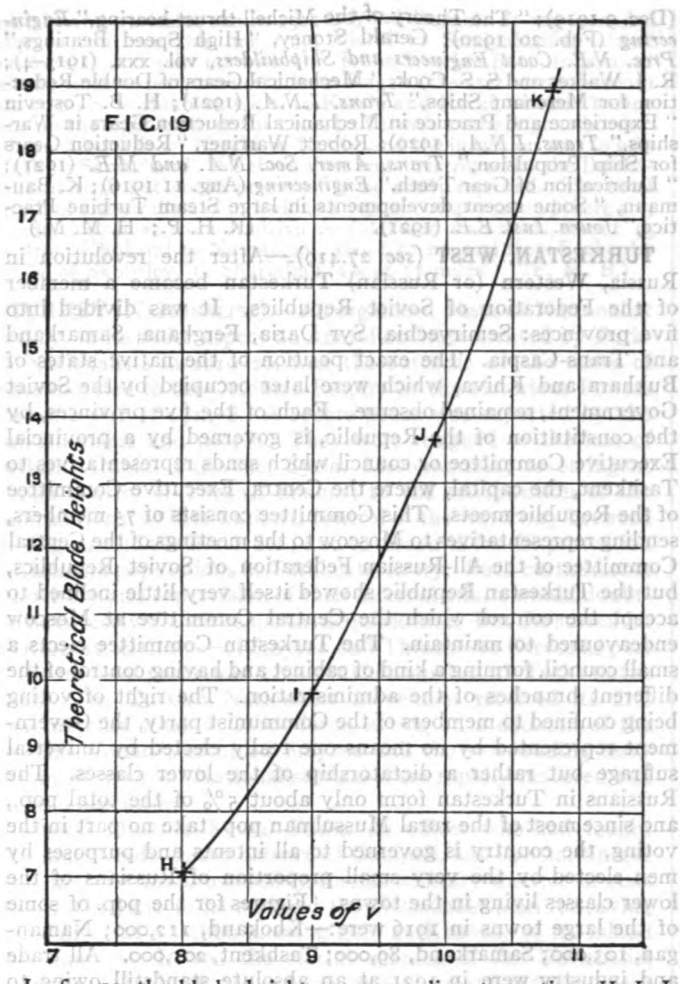


In fig. 19 the blade heights corresponding to sections H, I, J and K have been plotted, and from this graph we find that in the ideal turbine, if we have a stage at $\nu = 10{\cdot}81$ then the blade heights at stages 9·81 and 10·81 will be as follows:—

ν	8·81	9·81	10·81
h	9·20 in.	13·14 in.	18·94 in.

TABLE 4.

Section	log p	U	V	ν	h'	$h'(\bar{d})^2$	h	$\frac{dn}{d\nu}=\frac{h}{h'}$	n
A	1·3010	0	20·08	0	·710	1704	1·045	1·477	0
B	1·1400	14·9	27·89	1·306	·986	2367	1·431	1·452	1·89
C	0·9790	29·3	38·74	2·542	1·37	3287	1·940	1·416	3·69
D	0·8180	43·0	53·79	3·73	1·90	4565	2·60	1·370	5·34
E	0·6570	56·2	74·70	4·88	2·64	6339	3·47	1·311	6·89
F	0·4961	68·8	103·8	5·97	3·67	8792	4·58	1·250	8·28
G	0·3351	80·9	144·1	7·02	5·09	12230	5·97	1·172	9·56
H	0·1741	92·5	200·1	8·03	7·07	16980	7·68	1·087	10·68
I	0·0131	103·6	277·8	8·97	9·82	23570	9·79	·996	11·70
J	$\bar{1}$·8521	114·3	385·9	9·93	13·64	32740	12·40	·910	12·60
K	$\bar{1}$·6911	124·6	535·9	10·81	18·94	45470			

As the first step to the design of a practical turbine the blades at $\nu = 9{\cdot}81$ and $\nu = 10{\cdot}81$ must be replaced by two blades of equal height, say $\bar{h}$, which must be such that these two blades will pass the same weight of steam per second as the blades they replace. As a first approximation, the required height is equal to the height given in fig. 19 corresponding to $\nu = \frac{9{\cdot}81+10{\cdot}81}{2} = 10{\cdot}31$. This height is 15·7 inches. This approximation with blades so long in proportion to the drum diameter is not a very good one, although when the blades are not excessively long this simple rule gives quite good results. To determine a more accurate value of $\bar{h}$ we make use of equation (4) which in this case may be written as

$$(\bar{h})^2 = \frac{2+\log_e \frac{18{\cdot}94}{9{\cdot}20}}{2} \cdot \frac{6}{\left(\frac{1}{9{\cdot}20}\right)^2 + 4\left(\frac{1}{13{\cdot}14}\right)^2 + \left(\frac{1}{18{\cdot}94}\right)^2}$$

where the factor on the right is the mean value for the value of $\frac{1}{\Omega^2}$ as deduced from Cotes' rule for the mean value of a function defined by three equidistant coördinates, and which is exact for any curve which can be adequately defined by 4 ordinates.

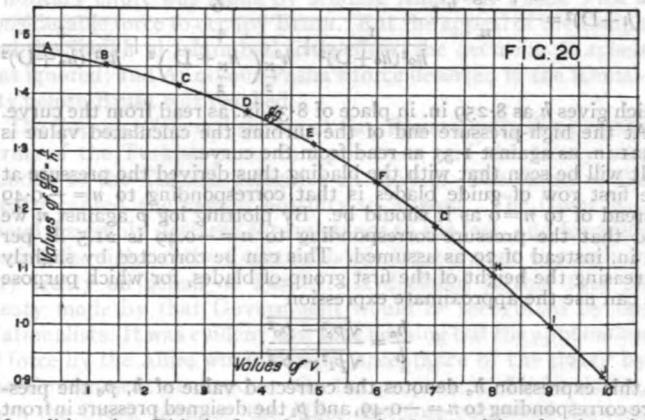
From this expression we get $(\bar{h})^2 = 216{\cdot}2$, whence $\bar{h} = 14{\cdot}7$, showing that the provisional value obtained from the diagram was about 7 % too long. It is only at the L.P. end of a turbine, however, where the blades are long and where the pressure drop per blade is high, that the error attains any such magnitude.

If we use semi-wing blades for these two rows, the height will be two-thirds of the figure given, or 9·8 inches. Let it be taken at $9\frac{3}{4}$ in., so that the drum diameter is $49 - 9\frac{3}{4} = 39{\cdot}25$ in., and to this diameter the blading of the ideal turbine must be reduced by means of an appropriate "transfer" formula.

If h denote the height of the blades after transfer to a drum of diameter D and h' the height of the blades of the ideal turbine as already calculated, all of which have the same mean diameter $\bar{d}$. Then we must have $h(h+\mathrm{D})^2 = h(\bar{d})^2$ and $\frac{dn}{d\nu} = \frac{h}{h'}$.

Here n denotes the number of blade rows in the practical turbine corresponding to ν rows of blades in the ideal turbine.

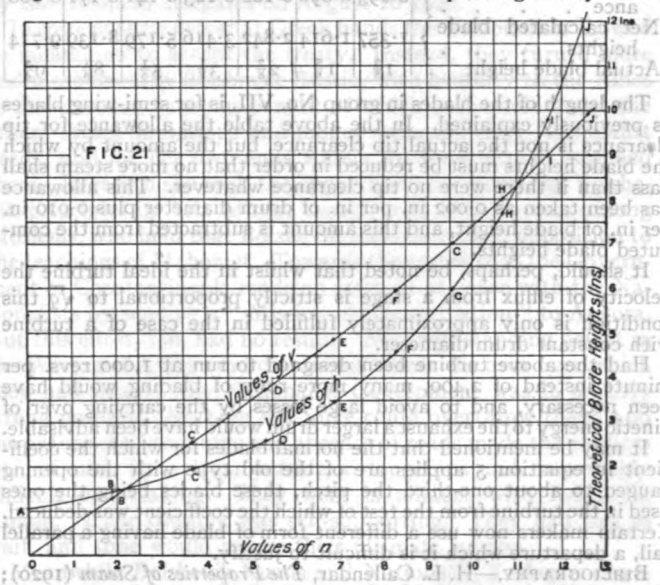
Values of $h(\bar{d})^2$ are tabulated in column 7 of table 4 and from these values the corresponding values of h are readily deduced by means



of a slide rule. This is done by assuming a provisional value of h. Calling this provisional value a a better value of h is got by writing

$$h = \frac{h'd^2}{(a+\mathrm{D})^2}.$$

A still closer value is then obtained by repeating the process. At the end of each operation the value of $\frac{h}{h'}$ is also found, and is entered in the adjoining column. These values of $\frac{h}{h'} = \frac{dn}{d\nu}$ have been plotted in fig. 20 and from them the value of n corresponding to any stated



value of ν can be determined, by means of Cotes' formula which may be written

$$n = \frac{\nu}{6}\left\{\left(\frac{dn}{d\nu}\right)_0 + 4\left(\frac{dn}{d\nu}\right)_{\frac{N}{2}} + \left(\frac{dn}{d\nu}\right)_N\right\}.$$

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Thus with $\nu = 9{\cdot}92$ we note that $\left(\frac{dn}{d\nu}\right)_0 = 1{\cdot}477$, $\left(\frac{dn}{d\nu}\right)_N = {\cdot}90$ and $\left(\frac{dn}{d\nu}\right)_{\frac{N}{2}} = 1{\cdot}311$, whence $n = 12{\cdot}60$. Proceeding in this way the figures in the last column of table 5 are obtained. In fig. 21, h is plotted against n as also is ν_{NP}.

Stages 9·81 and 10·81 of the ideal turbine have already been dealt with so that in proceeding further with the design we start with stage 8·81 of the ideal turbine. From fig. 21, it appears that $\nu = 8{\cdot}81$ corresponds with $n = 11{\cdot}51$ and from the curve of blade heights we get the following values for h

n	=	9·51	10·51	11·51
h	=	5·94	7·87	9·38

As before, an approximate value of $\bar{h}$ to replace the blades at 10·51 and 11·51 is the value of h at $n = 11{\cdot}01$. This value of h is 8·31 inches. Replacing the blades at the high pressure stages $n = 0{\cdot}51$ and $n = 1{\cdot}51$ the same method gives us $h = 1{\cdot}29$ inches.

If we determine the corrections for these two extremes the corrections for the intermediate groups can be determined with sufficient accuracy by linear interpolation. Equation 4 in this case becomes

$$h^2(\bar{h}+D)^2 = \frac{n + \log_e \frac{h'_0}{h'_e}}{\frac{n}{6}} \Big/ \left(\frac{1}{h_0^2(h_0+D)^2} + \frac{4}{h_{\frac{N}{2}}^2\left(h_{\frac{N}{2}}+D\right)^2} + \frac{1}{h_n^2(h_n+D)^2} \right)$$

which gives h as 8·259 in. in place of 8·31 in. as read from the curve.

At the high-pressure end of the turbine the calculated value is 1·321 in. as against 1·33 as read from the curve.

It will be seen that with the blading thus derived the pressure at the first row of guide blades is that corresponding to $n = -0{\cdot}49$ instead of to $n = 0$ as it should be. By plotting $\log p$ against n we find that the pressure corresponding to $n = -0.49$ is 21.5 lb. per sq. in. instead of 20 as assumed. This can be corrected by slightly increasing the height of the first group of blades, for which purpose we can use the approximate expression

$$\frac{h_0}{h} = \frac{\sqrt{p_0^2 - p_e^2}}{\sqrt{p_1^2 - p_e^2}}.$$

In this expression h_0 denotes the corrected value of h, p_0 the pressure corresponding to $n = -0{\cdot}49$, and p_1 the designed pressure in front of the first row of guide blades, whilst p_e denotes the pressure on discharge from the group.

We thus get $h_0 = 1{\cdot}45$, so that the computed blade heights are as follow:—

TABLE 5.

Group No.	I.	II.	III.	IV.	V.	VI.	VII.
No. of moving rows in group	1	1	1	1	1	1	1
Calculated blade height in in.	1·450	1·710	2·960	3·540	5·320	8·310	9·800
Allowance for tip clearance	0·093	0·096	0·108	0·123	0·141	0·171	0·186
Net calculated blade heights	1·357	1·614	2·842	3·416	5·179	8·139	9·714
Actual blade height	1⅜	1⅝	2⅞	3½	5⅛	8⅛	9¾

The length of the blades in group No. VII. is for semi-wing blades as previously explained. In the above table the allowance for tip clearance is not the actual tip clearance, but the amount by which the blade heights must be reduced in order that no more steam shall pass than if there were no tip clearance whatever. This allowance has been taken as 0·002 in. per in. of drum diameter plus 0·010 in. per in. of blade height, and this amount is subtracted from the computed blade heights.

It should, perhaps, be noted that whilst in the ideal turbine the velocity of efflux from a stage is strictly proportional to $\sqrt{q}$ this condition is only approximately fulfilled in the case of a turbine with constant drum diameter.

Had the above turbine been designed to run at 1,000 revs. per minute instead of 2,400, many more rows of blading would have been necessary, and to avoid large losses by the carrying over of kinetic energy to the exhaust a larger drum would have been advisable.

It may be mentioned that the normal blades for which the coefficient in equation 5 applies are of the old type with the opening gauged to about one-third the pitch, these blades being the ones used in the turbine from the test of which the coefficient was deduced. Certain makers now use a different form of blade having a parallel tail, a departure which it is difficult to justify.

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TURKESTAN, WEST (*see* 27.419).—After the revolution in Russia, Western (or Russian) Turkestan became a member of the Federation of Soviet Republics. It was divided into five provinces: Semiryechia, Syr Daria, Ferghana, Samarkand and Trans-Caspia. The exact position of the native states of Bukhara and Khiva, which were later occupied by the Soviet Government, remained obscure. Each of the five provinces, by the constitution of the Republic, is governed by a provincial Executive Committee or council which sends representatives to Tashkent, the capital, where the Central Executive Committee of the Republic meets. This Committee consists of 75 members, sending representatives to Moscow to the meetings of the Central Committee of the All-Russian Federation of Soviet Republics, but the Turkestan Republic showed itself very little inclined to accept the control which the Central Committee at Moscow endeavoured to maintain. The Turkestan Committee elects a small council, forming a kind of cabinet and having control of the different branches of the administration. The right of voting being confined to members of the Communist party, the Government represented by no means one really elected by universal suffrage but rather a dictatorship of the lower classes. The Russians in Turkestan form only about 5% of the total pop., and since most of the rural Mussulman pop. take no part in the voting, the country is governed to all intents and purposes by men elected by the very small proportion of Russians of the lower classes living in the towns. Figures for the pop. of some of the large towns in 1916 were:—Khokand, 112,000; Namangan, 103,000; Samarkand, 89,000; Tashkent, 201,000. All trade and industry were in 1921 at an absolute standstill owing to Bolshevism.

Great success had attended the cultivation of cotton, and the high prices obtained for the Turkestan article (most of which is grown in Ferghana, where 742,000 acres were cultivated in 1915), coupled with the increase of railways, led to the abandonment of corn in favour of the cultivation of cotton, and, although W. Turkestan is a good wheat-producing country, cereals were actually imported from Russia and Siberia and cotton exported in exchange. Factories for cleaning and baling raw cotton and for extracting cotton oil were set up, and employed a large number of people, mostly in Ferghana. These factories were worked by crude oil from the Baku wells. The total area under cotton in 1916, including that grown in Khiva and Bukhara, was 1,838,215 acres, yielding about 18,000,000 poods or 290,000 tons of raw cotton.

The cultivation of vines had also increased, and wine industries had been initiated, chiefly in Tashkent and Samarkand. A larger product of the vine was in the form of raisins and currants, of which quantities were exported to Russia.

Large quantities of fruits—apples, pears, quinces, peaches, nectarines, apricots, grapes and melons—were exported by special trains to central Europe, where the Turkestan crop was received a short time before the south European supplies ripened.

Minerals remained for the most part unworked, though the profitable coal fields and oil wells in Ferghana were used when disturbances in Trans-Caspia cut Turkestan off from the Baku oil, on which it relies entirely for its industrial life. Mining is hampered by the lack of roads and by the want of machinery.

A very large industry in Bukhara is the export of Astrakhan lamb skins (called locally Karakul). Enormous flocks of these sheep are kept in the deserts around Bukhara. Attempts to breed these sheep in other countries have always resulted in a deterioration in the quality of the skins owing to some peculiarity of climate. Before the World War about 1½ million skins were obtained annually at a cost of 6 to 8 roubles each.

There are practically no branch roads in Turkestan, and the only means of transport in bulk is either by wagon on the few main roads, or by railway. The largest new railway project is the Semiryechenskaya railway. This line was intended to leave the Orenburg–Tashkent line at Arys (146 versts N. of Tashkent) and go to Vierni, a distance of about 900 versts. Actual construction was completed to Burnoi (220 versts) when Bolshevism came to crush all enterprise and initiative. Some work was done E. of Burnoi, but the line was

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not laid and no trains ran in 1921 beyond Burnoi. It was intended later to continue this line from Vierni to Semipalatinsk (about 900 versts) and join up with the Trans-Siberian line. Important railway lines were constructed from Kagan (the station on the main line 10 m. S. of Bukhara City) to Karshi and Kerki, whence the line runs up the right bank of the Oxus to Termez on the Afghan border. A branch runs from Karshi to Kitab, and the intention was to join Kitab to Samarkand. All these lines were destroyed by the Bukharians in 1918 but could presumably be easily repaired. The total length of these railways in Bukhara was about 400 m. and there are, in addition, lines from Andijan to Jalalabad coal-fields, about 45 m., from Khokand to Namangan, about 57 m., and from Fechenko (N. E. of Skobelev) to Sharikhan, about 11 miles. (F. M. B.)

TURKEY (NATIONALIST).—An organized State of Nationalist Turkey, in its wider aspect an Anatolian State created by Turkish Nationalists in 1919–20, was the outcome of the terms of peace dictated to the Ottoman Empire by the victorious Powers after the war of 1914–8. A severe peace was expected by the Turkish rulers and people. They were resigned to the loss of Turkish Arabia, Palestine, Syria, Mesopotamia; to stringent foreign control of Turkish finance; to the reimposition of the Capitulations; to international control of the waterway between the Aegean and the Black Sea; and to measures for the protection of Christian populations in Turkish territory. Such curtailments of territory and supervision of their internal affairs would doubtless have received their reluctant acquiescence. But the surrender of Ottoman territory—of Smyrna and Thrace—to Greece as part of the terms of peace was a matter that touched all Turks to the quick. The Turkish Nationalist movement received its first great impulse when a Greek force, acting on a decision of the Supreme Council, occupied Smyrna and the surrounding territory in May 1919. Nationalist plans were rapidly matured and put into execution.

General Mustafa Kemal Pasha, an officer who had fought with much credit in the defence of Gallipoli, left Constantinople early in June 1919, ostensibly for his military district in Asia Minor. On June 19 he outlined the Nationalist plan for saving the country at a public meeting held at Khavsa, 50 m. inland from Samsun. It was the official opening of the Nationalist movement. In brief, the scheme was to create a government and army in the heart of Asia Minor to resist the partitioning of Turkish territory within "Armistice limits." The definition of area referred to the armistice of Mudros of Oct. 30 1918, and thus excluded Mesopotamia, Syria and Arabia from the territory to be preserved, but included Smyrna and Thrace. For this area Nationalists professed willingness to accept a single Great Power as mandatory; they would not, however, accept more than one. The movement spread rapidly. A provisional government was set up at Erzerum in August. In Sept. a National Congress was held at Sivas, which affirmed the purpose not only of maintaining the integrity of Ottoman territory within armistice limits, but of upholding the Caliphate and Sultanate. A few weeks later the seat of the government was changed to Angora, as a more central position. By the end of 1919 the Nationalist movement had been accepted by nearly the whole of Asia Minor, and the Ottoman Government at Constantinople became a government representing little, and wielding no authority.

Behind the Nationalist movement was the military class of Turkey, and the still powerful secret society known as the Committee of Union and Progress. In fact, though the movement represented on the part of the people a genuine patriotism and desire to resist what was deemed as aggression, it is doubtful if the Committee were not its real founders. At all events Talaat Pasha, Enver Pasha, Djemal Pasha, Sais Halim Pasha, and many other Committee leaders became exceedingly active in the Nationalist cause. They gave it, too, the Panislamist policy which the Committee had followed when in power behind the Ottoman Government at Constantinople. Owing to this connexion between Turkish Nationalism and Panislamism Moslem sympathy was excited in British India. Doubtless the agitation was arranged, but nevertheless it carried weight. A "Caliphate Committee" to oppose the imposition of harsh terms of peace on Turkey was formed, and a delegation sent to London. The delegation laid much stress on a speech made by Mr. Lloyd George on Jan. 5 1918, in which he said: "Nor are we fighting to deprive Turkey of its capital, or of the rich and renowned lands of Asia Minor and Thrace which are predominantly Turkish in race." This speech the delegation, and other supporters of a lenient policy towards Turkey, claimed as a pledge. At the Peace Conference of the Allies held in London early in Feb. 1920, to discuss the terms of the Turkish peace, it was decided to leave Constantinople in the possession of Turkey. At this time the Nationalists began military operations against Cilicia. Turkish troops drove the French out of Marash and other places in this region, and used their success to massacre great numbers of Armenians. Simultaneously the Nationalists organized resistance in Thrace under Col. Jaffas Tayar Bey.

The Government at Constantinople were now taken with the idea that they could suppress the Nationalists from within. They sought to rally to their side the sober and religious masses of the Turkish population by the joint influence of the Sultan as Caliph and of the Sheikh ul Islam. An Imperial decree was also issued declaring the Nationalists rebels. At the same time a military effort was made by sending Anzavour Pasha with a considerable force to occupy Brusa. But the appeal of the Caliph and the Sheikh ul Islam had little effect; the decree as to rebels was ignored; and Anzavour Pasha's force deserted to the Kemalists before Brusa was reached.

The Supreme Council sitting at San Remo finally decided the terms of the Turkish peace in April 1920, and the treaty was handed to the Turkish delegates on May 9. The terms of the treaty caused the fiercest hostility in Angora. The Great National Assembly declared for resistance to the last, and formally denied the right of the Constantinople Government to conclude any treaty on behalf of Turkey. It declared further that no treaty made by that Government would be recognized by the Nationalists. It was evident now that nothing but the application of force by the Allies would compel acceptance of the treaty by the Government at Angora. On the proposal of M. Venizelos, then the Greek premier, the Allies therefore entrusted the task to Greece of dealing with the Nationalist forces in western Asia Minor, and imposing the treaty. In support of Greece the Allies undertook minor naval operations. During June and July 1920 the Greek armies conducted a campaign in which they overran the part of Asia Minor lying westward of a line drawn from Brusa to Ushak in the valley of the Menderez. A Greek army also occupied Thrace. As the result of these operations, which destroyed any hope the Ottoman Government may have had of obtaining better terms by delay, the treaty was signed by the Ottoman delegates on August 20 1920.

In spite of their defeat at Greek hands the Nationalists showed no inclination to accept the treaty. Instead, they turned more and more towards Bolshevik Russia, with hostility to the Allies as the common cause in pursuit of which each could assist the other. Arms, munitions and money were the chief Nationalist needs; and for her own ends Russia, to some extent, supplied them. In return she took the opportunity for spreading Bolshevik principles in Asia Minor, though with little success among Moslems, who held that Bolshevik theories were in opposition to the teachings of Mahomet. Towards the end of 1920 the Government of Constantinople made an attempt at peace with the Nationalists by sending a "Mission of Reconciliation" to Angora. But this effort, too, had no results. Nothwithstanding defeat in the West, and risings and discontent within the area over which they had power, the Nationalist Government was in a fairly strong position. Nothing but force could overthrow them, and the nature of the country and absence of roads made the application of such force from outside a dangerous and exceedingly difficult undertaking. They were in alliance with Bolshevik Russia. Their country was self-supporting. They had but to wait, and time would assure their ultimate success.

Meanwhile Bolshevik Russia and Nationalist Turkey endeavoured to secure better land communications between their territories, to bring, in fact, their territories to a common frontier. Russia was established in the Transcaucasian Republic of Azerbäijän; but between Turkey and Azerbäijän lay the Ar-

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menian Republic of Erivan; and the line of railway from Azerbāijān to Turkish territory passed through the hostile Armenian State. In Sept. 1920 the Nationalists, in agreement with Russia, therefore began military operations against the Republic of Erivan. The upshot was that by the end of Nov. the Republic was crushed, its territory occupied, many thousands of its people massacred, its Government overthrown and replaced by a Soviet Government which accepted Russian mediation and onerous terms of peace. These included the cession of the districts of Kars and Ardahan to Turkey, together with additional territory traversed by the railway from Azerbāijān to the Turkish frontier.

Nationalist leaders had always urged that time was on their side. During Dec. 1920 the elections in Greece overthrew the Government of M. Venizelos; and the return of the ex-King Constantine took place the same month as the result of a plebiscite. These events changed the whole policy of the Allied Powers towards Greece. But a settlement of Turkish questions remained as necessary to the Allies as ever. They therefore invited the Greek and Turkish Governments to send delegations to a conference in London in Feb. 1921, for the purpose of reaching, if possible, a compromise on the Treaty of Sèvres. The condition was made that the Turkish Delegation should include representatives of Angora. The conference finally made an offer to the two delegations, to be accepted or rejected as a whole by their Governments. The offer proposed various important changes in the Treaty, including evacuation of Constantinople by the Allied garrison, an increase in the strength permitted the Turkish army, and the granting of autonomy to the Smyrna zone under Turkish sovereignty, and a Christian governor. These terms were promptly rejected by the Greek Government, who then reopened hostilities against the Nationalists in opposition to Allied advice. The Greek aim was to reach Angora, and destroy the Nationalist army. At the end of March, however, the Greek army was heavily repulsed before Eskishehr and compelled to retreat to its original positions before Brusa and Ushak. At the beginning of July another Greek offensive was made, this time on a much greater scale. Afium Kara Hissar, Kutahia, and Eskishehr were captured, notwithstanding determined Turkish resistance, and the advances continued along the railway towards Angora. But in a great battle at the end of Aug., on the line of the Sakaria river, the Greek army failed to break through the Turkish entrenchments, and again retreated, this time to positions covering Eskishehr and Afium Kara Hissar. (W. J. C.*)

TURKISH CAMPAIGNS.—Under this general heading the operations in the World War involving Turkey in (1) the Caucasus, (2) Mesopotamia, (3) the Sinai area, and (4) Syria, are described.

(I.) Operations on the Caucasus Front

A firm grasp of the military-geographical conditions on the Russo-Turkish frontier is an essential preliminary to an understanding of the operations in the Caucasus. In this region war, though waged with modern weapons, must be conducted by very old-fashioned methods; for the absence of railways and the rarity of good roads on the Turkish side from the first militated against, and indeed largely precluded, strategic mobility. In the vast area, 600 m. long by 300 wide, bounded by the S. coast of the Black Sea, the Russo-Turkish frontier, Lake Urmia and a line thence by Urfa to Angora, not a single railway exists. The only roads are the steep mountain track from Trebizond to Erzerum, a somewhat easier main road from Angora by Sivas and Erzinjan to Erzerum, the very steep mountain road from Kharput to Erzerum which at Garib meets the road crossing the wild Armenian Taurus from Diarbekr, the highway Mosul–Bitlis–Mush–Erzerum, and lastly the old caravan route from Erzerum by way of Bayazid into Persia. The only other means of communication are narrow tracks, made by use only and impossible to trace after a snowfall; they serve to indicate to the troops their lines of advance, but can in no sense be said to facilitate their march. Transport, apart from pack-animals, can only move in the few roads mentioned and even on these, which are all in bad condition, only with extreme difficulty. The rivers as a rule can only be crossed at the fords, as any bridges have long ago broken down, for in Turkey no attempt is made to keep up the roads, the high dues levied for this purpose disappearing into the pockets of the officials.

It must always be remembered that a Turkish army operating in the region of Erzerum has a line of communications over 600 m. long to the nearest railhead at Angora or Ulu Kyshla, from which points every shell has to be brought up by camel transport, taking six weeks in transit. It would, therefore, have been of urgent importance to the Turks, for this reason alone, to gain complete command of the Black Sea, which would have made it possible for them to send supplies for the army by sea from Constantinople to Trebizond and thence overland by the comparatively short route to Erzerum. However, they only succeeded for a short period at the beginning of the war, in asserting a sufficient superiority over the Russian Black Sea fleet to allow of safe transit by sea to Trebizond, and it became impossible to count on this. The present writer had in 1913 drawn up for the Turkish general staff a memorandum, in which he fully discussed and recommended the reconstruction of the wholly antiquated fortress of Erzerum, of which the newest works dated from 1864, the erection of barrier forts to secure the Trebizond road, and other measures aimed at facilitating future operations in this area. But this important problem received no attention, and the future theatre of war was left in such a condition as to render impossible the defence of the frontier against a resolute attack.

The main theatre of war of the eastern Anatolian campaigns of 1914–8 was Turkish Armenia. The geographical area of Armenia had no clearly defined limits, having become nothing more than a geographical term for the districts of Russia, Persia and Turkey, which were inhabited by people of Armenian nationality. The geographical limits of Armenia are clearly defined only in the Caucasian isthmus, where the boundary is formed by the little Caucasus, stretching south-eastward between Tiflis and Akhaltsikh. In Persia the Armenian population in the province of Azerbāijān melts gradually into the Persian from Lake Urmia eastward. To the S. the ethnographic boundary corresponds more or less with the line of the Armenian Taurus and the parts of the Taurus stretching from the Cilician frontier to the Euphrates gorge; but northern spurs of Kurdistan jut out into Armenian territory, *e.g.* especially in the region of Dersin, which extends with its population of Kurdish tribesmen, who have a mortal feud with the Armenians, to just S. of Erzinjan. In the W. conditions are the same as in Persia. As one goes towards Sivas, the Armenians melt away into the Turkish Mahommedan population, while to the N. Lazistan cuts off the Armenian highlands from the sea. The course of the Juroch may be taken as the frontier between Pontus and Lazistan on the one side and Armenia on the other. In all this "Armenia" there is no territory inhabited exclusively by Armenians. As against this, countless Armenians are dispersed all over Turkey, and these communities of the dispersion are frequently, as in Adana (Cilicia), numerically strong and economically predominant.

Turkish Armenia is in parts a fertile land, but the climate is most unfavourable from the military point of view. Long cold winters, with heavy and frequent snowfalls, render almost impossible all strategic movement, and large bodies of troops are always in danger of decimation by frost and hunger, while the short summer brings with it oppressive heat. Turkish Armenia, inside the stupendous mountain range which cuts it off from Russian Armenia, is a tangled mass of hills and valleys. The differences in height between the mountain ridges and the deep-cut gorges is very marked. The population is poor and scattered, so that in areas hundreds of square miles in extent there are neither tracks nor habitations to be found. Much of Turkish Armenia has never really been explored, and the representation of it on the maps is largely mere guesswork. Erzerum itself is one of the highest placed towns in the world; it stands over 6,000 ft. above sea-level. Its population was estimated (much too highly) at 120,000 in 1913.

For the Russians the strategic situation was much more favourable than for the Turks. Preparations for the eventuality

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of a war with Turkey had for some time been taken in hand by the Russian general staff. Russia fully realized the importance of possessing the Armenian plateau, with its Christian population and great mineral wealth. The frontier fortress of Kars, which with its whole district had passed to Russia in 1878, was modernized, placed in a permanent state of defence, and well provided with guns, ammunition and supplies. A lateral line through Transcaucasia from Baku by way of Tiflis to Poti on the Black Sea was constructed, from which branch lines led to the Turkish frontier. The network of roads was also carefully completed and the frontier area thus converted into an excellent base for strategical deployment.

From the first, then, the Russians had the better strategic position. In this country whichever side was nearest to its railways was bound to have a decisive strategical advantage over the other, especially if in addition it possessed a better network of roads. Enver Pasha, however, failed to realize this. As a strategist he was a hopeless amateur, who believed that his personal will in Constantinople could remedy in a moment the age-old defects of the Turkish military system and the Turkish general staff.

Long before Russia, in Nov. 1914, declared war on Turkey, Gen. Liman von Sanders had planned to create a diversion in favour of the German and Austrian armies in the eastern front by landing several Turkish corps near Odessa and advancing into the Ukraine, where he hoped to rally the numerous German colonists to his standards. This scheme may be considered to have been the one great strategic error which could be laid to the account of Liman von Sanders: for it violated all those canons of prudence, the disregard of which the general himself so often and vigorously censured in the projects of others.

Liman von Sanders earmarked for this operation the I., IV., V. and X. Corps, and proposed to lead the army in person. It is easy to understand that the Turkish High Command looked with disfavour on this plan, if only because it needed all its available forces for operations in the Turkish theatre of war. The project of effecting a landing at Odessa held out no promise of success; for the expedition could never have ventured far from its ships, and could therefore have exercised no effect on the general strategic situation. It might perhaps have served as a centre for a rising in the Ukraine, whose agents were in Constantinople. But, in view of the military strength of Russia at that time, the success of such a rising was more than doubtful. The adventurous scheme was finally abandoned on Sept. 18 1914, largely because the commander of the fleet considered it impossible to guarantee either the smooth disembarkation of the troops or the maintenance of the line of communications by sea between Odessa and Constantinople. The Corps comprising the I. Army were also needed for political reasons in the Adrianople area, where they were to be used to cover the rear of Bulgaria against a Rumanian attack, should the former commit herself to an offensive against Serbia.

For Liman von Sanders' scheme was now substituted Enver's great plan for an advance against Russia, to be carried out by the III. Army, assembling in Sept. and Oct. at Erzerum, under the incompetent Hasan 'Izzet Pasha (not to be confused with the Ahmad 'Izzet who later became commander-in-chief).

This army consisted of the IX. and XI. Corps, the 2nd Cav. Div. and the so-called 2nd Res. Cav. Div. made up of Kurdish irregular bands. This reserve cavalry, useless for fighting purposes, showed great skill in massacring and plundering the defenceless Armenians whenever opportunity offered. In Nov. the X. Corps also joined the III. Army. The condition of the troops may be gathered from a report of the middle of Nov. 1914, according to which the X. Corps alone was short of 17,000 overcoats, 17,400 pairs of boots, 23,000 tents and 13,000 packs—and this just before the Armenian winter, in a country where bivouacking is unavoidable on account of the settlements being far too thinly scattered to allow the housing of large bodies of troops. The III. Army was brought up to strength by reserves from E. Anatolia; they were excellent military material, but shortage of clothing and food in the autumn soon caused them to desert in masses.

Enver's plan of operations involved a frontal advance by the XI. Corps along the Erzerum–Sarikamish road, combined with an attack against the Russian right flank by the two other corps moving to the left over the mountains in the direction of Olti, with the idea of cutting the Russians off from Kars and capturing that fortress. The present writer repeatedly told the Turkish High Command that the whole operation was impossible of execution, and Liman von Sanders endeavoured in a personal interview with Enver to dissuade him from carrying out his plan, which was foredoomed to failure. The latter, who had an exaggerated idea of his own capacity, refused to listen to advice or to take warning. Not only would he not see that his scheme was impracticable, but he expressed to Liman von Sanders his ultimate intention of marching by way of Afghanistan against India. No better proof could be desired of Enver's incapacity to understand what strategy means.

As a matter of fact the scheme as it stood was never put into execution, for the Russians anticipated it by undertaking an advance on Erzerum with a Cossack division and a mixed bde. Hasan 'Izzet attacked them at Köprü Keui on Nov. 8, and by the 12th he had succeeded in taking the Russian positions. Meanwhile, however, the I. Caucasian Corps had taken up a position in rear near Asap, which resisted all the efforts of the Turks to storm it, though they gained ground at certain points. The Turks were already running short of ammunition and the arrival of parts of the II. Turkestan Corps to reinforce the Russians seemed to indicate that the Turkish superiority in numbers would shortly be lost, if it had not already been so. Hasan 'Izzet therefore withdrew the III. Army, gave up all idea of any further offensive, and turned his attention to completing the equipment and supply services of his troops, who were even now beginning to suffer privations. This wise decision must largely be attributed to the influence of his German chief of staff, Guse. The losses of the Turkish army in these first encounters amounted to 1,500 killed, 5,600 wounded—no inconsiderable proportion of the effective strength of the army, estimated at some 90,000 men.

At this point, however, Enver took the bit between his teeth. He ordered a detachment which had been assembled under a German officer at Haidar Pasha to be transported across the Black Sea and landed W. of Batum, and to advance thence into Russian territory—in fact, to attack Russia. The detachment pushed forward boldly to Ardahan, where it encountered overwhelming hostile forces and had to retire to the Russo-Turkish frontier. Enver himself, burning with impatience, and his German chief of staff, Bronsart von Schellendorf, who also was no strategist, sailed on board a warship for Trebizond. Leaving Constantinople on Dec. 6 he reached Erzerum on the 21st, and, taking over the command of the III. Army, set to work at once to carry into action his pet scheme outlined above. The various corps received the following missions. The IX. Corps was to drive the Russians from the pass between Erzerum and Olti and advance on the latter place. The X. Corps, moving from Erzerum northward, was to wheel round south-eastward in front of Olti in order to cut the line of retreat of the enemy in conjunction with the IX. Corps, marching parallel to it. The Russians would then be attacked frontally by the XI. Corps, as soon as the turning movement succeeded.

This scheme was a real piece of geometrical strategy, which in view of the bitter cold, the deep snow and the miserable equipment of the Turkish army was bound to turn out disastrously. Enver, however, persisted in his attempt to ape the deeds of Alexander the Great, and the operation proved a complete failure. The IX. Corps successfully forced the pass, but got utterly out of hand in the tangle of snowclad and pathless mountains. With its units inextricably mixed up it encountered near Sarikamish a superior and well-ordered enemy force, and suffered a complete defeat. The X. Corps, which had an even longer road to traverse, also arrived piecemeal on the battlefield on Jan. 4 1915, when the IX. Corps was already pouring back in complete disorder. The X. Corps shared its fate and retreated in disordered haste over the mountains. Enver attempted to retrieve the position by attacking with the XI.

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Corps. Naturally enough, this isolated attack was broken without producing any effect beyond making it possible for the remnants of the IX. and X. Corps to escape to Erzerum.

The III. Army, which owing to the heavy snow had been unable to take its field artillery with it, had suffered appalling losses, which were due not so much to the fighting as to the fact that the troops had had to bivouac in the snow without tents and practically without food. An epidemic of typhus now broke out in its ranks. After the offensive the strength of the army had been reduced to the following totals: IX. Corps 2,000, X. Corps 2,400, XI. Corps 2,400, Artillery and 2nd Cav. Div. 4,800; or 12,400 in all. The army had thus lost 86 % of its effectives, and had suffered a disaster which for rapidity and completeness is without parallel in military history. The miserable survivors were in a pitiable condition. Enver Pasha, with Bronsart von Schellendorf, at once left the army, handing over the command to Havis Hakki Pasha, his brother-in-law, and returned to Constantinople; he never again during the World War attempted to conduct operations, though he often interfered with the decisions of the other army commanders with disastrous results. Thus, soon after the defeat E. of Erzerum, he ordered the despatch of the V. Corps to that theatre from Constantinople, and was only at the last moment persuaded by Liman von Sanders to cancel his instructions. During his return journey he also announced that no orders other than his own should be carried out by the troops, and instructions to this effect were sent to all the Turkish armies. The greatest confusion would have resulted had not the Grand Vizier cancelled this ridiculous order. Havis Hakki Pasha dying in Feb. of typhus, the command was given to Mahmud Kiamil, who knew next to nothing of strategy and owed his rise solely to political considerations and his influential connexions.

It was an undeserved piece of good fortune for Turkey that the Russian losses and the increasing severity of the weather forbade any pursuit, and that the situation on the Polish front was absorbing all the available Russian troops and preventing the despatch of reinforcements to the Caucasus. There ensued therefore a cessation of all activity in this quarter, and Mahmud Kiamil had time to reorganize his army. By occupying the Id and Olti passes he secured his left flank against any raids and surprise attacks which the Russians might be planning. Farther still to the left the small detachment which had carried out the push into Ardahan was wintering at Artvin in Russian territory. It consisted of 1,000 regulars, reinforced by volunteers raised in Constantinople by the Committee of National Defence with the assistance of the German military representatives. More of these somewhat inferior troops were sent to the detachment in Feb. and March, and it was resolved to attempt a *coup de main* against Batum. The fortifications of the town, however, though antiquated, were quite sufficient to repel the attack of these unorganized and half-trained men, and the enterprise was a complete failure. This was all the more unfortunate for Turkey, as she had found herself unable, despite the presence in the Black Sea of the "Goeben" and the "Breslau," which were manned by German crews but had been transferred to the Turkish fleet, to maintain uninterrupted command of that sea. During 1915 the two German ships, the only effective portion of the Turkish navy, were needed to coöperate in the defence of the Dardanelles; so the Russians were able once more to venture out to sea and shell the coal-mines of Zunguldak and Eregli and the town and harbour of Trebizond. Henceforward the line of communication of the III. Army by sea had to be given up, and it now ran overland along the railway from Haidar Pasha (opposite Constantinople) by Konia, to Ulu Kyshla (in the Taurus N.E. of Adana), where everything was loaded onto carts and camels, and proceeded by road via Kaisariyeh and Sivas to Erzinjan, there to be distributed. The length of this line from the railhead at Ulu Kyshla to the main depot at Erzinjan was some 475 miles.

Mahmud Kiamil, with the assistance of the German Lt.-Col. Guse, who was still chief of staff, succeeded during the winter months in bringing the strength of his army up to 35,000 men; most of the new recruits, however, had had little or no training. His small army had to hold a wide front of some 220 m. from the Black Sea to Lake Van, and in these circumstances Mahmud Kiamil kept the main body of his army concentrated round Erzerum, and protected the rest of the front only by small detachments. This was not difficult, particularly in winter, since few passable paths led over the frontier mountains, which are in places over 9,000 ft. high.

The Russians were not strong enough to fight a battle along the Sarikamish–Erzerum road. They therefore had recourse to wide turning movements, but not until May 1915, when the snow on the roads had melted. They first pressed the Turks back from the Olti pass and pushed on to Turtum. This village lies in a wild and precipitous valley in the midst of the high mountains, and here it was therefore possible for the Turkish reserves to stem the Russian advance. The Id pass was also occupied by the Russians. While the attention of the Turkish Higher Command was thus attracted to the N., far stronger Russian forces began, likewise in May, an offensive over the passes of the Aghri Dagh (W. of Bayazid) in the direction of Lake Van, capturing the weakly defended villages of Dutak and Melassgirt and threatening Van and Bitlis. At the same time the Armenian population rose in arms. A Turkish division, hurriedly despatched to Bitlis, suppressed the rebellion with awful savagery, but the Russians continued their advance from Melassgirt on Bitlis, and on July 13 drove its defenders out.

Again fortune favoured the Turks. The Russians, presumably too weak to venture forward, contented themselves with what they had gained. Before them to the W. of Bitlis lay the high plateau which stretches eastward from Diarbekr. Strong Russian forces might have either descended thence on Mosul and down the Tigris, thus facilitating the British operations against Bagdad, or might have pushed forward in the Euphrates valley on Kharput and turned the whole line held by Mahmud Kiamil's army, which was known to be in no fit state to offer serious resistance, and would have no alternative but to retire hurriedly on Erzinjan or to accept battle before Erzerum with its front facing S.W., with the certainty of complete destruction if it were defeated. However, nothing was done. A few detachments crossed into Persia (Azerbäijän) and occupied Urmia and a few other places W. of the lake of that name. Here, however, they were cut off by a belt of stupendous mountains over 115 m. wide from the Mosul plain, so that this enterprise had no strategic effect and merely exercised some political influence in bringing over to the side of the Russians the Armenian and Persian population of that region.

Summer passed, and as early as Sept. the first snow fell. Mahmud Kiamil had now increased his army to a strength of 58,000 men, and had in addition assembled some 20,000 recruits in special training camps in Erzerum. The governor of Erzerum was a German, Gen. Posseldt, who exerted himself in every way to put the antiquated works of the fortress in a state of defence. Lack of all material, even wood, however, prevented the construction of anything except earth-works. Erzerum drew all its wood and fuel in peace-time from the Pontic Alps, whence it had to be carried for 115 m. in carts. The Russian bivouacs near Melassgirt were constructed of wood brought up all the way from the mountain forests W. of Kars.

Although Erzerum was by no means a strong fortress, some 60 guns in its outer works and some 40 in the inner line being out of date, it was of great importance as the only road junction in the whole theatre of operations, as the capital of an area disaffected towards Turkey and the central *point d'appui* of a weak army. In Oct. 1915 the situation in Mesopotamia appeared so serious that the Turkish Supreme Command, all being quiet at Erzerum, took away from Mahmud Kiamil two divisions (the 5th and 6th) and sent them to Bagdad. And just at this moment the Russian Grand Duke Nicholas assumed command on the Russian Caucasus front, and brought with him not only reinforcements and material, but—still more important—the will to utilize them to the full.

Nicholas had no need to resort to turning movements, and decided to attack the centre of the Turkish front and break

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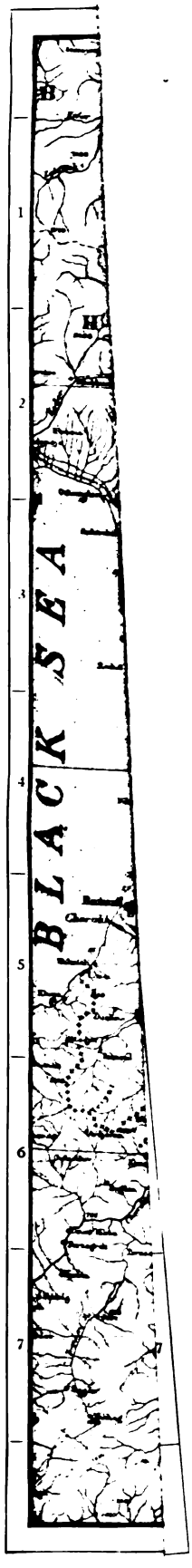

TURKISH CAMPAIGNS
(CAUCASUS)

PLATE I.

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through to Erzerum. The offensive began on Jan. 11 1916, up the Aras valley, and by the 14th the Turkish positions E. of Erzerum had been carried. It was unfortunate for the Turks that at this moment Mahmud Kiamil had been called away to Constantinople, and that his German chief of staff, Col. Guse, was on sick leave after a severe attack of typhus. The temporary commander of the III. Army, 'Abdul Kerim Pasha, was not equal to the situation. The Turkish forces, after losing heavily in a series of rearguard actions, took up a position on the heights N. and S. of Erzerum which had been hastily fortified. The Russians, who expected to overrun these defences at the first attack of their advanced guards, were checked for the moment; but a second assault, delivered by strong forces against the left of the Turkish line from Kara Gobek, proved decisive of the fate of the fortress, which fell into Russian hands on Feb. 15 1916, the troops of Gen. Yudenich advancing by surprise against the southern front, where no attack was expected.

The defenders of Erzerum had certainly put up a good fight, and the Russian claim to have captured in the fortress 100,000 prisoners, 437 guns in the inner and 374 guns in the outer forts and 200 field guns was certainly greatly exaggerated. The whole Turkish army, if we deduct the heavy losses suffered, was barely 50,000 strong, and the whole artillery of the fortress amounted to barely 10% of the figures given by the Russians.

The Turks, however, whose *communiqués* were easily the most inaccurate of all those issued by the belligerents, sent home on Feb. 16 an entirely fanciful account of what had happened: "On the Caucasus front," it ran, "in the violent position fighting which has continued for the last three days despite the cold and snow, the enemy lost 5,000 dead and 60 prisoners." The loss of Erzerum was not even mentioned, and even the Sultan and his entourage only heard of it some months later; and even when the facts were finally announced to the world the importance of the place was minimized and its evacuation represented as being a voluntary withdrawal on the part of the Turks. The Grand Duke Nicholas, far from resting content with his victory, vigorously followed up the Turks in their disordered retreat, and occupied Mamakhatun. On Feb. 24 the remnant of the beaten army crossed the Euphrates at Kotur. Mahmud Kiamil, who had resumed his command, was now replaced by Wahib Pasha; the greater part of the artillery and material had been left behind in the retreat, and he only succeeded with great difficulty in getting his troops across the river, which here flows from N. to S., and into position on the right bank on the heights of Baiburt. The V. Corps, which was arriving in haste and piecemeal from European Turkey, assisted in checking the Russian advance. In the coastal sector the detachment at Artvin, though reinforced by some units of the V. Corps, was assailed by superior forces and compelled to fall back after stubborn fighting. Maj. Hunger, the German commander, succeeded in making a renewed stand 20 m. E. of Trebizond, but by the middle of April the Russian 123rd Div. forced him back once more and occupied Trebizond.

The Turkish strategic situation had now become serious. The possession of Trebizond allowed the Russians to open up a much shorter line of communications across the Black Sea from the Ukrainian and Crimean seaports, and gave them a base close behind their front. The disadvantage of having this base behind the right wing of their army could be compensated for by reinforcing this wing, so as to avoid any possibility of its being forced away from its line of communications, while the land route to Erzerum from Kars was still in use and would be available to supply the whole army if necessary.

The Turks, therefore, had to expect that in the forthcoming spring the Grand Duke Nicholas, whose forces were continually being reinforced from the Caucasus, would resume the offensive on a large scale. The Turkish Supreme Command was now freed of all anxiety from the side of the Dardanelles, but it still maintained three armies, the I. (Essad Pasha), the II. (Ahmad 'Izzet Pasha) and the V. (Liman Pasha), massed in the Constantinople–Adrianople area, thousands of miles from the theatres of operations, in Mesopotamia and eastern Anatolia.

The loss of Trebizond finally aroused Enver Pasha to a realization of the full extent of the strategic danger in the E., and in March the II. Army was directed to the E. Anatolian front. It was to deploy on the line Lake Van–Mush–Kigi, and advance against the Russian flank and rear in the general direction of Erzerum; it was to be brought up to a strength of 10 divisions by the addition of the forces already in the area of operations, and to be reorganized in four corps. The commander, Ahmad 'Izzet Pasha, had been promoted commander-in-chief of the Turkish army after the Dec. armistice in the Balkan War.

The strategic plan adopted by the Turkish Supreme Command for the II. Army was as usual excellent in theory but impossible of execution. The idea of throwing a whole army on the flank and rear of the Russians must certainly have seemed seductive to anyone sitting over a map in Constantinople; for it seemed to promise a strategic encirclement, it followed famous precedents, and there was plenty of room for the manœuvre. In practice, however, the plan paid no attention to the actual conditions of time and space. The II. Army was despatched in the spring by rail from Constantinople to Ulu Kyshla; the line, which was a single one, with enormous intervals between stations, was already serving as the line of communication for the Palestine and Mesopotamia armies, so that any *rapid* transport of the II. Army was out of the question. The Turkish Supreme Command made a grave miscalculation in assuming that the army would be assembled and ready for the advance in 40 days; the distance from the railhead at Ulu Kyshla to the area of concentration (some 400 m.), which had to be covered on foot, would itself have taken up all that time. The amateur strategists at Turkish H.Q. took no account of these matters, and were mightily surprised when the event disappointed their expectations. As a matter of fact by July 8 the leading troops of the II. Army (III. Corps 7th and 11th Div.) had barely passed Malatia, and the rest of the army was still on the railway in August.

Meanwhile the situation on the III. Army front was going from bad to worse. At the end of May it had carried out a few successful minor operations; Mamakhatun and Surmene (E. of Trebizond) had been occupied, and the army command, which was now at Gumuskhane, misconceiving the general situation, proposed to carry out a powerful offensive S. of Trebizond early in July. For this purpose it suggested that the units of the II. Army already available should push forward without delay to the area S. of Erzerum—an advance which, with the weak forces which 'Izzet Pasha had at his disposal, could only have been effective as a demonstration or a piece of bluff. But even this could hardly have succeeded, in view of the excellent intelligence as to the Turkish movements which the Russians were known to have, and 'Izzet Pasha rightly declined to fall in with the scheme. As a matter of fact the Russians had full information as to these happenings, and especially the progress of the transport of the II. Army, and seized their chance to attack the III. Army in July, before the II. Army's menace to their flank could become effective. This was the best solution of their problem of operations on the inner line, and it met with complete success. On July 7 the Turkish III. Army was driven from Erzinjan and Baiburt with heavy losses in men, guns and material, and was able to make another stand only on the line Kemach (on the Euphrates 30 m. W. of Erzinjan)–Chadali Pass–Tireboli on the Black Sea. The most serious result of this defeat was the complete demoralization of the defeated troops; thousands of deserters, plundering and robbing, flooded all the country as far back as Sivas; columns and transport melted away in panic on the appearance of the Russian cavalry, who had broken through the Turkish line at two points and suddenly appeared in its rear. The III. Army reported in Aug. that 13,000 deserters had rejoined their units, but the governor of Sivas estimated that some 30,000 were still at large in his area. The fact that the Mahommedan population in the area evacuated by the Turkish army fled in terror before the advance of the Russians added to the indescribable confusion.

When 'Izzet Pasha with the III. Corps advanced at the end of July into the zone of assembly allotted to the II. Army the

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situation was as follows. In the hilly country S. of Bitlis was the 5th Div., which had been driven from that town by the Russians, and the 8th Div. was in the hilly country S. of Mush. 'Izzet formed them into the XVI. Corps. N.W. of them were only a few small detachments, holding the main roads as far as the Elmali valley, in which stood the 11th Cav. Bde. as the extreme right wing of the III. Army.

'Izzet Pasha's intention was to assemble the main body of his II. Army at Diarbekr and the smaller part at Kharput, and only then to advance in the direction of Erzerum and the country to the E. of it. He knew that in front of him the reinforced IV. Caucasian Corps had taken over the task of guarding the flank of the Russian main army.

This plan, however, was not carried out. The Turkish Supreme Command, in view of the disaster to the III. Army and the reports of constantly arriving Russian reinforcements, urged 'Izzet to attack before the assembly of his forces had been finished. 'Izzet had no option but to obey, though he was under no illusion as to the result. He wished at least to concentrate all his few available forces on the left wing of his area of deployment and to make a push into the district W. of Erzerum, in order to relieve the pressure on the III. Army. But this also proved beyond his powers. The 1st, 14th and 53rd Divs., which had arrived at the end of July and the beginning of Aug., were pushed forward against the Russians, who were still being reinforced on the front opposite the II. Army; a few local successes were achieved, and 'Izzet Pasha on Aug. 10 decided to renounce a general offensive and to hold and fortify the line Kigi–Ognot heights S. of Mush.

Thus ended the geometrical strategy of the Turkish Supreme Command, which had from the first been based only on wishes and hopes rather than on definite realities. The administrative deficiencies in the II. Army had been, as usual in Turkey, so great as alone to ruin all hope of success. The army was sent forward into wild and mountainous country, in which only mountain artillery and columns of pack-animals could be moved, and it was supplied with only 18 mountain guns and with ox-wagons for transport—and far from enough even of these. Figures as to the number of cattle in the deployment area were accepted without verification, and proved to be exaggerated some five fold. Those responsible for the supply services were, as ever in Turkish wars, quite incompetent to make the best of what turned up, and very disposed to steal the little that was available. Under such conditions the best plans are of no avail, for they can never be translated into actual practice.

Meanwhile Wahib Pasha was displaying praiseworthy energy in reorganizing the III. Turkish Army, of which the headquarters were at Andria. Divisions were formed out of the old corps, regiments out of divisions, battalions out of regiments. The army was divided into two "Caucasian Corps," the I. and II., the former comprising the 5th, 11th and 37th Caucasian Divisions. But even these combined divisions were very weak. The volunteer formations and other irregular bands proved wholly useless, and were soon broken up. German motor transport columns, established in the winter of 1916–7 on the line of communications of the III. Army between Ulu Kyshla and Sivas, prevented a threatened catastrophe due to starvation. All Wahib Pasha's efforts, however, could not restore the spirit of the III. Army and give back to it that confidence which was essential to the prosecution of a successful offensive.

The II. Army, when its concentration was completed, was composed of the XVI., II., IV. and III. Corps. Mustafa Kemal (later to become famous as leader of the Nationalist army) was the army commander. 'Izzet Pasha was entrusted with the general direction of the II. and III. Armies operating on the Armenian front, and moved his H.Q. to Kharput.

The II. Army, which had its H.Q. at Diarbekr, was experiencing even greater difficulties in the matter of its communications than was the III. In the winter, however, the strain was eased by both sides going into winter quarters, as in the old days. Only in the passes small observation detachments stood facing each other. In Nov. most of the troops were moved back into more sheltered districts, so that the Turkish and Russian winter quarters were some 30 to 40 m. apart, about the equivalent of five days' march in this difficult country. The Turks, however, were still short of food. As early as Nov. the men were getting only one-third of their regular rations, the pack-animals had themselves to find what meagre pasturage they could, and to find any was soon impossible on account of the deep snow; the cavalry horses were getting only 1½ kilogrammes of oats. Hundreds of animals died every day. Again and again outposts, patrols and whole detachments of men were found starved or frozen to death in the holes of the rocks. In the terrible cold, which when snowstorms raged might well chill to the bone even the warmest clad men, the majority of the troops had only their summer clothing. The percentage of sick grew higher day by day. The sanitary arrangements were in the highest degree defective, so that these miserable beings lived and died in boundless wretchedness. In the hospital at Kharput alone the average deaths in the winter of 1916–7 amounted to 900 per month. Medical requisites were insufficient, and there were no means of combating the plague lice and the epidemic of typhus which followed it. Of the III. Army 60,000 men perished between July 1916 and the spring of 1917, and in the autumn of the latter year barely 20,000 men remained at the front.

The strategic position in Armenia at the beginning of 1917 was extremely unfavourable to the Turks. The Russians, who had obtained undisputed control of the Black Sea, had massed such strong forces in front of the II. and III. Armies that there could be no idea of a Turkish offensive. At the same time railways were being built from Sarikamish by Hasan Kala to Erzerum and from Trebizond and Gumuschane, on the completion of which the Russians in their turn would be in a position to resume the offensive without being hampered by transport difficulties. This offensive might be directed either against the front of one of the two Turkish armies, or from Lake Urmia along the southern shore of Lake Van against the almost unprotected flank of the III. Army. In view of the fact that a new English advance against Bagdad was in preparation, this latter seemed very probable, and Liman von Sanders did rightly in asking the Turkish Supreme Command, in the late autumn of 1916, to hold another army ready at Mosul. The proposal, however, was rejected by Enver. It would also have been sound policy to have placed the II., III. and VI. Armies (the latter being at Bagdad) under one command; for the transference of forces between Armenian and Bagdad fronts could not be carried out quickly enough from Constantinople, and a junction of the Russian and British fronts by an extension of the former by Urmia and the western frontier of Persia was shortly to be expected. A Russian offensive from Persia against Mosul would certainly place both the III. and the VI. Turkish Army in a perilous position. The completion of the railway from Igdir by Bayazid to Kara Kilissa and its continuance by Tutak and Melassgirt seemed to indicate the probability of a Russian offensive against the right of the II. Turkish Army. The offensive against Mosul did not in fact take place; but this omission was a serious error on the part of the Russians and a piece of good fortune for the Turks, on which they had no right to count. However, Liman von Sanders' request for the establishment of a single command was rejected by the Turkish Supreme Command. The relations between Enver and Liman had in fact gradually become so strained, that Enver made a point of refusing anything that Liman wanted.

The Grand Duke Nicholas had, for his part, been making energetic preparations during the winter of 1916–7 for a powerful new offensive. The III. Turkish Army was opposed by the V. Caucasian, II. Turkestan, and I. Caucasian Corps; the II. Turkish Army by the VI. and IV. Caucasian Corps as far as Van. Thence to the W. of Lake Urmia came the II. Caucasian Cav. Corps and a number of detachments (fortress regiments from Kars, frontier guard units, Armenian and Assyrian irregulars). The VII. and I. Caucasian Cav. Corps prolonged the front from Sauj Bulak along the Persian frontier to W. of Kermanshah.

But the Grand Duke's plans, which in view of the wretched condition of the Turkish armies must have led to a complete

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victory and perhaps driven Turkey out of the war in the summer of 1917, were never carried out. This was in part due to the fact that all available Russian forces were being concentrated for Brussilov's great offensive in Volhynia, but mainly to the outbreak of the Russian revolution, which checked all large operations in Asia. When the revolution broke out in April the advance had not begun. In the course of the winter there had been nothing but local skirmishes for the possession of a hill or pass, which, whether they turned out to the advantage of Turks or Russians had no influence on the general strategic situation.

The outbreak of the revolution was taken by many of the Russian troops as a signal that the war was at an end, though there were formations which still maintained their cohesion and discipline. The Turks, however, were prevented partly by the general military situation of Turkey and partly by the peculiar difficulties of the II. and III. Armies, from seizing and exploiting their advantage as they might have been expected to do. The rapid progress of the English towards Bagdad had necessitated the despatch of reinforcements to that theatre, and the maintenance of the Palestine front also absorbed large forces, so that there were neither men nor material left over for the Caucasian front. The two armies, barely 40,000 strong in the spring of 1917, were now formed into the "Caucasian Army Group" under 'Izzet Pasha, whose H.Q. were still at Kharput, and who had now been provided with a German chief of staff, Maj. von Falkenhausen. All this, however, did not in any way make it possible to resume operations. Typhus was still raging; in Feb. the II. Army lost 42 of its few doctors from this cause. There was so little wood that the delousing stations could not be heated. The deportation of the Armenian population had left the fields untilled, and the villages deserted and in ruins. Of the craftsmen who exhibit a multitudinous activity behind the armies on the European fronts there was not a sign, and even the workshops which had been busy in peace-time were deserted. The supply often broke down entirely. A shameless traffic in waggons went on on the single railway from Haidar Pasha to Ulu Kyshla, which served the Palestine, Mesopotamian and Caucasian fronts. These waggons, which should have been used for military purposes, were privately hired out by officers and officials to contractors and war profiteers at high prices, and on this railway an illicit carrying trade was developed on a gigantic scale. The higher authorities, who also took their quota of profit, were not inclined to interfere. So for the sake of these brutes thousands of brave Anatolian soldiers perished of cold and starvation without even knowing the true cause of their miserable death.

The reports of the hopeless military position in 1917, which were sent to Berlin by the Turkish Supreme Command, were from first to last lies, and served only to increase the exaggerated estimate of themselves which obsessed the minds of the German Supreme Command as well and caused the loss of every opportunity of arriving at peace of understanding.

When Bagdad fell to the English on the night of March 10–11, the chance offered itself of a successful Russian offensive on Mosul either westward from Lake Urmia or from the region of Lake Van southwards. Had it been carried out even by one good corps it could not have failed to be successful. During the whole of 1917 some 15 infantry and 2½ cavalry divisions remained on the Russian front facing the Turks, but nothing important was undertaken. The front from Trebizond to the Diala near Bagdad, where it connected with the English line in Mesopotamia, measured over 600 m. from flank to flank, and afforded far greater scope for free strategic manœuvres than the narrow fronts in France, which were actually filled with guns and men. Warlike activity was only resumed in E. Anatolia, however, when Russia at the end of 1917 entered into negotiations with the Central Powers. The political event which decided the resumption of the offensive by the Turks, which took place early in 1918, was the notification by the Turkish plenipotentiaries at Brest Litovsk on Jan. 17 that a Russian retirement from all the area occupied by them in Asia Minor was an essential preliminary to the conclusion of peace. At the same time the Ukrainian delegates were asked by the Turkish delegates how far they were interested in the retention of the Caucasus by Russia. On their replying that they had no interests in the Caucasus, the Turks resolved to conquer it, and obtained Germany's consent to their doing so, though at the time they did not disclose to her all their ulterior designs.

The Russians retired at the end of Jan. 1917, and in Feb. the Turks advanced across the line Van–Erzerum–Trebizond. The Turkish armies, which together could muster only the strength of a weak army corps, were in such poor condition that even the small, unorganized Armenian bands, who opposed them, were able to give them greater trouble. Their *communiqués* at this time were full of stories of great victories which never took place.

The forward march was carried out in two columns. The northern one, feeling its way very cautiously along the coast of the Black Sea, reëntered Trebizond on Feb. 24; the other reached Erzinjan on the 14th, and moved thence by Mamakhatun on Erzerum. Nothing was seen of the Russians, who, as a matter of fact, had long since recrossed the frontier; only a few desperate Armenians endeavoured to dispute the reoccupation of their country by their hereditary tormentors. The Turks were held up for some time by these bands in front of Erzerum, which they only "recaptured" on March 11, and revenged themselves by the usual revolting barbarities on the unhappy Christian population.

While Erzerum was being taken, the left Turkish column advancing from Trebizond was approaching the frontier between Chopa and Magriali, and the political problem of the provinces of Kars, Ardahan and Batum, the occupation of which had been the motive of the advance, became acute. Their interest in these provinces caused the Turks to commit their last and decisive strategic blunder, the greatest of which they had been guilty since 1914. The Turkish Government considered these operations in the Caucasus to be of the first importance, although the true decisive theatre for Turkey in 1918 was Palestine. Instead of concentrating in Palestine the few troops it had available, the Supreme Command withdrew troops and war material from that front and despatched them to the "East Caucasian Group." Even the small German contingent, which formed the backbone of the Palestine army, was also sent to the Caucasus. Liman von Sanders' words to Count Bernstorff, the German ambassador in Constantinople, written in June 1918, were fully justified by events: "The Turks are sacrificing all Arabia, Palestine and Syria to these boundless undertakings of theirs in Trans-Caucasia. Germany will some day be burdened with the responsibility for this."

Enver and the German High Command had, however, succeeded in completely deceiving the German ambassador as to the Turkish objective, for the latter, in reply to Liman von Sanders, wrote on June 21 that the German Jäger battalion was being transferred from Palestine to Georgia, "not in response to Turkish wishes, but, on the contrary, for the purpose of restoring order in the Caucasus, so as to allow of the whole Turkish army being transferred thence to Mesopotamia by way of Urmia and Tabriz." This, of course, could have been done more quickly and easily if the Turkish army had never advanced from Armenia into the Caucasus. The motive of the Caucasus adventure lay deeper. Enver's idea of attacking India, childish as it was, had yet proved enticing to the German High Command, and the strategic base for an invasion of India by way of Persia was actually established in the Caucasus in the summer of 1918. And this at a time when the decision of the World War was ripening on the front in France!

Considerations of an economic nature, it is true, carried great weight in the minds of the German Supreme Command at this time. The output of the Rumanian oil wells was insufficient; and it was therefore thought necessary to occupy Baku, and to despatch petroleum thence to the Black Sea by the Tiflis railway. It has been necessary to mention these considerations in order to make clear the motives of the Turkish operations in 1918.

After the occupation of Erzerum the southern Turkish column reached Olti, the first objective of the Turks in the winter of 1914–5, on March 26. Meanwhile the coast column was moving

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on Batum. The Georgians, however, who, naturally enough, had little sympathy with the Turkish "restorers of order," banded themselves together to oppose their further advance. The latter were not even able to keep a firm hand on insurgent Armenia. Behind their backs Armenian bands even succeeded in occupying Erzerum for a time and thereby interrupting all movement on the Turkish line of communications. Meanwhile Georgian bands had occupied Batum. The Turks attacked the town and stormed the advanced positions on April 9; one fort fell on the 10th, two others on the 11th, and on the 14th the town surrendered. The Turkish Supreme Command seized the opportunity to telegraph to the world at large the most incredible stories of victory.

Early in April Nuri Pasha, who was now in command of the "East Caucasus" Army, pushed a strong column from Lake Van in the direction of Kars. Vostan, at the S.E. corner, and Arnis, at the N.E. corner of the lake, were occupied after violent conflicts with Armenian bands, who fought with the utmost fierceness. Van fell on April 7.

While this column was advancing on Kars by way of Kara Kilissa, the Erzerum column, which had been brought to a halt after the above-mentioned capture of Erzerum by Armenian bands, pushed forward by Sarikamish, and the two columns thus converged on Kars. As there was no strategically effective enemy to overcome, the operation was successful, despite the late arrival of the Van force. The Erzerum column approached Kars on April 5, after driving off some Armenian irregulars near Sarikamish; the Van column made slow progress through the revolted province of Bagasia, arriving at Kara Kilissa April 18.

On the 26th the Turkish *communiqué* reported the "storming" of the fortress of Kars (which was apparently undefended) with the capture of 860 guns. This number was considerably in excess of the truth. There is no doubt, however, that the provisions secured in the fortress considerably facilitated the further prosecution of the operations. The column advancing along the coast had meantime pushed on from Batum to Kobuleti and Ozurgeti on the edge of the Caucasus mountains.

The Turks now felt themselves to be masters of the situation, and their pretensions became so outrageous as to lead to serious controversies with the German Government, which, for the first time in the war, was compelled to protest energetically against their exorbitant claims. It had, however, only itself to blame for their exaggerated estimates of themselves.

In the middle of May the plenipotentiaries of the Government of Northern Caucasia addressed a note to all the Powers, announcing the formation of an independent state, separated from Russia. Transcaucasia, however, remained in a complete state of confusion, though the proclamation of the independence of the country by the assembly which met early in June at Baku was plainly directed against Turkey. What exactly was meant by Transcaucasia, however, must have been obscure even to the assembly, for a few days earlier there had been set up under Turkish auspices three independent states, known as the Georgian, Tartar (Azerbäijän) and Armenian Republics. Necessity had compelled all three to conclude treaties of perpetual amity and alliance with Turkey, who had every intention of annexing these weak states at the earliest possible moment.

Enver did everything to strengthen his political army in the Caucasus. Accelerated promotion and doubled pay were promised to the officers serving with it, with the result that many officers, who were urgently required in Palestine, got away from that theatre, where they received no pay at all.

In the summer the Caucasus Army was increased to six complete divisions, which were stronger than they had been at any time since 1914, numbering 9,000 men each. The transport of these troops, and their reserves, material and supplies absorbed all the fuel available, so that no trains could be sent to the Palestine Army, on whose fighting force the ultimate decision of the war depended. The Pan-Islamic idea, which had been propagated since the beginning of the war, had produced a complete confusion of mind and robbed Enver and his entourage of the last vestige of that strategic sobriety which alone could now save Turkey from ruin. Every week 14 coal trains were sent from Germany to Constantinople; of these seven—far more than were necessary—were kept for the use of the capital itself; 2,500 tons were shipped by way of the Black Sea to the E. Caucasian Army, and the rest was absorbed by the Anatolian railway—or in other words the war profiteers, who filled whole trains with their goods and paid out untold sums in bribes to the railway officials to give them priority of passage.

The E. Caucasian Army extended itself in Transcaucasia and N. Persia, from Lake Urmia to Arax, during the course of the summer, without troubling themselves in the least about the dangerous English offensive against Mosul, where 4,000–5,000 Turkish soldiers were posted in conditions of the utmost misery.

The few events that followed in Transcaucasia were of little military interest, and consisted mainly of a few petty scuffles without influence on the general situation, and unsuitable for inclusion in a strategic narrative. Even the despatch of a German division to Georgia in the summer of 1918 had no other object than the furtherance of those plans, on the futility of which we have already insisted.

Nuri Pasha, with Bolshevik help, certainly succeeded in expelling from Baku a small British force which had crossed the Caspian and occupied the town on Aug. 12. This incident, however, had no effect on the strategic position. In Persia Nuri pushed forward to Tabriz.

The final conclusions as to the Transcaucasian operations may be summed up as follows. The position of Turkey and of the Central Powers in 1918 was such that a military victory was out of the question. This fact, however, was recognized neither by Ludendorff, who wasted the defensive strength of the German army in a purposeless spring offensive, nor by Enver, who was obsessed by his vast schemes for annexation of territory. The despatch of a strong German division to the Caucasus, and the operations of large German forces in the Ukraine in the summer of 1918, when the war was being lost in France, show the kind of strategic conception then prevalent. In the case of Turkey the theatres of war which had to be supplied with men and material were too numerous for the resources available. When the Russians collapsed in 1918 a wise strategy would have considered the elimination of one theatre of operations as a relief to be accepted with gratitude, and would have, as a natural consequence, transferred all the forces thus liberated to the Palestine front. Such a course would of itself have relieved the pressure on the Mesopotamian front, which could no longer be saved by direct means. The underlying idea ought to have been that a tenable military position in Palestine would have been more favourable, in the event of negotiations for peace, than any conquests in the Caucasus, which would have to be given up again in case of military defeat. Enver, and with him a whole series of Turkish and German military men, had never had that conception of the limits of the possible which is the prime characteristic of every great strategist. They mistook the elaboration of immense and impracticable schemes for genius, whereas true genius consists of getting the best possible results from the material available. The events on the E. Anatolian front also serve to prove very clearly that strategy is an art not to be mastered, even with the best will in the world, by a layman such as Enver, and that it is governed almost entirely by the geographical conditions of the theatre of operations. This should have been recognized by the office strategists of Constantinople, who had no clear grasp of the geographical conditions of the country in general or in detail, and failed to realize that strategical manœuvres which seem highly promising on the map may be impossible of execution in practice. In the German schools of strategy, and also in Turkey, so-called military geography was before the war treated with complete contempt, as it was believed that it tended to limit freedom of strategic conception. The campaigns in the East proved that freedom of strategic conception, unless based on accurate geographical knowledge, is not only profitless but a fruitful cause of defeat. Finally, the war in Eastern Anatolia may teach us one valuable psychological

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lesson, which was insufficiently appreciated by the Turkish Supreme Command. The form of a strategic movement has of itself no driving force; the vital factor, in strategic force too, is the troops. Now the spirit of the troops depends mainly on their physical condition. An army called on, when insufficiently clad and underfed, to face the snows of winter soon loses its fighting value. If strategy depends on the efficiency of the troops, this in its turn depends on the efficiency of the supply and transport services, and the administration of the army in general. Only when this organization is in good order and working well can the leading strategic conception be, in the true sense of the word, free. On this simple truth the strategy of the Turks during the World War always suffered shipwreck, even when they had better leaders than those who appeared during the war in Armenia. (F. C. E.)

(II.) Mesopotamian Operations

The Anglo-Indian operations of 1914–8 in Mesopotamia, which ended in the military occupation of almost the whole of that extensive region, were in their initial stages conceived on comparatively modest lines. They were at the outset undertaken merely with the object of (1) protecting the Anglo-Persian oil installations of the Qarun; (2) occupying the greater part of the Basra vilayet, so as to secure possession of the Shatt al 'Arab and to maintain control of the districts immediately round the head of the Persian Gulf; and (3) impressing the Arabs and others in this and neighbouring regions and influencing thereby the inhabitants of the territories intervening between the Ottoman Empire and India. It was foreseen in London and at Simla that the Ottoman Government would be likely, under instigation from Berlin, to send troops in this direction, for the purpose of harassing the Indian executive by stirring up trouble in Persia and Afghanistan; and steps had been taken to deal with the contingency before relations between the Entente Powers and the Porte were actually broken off. The Poona Bde. of the 6th Indian Div. had been dispatched to an island near the head of the Persian Gulf in the middle of Oct., and on Nov. 7, two days after the British Government declared war on Turkey, these advanced troops appeared in their transports at the mouth of the Shatt al 'Arab.

The fort guarding the entrance to the estuary was taken after a brief bombardment, and the brigade then disembarked and encamped some miles up-stream on the right bank. On learning this the Turks hurried all available forces down from Basra to bar the way to the invader; but, the rest of the 6th Div. under Sir A. Barrett having arrived, they were attacked on the 17th and effectually overthrown. Basra fell on the 21st. The vanquished Osmanlis for the most part retired to Qurna, at the junction of the Euphrates with the Tigris, the point where the water-way ceases to be navigable for ocean-going vessels proceeding up-stream; but Barrett promptly pushed troops to a point higher up, and the place surrendered on Dec. 9. Considerable Ottoman reinforcements had, however, been on the way from Bagdad towards Basra since the arrival of the Anglo-Indian expeditionary force in the Shatt al 'Arab, and these now began concentrating, partly in the direction of Ahwaz and menacing the oil-fields, and partly about Nasiriya on the Euphrates. Threatened in a measure on either flank, and necessarily dispersed owing to having many posts to hold, the 6th Div. was not comfortably situated; but, as the Turkish fighting forces which had come down from the N. were not as yet organized for active operations nor in an aggressive mood, the invaders were enabled to consolidate their position, and they were little interfered with during the first three months of 1915.

The Indian Government was, however, anxious to obtain a stronger hold upon the district already occupied, and so in March it was decided to raise the expeditionary force to the strength of an army corps. Early in April Sir J. Nixon took over command from Gen. Barrett, who with limited means had conducted the campaign with signal skill and judgment, and Gen. Townshend at the same time assumed charge of the 6th Division. The last units of the new division (the 12th) had arrived by the middle of the month. These changes, as it turned out, synchronized with a marked increase of activity on the part of the Turks; for they appeared in some force near Qurna and also seriously threatened Ahwaz; they were, however, driven off with no great difficulty at both points. Encouraged by these successes, Nixon decided to assume the offensive and to occupy 'Amara, a town of some importance 60 m. N. of Qurna on the Tigris, but considerably farther if following the sinuosities of the stream. This task was entrusted to Townshend, who carried it out by making free use of water-transport of all kinds for moving his troops. Aided by a naval flotilla, on May 31, he signally defeated a hostile force which tried to bar the way; and then, as the result of a bold stroke, on June 3 made himself master of 'Amara, capturing 17 guns and 1,800 prisoners. This operation accomplished, Nixon resolved on a blow against Nasiriya. The heat was now intense; but, in spite of this, portions of the 12th Div., relying for mobility largely upon water transport, took possession of the town after some hard fighting on July 25, another 17 guns with 1,000 prisoners being the prize of victory. The Anglo-Indian army which had descended upon this corner of the Ottoman Empire could then fairly claim that it had achieved the object for which the campaign had been originally undertaken.

Its triumph had been all the more creditable seeing how seriously it had suffered from want of transport, and taking the inadequacy of its administrative branches into consideration. It must be remembered that the Indian Government had accepted heavy commitments in other fields of military action. Two divisions had been dispatched to the western front. Large forces had been furnished for the protection of Egypt. The E. African campaign also at that stage was an Indian undertaking. The military organization of the great British Asiatic dependency had not in pre-war days been framed with the idea of prosecuting martial operations on an ambitious scale overseas. Large reserves of trained men did not exist to fill those gaps in the ranks that contests with well armed antagonists bring about in the present day. The available departmental services—notably the medical service—had been starved. The troops now operating at the head of the Persian Gulf were, moreover, faced by quite exceptional difficulties, owing to the insufficiency of that shallow-draught water transport upon which their efforts and their maintenance virtually hinged.

Unfortunately, the success which had hitherto attended the combinations of Generals Barrett and Nixon inspired the civil and military authorities at Simla with the desire for a more ambitious programme in Mesopotamia than that which had been contemplated in Oct. 1914, and they readily fell in with Nixon's proposal that an advance up the Tigris to Kut should be undertaken. The Home Government agreed. This meant an advance of some 180 m. up-river into the heart of the enemy's country by troops who had already undergone much hardship, the maintenance of the force depending upon a flotilla that was barely adequate for the purpose and that would become entirely inadequate were the strength of the force to be increased above that of the division and the cavalry brigade already told off for the undertaking. News had come that a Turkish force was assembling at Kut under Nur ed Din Bey. Although Nixon made strong representations with regard to his lack of water transport, he perhaps hardly made the danger of advancing beyond 'Amara unless this were substantially increased sufficiently clear to authorities far away from the scene of action. Nor, perhaps, was the virtual impossibility of rapidly augmenting it realized. Townshend was charged with carrying out the proposed advance and early in Aug. his 6th Div. began gradually to push forward up the Tigris. On Sept. 14 he concentrated his force at Sheikh Sa'd.

On the following day he drove an advanced Turkish force in disarray out of a fortified position at Abu Rumman on the right bank of the Tigris, about 15 m. from Kut, and he then halted for some days to admit of supplies coming up and of reconnoitring the lines which the enemy had established on both banks of the river about Es Sinn. On the 28th he attacked Nur ed Din in his entrenched position and completely defeated him,

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taking 1,650 prisoners, 13 guns and much war material, and the cavalry pursued the fleeing Osmanlis as far as 'Aziziya, halfway from Kut to Bagdad. The enterprise had in fact been carried out with a success equal to its audacity.

Kut was a locality of some strategical significance. Issuing here from the Tigris, the Shatt al 'Arab creates a link with the Euphrates at Nasiriya. The natural route for troops from Bagdad proceeding to the lowest reaches of the Euphrates immediately above Qurna would be by way of the Tigris and the Shatt al Hai. Therefore, installed in his new position at Kut, Townshend in a measure blocked both the routes from Upper Mesopotamia to Basra—that following the Tigris right down to Qurna, and that turning off by the Shatt al Hai. Kut was furthermore the most important place between 'Amara or Nasiriya and Bagdad, and its capture was calculated to exert a considerable moral influence over the Arabs who dwelt in this region and who were disposed to be troublesome. But almost the whole of the Anglo-Indian troops in the theatre of war, apart from detachments required for garrison duty nearer the Persian Gulf, had now been projected into an isolated situation far within the enemy's territory; they were, moreover, depending upon a long line of water communication, not easy to protect against marauding attacks and served by only a restricted number of steamers and smaller craft. But for the severe defeat suffered by the Turks at Es Sinn, the disposition of the invading forces at the beginning of Oct. would have justified some anxiety.

But the idea of pushing on to Bagdad had already taken shape even before the occupation of Kut. The Aug. discomfiture in the Gallipoli Peninsula (*see* DARDANELLES CAMPAIGN), coupled with a belated realization that the Dardanelles venture would not succeed, had rendered the Home Government eager for some dramatic achievement in Mesopotamia. The Indian Viceroy had advocated an advance to Bagdad when the start up the Tigris from 'Amara was materializing. Townshend's gratifying triumph acted as a stimulus to these aspirations, and during the month of Oct. there was much inter-communication between London, Simla and army headquarters in Mesopotamia on the subject of a further advance. Nixon intimated early in the month that he was strong enough to open a road to Bagdad under the circumstances then existing, but he did not consider himself able to hold the city if taken. The question of even reaching the place, however, depended in reality upon whether the advance were to take place before the enemy was reinforced. The military authorities who were consulted at home, while admitting the possibility of capture, regarded permanent retention as out of the question with the limited forces available; they declared that, if Bagdad was to be held, the army in Mesopotamia must be reinforced by two divisions. Influenced by political considerations, however, the Home Government became more and more insistent. The dispatch of the two Indian divisions that were on the western front at the time to the Persian Gulf was under consideration, but it could not be promised at the moment. Although no reinforcements could be sent him, and although had they been sent him they could not have taken part in the operation owing to the time that must elapse in getting them to the theatre of war and owing to the absence of water transport to move them and to feed them when they got there, Nixon was on the 31st informed that he might advance on the city.

Townshend had pushed large parts of his force from Kut on to 'Aziziya while the discussion was proceeding. He found that the Turks were less demoralized by the reverses they had met with than had at first been supposed, and they had been given time to rally and to reorganize. His own troops had been severely tried, and all his units were short of establishment. He entertained serious misgivings as to progressing farther, in view of the isolation of his force, of the length of his communications, and of the manifest insufficiency of that water transport which was the governing factor in any operations that he might have to undertake. Even after receiving his orders to advance, he was unable to move for a fortnight owing to time lost in getting up supplies to 'Aziziya and in organizing for the hazardous effort. On Nov. 11, however, the advance began, and on the 21st the Turks were dislodged from a fortified position at Laj. It was known that the enemy was in strong force at Ctesiphon and had constructed elaborate entrenchments at that point; news had also come that hostile reinforcements were expected. A night march was therefore carried out, and at dawn Townshend attacked. The assault was most successful in the first instance. Two lines were carried and many prisoners were captured. But strong Ottoman reinforcements arrived on the battlefield while the fight was still in progress, and these recovered much of the ground that had been lost earlier in the day. For three days the two armies remained facing each other at Ctesiphon, the Turks being much superior in numbers and their array gradually swelling as fresh troops arrived from Bagdad. Townshend was in the meantime making all preparations for a retreat and was getting his wounded away—a service of no small difficulty owing to the insufficiency of transport. Then on the night of the 25th he moved off.

His losses since quitting 'Aziziya amounted to 3,500—nearly one-third of his strength. Except in respect to cavalry, the enemy enjoyed a great advantage in numbers, and as soon as the retreat began the Arabs started harrying the retiring force. Still, thanks to Townshend's skilful dispositions and to the resolute marching of his weary troops, no great difficulty was experienced in evading grave molestation during the first four days of the backward march. But, owing to the flotilla of supply transports, barges and fighting craft being delayed by the shoals, and to some of the craft getting aground, a halt had to be called on the 29th. This enabled the pursuing Ottoman columns to come up, and on Dec. 1 they delivered a resolute attack upon the Anglo-Indian force, but the assailants were beaten off after a sharp encounter and the retreat was then resumed. It had been necessary to abandon three steamers, but so great was the effect of the stalwart resistance offered by Townshend's sorely tried little army that it was little interfered with during its last three days of retreat. It assembled at Kut on Dec. 3, having suffered another 1,000 casualties since quitting Ctesiphon, but bringing in the 1,600 prisoners taken on Nov. 22.

So—for the moment—ended the Bagdad adventure. On Dec. 3 the first of the reinforcements spoken of six weeks before (when London and Simla were pressing for an advance) had only started a few days on their four weeks' voyage from France to the Shatt al 'Arab. Military authorities had admitted the possibility of a successful dash on the city, but had denied the possibility of so small a force holding the city unless reinforced; and even had additional troops been available in the country, the water transport to get them up the river was lacking. When Townshend moved forward the best to be hoped for was that he might reach his goal and might then escape if he straightway hurried down the Tigris again. Seldom in the history of war has a military force been committed to an undertaking so unwarrantable.

But worse, from the British point of view, was to follow. For, with the approval of the Home and Indian Governments, Nixon decided that Townshend should stop where he was, although if he did so he was bound to be invested. They assumed too readily that he would be relieved ere his supplies ran out. So his sick and wounded, his cavalry, most of the flotilla and a proportion of his animals were sent off down Tigris, although the civilian population was unfortunately allowed to remain; preparations for a siege were put in hand; and on the 8th Kut was hemmed in on all sides. Its situation in a deep loop on the left bank of the river rendered the place readily defensible against attack, and the German Field-Marshal von der Goltz, who had just taken supreme command of the Ottoman forces in Mesopotamia, perceived that unless it fell to an early assault the main task of his advanced troops would be to guard against a relief. Nur ed Din had four divisions at his disposal, and on the 10th, 11th and 24th he delivered unavailing onsets upon the narrow front that was not covered by the river. Then the siege became a blockade, part of the Turkish army moved down the Tigris to Sheikh Sa'd and 'Ali Gharbi, and the work of constructing formidable lines at Es Sinn on the right bank of the river, and athwart a defile on

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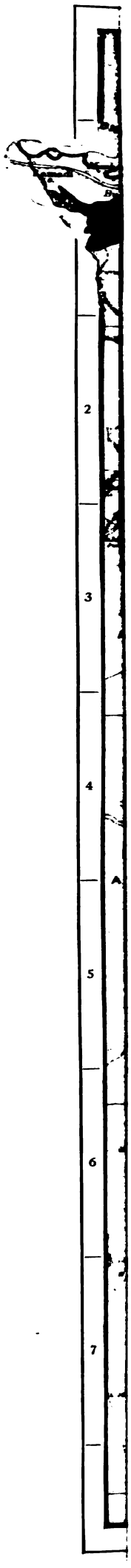

TURKISH CAMPAIGNS
(MESOPOTAMIA)

PLATE II.

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the left bank between the channel and the Suwaikiya marshes, was taken in hand. About the end of the year Khalil Pasha assumed command.

Meanwhile the 7th and 3rd Indian Divs. had begun to arrive in the Shatt al 'Arab in the middle of Dec., and Gen. Aylmer took charge of the troops who were to undertake the relief of Kut. Units as they disembarked were pushed on to 'Amara and proceeded thence up the Tigris. The urgency of joining hands with Townshend forbade delay. There was no time to organize the force properly, it lacked powerful artillery for dealing with entrenchments, and the shortage of river transport multiplied its difficulties. The Turks were nevertheless driven out of 'Ali Gharbi and were on Jan. 6 1916 defeated with heavy loss at Sheikh Sa'd. Three days later Aylmer again defeated them, whereupon they fell back to the lines of Hanna at the entrance to the awkward defile on the left bank of the Tigris. The relieving force had hitherto triumphed over every obstacle; but when on the 21st it essayed the storming of the Hanna position the effort failed; and so numerous were the casualties, coming on the top of losses in the previous actions, that Aylmer had to pause in his offensive and to await reinforcements. About the same date Sir P. Lake succeeded Sir J. Nixon in chief command.

Lake set himself to rectify organization in so far as means permitted, to place Aylmer's line of communications on a better footing, to improve the medical arrangements (which had broken down under the stress of Ctesiphon), and to develop the wharves at Basra and Qurna. Material of all kinds was, however, deficient, and the sands were running out. The Home Government transferred the 13th Div. from Egypt to Mesopotamia on receipt of the bad news from Hanna; but it was now too late to so expand the water transport as to enable the growing Anglo-Indian army to act with real vigour and independence during the few weeks that Townshend could still hold out. Aylmer attempted no forward movement during Feb.; but on the night of March 7–8, without waiting for the 13th Div., he advanced from near Sheikh Sa'd against the Es Sinn position, intending a surprise. This involved a long march in the dark hours; when day broke part of the force had not arrived; and although the Turks were at first in no great strength the attack was delayed. Then when the assailants after a pause of some hours advanced against the reinforced enemy, they were beaten back, and they had to retire to Sheikh Sa'd, having suffered severely in the combat.

The garrison of Kut was already on much reduced rations; but Gen. Gorringe, who had succeeded Gen. Aylmer, could make no fresh attempt for nearly a month owing to transport and supply problems. However, on April 5 the 13th Div., under Gen. Maude, stormed the Hanna lines and penetrated well into the defile on the left bank of the Tigris; but, when first the 7th Div., and then the 13th Div. attacked the Sanna-i-yat lines at the farther end, they were in each case repulsed. Kut could hold out only a few days longer, so Gorringe now tried to advance to the right bank. After making some progress on the 17th in spite of almost insuperable difficulties caused by floods, this movement was brought to a standstill. A final effort was made against Sanna-i-yat by the 7th Div. on the 22nd, which nearly succeeded. Then on the night of the 24th a steamer loaded with provisions tried to run the blockade but failed, and on the 29th Kut with its garrison of 9,000 British and Indian troops surrendered. The attempts to relieve it had cost 24,000 casualties.

The tidings of this very grave mishap gave rise to profound dissatisfaction in the United Kingdom, a dissatisfaction that was aggravated by information gradually leaking out with regard to the sufferings of the sick and wounded after the retirement from Ctesiphon. It was feared that so unmistakable a reverse to British arms in Asia might exert a more untoward influence in the East generally than in the event proved to be the case. As a result of strong feeling in the public mind a commission was, it may be mentioned, set up a few months later by Act of Parliament to inquire into the operations that had taken place in Mesopotamia. The commission did not report till nearly a year later, when the military situation in the land of the Two Rivers had come to be very different from that which had prevailed in May 1916 after the fall of Kut. Its conclusions were to the effect that much in connexion with the undertaking of a campaign on so ambitious a scale without adequate forethought and efficient preparations was worthy of blame, and it animadverted in strong terms on the very unsatisfactory character of the medical arrangements during the early stages of the venture.

No reference has been made hitherto to the Russian forces in Persia. These, based on the Caspian Sea, were actually in occupation of a considerable area of the Shah's northern territories. They did not, however, represent a large body of troops, they were operating in a region of wide extent, and the avenues leading from the tracts in their occupation towards the plains of Iraq traversed rugged and unproductive uplands. For military contingents so situated to have afforded any practical help to the Anglo-Indian army during the critical months that followed Townshend's advance from Kut, was virtually prohibited by the conditions. Nor did their activities furnish indirect assistance to their allies by withdrawing any appreciable proportion of the Turkish forces serving under von der Goltz and Khalil Pasha from the theatre of war on the Tigris.

In view of the disaster which British arms had met with—a disaster directly traceable to those in authority drifting into a comprehensive scheme of warlike operations without providing the necessary means for prosecuting the campaign—it was decided that Kut must if possible be reoccupied. The hot season was, however, at hand. The troops had suffered exhausting trials and had met with cruel loss. Water transport, as well as artillery and war material of almost every kind, remained inadequate. There could be no question of resuming the offensive on the hand-to-mouth lines on which the advance from 'Amara had been initiated a year before, and which Gen. Lake had been obliged to continue when striving against time to relieve Townshend; so that a prolonged pause became inevitable. Von der Goltz had left Mesopotamia and the Turks, as it turned out, manifested no inclination to advance from the scene of their recent triumph—they withdrew, on the contrary, from Es Sinn and formed an entrenched camp nearly all round Kut, while holding on to Sanna-i-yat—and a period of several months in which no active operations took place set in.

Great developments, however, in the meantime took place on the Anglo-Indian line of communications, as also at Basra and Qurna, thanks to Gen. Lake's representations and to his powers of organization. A reasonable amount of heavy artillery was gradually accumulated. A narrow-gauge railway was laid down leading from Sheikh Sa'd to Es Sinn. Landing facilities at the ports were much improved. An additional division arrived from India. Gen. Gorringe was in July succeeded in charge of the troops at the front by Gen. Maude, who, a few weeks later, replaced Sir P. Lake as army commander.

Although much had been effected by the outgoing army commander in respect to organization, Maude realized that there was yet vital work to be done before his forces could act with effect in this peculiarly conditioned theatre of war. A master of administration and endowed with phenomenal energy, he was resolved not to commit his troops to a formidable undertaking until they were furnished with all that was necessary to insure their mobility and their tactical efficiency. From Sept. till the close of Nov. he laboured unceasingly at the base, enjoying full support from the War Office in London, which had definitely taken over charge of the campaign from the Indian authorities. By the beginnng of Dec. he had been furnished with enough river craft, his supply arrangements were in a sufficiently forward state, and he had furthermore a sufficiency of war material at his command, to justify his embarking upon offensive operations of a far-reaching kind, and on the 13th he struck suddenly and with signal success.

Being in occupation of the right bank of the Tigris to a little above Es Sinn, while blocked on the left bank by the fortifications of Sanna-i-yat, the Anglo-Indian army, astride the river, was by the conditions of the case necessarily disposed in echelon, with its left well pushed forward and its right withdrawn. It was organized in two army corps, the I., under Gen. Cobbe, on

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the right on both banks of the water-way, the II., under Gen. Marshall, on the left. Maude's plan was to start by pushing his left still farther forward, to clear the right bank of the Tigris of the enemy to well above Kut, and, when these dispositions had in due course taken effect, to force the lines of Sanna-i-yat with his right. So long as Sanna-i-yat remained in Ottoman hands his flotilla could not advance above that point; but, with the railway from Skeikh Sa'd running to Es Sinn, his troops operating on that side of the Tigris could be supplied, provided they did not advance more than a few miles. Marshall, being on the left, opened the attack by forcing the Shatt al Hai, after a night march, and by capturing some of the Turkish defences which formed a bridgehead S. of Kut. During the struggles that ensued, lasting several weeks, Khalil Pasha's forces offered a stout resistance, and although Maude's operations on the right bank of the great river were uniformly successful, they proceeded slowly and by successive stages. It was not till the middle of Feb. that the whole of the Turkish entrenched camp on that bank was in Anglo-Indian hands and that the Ottoman troops had withdrawn across channel.

No sooner had this part of the programme been accomplished than, on the 17th, Gen. Cobbe attacked Sanna-i-yat. The effort failed for the moment; but five days later the lines were assaulted again, and they were at last carried after a desperate contest in which the Turks lost very heavily. On the same day Marshall's II. Corps by a brilliant feat of arms forced a passage across the Tigris at Shumran. There was then no course left to the Ottoman commander but to abandon Kut in haste and to withdraw his forces as best he could up the left bank of the river. Maude's flotilla instantly pushed up to the front past Kut, which fell automatically into his hands, and the Anglo-Indian army in Mesopotamia could then claim to have won a victory that went far towards wiping out the discomfitures of the previous year. Within the space of two months the military situation had been completely transformed as the result of a happily conceived and resolutely executed plan of campaign that had been rendered possible by prescient and comprehensive organization in rear of the fighting front.

But Maude was not the man to tarry after gaining a signal triumph and thereby to give his vanquished opponents breathing space to recover. His supplies guaranteed by the arrival of his water transport, he pushed on along the left bank of the Tigris on the heels of the fugitive Turks, his troops ready for any exertion in their enthusiasm and full of confidence in their leader. The river channel between Kut and 'Aziziya has many loops and bends, making it difficult for a naval force and a military force to act in tactical concert, but on the 26th the British gunboats, steaming up almost ahead of the mounted troops, destroyed or captured practically the entire Ottoman flotilla after a sharp combat. Great prizes in war material as well as many prisoners were also made by the advancing army. Keeping his own counsel, as was his wont, the army commander had from the outset of his active operations contemplated an immediate advance on Bagdad after expelling the enemy from Kut, and he now requested permission from the Home Government to make the historic city his objective. He received the requisite sanction. But he found himself obliged, in spite of his eagerness to press on, to halt for some days at 'Aziziya for fear of outrunning his supplies—a check which enabled the rear of his army to close up and which afforded the troops a welcome rest, although the brief relaxation in the pursuit gave the Turks time to occupy defensive positions covering the capital.

All being ready, the Anglo-Indian army resumed its advance on March 4, whereupon it was found that the enemy had abandoned Ctesiphon and retired behind the Diala. This river represented a serious military obstacle, and when an attempt was made to force the passage the Turks were discovered to be in such strength and to be so favourably posted that the effort proved in the first instance unsuccessful. Maude thereupon threw a bridge across the Tigris and passed the cavalry and the I. Corps across the channel. Then, his troops pressing forward on either bank, the Diala was forced by Gen. Marshall, opposition on the other side of the Tigris was gradually overcome, and by the 11th the City of the Caliphs was in British hands, the enemy having withdrawn northwards, unable to stem the resolute advance of the victors. Maude, however, allowed no pause in his offensive operations to take place. Cobbe, pushing up the right bank of the Tigris along which a stretch of railway ran as far as Samarra, heavily defeated a Turkish force which attempted to bar his progress at Mushaida, while Marshall cleared the triangle of country between the Tigris and the Diala in the direction of the Jebel Hamrin. Russian forces in Persia had been penetrating into the mountainous country on the Turko-Persian borders while Maude was advancing from Kut, and it had been hoped that they might coöperate effectively with an Anglo-Indian column which was pushed into the hills towards Khanivin; but this project did not materialize. Marshall, however, conducted a most successful campaign on the Shatt al Adhaim during the month of April, inflicting a number of severe defeats upon the Turkish XIII. and XVIII. Army Corps in that direction, and Cobbe completed the operations on the right bank of the Tigris by the capture of Samarra with many prisoners and much war material. Then, having secured possession of a wide area of fertile territory to the N. of Bagdad and driven the enemy in confusion into the deserts and uplands beyond, Maude was at last enabled to afford his victorious troops rest—just as the hot weather set in.

The virtual conquest of Mesopotamia in a four and a half months' campaign had been brought about by the resolute execution of a plan of operations based on correct calculation of requirements. It had been a triumph of forethought and of strategical and tactical skill on the part of a chief who followed up his successes relentlessly and who inspired his subordinate commanders and his troops with his own unconquerable spirit. Neither the stout resistance offered by the Ottoman troops at the outset and which they had maintained even after the tide began to set against them, nor yet the formidable defences which their engineers had elaborated around Kut, had in reality proved the greatest stumbling-block to be overcome. The vast extent of the theatre of war, the lack of communications, and the fact that fighting forces advancing from the Shatt al 'Arab must almost inevitably adhere to the line of the Tigris constituting virtually one long military defile, had interposed even greater obstacles in the path of conquest. But those obstacles had been surmounted as a result of appropriate and effectual organization consummated during the months which had immediately preceded Maude's advance; and during the torrid summer of 1917, when little fighting took place, he was busily engaged in perfecting administration in the territory won, improving communications, and preparing for a fresh offensive in the cold weather.

A railway was constructed from Kut to Bagdad, as the intervening section of the Tigris channel was shallow and awkward to navigate. Sanitation and policing were secured in the capital. Comfort and recreation were provided for the troops. Steps were taken to tap the supply resources of the fertile districts in occupation of the army. A division that had been in reserve at Nasiriya was brought up to the front. Great efforts were for a time made to arrange for coöperation with the Russian forces in Persia; but the influence of the revolution in Petrograd made itself more and more felt in that quarter as the weeks passed, and before Maude started his autumn campaign it had become manifest that little was to be hoped for from that direction. Indeed the situation in Armenia was becoming such as to affect adversely the prospects of the Anglo-Indian host operating in Mesopotamia, and in the late summer there were indications that under German instigation the Turks were contemplating an effort to recover Bagdad. This merely made Maude the more anxious to resume the offensive, and on Sept. 28 he struck his first blow by the capture of Ramadi on the Euphrates, with much booty. This victory was followed by successful operations in clearing the Jebel Hamrin and by the capture of Tikrit on the Tigris at the beginning of Nov. A few days later, however, the army commander was struck down by cholera, and he died on the 10th. He was succeeded by Sir W. Marshall.

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Above Tikrit and extending N. for a long distance, the country traversed by the Tigris is a sterile tract, hilly and broken at some points; the ordinary route from Bagdad to Mosul does not therefore follow the river but takes a line to the E. through Kifri and Kirkuk. Maude had intended to conduct his main advance by this line—a plan of operations which would make it possible for the Russians in Persia to coöperate should they be prepared to do so. The death of the distinguished general, just at the moment when the project was about to be put in execution, created some delay, but his successor set troops in motion through the Jebel Hamrin in Dec. and Kifri was occupied in Jan. Having secured that point, Marshall in the middle of Feb. determined on a sudden advance of his extreme left wing up the Euphrates. Hit was captured, and on the 19th a complete victory was gained over the Turks who had retired up the river from that place; they consisted of the 50th Div., which was surrounded and captured, 5,000 prisoners and all its guns being taken. Difficulties of transport in the meantime hampered the force moving forward beyond Kifri, the distance from railhead being considerable, but on April 29 the Ottoman forces were heavily defeated on the road to Kirkuk, losing 3,000 prisoners, and a week later that town was occupied, much war material falling into the hands of the Anglo-Indian army. In view of the distance of the place from the railway the army commander however decided to withdraw his troops from the place after the booty had been evacuated; the troops then fell back to Kifri, and, the hot weather having now set in, active operations practically ceased for five months. The collapse of Russian fighting power in Armenia had enabled the Ottoman staff to move troops from there down to Mosul and northern Mesopotamia, and scarcely any assistance had been received from the side of Persia; but Gen. Marshall's first campaign had nevertheless been remarkably successful and his position to the N. of Bagdad had been effectually consolidated.

In the meantime a special British mission, sent off in Jan. under charge of Gen. Dunsterville and originally intended for Tiflis with the object of coördinating resistance of Armenians, Georgians and Russians to the Turks threatening Transcaucasia, had been endeavouring to maintain satisfactory relations with the Russians in Persia, and had arranged for supplying food to certain parts of that country which were almost famine-stricken. The allocation of a considerable amount of motor transport to this latter service had indeed somewhat hampered Marshall's operations about Kirkuk and the Persian border. Great difficulties were placed in Dunsterville's way by Russian officials who were tending towards Bolshevism, while open hostility was displayed by certain of the Persian tribesmen. Some Russian troops, however, remained loyal to the Entente and, coöperating with these, small bodies of British troops were gradually pushed up to establish a line of communications between the Anglo-Indian army in Mesopotamia and the Caspian Sea at Enzeli. During the early summer resistance to the Turks in Transcaucasia was gradually breaking down, and at the beginning of July the last of the organized Russian fighting forces in Persia proceeded thither by ship. On the Ottoman troops appearing before Baku shortly afterwards, Dunsterville sailed for that city in Aug., followed by a brigade of British infantry.

He found a complex and disturbing situation to prevail. The Armenian garrison was unreliable. The attitude of the Russian officials was suspicious. Bolshevik armed craft were afloat on the Caspian. The lines constructed for the defence of Baku were of such extent as to require a large force to man them. It soon became apparent that the safety of the city depended entirely upon the meagre British force as the Armenian soldiery displayed little stomach for combat. For a very few weeks Dunsterville and his men did what they could to save the place; but on Sept. 14 the Turks broke through the outer defences, and that night the British reëmbarked and returned to Enzeli, whereupon Baku fell into the enemy's hands. A somewhat risky venture had proved unsuccessful, but it had at least prevented the dispatch of some of the Ottoman troops in Transcaucasia to confront the Anglo-Indian army in N. Mesopotamia.

On news of the fall of Baku reaching London—it occurred just when the season was suitable for commencing active operations in the theatre of war farther to the S.—Marshall was instructed to occupy Mosul, an undertaking for which he had been preparing during the summer. The best of the Turkish divisions in Mesopotamia were at this time assembled astride of the Tigris at Fatha, where the river breaks through the Jebel Hamrin range of hills. A naturally strong position had been assiduously fortified, and the enemy possessed a second fortified position a few miles higher up at the confluence of the Lesser Zab and a boat bridge was established at that point. Realizing that a frontal attack would be hazardous and that, owing to the extreme ruggedness of the ground in the immediate vicinity of the hostile lines a turning movement of the ordinary kind was out of the question, resolved nevertheless to strike a decisive blow, Marshall determined on a combination of war by which adequate mobile forces would be thrown right across the Ottoman communications between Fatha and Mosul. He entrusted the conduct of these operations to Gen. Cobbe, and arranged for a column to advance simultaneously by Kirkuk towards Mosul.

The final campaign in Mesopotamia lasted only a single week, the movement beginning on Oct. 23. Two cavalry columns, that with the shorter distance to cover being accompanied by some infantry, crossed the Jebel Hamrin many miles E. of Fatha and passed the Lesser Zab a long way above its junction with the Tigris. In the meantime the 17th and 18th Divs. advanced against the Ottoman position, the 17th on the right bank and the 18th on the left bank of the Tigris. Finding himself threatened in rear, Isma'il Hakki Pasha, who commanded the Turks, withdrew from the Fatha position to that higher up, followed by the two Anglo-Indian divisions, while the cavalry columns made for the Tigris many miles above the confluence of the Lesser Zab and placed themselves across Isma'il Hakki's line of retreat. The 18th Div. forced a passage across the Lesser Zab on the 25th, whereupon Isma'il Hakki withdrew those of his troops that were on the left bank of the Tigris across the river, and pulled up his bridge. On the 26th the 17th Div. was pressing the Turkish main body on the right bank, and that same day the outer one of the cavalry columns forded the river and began moving down that side of the channel. On the 27th and 28th the 17th Div. was heavily engaged, before it finally made itself master of the enemy's position at the confluence of the Lesser Zab, whereupon Isma'il Hakki retired N. to Sherghat, but on the 29th the last hope of the trapped Ottoman force was destroyed owing to a relieving column from Mosul being defeated by the cavalry. All that day Isma'il Hakki resisted the advance of the Anglo-Indian forces on Sherghat, but on the morning of the 30th, just as the 17th Div. was about to launch a final attack, the white flag was displayed and the 14th and the bulk of the 2nd Turkish Divs. surrendered.

Eleven thousand prisoners, 51 guns and much war material were taken as a result of Cobbe's brilliantly successful operations. Two days later tidings of the signing of the Armistice arrived. The Kirkuk column had, in the meantime, been working its way forward, almost unopposed, toward Mosul. That city was occupied within a week; and so, in a blaze of triumph for the Anglo-Indian forces, the long-drawn-out campaign in Mesopotamia, in which they had experienced both extremes of fortune, came at last to an end, concurrently with the most sweeping tactical success gained by either side during the course of the struggle.

(C. E. C.)

(III.) The Sinai Campaign, 1916–7

When the Dardanelles expedition came finally to an end during the first days of Jan. 1916, the British troops which had been engaged on the Gallipoli Peninsula were dispatched to Egypt, there to refit and reorganize, and to undertake the defence of Egypt against a possible attack by the Turks, who were now freed from any menace on the shores of the Dardanelles. On Jan. 10, the evacuation of Cape Helles having been successfully completed, Gen. Sir Charles Monro handed over his command to Gen. Sir Archibald Murray and returned to France. Sir Archibald Murray's instructions were to protect Egypt against attack

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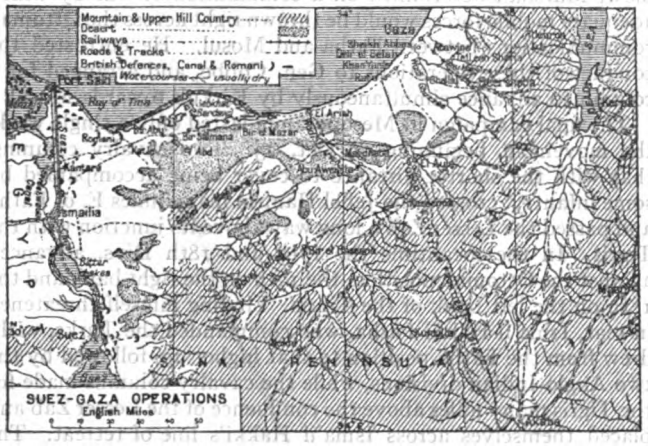
from the E., and to maintain a general strategic reserve of troops for the whole Empire, ready for use wherever required. The reorganization, reëquipping and refitting of the war-worn troops from the Dardanelles was the first consideration. In measure, as this progressed, the "general strategic reserve" was drawn upon to meet the exigencies of other theatres of war; and by the end of June 1916 nine divisions, three infantry brigades, a number of Indian units, and a number of heavy artillery batteries had left Egypt, most of them for the main theatre in France and Flanders. By July, therefore, Sir Archibald Murray's force available for the defence of Egypt against attack from the E. had been reduced to four divisions, three dismounted yeomanry brigades, one mounted division, one mounted yeomanry brigade, and a few Indian and garrison battalions.



During this period, the first half of the year 1916, the scheme of defence on the E. of Egypt had undergone very considerable modification. The rapid depletion of Sir Archibald Murray's force rendered modification essential, while the Russian victory at Erzerum in the spring, and the fact that no Turkish attack on a great scale was to be apprehended during the hot weather, rendered it also practicable. In Jan. Sir Archibald Murray had taken over a scheme, prepared with Lord Kitchener's personal approval, for the construction of a great defensive system, suitable for withstanding an attack with heavy artillery, of which the front line was some 7 or 8 m. of the Suez Canal, and which extended from the head of the Gulf of Suez to the Mediterranean. By Feb. 15, however, Sir Archibald Murray had already written to the chief of the Imperial general staff pointing out that this scheme of defence was very wasteful in men and material, and recommending an advance across the Sinai Peninsula towards the Egyptian frontier, with dispositions for an active instead of a passive defence. He showed that strategically the true base of the defensive zone of Egypt against invasion from the E. was not the 80 odd miles of the Suez Canal, but rather a line less than half as long near the frontier running S. from El 'Arish. From El 'Arish it would be possible to oppose any advance against Egypt directed along the N. Sinai road; to attack in flank an invader moving on the lines of approach farther to the S.; and to undertake rapid offensive operations against enemy concentrations in S. Palestine. Five divisions and not less than four mounted brigades would be required, but this was a considerably smaller force than would be needed adequately to hold the great defensive system prepared from end to end of the Suez Canal. Moreover, the farther the defence was removed from the Nile delta the less would be the unrest and the chances of disturbance in Egypt in the event of attack by the enemy.

As a first step Sir Archibald Murray proposed in Feb. an advance to a suitable position E. of Katia on the N. Sinai road, and the construction of a railway to that place. Katia itself is some 25 m. E. of the Suez Canal, and its importance lay in the fact that round it, and in the district immediately to the E. of it, it is possible to find or to obtain in shallow "wells" a considerable supply of drinkable though brackish water. It was the only district in which any considerable force of the enemy could possibly be collected, and for a time maintained, within striking distance of the Suez Canal. The organization of camel transport for the troops undertaking this advance was immediately put in hand, and the construction of the railway was begun. By the end of May Sir Archibald Murray had established a strong position near Romani, about 20 m. E. of the Suez Canal at the head of the Bay of Tine. This position was held by the 52nd Div., and from it the Australian and New Zealand Mounted Div. was able to keep under constant observation the whole of the "watered" district round, and E. of, Katia. More advanced positions, E. of Katia, were in course of preparation. A standard-gauge railway had reached Romani, and water from the Sweetwater Canal had been brought there by pipe-lines. Lieutenant-General Hon. H. A. Lawrence was in immediate command of this northern portion of the forces in the Sinai Peninsula. Meanwhile the enemy had not permitted this advance to take place entirely undisturbed. Towards the end of April he had made a partially successful raid, which penetrated to some considerable distance W. of Katia and caused the loss of three and a half squadrons of yeomanry besides other casualties. His raiding force was, however, driven off without difficulty, and for about three months he gave no further sign.

By about the middle of July preparations were well in hand for undertaking the advance across the desert to El 'Arish and the Egyptian frontier. Railhead was some 30 m. E. of the Suez Canal. The construction of a large filter plant at Qantara, of a series of storage reservoirs, and of a great new pipe-line had been ordered, with a view to supplying the troops throughout the advance and as far as El 'Arish with half-a-million gallons of water a day from the Sweetwater Canal. Large numbers of camels were being collected, and all manner of equipment designed to facilitate the passage of the desert—from "pedrails" for the wheels of the artillery to wire-netting for roads—was being procured and tested.

Then on July 19 an enemy force was found to be advancing, and to have entered the eastern part of the area of "wells" and palm groves which extends about 18 m. E. of Katia. By the 24th this force had come to a standstill within 10 m. of the Romani position on a line on which it entrenched itself. From that day until the end of the month there was little further movement. During this period it became fairly clear that the enemy's force consisted of the Turkish 3rd Div., of three regiments, with a number of machine-gun companies, mountain artillery, some batteries of 4-in. and 6-in. howitzers and a body of Arab camelry. It was commanded by the German Col. Kress von Kressenstein.

Sir Archibald Murray was in no hurry to force the issue. His troops were in a strong position with all their requirements close at hand, while the enemy, if he attacked, would fight with a desert behind him and very far from his base. All that Sir Archibald required was time to complete the provision of camel transport for Gen. Lawrence's force so as to render its mobility adequate for counter-attack or pursuit, or for attack eventually if the enemy should refuse to take the initiative. General Lawrence was, therefore, reinforced, till he had under his orders the 52nd and 42nd Divs., a brigade of the 53rd Div., two battalions of the 54th Div., a dismounted yeomanry brigade, the Australian and New Zealand Mounted Div. and a yeomanry brigade. By Aug. 1 over 10,000 transport camels had been provided for this force. An independent mobile column, composed of camel corps with a few squadrons of yeomanry and light horse, had also been organized for coöperation from the section of the Canal defences which lay to the S. of that for which Gen. Lawrence was responsible.

Not until Aug. 3 did the enemy disclose his intention, but on the night of the 3rd–4th he launched an attack against Gen. Lawrence's southern flank with the aim of outflanking and enveloping the British force. General Lawrence's prepared defences extended from the sea on the N. southward for some 5 or 6 m., into a region of heavy sand-dunes, with the southern flank refused. The enemy's blow fell first on the Australian Light Horse, the Australian and New Zealand Mounted Div. being posted on Gen. Lawrence's right. These troops were obliged

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very gradually to give ground, while from daybreak on the 4th the enemy's attack developed also against the British centre and left-center, held by troops of the 52nd and 53rd Divisions. The enemy was evidently now fully committed. He appeared, however, to have miscalculated to some extent the direction of his main enveloping attack. As his captured air-reconnaissance reports subsequently showed, he was probably unprepared to find the British right flank extended so far S., and consequently failed to direct his enveloping movement sufficiently far to the westward. General Lawrence had the 42nd Div. in reserve at Pelusium station, 5 or 6 m. W. of Romani, and he ordered this division up to his right in order to be ready to attack the enemy's outer flank. Sir Archibald Murray, meanwhile, ordered the independent mobile column to move out wide round the enemy's flank against his left rear. Naval coöperation was afforded by monitors, whose fire from the sea helped to keep down the fire of the enemy's heavy howitzers.

The enemy's containing attack against the British left and centre was not pressed; his force was insufficient for any such purpose. His main enveloping attack, in a waterless region of soft sand and high dunes, had spent its force by the early afternoon. The march of the 42nd Div. from Pelusium had been delayed, but long before its leading troops could come up the mounted troops, with the reserve of the 52nd Div., had begun to press back the enemy's left, and by nightfall had removed any danger on the southern flank. At daybreak on the 5th the southern front was completely cleared, the 42nd Div. advancing on this flank. Farther N. the 52nd Div. moved out in a south-easterly direction against the enemy's right wing, which assumed the rôle of rearguard, while the mounted troops on its right pressed on eastward. These converging movements drove the enemy back to Katia in the course of the day.

On the morning of the 6th the enemy was found to have retired from Katia, and the mounted troops took up the pursuit. The Turkish rearguards fought stubbornly against the direct pressure of the mounted troops. The independent mobile column with its camelmen, however, working right round the enemy's southern flank, fought a very skilful and successful little action on the 7th which no doubt had a great effect in hastening the retreat; and by the evening of the 8th the enemy was at Bir el 'Abd, some 20 m. E. of the Romani battlefield.

On Aug. 9 the mounted troops made an attempt to envelop the enemy's position and to cut off his further retreat. This attempt was unsuccessful, and a direct dismounted attack was launched which also failed to dislodge the Turks, who made several determined counter-attacks. During the 10th and 11th the situation at this point remained unchanged. But in the meantime the independent mobile column again worked round the enemy's left and fought a sharp action on the 11th, as a result of which the enemy evacuated Bir el 'Abd during the night. The pursuit had to be abandoned on the 12th, and the remnant of the Turkish force retired to El 'Arish.

Out of a force of about 18,000 troops the enemy must have lost about half. Four thousand prisoners, a mountain battery and a number of machine-guns were left in Gen. Lawrence's hands, besides other booty; but the enemy was able to withdraw his heavy howitzers in spite of the difficulty of moving them through the soft desert sand. It is impossible to say under what pressure Col. Kress von Kressenstein undertook this forlorn hope, nor what real prospects he or his superiors conceived it to offer. It failed completely, with the loss of half the force employed. Yet even so Kress may perhaps be accounted fortunate. Somewhat earlier and more vigorous handling of the 52nd Div. against the enemy's right, at the time when his left began to give way on Aug. 4–5, might have rendered it very difficult to extricate any considerable portion of the Turkish force. Again, as was indicated by the successes of the miniature independent mobile column during the pursuit, wider envelopment, especially on the southern flank, by the mounted troops might have effected more than the direct pursuit actually undertaken, and might have cut off the retreat of more of the enemy's troops and guns. It should be said, however, that the weather was exceedingly hot and trying for white troops; the difficulties of watering in the desert were very great; and the going in the soft sand of that part of Sinai was so bad that the infantry rate of marching was reduced to 1½ m. a day.

After this action the enemy remained about El 'Arish on the Egyptian frontier, with an advance force at Bir el Mazar, over 40 m. E. of Romani. Apart from a successful reconnaissance in force against Bir el Mazar, carried out by the Australian and New Zealand Mounted Div. in the middle of Sept., no further fighting took place for a considerable period. The enemy, made nervous by the proof of extended radius of action given by the appearance of Gen. Lawrence's mounted troops before Bir el Mazar, withdrew all his forces to the neighbourhood of El 'Arish.

The instructions given to Sir Archibald Murray by the War Cabinet about this time were to the effect that the policy in Egypt was to be mainly defensive, though all preparations should be made for an advance on El 'Arish. Sir Archibald took occasion to point out that he adhered to his previously expressed opinion that, in order both to occupy El 'Arish and to be able effectively to operate from that neighbourhood against an invader on any of the routes crossing Sinai, he required at least five divisions and four mounted brigades. Actually at this time he had only four divisions available for the defence of Egypt on the E., though he disposed of a sufficiency of mounted troops. Nevertheless, in the situation as it then was, he signified his willingness to defend Egypt and to undertake the advance on El 'Arish with the troops actually at his disposal.

After the action at Romani, therefore, arrangements were actively pressed forward for the advance across the desert to El 'Arish and the Egyptian frontier. In Sept. Gen. Lawrence left to take up a new command elsewhere, and was succeeded by Lt.-Gen. Sir Charles Dobell, to whom Sir Archibald Murray now entrusted the whole of the forces in the Sinai Peninsula and on the Suez Canal. Sir Charles Dobell's command was called the "Eastern Force" of the Egyptian Expeditionary Force.

In the great ebb and flow of the war as a whole, the autumn of 1916 marked, almost everywhere, a turning-point. In the main theatre in the W. the great battle of the Somme roared to a conclusion far more momentous than appeared to those who were looking only for a definite breaking of the German line. In the Russian theatre, on the other hand, high-water mark had been reached in the summer, and Brussilov had been checked. In Rumania von Falkenhayn and later von Mackensen swept over the country to the lines of the Sereth. In the Balkans Gen. Sarrail had captured Monastir, but his offensive had failed to bring relief to the Rumanians. Greece was in a state bordering on chaos. Everywhere in Europe the superficial signs seemed to indicate either turn of tide or definite ebb. In the eastern theatres affairs seemed somewhat better. The Russian front had been reconstituted in Armenia, though there was little progress anywhither. In Mesopotamia, since the fall of Kut, the hot weather and the necessity for reorganization and preparation had forced a suspension of active operations. Only in the Sinai desert was any forward movement in progress,—one of the least of all the eddies of the war. In Arabia, the Grand Sherif of Mecca had proclaimed independence of Turkey.

The new Government in England, pressed by man-power questions after the losses in the Somme battle and increasingly feeling the submarine menace, probably turned its eyes rather naturally to the eastern theatres for something to show in the way of success, when Sir Stanley Maude's preparations should have been made, the Arabs should be in motion, and Sir Archibald Murray nearing El 'Arish. In any case it was pointed out to Sir Archibald Murray early in Dec. that the gaining of a military success in his theatre was very desirable. Sir Archibald Murray continued to adhere firmly to his original opinion that a fifth division would be necessary if he was to hold and to operate from El 'Arish, and he asked for a sixth division if he should be required to make any further advance. In reply, he was told that the War Cabinet was not prepared to send him additional troops. He was to make the utmost effort during the winter, but his primary mission was the defence of Egypt.

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In the meantime the movement on El 'Arish had progressed with such speed as was possible where the pace had to be set by that of the construction of the railway and pipe-line. Early in Dec. Gen. Dobell's advanced guard, which was called the Desert Column, came under the command of Lt.-Gen. Sir Philip Chetwode. This force varied in strength from time to time according to circumstances. On Dec. 10, when railhead was within 20 m. of El 'Arish, and the final advance was in view, Gen. Chetwode had under his command the Australian and New Zealand Mounted Div. and the 42nd and 52nd Divs.

The enemy had about 1,600 infantry in El 'Arish with supporting forces at Magdhaba and Abu Aweigila, and he held the only water supplies. The supply of water for the final advance of the Desert Column required the most elaborate arrangements and the establishment of a large reserve of water, rail-borne from Bir el 'Abd, at railhead. Thus the movement had to be delayed till Dec. 20. Just before the advance of the Desert Column the enemy hurriedly withdrew, and Gen. Chetwode's mounted troops, surrounding El 'Arish after a 20-m. night march on Dec. 20–21, found the place unoccupied.

The nearest Turkish force was at Magdhaba, about 20 m. S. of El 'Arish, and consisted of some 1,600 infantry with four mountain guns. During the night of Dec. 22–23, Gen. Chauvel, commanding the Australian and New Zealand Mounted Div., led a column composed of the majority of his mounted troops and the Imperial Camel Bde. against this force. The enemy's position was reached in the early hours of the morning. Some sharp fighting ensued. The enemy was practically surrounded by mid-day; but no water having been found for his horses Gen. Chauvel was faced with a situation in which, if he could not force the enemy's surrender before nightfall, he would have had to withdraw. By the late afternoon, however, the enemy's stout resistance was overborne, and practically the whole of his force was killed, wounded or captured. Four guns and 1,282 prisoners were taken, at a cost of under 150 casualties.

After this the enemy withdrew the few small posts which he had maintained farther S. within the borders of Sinai, and the only Turkish force remaining in Egyptian territory was a detachment about 2,000 strong near Rafa, the frontier post on the "road" into Palestine, some 25 m. E. of El 'Arish. On the night of Jan. 8–9, Gen. Chetwode moved out against this force with the greater part of the Australian and New Zealand Mounted Div., a mounted brigade (yeomanry) and the Imperial Camel Bde. The long night march was carried out with remarkable speed and efficiency; the enemy was completely surprised, and found his position almost entirely surrounded as day broke. As at Magdhaba, however, he offered a very determined resistance, and again he held the only water obtainable for Gen. Chetwode's horses. In the middle of the afternoon a small relieving force approached from Shellal; this force was, however, neither in time nor strong enough to effect its purpose. At one time it looked as if the Turks might hold out long enough to force Gen. Chetwode to relinquish his hold; but by 5:30 P.M. their resistance had been worn down and their position taken. The whole of the Turkish force, with its commander, was accounted for, and Gen. Chetwode returned to El 'Arish with over 1,600 unwounded prisoners, four mountain guns and other booty, his own casualties being less than 500.

As a result of these two actions—both admirable examples of the tactics of mounted troops relying on fire action—the Sinai province of Egypt was finally freed from the enemy.

The defender who holds the country between Gaza and the sea on the W. and Beersheba on the E. commands the access to S. Palestine from the direction of Egypt. East of Beersheba, a mountainous country, lacking roads and water, opposes a barrier which could only be overcome by preparations so long and arduous as hardly to admit of their inception. At the beginning of 1917 the enemy held Gaza and Beersheba, and, after the actions at Magdhaba and Rafa, began to concentrate his advanced force at Shellal, a point on the Wadi Ghuzze nearly equidistant from Gaza and Beersheba, and some 7 or 8 m. in front (from the Turkish point of view) of the general line between those places. From Shellal he was in a position to watch the approaches to Gaza and to Beersheba, and to cover his lines of communication to those places—especially the railway to Beersheba from the north. Behind the advanced position which the enemy began to prepare at Shellal lay the line of ridges which, running almost direct from Gaza to Beersheba, dominated the open plain to the S.W. and formed a naturally favourable line on which to organize a strong defensive position to bar the way into S. Palestine.

Meanwhile, the desert railway having been pushed on through El 'Arish to within a few miles of the Egyptian frontier, Gen. Dobell advanced his headquarters to El 'Arish before the end of Feb. Sir Archibald Murray, so far from receiving the fifth division which he had always held to be necessary for the further prosecution of the campaign, was now required to send one of his divisions to France—the 42nd. This left available for the eastern force only three divisions, the 52nd, 53rd and 54th, with the nucleus of a fourth—the 74th—to be formed from dismounted yeomanry; but the satisfactory position of affairs in Egypt and the western desert enabled the available mounted troops to be increased to two mounted divisions.

It had by now been made clear to Sir Archibald Murray that the forward policy of Dec. had been altered. The general situation of the Allies, envisaged as a whole, had developed and wore a new aspect. Naturally there could be no ground for surprise at any alteration or transformation of the policy governing the conduct of operations in one of the very minor theatres. On Jan. 11 1917, the day on which, in France, the British attack was launched against the Beaumont Hamel spur, Sir Archibald Murray was told that his primary mission was the defence of Egypt during the summer months and the preparation of an offensive campaign in the autumn. Meanwhile Beaumont Hamel developed into the great German retreat in the west. Nearer to Egypt, the Rumanian retreat came to an end—Wallachia lost but Moldavia held; and Gen. Maude's victorious campaign in Mesopotamia carried him from success to success past the ill-omened Kut to the capture of Bagdad.

Nor were these happenings without effect upon the attitude of the Turks on the confines of Egypt. Early in March the enemy evacuated his positions near Shellal before he could be attacked. His general intention appeared to be to avoid battle, trusting to the severe limitations set to the pace of Gen. Dobell's advance by the difficulties of overcoming the desert. Thus he would conserve his strength, retain his liberty of action in other directions, and choose his ground at leisure for an eventual contest *à outrance* in S. Palestine. Obviously this did not suit Sir Archibald Murray's plans.

In the early days of March the Turkish dispositions were as follows: rather less than a division (say 7,000 fighting troops) held Gaza; about a division was in the neighbourhood of Tellesh Sharia, roughly half-way between Gaza and Beersheba and 15 m. distant from either; and a small garrison occupied Beersheba. In these circumstances, apart from the desirability of foiling the enemy's Fabian tactics, to which reference has been made, Sir Archibald Murray was influenced by other considerations of more or less weight. In order to make adequate preparations for a serious autumn offensive, in accordance with the instructions of the War Cabinet, it was necessary to move railhead forward, and for this purpose it was necessary to advance to within a few miles of Gaza and to seize the line of the Wadi Ghuzze. Further, the enemy's detachment at Gaza was a day's march distant from any supporting troops; by an operation of the same nature as—though on a greater scale than—those at Magdhaba and Rafa it might be disposed of by a *coup de main*. Finally, such a *coup de main*, if successful, might result in Gaza passing not only temporarily, but perhaps permanently into British hands. If so, the effect would be to open the gate into S. Palestine and to make it impossible for the Turks to hold the naturally strong Gaza–Beersheba line as their first line of defence, when the time came for the main effort later in the year.

General Dobell commanding the Eastern Force, and Gen. Chetwode commanding the Desert Column under him, agreed that the chances of capturing Gaza by a *coup de main* were on

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the whole favourable. General Dobell reported accordingly to Sir Archibald Murray, being careful, however, to add that all would depend on whether or not the enemy's resistance could be broken before nightfall on the day of attack; if the decision should be longer delayed the Turkish force from Tellesh Sharia would probably interfere, and water difficulties might in any case make it necessary to draw off the attacking force. On the whole Gen. Dobell thought the game worth the candle. Sir Archibald Murray, after hesitation, signified his consent.

The problem with which Gen. Dobell had to deal was no easy one. Surprise and celerity were the two essentials. In order to retain the element of surprise he must strike while yet his advanced base was so far off that the Turks should think themselves securely beyond his reach. Actually, when the operation was launched, his railhead was full 20 m. from Gaza. This involved an exceedingly difficult series of approach marches to the place of concentration, in a country where water was very scarce, supplies wholly lacking, and concealment by day very hard to secure. A considerable portion of the force had three consecutive marches to make under these conditions in order to reach the scene of action undiscovered. The movement once started, therefore, no alteration or postponement was possible without the practical certainty of its being discovered, and the chance being lost for all. Moreover, in order so far as possible to insure a rapid decision, Gen. Dobell was obliged to employ a large force. There were two and a half Turkish divisions—somewhat weak, it is true—at, and within a day's march of, Gaza. General Dobell employed the Desert Column (two mounted divisions and the 53rd Div.), the 52nd and 54th Divs. and the Imperial Camel Bde. But even the difficulties of moving this force in secrecy to a place of concentration 20 m. in advance of railhead were less than the difficulties of providing it there with the necessary ammunition, water and supplies, and of maintaining that provision during the action. The whole of the transport of the Eastern Force had to be pooled and rearranged. The troops had to be deprived of all but the barest minimum. Fifteen "trains," each carrying one day's supplies for a mounted division or a division, were improvised in about as many days. Camel water convoys were prepared. Ammunition columns were specially grouped and organized. Every available horse, mule and camel, every available cart and waggon, Ford car and caterpillar tractor, whatever its normal use, was pressed into this service. The troops marched with the barest essentials. And, as the result—no small feat of organization—two mounted divisions were given a 30-m. radius of action, two and a half divisions a 20-m. radius of action, and the remaining half division what was required to enable it to protect and assist the line of communication from railhead forward.

In essence, then, the operation was a raid on a great scale, and, as has been said, Gen. Dobell made it clear that he considered that success depended on his being able to force the surrender of the Gaza garrison before dusk on the day of attack. He came within an ace of succeeding.

The concentration took place successfully and without alarming the Turks by the night of March 25–26. In the early hours of March 26 the mounted troops crossed the Wadi Ghuzze to surround Gaza from the N. to the S.E.; thus they would be in a position to cut off the retreat of the garrison and to prevent or much delay the arrival of Turkish reinforcements whether from the N. or from the direction of Tellesh Sharia. The 53rd Div., which was to attack the enemy's position on the heights E. and S. of Gaza, of which 'Ali Muntar was the chief feature, followed the mounted troops, and was in turn followed by the 54th Div., to support the 53rd and to protect its exposed right flank.

The mounted screen was in position, though not without delay, yet in good time. The infantry was late owing to a cause which no one could either have foreseen or prevented. As dawn broke a dense fog spread over the land from the sea. The troops could only grope their way slowly and uncertainly. They were delayed in reaching their position of deployment. No attack could be delivered until the fog had cleared. Nor did the fog clear until 8 o'clock, when two precious hours had been lost. At the end of the day those two hours would in all human probability have made victory complete.

By 10 A.M. the battle was joined. By the early afternoon the 53rd Div. had fought its way close to its objectives. But the Turkish position was very strong, and the ground over which the attackers fought their way forward was absolutely devoid of cover. General Chetwode, then, ordered the Australian and New Zealand Mounted Div. to attack the town from the N. and N.E., while the Imperial Mounted Div. and the Camel Bde. were to extend so as to take over the screen on the N. of Gaza as well as on the E., though the Turkish reinforcements were already seen to be approaching from N., N.E. and S.E.

Before 5 o'clock the 53rd Div., strengthened by a brigade of the 54th, had taken 'Ali Muntar and had pushed beyond the crest of the line of heights overlooking Gaza. The Australians and New Zealanders were in the north-eastern outskirts of the town, fighting among the cactus hedges. N.E. and E. of the battle, the weakened mounted screen held off the enemy reinforcements, but was being slowly forced to give ground.

Two more hours of daylight were required. Gaza lies in, and is bordered by, an immense labyrinth of great cactus hedges, impossible to fight through and clear by night. The 53rd Div. and part of the 54th were extended on the hills over Gaza on a line facing nearly N.W. Below among the houses and cactus hedges was the Gaza garrison, still not surrendered. Bearing down on the very point of the exposed right flank of the 53rd Div. was a strong Turkish force, now within a few miles. Approaching the back of that same exposed right flank was another strong Turkish force, also within a few miles, coming from the direction of Tellesh Sharia. The thin mounted screen could not long delay these forces; no water had been found for the horses all day, and it must in any case be soon withdrawn. Part of the 54th Div. protected what was now the rear of the 53rd on the Mansura and Sheikh 'Abbas ridges S. of Gaza. One brigade of the 52nd Div. was available and no more. This was far from sufficient to protect the right of the 53rd Div. in its actual position, and at the same time to join it securely with the 54th. The one day's fighting, for which alone it had been possible to make effective arrangements as regards water supply, was drawing to a close. No water had been found in the Wadi Ghuzze or elsewhere by the parties detailed to search for it; and the water supply of the troops already engaged was now a matter of some anxiety. Half an hour before sunset, then, there were two alternatives. One was to launch the 53rd Div. and the Australian and New Zealand Mounted Div. down into Gaza in an attempt by night to clear up, or even to drive back into the Wadi Ghuzze, the disorganized remnants of the garrison, while using the 54th Div. and the Imperial Mounted Div. as a rearguard during the night. The other was to withdraw the mounted troops while the way between Gaza and the Turkish reinforcements was still open, and to form some sort of line on the ground won, by advancing the left of the 54th Div. and retiring the right of the 53rd until the two flanks met in a secure junction. General Dobell thought the former alternative, on a dark night, in unknown and extremely intricate country, with strong enemy reinforcements already on the very outskirts of the battle, too hazardous. General Chetwode, who was at this time at Gen. Dobell's command post, emphatically agreed.

The second alternative was, therefore, adopted, and Sir Archibald Murray, who had come up in his travelling *poste de commandement* on the railway to Khan Yunis, within a few miles of the action, was informed accordingly. Several hours later Gen. Dobell received from Cairo the decipher of an intercepted wireless message sent by the enemy commander in Gaza indicating his intention to surrender. This message had been sent in the early evening. Its receipt by Gen. Dobell was too late. But even had it reached him earlier it is not easy to see how, with darkness actually falling and the enemy's reinforcements at hand, he was to have taken advantage of it. The two hours' fog on the morning had destroyed his opportunity.

The new dispositions ordered were successfully taken up during the night—not without protest from the commander of the

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53rd Div., who had to withdraw his right from 'Ali Muntar. Early on the 27th his patrols again occupied the hill. But the Gaza garrison had now been reinforced, and the patrols were driven off again. The point of junction of the 53rd and 54th Divs. was now the apex of an acute salient. The latter division, in order to join the former, had had to leave the Sheikh 'Abbas ridge, on which the Turks now appeared. The 54th Div. and the Camel Bde. on the S.E. face of this salient were heavily attacked. All attacks were repelled, but the position towards the apex of the salient grew more and more precarious. General Dobell, therefore, ordered a further retirement during the night of the 27th–28th to a strong position on the W. bank of the Wadi Ghuzze. This movement was successfully carried out and the action came to an end.

The advance to the Wadi Ghuzze had been effected, covering the further progress of the railway. The enemy had been brought to battle and was now pinned to the Gaza–Beersheba line. Nearly a thousand of the enemy had been taken prisoner, besides two guns, and he had lost several thousand killed and wounded. The cost of this to Sir Archibald Murray was some 4,000 casualties. Gaza, however, and its garrison had escaped, though this was owing to climatic conditions against which both commander and troops were powerless.

In spite of the fact that an unkind fate had snatched away the fruits of complete success just as they were within Gen. Dobell's grasp, in Sir Archibald Murray's view the military results of the action had justified his anticipations. The enemy had been brought to battle, and had been severely mauled, and the advance of the railway to the Wadi Ghuzze was assured. It will be remembered that the instructions under which Sir Archibald Murray was acting at this time were to defend Egypt during the summer and to prepare for an offensive campaign in the autumn. The railway could now be pushed forward sufficiently to admit of what would be required.

Meanwhile, within three days of the Gaza action, Sir Archibald Murray suddenly received altered instructions. The general strategic situation was again changing. In France the great German retreat was slowing to a halt on the Siegfried line; the preparations for the battle of Arras were in hand, and farther S. the second battle of the Aisne was shortly to begin. In Russia the revolution was fairly launched. In Mesopotamia Sir Stanley Maude was driving the Turks far from Bagdad towards Samarra. Sir Archibald Murray was ordered accordingly, on March 30, in view of the altered situation, to make his objects the defeat of the Turks S. of Jerusalem and the occupation of that city. Sir Archibald replied that he still required the five divisions which he had always considered necessary for a further advance—an estimate from which he had never varied; he also indicated that the prospects of a rapid advance were to say the least doubtful. In reply, he was instructed to push his operations with all energy, though no additional troops could be sent to him, since it was considered that, in view of the military situation of the enemy, his present force would suffice. Undoubtedly the latter portion of this instruction was unhappily expressed. The War Cabinet, with the whole strategic situation in its view, was no doubt more competent than Sir Archibald Murray to judge of the advisability of taking certain risks on the Palestine frontier, so there can be no question but that the alteration in the instructions was justified. But Sir Archibald Murray, on the other hand, was more competent than the War Cabinet to judge of the actual military situation of the enemy opposed to him, and of the probable sufficiency for their task of the forces of which he disposed. However, immediate preparations were begun for a renewed offensive, and on March 30 Gen. Dobell moved forward the Eastern Force headquarters to Deir el Belah, on the coast some 8 or 9 m. from Gaza.

If anything was to be done quickly, as the War Cabinet's new instructions evidently contemplated, there was nothing for it but a renewed attack on Gaza. Already Gen. Dobell's thoughts had been turned in the direction of Beersheba; but, in discussing with Sir Archibald Murray the question of operating by his right, he was constrained to say that it was difficult to estimate how long a delay would be involved in the preparations necessary for such an undertaking. The whole of the existing organization, and in particular the position of the railway running close to the sea-coast, restricted the area in which it was immediately possible to undertake serious operations on the confines of the desert to within a very strictly limited distance from railhead. To prepare for an effective operation farther to the right would involve weeks of preparation and rearrangement. Sir Archibald Murray decided, therefore, to attack Gaza again, and instructed Gen. Dobell accordingly.

In any case a vast amount of preparation had to be made. The Turks were daily increasing their force on the Gaza–Beersheba line, and it was evident that Gen. Dobell's troops, specially lightly equipped for the passage of the desert, would have to be organized for the battle on more normal lines. The divisional artilleries, which had had to be reduced in the desert, had to be increased again; heavy guns and howitzers had to be railed up and heavy artillery groups formed. A few tanks were brought up, and the troops had to be instructed in methods of coöperation with this new weapon which they had never before seen; they had also to learn the use of gas shell and smoke-clouds. New large-scale maps had to be made and issued, including trench maps hastily prepared and incessantly revised from aeroplane photographs. Aircraft coöperation with the artillery had to be reorganized. The latest methods, in these and a hundred other matters, found advantageous by experience in more important theatres, had to be hurriedly assimilated by an army which had just painfully emerged from a 15-months' sojourn in the wilderness, and whose last pitched battle, so to speak, had been fought on the Gallipoli Peninsula. The limited capacity of the communications and transport available made the organization of the supply of ammunition and engineer stores a matter of great complexity. Preparations for water supply were far more difficult and arduous still. Arrangements had to be made for bringing up rail-borne water from pipe-line head at Rafa to Deir el Belah, and for pumping it thence by a small pipe-line into tanks prepared in the Wadi Ghuzze. Scores of wells were sunk in the wadi. Several hundred thousand gallons storage capacity was prepared at these wells, and by repairing and filling the great underground grain-reservoirs of the natives in the neighbourhood. Scores of prepared crossing-places over the Wadi Ghuzze had to be made and allocated to the various formations, arms and transport. Between March 30 and April 15, however, all this work was practically completed, and Sir A. Murray brought up his advanced G.H.Q. to Khan Yunus, on the railway about 6 m. S.W. of Deir el Belah.

By this time the enemy had five divisions and a force of cavalry in line, and he had been considerably strengthened in heavy artillery. The Gaza defences were now strong and well wired, and the Turkish trench system extended S.E. from Gaza for some 7 m. to the Atawine ridge. Farther to the S.E. the defensive system was less continuous, but one division was about Tellesh Sharia (16 m. from Gaza) and between that place and Atawine. Beersheba was also held.

General Dobell disposed of the 52nd, 53rd and 54th Divs., the still incomplete 74th Div. in process of formation from dismounted yeomanry, the two mounted divisions of the Desert Column, and the Imperial Camel Bde. The French battleship "Réquin," and H.M. Monitors 21 and 31 were also to coöperate by fire from the sea when the time came. General Dobell had planned his operations in two stages. The first stage was limited to securing the outer defences from the sea to Sheikh 'Abbas, a commanding feature rather over 4 m. S. of Gaza. The second included the attack on the 'Ali Muntar position and Gaza.

The first stage began at dawn on April 17, and success was complete. The 52nd and 54th Divs. took all their objectives by 7 A.M. with but few casualties. The 53rd Div. on their left pushed forward reconnaissances along the coast. One mounted division protected the right of the 54th Div.; the other watched and immobilized the enemy's force about, and W. of, Tellesh Sharia. The ground gained was consolidated, and final preparations for the second stage completed on the 18th.

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On the 19th the bombardment of the enemy reopened at dawn, the "Réquin" and the two monitors now joining in the battle. At 7:15 A.M. the 53rd Div. launched its attack along the coast. A quarter of an hour later the 52nd and 54th attacked—the former astride the ridge running S.W. from 'Ali Muntar, the latter, with the addition of the Imperial Camel Bde., immediately on the right of the 52nd. Farther to the right again the Imperial Mounted Div. made a dismounted attack on Atawine, while the Australian and New Zealand Mounted Div. protected the extreme right flank, and prepared to take advantage of any success gained by the Imperial Mounted Div. The 74th Div. was in reserve W. of Sheikh 'Abbas.

The 52nd Div. was the first to be checked, after progressing about half-way to its objective at 'Ali Muntar. This resulted in checking also the progress of the 53rd Div. on its left, and the left of the 54th Div. on its right. The right of the 54th Div., however, entered the enemy's works at Khirbet Sihan, just W. of the Atawine ridge, while the containing attack of the Imperial Mounted Div. was successful in occupying the defenders of the Atawine works. But the situation of the 54th Div. was far from favourable. Owing to the continued inability of the 53rd to make headway its left was exposed to heavy enfilade fire from 'Ali Muntar, while its right, with the Camel Bde. thrust far forward, was subjected to a series of determined counter-attacks. In this position, reached in the early afternoon, the battle swayed with little change for the rest of the day. Air reconnaissance indicated that the enemy's reserves had not yet been drawn in, and Gen. Dobell, though moving part of the 74th Div. closer up, would not be the first to launch his last reserve, especially in view of the fact that it was the 52nd Div. which was checked and that the reserve brigade of that division had not yet been employed.

Towards evening Gen. Dobell reported the situation to advanced G.H.Q., when Sir Archibald Murray instructed him by telephone that all ground gained must without fail be held and the attack resumed under cover of an intense artillery bombardment at dawn on the 20th. General Dobell issued his orders accordingly, and as night fell every preparation for the pursuance of the offensive was actively in hand. Between 10 and 11 o'clock at night, however, Gen. Dobell was in communication with the Desert Column and all his divisional commanders, who by this time had received more detailed and accurate reports of the situation on their respective fronts. These reports made it clear that the enemy's resistance nowhere as yet showed any signs of weakening, that the British casualties amounted to some 7,000, and that the prospects of being able to make any considerable further progress without a much longer, more intense, and less hurriedly planned artillery preparation, were, to say the least, dubious. By 1 A.M. the new artillery plan, including the divisional arrangements, was ready. General Dobell was not satisfied that in the time, and with the means available, the prospects of success were sufficient to warrant the immediate resumption of the action. Telephonic communication with divisional commanders and their artillery chiefs more than confirmed his doubts. General Chetwode, commanding the Desert Column, was equally clearly of opinion that the prospects were not sufficiently favourable to justify a hurried resumption of the attack. About 4 o'clock in the morning, therefore, Gen. Dobell issued orders to postpone further operations, with Sir Archibald Murray's assent.

The ground gained was consolidated during April 20 and following days. The enemy made no serious counter-attacks. It became clear that, before Gaza, there was nothing for it but the deliberate methods of trench warfare. The alternative involved long preparation, new communications, and an eventual movement far away in the direction of the British right flank. On April 22 Sir Archibald reported to the War Office that with his present force he could not count on more than a local success; and here the Sinai campaign proper came to an end.

There was no further considerable action during the spring or summer. The opposing lines stabilized, and there ensued a period of preparation and training, of trench-raiding, and of enterprises by mounted troops and camelry in the direction of Beersheba, and against the railway running S. from that place which was demolished. But the Sinai desert had been conquered and passed. The defence of Egypt was secure. And room had been gained for the preparation of a great offensive campaign in the autumn. Thus the mission assigned to Sir Archibald Murray at the beginning of the year had been fulfilled. Meanwhile, at the headquarters of the Eastern Force, where Lt.-Gen. Sir Philip Chetwode had now succeeded Sir Charles Dobell, the plans were already in course of preparation which were to become the basis of the great campaign fought in the autumn by Gen. Sir Edmund Allenby, who succeeded Sir Archibald Murray in the Egyptian command in June. (G. P. D.)

(IV.) The Palestine Campaign

The successful defence of Gaza on April 19 1917, when Gen. Kress von Kressenstein for the second time in little more than three weeks had beaten off formidable British attacks, was followed by a prolonged pause while both armies went into "summer quarters." Every effort was made on both sides for a resumption of the struggle in the autumn, and by the beginning of Aug. 1917 the German staff, realizing that the next British effort was likely to be considerably more formidable than the last, represented to Constantinople that the Gaza–Beersheba line was inherently weak in that its left flank was "in the air," and that the only remedies were either readjustment, involving withdrawal, or reinforcement on a generous scale.

Unhappily for the Ottoman cause political ambitions came into conflict with military necessities. The loss of Bagdad on March 11 1917 had been a blow to the prestige of the Sultan, more severe in that it followed upon that of Mecca, and the Pan-Islamic party in the capital was insistent that steps should be taken to retrieve the loss and rehabilitate the Ottoman Khalifates in the eyes of the Moslem world by a triumphant recovery of the city of the Khalifs. In this contention the Pan-Islamic leaders were supported by Berlin, where the influence of alliterative war cries indicative of future trade domination was strong. "Berlin to Bagdad" still reigned in official and public esteem, not yet supplanted by "Hamburg to Herat."

In consequence of this political counter-attraction Constantinople sent men and supplies for the reconquest of Iraq (Mesopotamia), until it was persuaded to realize that the Palestine front, if starved of needed reinforcements, would inevitably give way in a *débâcle* which might permit an active enemy to advance up the whole length of Syria and establish himself on the Upper Euphrates, thus cutting off the whole of the force in Mesopotamia from communication with Constantinople except by way of the railless and mountainous Armenia and Kurdistan. The Pan-Islamists fought hard for their policy and succeeded in delaying the dispatch of troops to Palestine until the middle of October. It was then too late, but this was not realized.

As soon as Constantinople had accepted the principle that the presence of a powerful British striking force in front of Gaza constituted a menace to the operations destined for the recovery of Bagdad, Marshal von Falkenhayn, in command of the Yilderim Army Group, then at Aleppo, was directed to drive the British back into the Desert of Sinai. The marshal planned to strike at the British right flank, which, it was thought, had probably been weakened in order to mass troops upon the left for the expected third assault on Gaza. It was proposed to start this Turkish offensive about the middle of Oct., which would forestall the British offensive, calculated by the German staff to be due in the first week of November.

Serious difficulties, however, arose which fatally delayed the completion of these dispositions. In the first place the Turkish transport was poor. The sector of the Turkish lines of communication from Bozanti, the then railhead from Constantinople or, rather, Haidar Pasha on the Asiatic shore of the Bosporus, to Beersheba, was under the Syrian Western Arabia command of which Ahmad Jemal Pasha was G.O.C.: unfortunately this politician was jealous because the command of the Yilderim Group, which since the beginning of July 1917 had included his

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own army, had been given to a German. He made trouble and caused delays in the working of a system which could not really have been efficient even if worked with perfect goodwill.

As the Taurus and Amanus tunnels were not yet open for ordinary traffic, all stores coming from the W. to Bozanti had to break bulk there and, reloaded into narrow-gauge trucks, to be taken through the tunnel by compressed air engines, or hauled by lorry, mule or camel to Dorak, where they were again packed into standard-gauge trucks. The same performance had to be repeated at Baghche for transport across the Amanus to Islamié. Stores could be taken thence in standard-gauge trucks as far as Rayak, where they had to break bulk for the fifth time to be restowed in narrow-gauge trucks for Damascus, where, owing to lack of railway rolling-stock, a portion was sent to the front by lorry via Jisr Banat Ya'qub on the Jordan, Nazareth, Nablus and Jerusalem. Where railway rolling-stock was available fuel was often scarce, locomotives had to be adapted to burn wood, and instances occurred of this being supplied in unsuitable lengths, so that trains were delayed while the crews cut up the wood afresh before it could be fed to the furnaces.

General Allenby, however, having brought his railway right up to the front and constructed a strategic development of his pipe-line in addition, to the considerable improvement of his local water supplies, determined to forestall the impending Turkish offensive. His force was disposed along a front of some 22 m. from Gaza to Gamli and beyond to where the Desert Mounted Corps had detachments as far inland as Asluj, 38 m. from the coast. On the eve of the British attack the rival forces were disposed as follows. Facing one another in the strongly fortified Gaza sector were the Turkish VIII. Army (Gen. Kress von Kressenstein) consisting of the XX. Corps (3rd, 7th and 53rd Divs.—the 7th being in reserve near Herbie, 10 m. behind the line) and the XXII. Corps (16th, 26th, Fakhr-ed-Din Bey, and 54th, Nasuhi Bey, Divs.) aligned out towards Tellesh Sharia, opposing the British XXI. Corps (Lt.-Gen. Sir E. Bulfin) consisting of the 52nd (Lowland), Maj.-Gen. Hill, the 54th (East Anglian) Div., Maj.-Gen. Hare, and the 75th Div., Maj.-Gen. Palin. The British XX. Corps (Lt.-Gen. Sir P. Chetwode), consisting of the 53rd Welsh Div. (Maj.-Gen. Mott), the 60th London Div. (Maj.-Gen. Sir J. Shea) and the 74th Yeomanry Div. (Maj.-Gen. Girdwood), was wheeling into position in support of the Desert Mounted Corps (Lt.-Gen. Sir H. G. Chauvel), consisting of the 4th Cav. Div. (Maj.-Gen. Sir G. Barrow), the Australian and New Zealand Mounted Div. (Maj.-Gen. Sir E. W. C. Chaytor) and the Australian Mounted Div. (Maj.-Gen. Hodgson); this was concentrating near Khalasa for its swoop upon Beersheba, held by Ahmad Feizi Pasha's VII. Army consisting of the III. Corps (Ismet Bey)—composed of the 24th Div. (Wilmer Bey), the 27th (Arab) Div. in Beersheba itself, with the 3rd Cav. Div. in front of it, and the XV. Corps, which was hardly constituted as yet, its 19th Div. (Sedad Bey) being still in the XX. Corps area behind Gaza on its way to the front, and its 20th Div. being still on the lines of communication S. of Aleppo and not destined to arrive even at Ramleh, far in the rear, until Nov. 6. General Allenby further had the support of certain warships, H.M.S. "Grafton" (a "blister"), four monitors, 15, 29, 31 and 32, the destroyers "Staunch" and "Comet" and the gunboats "Amphis" and "Ladybird," which were able to enfilade the Turkish positions near Gaza and destroyed important ammunition dumps.

During the night of Oct. 30–31 1917 the British XX. Corps had moved forward to positions of deployment, and at dawn, when the Desert Mounted Corps had got right round to the E. of Beersheba, the 60th and 74th Divs. were ready to close in from the W., while the 53rd Div. at Abu Irgeig threatened the Turks along the Wadi Saba front in such a position as to break through them and take in flank any reinforcements which might be sent down to the Turkish III. Corps in Beersheba.

At 05:55 (5:55 A.M.) on Oct. 31 a hundred field guns and howitzers opened against a Turkish front of 4,500 yd., while the 96th Bde. R.G.A. was engaged in counter-battery work. At 08:30 the 181st Bde. (Brig.-Gen. Da Costa) of the 60th London Div. captured the first Turkish position; at 12:15, the guns having moved up to cut the Turkish wire, the main assault was delivered and all objectives gained by 13:30, whereupon the 230th Bde. (Brig.-Gen. McNeill) of the 74th Div., which had formed the extreme left of the main assault, coöperated with the 160th Bde. (Brig.-Gen. Pearson) of the 53rd Div. against the Wadi Saba front and rolled up all the Turkish defences as far as the Beersheba–Tell el Fara road. Meanwhile the cavalry had completed their wide swing round from the E., and after hard fighting the 2nd A.L.H. Bde. (Brig.-Gen. Ryrie), belonging to the Anzac Mounted Div., was astride of the Hebron–Beersheba road by 13:50.

At 16:00 the 4th A.L.H. Bde. (Brig.-Gen. Grant), belonging to the Australian Mounted Div., which had reached Iswaiwin by 11:00, moved forward against Beersheba itself. It charged over a succession of strong Turkish positions, demoralized the defence and captured the town at 18:00 with 1,148 prisoners, and was joined at 18:30 by the 7th Mounted Bde. (afterwards 14th Cav. Bde.—then commanded by Brig.-Gen. Wigan), which had turned the Turkish defences on Ras Ghannam.

Immediately upon its capture the Royal Engineers, upon whose careful preparatory work in the provision of pipe-lines and camel-convoys of water the success of the attack had been based, began to develop the wells in hopes of being able to produce enough water for the horses and men, who required 400,000 gal. per day. Fortunately the Turkish evacuation had been so hurried that the wells were less damaged than had been expected, and two reservoirs were left intact. The discomfort of the thirsty cavalry was much enhanced by the fact that a hot *khamsin* blew up off the desert, and on the afternoon of Nov. 3 the water situation was most acute, as all stored water had been drunk, and the output was barely adequate for the demand, and at 16:00 a brigade some 2,000 strong rode into Beersheba with a 48 hours' desert thirst. Fortunately at 17:00 a new well came into working, and by midnight the brigade was watered, consuming some 8,000 gallons.

Owing to this water difficulty the Australian Mounted Div. had to go into reserve temporarily, and actually returned to Karm for water while preparations were made for the next attack against the positions covering Tellesh Sharia. The fall of Beersheba had cost the Turks over 500 killed, 2,000 prisoners and 13 guns, and exposed the left flank of the Gaza position.

The next step towards the final attack on Gaza was the capture of Umbrella Hill by the 156th Bde. (Brig.-Gen. Leggett) of the 52nd Lowland Div., temporarily attached to the 54th Div., at 11:00 on Nov. 1 as a preliminary to the main assault timed for 03:00 on Nov. 2. This attack with its preliminary bombardment caused severe casualties to the Turks and, so far from being able to detach troops from Gaza to strengthen the left flank, the Yilderim command had to bring the 7th Div. into the line. The attack, therefore, of the 54th Div. had the required effect of "pinning" the Turks in the Gaza sector, and cost them over 1,000 dead in the captured positions, 654 prisoners and 3 guns.

Meanwhile, next day Gen. Allenby delivered another heavy blow with his right when the 53rd Welsh Div., temporarily under the Desert Mounted Corps, attacked the VII. Army at Khuweilfe on the extreme eastern end of the line, and by its obstinate fighting against great odds did much to persuade the Turks that the British were trying to make a great turning movement from the E., whereas in point of fact the 10th, 60th and 74th Divs. were about to break the line between the VII. and VIII. Armies in order to make a gap through which the Desert Mounted Corps could pass. After fighting for three days and nights almost continuously against what was left of the III. Corps and the 19th and 26th Divs. brought across from the coastal sector, the positions were captured by the 158th Bde. (Brig.-Gen. Vernon) and held in spite of counter-attacks on Nov. 6 and 7, and on Nov. 8 the division concentrated in Khuweilfe.

The Turks being thus fully occupied on the extreme left of their front and "pinned" by operations at Gaza, Gen. Allenby at dawn on Nov. 6 broke through the middle of their line with an attack against Kawuka with his 10th, 60th, 74th Divs. and

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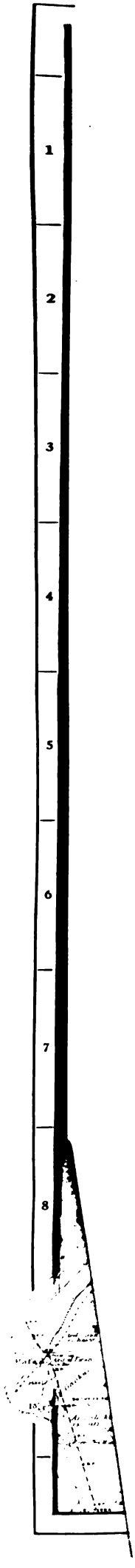

TURKISH CAMPAIGNS (SYRIA)

PLATE III.

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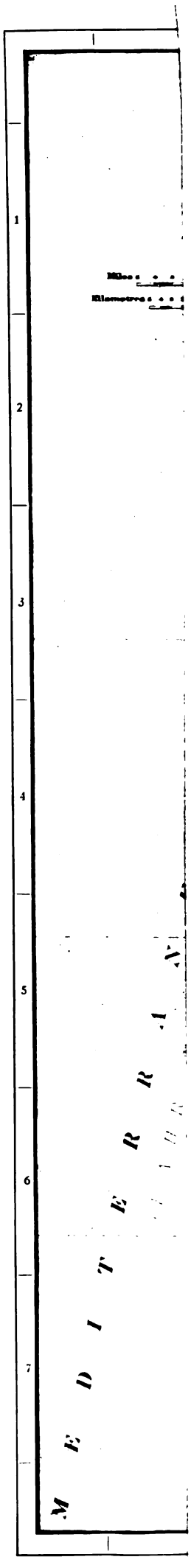

TURKISH CAMPAIGNS (SYRIA)

PLATE IV.

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the Yeomanry Mounted Div. The Turks opposed him with the right wing of their VII. Army and the left wing of their XXII. Corps, but by 14:30 the 179th Bde. (Brig.-Gen. Edwards) and the 180th Bde. (Brig.-Gen. Hill) had captured Sharia for the 60th Div., while the 74th Div. was stiffly engaged to the right. The Turks, however, still held positions above Sharia, and it was not until 06:00 on Nov. 7 that the 60th Div. was finally able to open the way through the Turkish line for the Desert Mounted Corps. The stout defence made by the VII. Army, the artillery of which was notably accurate, and the XXII. Corps, had delayed the start of the cavalry advance, which was still further hindered by lack of water, and Gen. Allenby was unable to cut off the Gaza troops by a flanking attack from the N.E., the more so as the Turks, under pressure of bombardment by land and sea on Nov. 5 and 6, had begun to withdraw. Their rearguards were unable to hold even the most formidable positions.

Outpost Hill and Middlesex Hill fell to the 233rd Bde. (Brig.-Gen. Colston) during the night of Nov. 6, and by 13:30 on Nov. 7 the 232nd Bde. (Brig.-Gen. Huddleston) had taken 'Ali Muntar itself and a number of strongly fortified works. Farther to the E. the 52nd Div. and the XXI. Corps Cav. had pushed through on the heels of the retiring Turks. The Imperial Service Cav. Bde. (Brig.-Gen. Harbord) actually rode through the ruins of Gaza at 09:00 on Nov. 7. Gaza had fallen, and all that remained for the Yilderim command was to get its armies away.

In places their *moral* was shaken, but for the first stages of the retreat the Turks fought strong rearguard actions, notably at Deir Sineid, where the Turkish XX. Corps four times recaptured the position from the 52nd Lowland Div., and at Huj, where the Turks stood up to a cavalry charge by the 5th Mounted Bde. (Brig.-Gen. Fitzgerald) and served their guns until actually cut down. The VIII. Army retreated along the line of the light railway and the motor road on Ramleh while the VII. Army fell back on Hebron and the main N. road. The line of advance across the Plain of Philistia was easier than that over the hills of southern Judea, consequently British transport was concentrated as far as possible so as to facilitate the advance of the left wing, and the 54th Div. was immobilized at Gaza as all its transport went N. with the rest of the XXI. and Desert Mounted Corps which pressed on regardless of thirst, greatly enhanced by a hot *khamsin* which began to blow on Nov. 19.

The hardest fighting during the pursuit was that at Qatra and El Mughar on the Wadi Tahhana, when the 3rd, 7th and 10th Divs, tried to hold the 52nd Lowland Div. on Nov. 13. In ordinary circumstances perhaps such a pronounced advance of a left wing would have been dangerous, as the VII. Army was still in the Hebron area and even tried to make a diversion, but Gen. Allenby declined to be overawed by a force which he rightly estimated to be largely disorganized and almost destitute of transport. He attached the XX. Corps Cav. to the 53rd Welsh Div. and sent them—to be known as Mott's detachment—to contain the southern detachments of the VII. Army.

General Allenby proposed to push the VIII. Army back beyond Jaffa and contain it while he turned to the E. and struck up through the hills at Jerusalem, upon which the Turks were concentrating. The Holy City, of no great strategic or commercial value in itself, had an immense sentimental value, and the Turks were unwilling to suffer the blow to their prestige which its loss would entail, the more so as Mecca and Bagdad were now no longer in their possession. Ramleh was taken on Nov. 15 and Jaffa by noon next day, while the 54th Div., which had regained its transport, was hurrying up from Gaza, arriving in the Desert Corps area on Nov. 18. Next day the advance toward Jerusalem began and the 60th Div. started N. from Gaza. The 75th Div. had to encounter much resistance near Saris amid the barren and precipitous hills dominating the main road to Jerusalem, while the 52nd Div., moving eastward up the parallel valley of Beth Horon, had turned off up the Beit Likia road in face of Turks on the heights and transport difficulties in the valleys, and the Yeomanry Mounted Div., which was trying to reach the Nablus–Jerusalem road in order to force an evacuation of the Holy City, had even greater difficulties to surmount.

All through Nov. 20 and 21 there was hard fighting during which the Turks were steadily thrust back, a fog being of great value to the 75th Div. just before the attack on the positions covering 'Enab, which the 232nd and 233rd Bdes. (Brig.-Gens. Huddleston and Colston) took at the point of the bayonet at 17:00 on Nov. 20. Kustul and Soba, two dominating positions, were taken next day by the 232nd and 234th Bdes. (Brig.-Gen. Anley), and at 23:45 Nebi Samwil was successfully stormed by the last-named brigade, and contact was established with the 52nd Div. at this point. Both divisions, however, were suffering much from rain and cold winds, and having come straight from an exhausting and rapid advance from the heat-stricken plains, were marching light with nothing to protect them from the cold. In the plain the 54th Div. went into the Desert Corps area to hold the front N. of Jaffa and Ludd, where it was faced by the 3rd, 7th, 16th and parts of the 19th and 20th Turkish Divs., and the 60th Div. arrived near Mejdel from Gaza where it had had to wait until the 54th was off the lines of communication.

The VII. Army, now consisting of the 3rd Cav. Div., engaged against the Yeomanry on the extreme right of the Turkish line, and the 24th, 54th, 26th, 53rd Divs. covering Jerusalem from the W., while the 27th was observing Mott's detachment as a cover against a possible advance from Hebron, now made strong counter-attacks against Nebi Samwil; and although unable to recover it was at least able to prevent either the 75th or the 52nd from taking Ej Jib. It became apparent that for the moment the British thrust had spent itself. Accordingly the wearied divisions which had forced their way so far into the mountains were taken out of the line and sent to rest near Ramleh; their hard-won positions were turned over to the 60th and 70th Divs.

The delay in the British advance occasioned by this necessary relief gave fresh hope to the Turks, who began, after a period of depression, to hope once more that they might retain Jerusalem; accordingly reinforcements were brought down from the N. and across from beyond Jordan by way of Jericho, and by the time that the British were ready to resume their advance after the 10th Div. had arrived from Gaza, the 19th Div. and parts of the 20th, 48th and 49th Divs. had arrived to strengthen the VII. Army, which held a strong series of positions overlooking from the E. the steep slopes of the deep valley of the Sarar (vale of Sorek) and across the Bethlehem road.

After a preliminary concentration during which Mott's detachment was advanced up the Hebron road to within striking distance, and heavy guns had been brought up into the mountains, the general assault which was to result in the fall of Jerusalem began in driving rain at dawn on Dec. 8. The 60th Div. had great difficulty in capturing the "Heart" and "Liver" redoubts, and the strong works at Deir Yesin, and was hampered by the inability of the 53rd Div. to coöperate with its right flank owing to the strenuous Turkish opposition and the bad weather which were delaying its advance. However, by nightfall the British were established on the crests to the E. of the valley of the Sarar, and the 180th Bde. (Brig.-Gen. Watson) of the 60th Div. took Lifta by dusk, and by 07:00 on Dec. 9 the Worcester Yeomanry had moved across the front of the 53rd Div. and got astride of the Jerusalem–Jericho road.

The news of the capture of Lifta started a panic among the Turks, and a disorderly retreat ensued which would have been disastrous for the Turks had not Gen. Allenby been unwilling to allow any hostilities in the immediate vicinity of the Holy City. It was now militarily speaking untenable, and he was anxious to secure a peaceful occupation even at the cost of sparing the Turks in this panic-stricken withdrawal.

At 07:00 on Dec. 9 the last Turkish troops left Jerusalem, 'Izzet Bey, the Mutesarrif, being the last civil official to depart. Before 08:00 the mayor started out to surrender, and by 09:30 Brig.-Gen. Watson, the first British soldier to reach the Jaffa Gate, arrived and posted guards in anticipation of the formal act of accepting the surrender, which was performed by Maj.-Gen. Shea, in command of the 60th Div., soon after 11:00.

Having thus obtained the chief objective of the campaign all that was now necessary was to thrust back the Turks in order

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to remove the Holy City from danger of long-range bombardment. The first steps towards this were taken on Dec. 10 when the 53rd Div. captured ridges to the E. of the city, and was resumed, after Gen. Allenby's formal entry into Jerusalem on foot, on Dec. 11, in conformity with a general plan for improving the front. The 52nd Div. forced a passage of the Nahr el 'Auja, Dec. 20 and 21, and by pushing the front to a point 8 m. N. of Jaffa made it possible to make use of such harbour facilities as did then exist there. Troops were redistributed along the front, and a number of minor advances were made while everything was being prepared for the expected Turkish attempt to recover Jerusalem, the loss of which had much affected Ottoman prestige. This attempt was made at 23:30 on Dec. 26 by the VII. Army, which had been reinforced by the arrival of the 1st Div. and of troops from across Jordan.

A vigorous attack was made on the sector round Tel el Ful, held by the 60th Div. which, in common with the rest of the XX. Corps, was standing by for a general offensive with which Gen. Allenby had intended to forestall the Turkish counter-attack at dawn a few hours later. Consequently the moment for the VII. Army's attack was unhappily chosen, and while every effort was being made to drive the 60th Div. back on Jerusalem and dislodge the 53rd Div. from its advanced positions the British counter-offensive on the part of the 10th and 74th Divs. started according to plan at 06:30. At 12:55 the Turks, who were beginning to feel the pressure of this advance, made redoubled efforts to break through the 60th Div. which lay astride of the Nablus road only some 4 m. N. of Jerusalem. In spite of their courage and energy the Turks were unable to make any impression on the 60th, and were unable to prevent the 10th and 74th from advancing 4,000 yd. on a 6-m. front by nightfall.

Next day, Dec. 28, the whole XX. Corps advanced, the Turkish transport was harassed by aeroplanes, and the VII. Army, having failed to recapture Jerusalem, found itself on the last day of the year 7 m. farther from its objective than when it had started. So ended the first battle of Mount Ephraim, during which the XX. Corps had gone forward on a 12-m. front to a depth of 6 m. on the right and of 3 m. on the left, occupying the Ram Alla-Bire ridge. The N. front was now secure, but the Turkish XX. Corps still held Jericho and the fords and bridge of the Jordan, and remained in positions more than two-thirds of the way up the steep and almost waterless slope leading up from the E. to the Mount of Olives.

During Jan. the standard-gauge railway was pushed forward across the plain of Philistia, and the problem of transport, which all through the Dec. fighting had had to rely on camels and donkeys or mule-drawn wheels over half foundered roads, was greatly simplified by the opening of Ludd as railhead with adequate sidings on Feb. 4 just after the narrow gauge to Jerusalem from Ludd had been restored to use on Jan. 27. It thus became possible to provide supplies for the large hunger-stricken civil population of Jerusalem and to form an advanced base there for further military operations. These were undertaken on Feb. 19, when the 60th Div., which had changed places with the 53rd, coöperated with the 231st Bde. (Brig.-Gen. Heathcote), lent by the 74th Div., the 1st A.L.H. Bde. (Brig.-Gen. Cox), and the N.Z. Mounted Rifles (Brig.-Gen. Meldrum) of the Anzac Mounted Div., in the capture of Jericho, from which the Turks were driven by 08:20 on Feb. 21 after operations over extremely broken and bad country. The acquisition of Jericho prevented the Turks from making use of the Ghoraniye bridge as a means of communication with their forces beyond Jordan, and enabled the British to get command of the Dead Sea, across which the Turks had been bringing up supplies from the wheat-growing area round Kerak.

In March Gen. Allenby raided across Jordan to Es Salt and 'Amman and damaged the Hejaz railway. To do this it was necessary to capture the Ghoraniye bridgehead on the left bank of the river. General Shea of the 60th Div. was given command of a special force, called Shea's group, consisting of his own division, the Anzac Mounted Div., the Imperial Camel Corps Bde. (Brig.-Gen. Smith), some light armoured cars and guns with bridging-trains. The Jordan was crossed by swimming in spite of the flood-water by 01:20 on March 22 at Hajla as a preliminary to bridge-building, and after hard fighting the Turks lost Ghoraniye. Es Salt was occupied on March 25 at 18:00 by the 3rd A.L.H. Regt., and Brig.-Gen. Meldrum with the N.Z. Bde. reached the Hejaz railway S. of 'Amman at 15:00 on March 27 and cut it. 'Amman itself, however, was successfully held by the Turkish E. of Jordan Group, and the 703rd German Batt. and the Turkish 3rd Cav. Div. which crossed by the Jisr ed Damie from Palestine threatened the lines of communication at Es Salt, which was held by the 179th Bde. (Brig.-Gen. Humphreys) of the 60th Division.

The weather was bad for camel transport, and the camel park at Shunet Nimrin was, moreover, bombed by German aeroplanes; thus the raid, owing to the stout Turkish resistance and the Jordan floods, had been less rapid and less successful than it might have been; but a number of Christian refugees were able to get into safety under cover of the raiding troops, and solid results were obtained in the permanent possession of the Ghoraniye bridgehead and the attraction of some 4,000 or more Turkish troops from the Hejaz to contain it.

The withdrawal of these men and their immobilization just above the Lower Jordan did much to facilitate the operations of the Arab army under the Sherif Faisal, but the Turks had good reason for supposing that this raid was but a single feature in a far wider and more formidable movement on the part of the British, which had been countermanded at the last moment owing to the sudden necessity for sending troops from the Palestine front to help resist the German offensive in France.

As it was, Gen. Allenby by the end of April had to part with his 52nd and 74th Divs., ten British battalions drawn from other divisions, nine yeomanry regiments, five and a half siege batteries and five machine-gun companies, receiving in exchange the 3rd (Lahore) and 7th (Meerut) Divs. of the Indian army from Mesopotamia and Indian cavalry from France—all experienced troops. His reinforcements received, in exchange for his British battalions, were, however, raw troops fresh from India. In May he had to send away 14 more British battalions, and received only a partial equivalent of Indian troops. Thus the character of the force opposed to the Turks was profoundly modified, and its activities were largely suspended during reorganization: yet the Yilderim command, although strengthened by the formation of the Asia Corps with German units in March and the arrival of reinforcements with which the VIII. Corps and the IV. Army were constituted, was unable to make an offensive during these weeks of opportunity. On the contrary Gen. Allenby took pains to sow the seeds of future victory by again raiding into the Oultre Jourdain country, and took Es Salt on April 29; a good deal of fighting ensued, and the raiders were finally turned back by the 24th and 48th Divs. of Turkish infantry and the action of the 3rd Cav. Div. which had been brought across from Palestine by the Jisr ed Damie. Yilderim, however, were deceived by this raid into thinking that the next serious British move would be by way of Gilead towards Damascus; and Liman von Sanders Pasha, who had taken over the command of the group, allowed the 'Amman and Es Salt raids to influence his plans more than the "readjustments of front" in the Sharon and Berukin sectors in April and June, which might otherwise have appeared to him to be directed for the purpose of depriving him of observation posts from which he could overlook some great future concentration.

At the end of the summer, just before Gen. Allenby struck his final blow, the Yilderim Group of Armies was arranged along a front of some 65 m. running from the Mediterranean a little to the N. of Arsuf to a point some 4 m. E. of the influx of the Jordan into the Dead Sea. From his headquarters at Nazareth Marshal Liman von Sanders Pasha commanded the four armies composing the group. On the right the VIII. Army (XXII. Corps, 7th, 20th and 46th Divs., and Asia Corps, 16th and 19th Divs. and 701st, 702nd and 703rd German Bdes.) held some 20 odd miles as far as Furkha. Then came the VII. Army (III. Corps, 1st and 11th Divs., and XX. Corps, 26th and 53rd

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Divs.) holding another 20 m. astride of the Nablus road, and running down into the Jordan valley, where it was flanked by the IV. Army (II. Corps, 24th Div. and 3rd Cav. Div. in the Jordan valley, VIII. Corps, 48th Div. and Composite Div. on the hills of Moab). This array of armies and corps would have been exceedingly imposing had the Turkish units of which they were made up been at full strength, but, as it was, the British army commander estimated their numbers as follows: VIII. Army, 10,000 rifles and 157 guns; VII. Army, 7,000 rifles and 111 guns; IV. Army, 6,000 rifles, 2,000 sabres and 74 guns. The Ma'an garrison and the troops on the Hejaz railway were estimated at 6,000 rifles and 30 guns, while the general reserve was 3,000 rifles and 30 guns. All told the troops with which the Turks hoped to hold Syria and what was left of Palestine amounted to some 4,000 sabres, 32,000 rifles and 400 guns, representing a ration-strength S. of Rayak-Beirut of 104,000. Against this Gen. Allenby had at his disposal 12,000 sabres, 57,000 rifles and 540 guns, and arranged his forces so as to strike with an overwhelming force of men and guns at the most favourable point in the Turkish line for making use of his cavalry.

For this purpose the Desert Mounted Corps was brought right across the front and concentrated in the olive and orange groves in the Sarona area. The 60th Div. came from the XX. Corps area and went into the front line at Arsuf, near which the 7th (Indian), 75th and 3rd (Lahore) Divs. were closely concentrated along a front of about 4 miles. The 54th Div. and the French detachment in the foothills immediately E. of Mejdel Yaba formed the hinge upon which the offensive across the plain of Sharon was to pivot. The 31st and 29th Bdes. of the 10th Div. were strung out along a considerable front of some 13 m. from Arura to Rafat, with the 30th Bde. in reserve above the Wadi Ballut. The 53rd Div. held some difficult country in front of Et Taiyibe well to the E. of the Nablus road; and in the Jordan valley a specially formed force, under Maj.-Gen. Sir E. W. C. Chaytor (Australian and New Zealand Mounted Div., 20th Indian Bde., 38th and 39th Royal Fusiliers [Jewish troops], two battalions of the British West Indies Regt. and some guns), was to give the Turks the impression that another offensive in the direction of Es Salt was contemplated.

The necessary concentration of troops in the Sharon sector was effected by a bold policy which left great stretches of the British front either entirely unoccupied or merely watched; and, had the Turkish Intelligence Service been less hampered by Gen. Allenby's counter-espionage measures, advantage might have been taken of the existence of these gaps. As it was, the care with which the concentration was achieved, by silent night marches to the W. while deceptive dust was clearly visible by day going eastward, completely deceived the Turks, who were, moreover, further misled by the strangely faulty reports sent in by the German aeroplane scouts. The ascendancy in the air was so entirely in Gen. Allenby's hands, and had been so for several weeks, that it was only occasionally that the Germans came over, and then at very considerable height, which made observation difficult. That this made for inaccurate observation was amply proved by the German air reconnaissance reports which were subsequently captured with other documents of the Yilderim Group headquarters at Nazareth, since the report for the day before the British advance still shows an entirely erroneous distribution of Gen. Allenby's troops, incorrectly locates his G.H.Q., the headquarters of the XXI. Corps, and even tentatively "identifies" a non-existent division. Thus the surprise for which the British commander had been working was complete.

At 04:30 on Sept. 19 the artillery on the Sharon sector of the front opened, and after a preparation of 15 minutes, during which the whole striking force advanced across the wide "no man's land," the attack was begun at 04:45. The plan provided for a pivoting movement of which the 54th (East Anglian) Div. (Maj.-Gen. Hare) and the French detachment (Col. de Piepape) formed the hinge, while the 3rd (Lahore), 75th, 7th (Indian) and 60th moved like a door opening away from the sea, pushing back the Turks from an ever-widening gap through which the cavalry poured. The Turks were thus overwhelmed and thrust aside. The cavalry began the advance which was to carry the front beyond Aleppo, and behind them the Royal Engineers, while the action was still in progress, began to lay the pipe-line which by 13:00 had reached Jiljulie from the mill-race on the Nahr el 'Auja 7,000 yd. away, and was able to provide 4,000 gal. per hour to the troops in an area where the water supply was wholly inadequate behind the 3rd Div. By 07:30 the 5th Cav. Div. (Maj.-Gen. MacAndrew) was crossing the Nahr Falik, by noon it had reached and crossed the Iskanderune, and the 4th Cav. Div. (Maj.-Gen. Barrow) and Australian Mounted Div. (Maj.-Gen. Hodgson) swept up behind them.

The speed of the advance was entirely bewildering to the Turks, who could get little or no news of its progress, and only realized its results by actual contact, as every artifice had been employed to cripple the Turkish Intelligence Service. A special bombing squadron had been sent out to reinforce the Royal Air Force, which at the opening of the offensive consisted of a brigade with two wings, seven squadrons, and a balloon company; and during the night of Sept. 18–19 a Handley-Page with more than half-a-ton of bombs attacked the German aerodrome at 'Afule. At dawn on Sept. 19 the special squadron attacked all Turkish telephone and telegraph exchanges behind the line, while the corps squadrons bombed the smaller exchanges just behind the front, with the result that Turkish communication by telephone or telegraph was completely deranged. To prevent Liman von Sanders Pasha from becoming aware of the progress of the advance, steps were taken to keep all German aeroplanes from leaving the ground. For this purpose two scouts at a time hovered over the main German aerodrome at Jenin, each carrying four bombs, which were dropped on the aerodrome at any sign of activity. Each pair was relieved while still patrolling over the aerodrome, and, before leaving, came down and fired machine-guns into the hangars. In this way the German air service was immobilized throughout the day, and the Yilderim command deprived of its only remaining means of obtaining rapid information about the British advance. Furthermore, the general attack on the Sharon front had been preceded at 22:00 on Sept. 18 by a vigorous offensive on a smaller scale by the 53rd Div. (Maj.-Gen. Mott), which by attacking the Turkish XX. Corps diverted attention from the coastal sectors in the last hours during which the Turks could use their field telephones.

In this way, by dint of elaborate preparation, the Yilderim command was kept in the dark as to what was happening, and the Turks had to fight as best they might, relying on lines of communication after they had been cut, relying on reinforcements which never knew when or where they were wanted, and were never sent, and finally trying to retreat along roads already occupied by the British. As a final measure to complete the confusion of the Turks, Gen. Allenby, after his first feint by the 53rd Div. and his main attack across the plain of Sharon, put the whole of the rest of his front W. of Jordan in motion, and began to press the Turks northward through Mount Ephraim.

The main advance pressed northward, and while the 5th and 4th Cav. Divs. headed for the plain of Esdraelon in order to seize 'Afule and its railway junction, the infantry [60th (London) Div., Maj.-Gen. Shea, 7th (Indian) Div., Maj.-Gen. Fane, and 3rd (Lahore) Div., Maj.-Gen. Hoskins], turning eastward, began to drive the XXII. Turkish Corps and the Asia Corps into the hill country. The Londoners captured Tul Keram after fighting and marching for 18 m. over heavy sand before dark, driving a mass of retreating Turks and transport into the narrow defile up which the road and railway ran to Nablus. Here the retreat was scourged from above by aeroplanes, which finally blocked the pass by killing multitudes of transport animals across its narrowest part, while the 5th Australian Light Horse Bde. (Brig.-Gen. Onslow), with cavalry of the French detachment, temporarily attached to the 60th Div., made a detour and came into the pass from the N.E. of Anebta, cutting off all hope of retreat from Tul Keram and engaging the extreme right of the Asia Corps, which tried to hold the upper part of the pass so as to facilitate retreat along

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the Nablus and Messudie roads to Jenin. Individual Turkish units fought well. If they were unaware of the disaster which had befallen their cause, they were at least not oppressed by news of defeat; the opposition encountered by the 3rd and 7th Divs. in the W. was tenacious and well organized, and the XX. Turkish Corps in the E., not realizing the necessity for immediate retreat, even made a successful counter-attack against the 53rd Div., and for the moment recovered some minor positions.

While the infantry hammered away at each other Gen. Allenby's cavalry had broken through the Carmel Range by the historic pass of Megiddo, captured Nazareth with the Yilderim headquarters (dawn Sept. 20), and 'Afule (08:00); and the 4th Cav. Div. after coöperating with the 5th in its capture hastened to Beisan, which was taken at 16:30, while part of the 12th Bde. (Brig.-Gen. Wigan) reached Jisr el Mujami', where the railway crosses the Jordan, at 08:00 on Sept. 21, thus cutting off alike all hope of retreat northward from the Turks and guarding against the possible arrival of reinforcements from Damascus. As additional insurance, raiding parties from the Arab N. Army operating in Gilead had broken the railway near Tel 'Ar'ar and at Muzerib on Sept. 17. Meanwhile the 3rd Australian Light Horse Bde. (Brig.-Gen. Wilson), driving in from the N., had captured Jenin (evening of Sept. 20) in spite of the resistance of a German force, and Turkish troops and transport on the road between Jenin and 'Afule and Jenin and Nablus were plentifully bombed from aeroplanes.

On Sept. 21 at 13:45 Nablus was captured, and the Turks, having in vain endeavoured to retreat along the newly restored Roman road from Nablus to Beisan, only to be the target of aeroplanes while on the way and to find the British at the end of it, tried as a last resort to withdraw the wreckage of the VII. and VIII. Armies down the Wadi Fara road, so as to retire upon Es Salt and the IV. Army crossing over the Jordan by the Jisr ed Damie. This movement was detected by an air scout early on the morning of Sept. 21, and the importance of checking the retreat was at once realized, as the Jordan valley troops had not yet been able to capture the Jisr ed Damie, nor could the fords to the N. of it be guarded even by the cavalry at Beisan in time. All available aeroplanes were at once detailed for an intensive air attack upon this line of retirement; departures from the Ramleh aerodrome were so timed that two machines should arrive over the objective every three minutes, and that an additional formation of six machines should come into action every half-hour. Machines on arriving over the objective bombed it first and then swept down to a low altitude and raked the column with machine-gun fire, crawling uneasily along a narrow road cut out of a precipitous slope, before flying back to Ramleh to replenish with bombs and fresh drums of cartridges.

This form of attack continued from 08:00 until noon, when Chaytor's force came within striking distance of the bridge, and the line of retreat itself was blocked for a distance of 5 m. with countless corpses and carcasses and the debris of 87 guns with their limbers, 55 motor lorries, 4 staff-cars and 842 waggons, all of which had been put out of action by the attacks of the Royal Air Force unaided by any surface coöperation. At 01:30 on Sept. 22 Chaytor's force, which had been pressing all through the previous day, captured Jisr ed Damie, and at 08:00 a Turkish column was observed by air scouts to be moving up towards Beisan from the still unoccupied area E. and N.E. of Nablus. It was bombed from above, while the XX. British Corps shepherded it up toward the 4th Cav. Div., which came down to meet its survivors and patrolled along the left (E.) bank of Jordan to cut off such stragglers as might cross the stream.

Meanwhile the Jewish battalions of Chaytor's force had captured Umm esh Shert ford at 03:00, and by nightfall the 2nd Australian Light Horse Bde. (Brig.-Gen. Ryrie) was in contact with the main Turkish position at Shunet Nimrin. A little later it became apparent that the IV. Army had realized how isolated and unsafe its position had suddenly become, and that it had begun to retire in hopes of reaching Damascus before it was too late. It was, however, vigorously pressed by Chaytor's force, its railway had been cut by the Hejaz Camel Corps of the Northern Army, and the whole country-side appeared to be boiling up into sudden revolt about its path.

The IV. Army still carried a sting in its tail, and although it lost Es Salt by 16:30 on Sept. 23 it held 'Amman gallantly until 15:10 on Sept. 25, in hopes of being able to keep the line of retreat open for the garrison of Ma'an under 'Ali Bey Wahbi, which, though hastening northward amid a perpetual whirl of Arab rifle-fire, was still S. of the town. With all hope of retreat cut off, the Ma'an force became anxious to surrender, and as soon as the 5th Australian Light Horse Regt. was near enough to Qastal to afford protection, the Turks, to the number of over 4,000, with 500 sick and 12 guns, surrendered on Sept. 29. The Australians had some difficulty in saving their prisoners from being massacred by the Arabs who were eager for vengeance and plunder.

The news that the IV. Army was trying to avoid the fate which had overwhelmed the VII. and VIII. caused Gen. Allenby to order his available cavalry to advance upon Damascus, in order to prevent the Turks on the E. of Jordan from reaching it and re-forming in combination with the small force there.

The 5th Cav. Div. was employed during the greater part of Sept. 23 in capturing Acre and Haifa, when the Turks, contrary to the wishes of the Germans, who did not wish to risk the numerous houses of the German colony in a bombardment, put up a stout resistance, and were only quelled by a charge of the 15th (Imperial Service) Cav. Bde. (Brig.-Gen. Harbord). The 5th Cav. Div. then went to Nazareth en route for Damascus with the rest of the Desert Mounted Corps by way of Jisr Banat Ya'qub and the main motor road beyond Quneitera.

At Jisr Banat Ya'qub a stiff resistance was made, chiefly by German technical troops, who had blown one arch of the bridge and formed a laager of lorries and machine-guns commanding the ruin. This delayed the Australian Mounted Div. until the position was turned by the action of the 3rd and 4th Australian Light Horse Bdes. (Brig.-Gens. Wilson and Grant), which crossed the river N. and S. of the bridge late on Sept. 27. The position was taken, but the delay had enabled the 5th Cav. Div. to come up, and by 20:30 on Sept. 28 both divisions had reached Quneitera. To the S. the 4th Cav. Div., having crossed the Jordan at Jisr el Mujami', engaged the Turks on the Zebda–Irbid–Beitras line on Sept. 26, where a good deal of opposition was made, took Irbod during the night, then pressing on through Remte made contact with the Hejaz Northern Army, which had just taken Der'a, a few miles W., at dawn on Sept. 28.

The Arab Camel Corps, with which was Col. Lawrence, had started on its northern raid on Aug. 31, by unfrequented and often waterless paths through the desert from a point near Akaba and had reached the railway between Der'a and Damascus on Sept. 17. The line was wrecked, and in spite of the activity of the garrison and aeroplanes at Der'a the Arabs continued to prey upon the lines of communication, which they kept in a state of disorganization all through the critical days of Gen. Allenby's advance, and now were able to get their fill of fighting in trying to impede the retreat of the IV. Army.

Under the constant pressure of the Desert Mounted Corps and the Arabs, both regular and insurgent, driving in from W., S.W. and S., the IV. Army melted into rout. It still fought when it could, but it was with the spasmodic jerks of a body no longer under control of its brain, and after actions at Kaukab Jasa and Kiswe the end came for the Yilderim Army Group when the Australian Mounted Div., with the French cavalry attached, got across the Damascus–Beirut road on the afternoon of Sept. 30, capturing 4,000 Germans and Turks as they tried to escape along it. Next morning Maj. Olden with men of the 10th A.L.H. Regt. (3rd Bde. A.L.H.) reached the Serail of Damascus, at 06:30 on Oct. 1., just a little ahead of the Hejaz Camel Corps. Damascus had fallen, and a Turkish column trying to reach safety by the desert road to the N.E. was overtaken, attacked and captured near Duma on Oct. 2.

Nor was the victory a day too soon—the British cavalry had been stung by malarial mosquitoes in the plain of Esdraelon, in the marshes round Beisan and in other areas behind the Turkish lines where army sanitation was grossly neglected. The malaria

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had incubated for a fortnight, and immediately after the capture of Damascus, officers and men sickened by scores—whole regiments were temporarily out of action, and on top of the malaria came a savage visitation of the so-called "Spanish" influenza, which preyed upon captors and captives alike, particularly the latter, whose resisting power had been greatly impaired by the privations of a fortnight's disaster and rout.

There now remained no formidable Turkish force in southern or central Syria, and all that remained for the victorious general to do was to occupy the starving lands which he had liberated and move northward in search of a Turkish formation to attack. The 7th (Meerut) Div. was ordered to march up the coast, and made remarkable progress, leaving Haifa on Oct. 1, occupying Tyre on the 4th, Sidon on the 6th, Beirut on the 8th, and Tripoli (Tarabulus) on the 18th, while the 5th Cav. Div., less affected by malaria and influenza than other cavalry, moved up through the Biqa' along the railway to Hama (Oct. 20), engaged German armoured cars near Khan es Sebil (Oct. 22), and reached Aleppo, which had just been occupied by Arabs, at 10:00 on Oct. 26. The division passed through Aleppo, engaged the Turks on the Alexandretta road, and on the 28th relieved Arab troops at Muslimie junction astride of the Bagdad railway.

During this advance an uncounted number of Turks were killed, 200 German and Austrian officers and 3,500 men, while over 72,000 Turkish prisoners, 360 guns, 800 machine-guns, and large quantities of locomotives and motor transport were captured. (H. P.-G.)

TURNER, SIR GEORGE (1857–1916), Australian politician, was born at Melbourne Aug. 8 1857 and educated at its Central school, proceeding on to its university. He was called to the Victorian bar and in 1889 was elected to the Victorian legislature as member for St. Kilda. Two years later he became Minister of Health and later held office as Minister of Customs, Solicitor-General and Minister of Defence. From 1894–9 he was Premier and Treasurer of his colony and again from 1900–2. From 1901–5 he was Treasurer of the Commonwealth of Australia. He was also president of the Federal Council of Australasia, which came to an end in 1899. He represented his colony at Queen Victoria's Diamond Jubilee (1897) and was then created G.C.M.G. and sworn of the Privy Council. He retired from politics in 1906 and died at Melbourne Aug. 14 1916.

TURNER, SIR WILLIAM (1832–1916), British anatomist, was born at Lancaster Jan. 7 1832. He was educated at various private schools, and afterwards studied medicine at St. Bartholomew's hospital, and graduated M.B. at London University. In 1854 he became senior demonstrator in anatomy at Edinburgh University, in 1867 professor of anatomy, and in 1903 was elected principal and vice-chancellor of the university. He was from 1898 to 1904 president of the General Medical Council, and in 1900 was president of the British Association. He was knighted in 1886 and made a K.C.B. in 1901. Turner was best known as a brain surgeon, and published various valuable papers on the subject. He died at Edinburgh Feb. 15 1916.

TWINING, LOUISA (1820–1912), English philanthropic worker, was born in London Nov. 16 1820. In early life she was an artist, and published *Symbols and Emblems of Mediæval Christian Art* (1852) and *Types and Figures of the Bible* (1854). In 1853, however, she became interested in movements for social reform, and began the work in connexion with the Poor Law to which she devoted the rest of her life. In March 1861 she helped to establish a home for workhouse girls sent out to service, and in 1864 a Workhouse Visiting Society. In 1867 an act was passed separating infirmaries from workhouses, and after 12 more years of work Miss Twining in 1879 established the Workhouse Infirmary Nursing Association. She was a Poor Law guardian for Kensington during 1884–90, and for Tonbridge Union during 1893–6. She promoted the opening of Lincoln's Inn Fields to the public, helped to start the Metropolitan and National Association for nursing the poor in their homes, did much to secure the appointment of police matrons, and was president of the Women's Local Government Society. She published *Recollections of Life and Work* (1893), *Workhouse and Pauperism* (1898), and many papers on Poor Law subjects. She died in London Sept. 25 1912.

TYLOR, SIR EDWARD BURNETT (1832–1917), English anthropologist (*see* 27.498), died at Wellington, Som., Jan. 2 1917. He was knighted in 1912.

TYPHUS FEVER (*see* 27.508).—This acute specific fever is spread by the agency of the body-louse, and is characterized by a sudden onset, a maculo-petechial eruption, severe toxaemia, lasting some 12 to 15 days, and ending by a rapid lysis. The disease has many synonyms:—Typhus exanthematicus, synochus putrida, spotted fever, gaol fever, famine fever, prison fever, Brill's disease. This last term is often applied to denote a very mild type of the disease occurring in the United States.

Hippocrates mentions the word "typhus," but he applied it to any stuporous and delirious condition and does not appear to have been acquainted with the fever in question. The malady was apparently confused with plague until the 16th century, when Fracastorius differentiated it from the latter disease and called it petechie. During the 18th and 19th centuries typhus fever was well known in Europe, but included typhoid and relapsing fever, from the former of which it was distinguished by a long series of researches beginning with those of Strother, Gilchrist and Huxham in the early 18th century and ending with the classical work of Still in 1837. From relapsing fever typhus was definitely differentiated by Henderson of Edinburgh in 1843.

Climatology and Epidemiology.—Typhus is mostly a disease of temperate and cold climates; in tropical countries it occurs only in the hills or during the cool season. In 1921 typhus was endemic in many parts of E. and S.E. Europe, Poland, Galicia, many provinces of Russia and certain districts of the Balkans. It was endemic also in some parts of Asia, Persia, Afghanistan, and an endemic area exists in India on the W. of the Indus, stretching from Baluchistan in the S. to Yusafzai, Hazara, and Kashmir in the N., and then passing eastwards along the ranges of the Himalayas, where it is especially prevalent at Kulu, and also passing southwards into the district of Rawal Pindi. It also occurs in Indo-China, in N. China and in Japan in the province of Hiogo. It does not occur in Australasia or Oceania. In America it is endemic in Mexico, in certain districts of Peru and northern Chile.

Before the World War it was eradicated from most European countries where hygienic measures for the destruction of vermin were in existence. During the war, extremely severe epidemics raged in the Balkans, Poland and Russia. Epidemics are caused by anything which favours the propagation and dissemination of lice. The principal factors which do so are:—(1) massing together of people of all classes; (2) retaining these masses under conditions which render personal cleanliness and clean clothing difficult or impossible, typically in times of war or famine; (3) a suitable atmospheric temperature, not too high—*i.e.* a temperate zone temperature.

Aetiology.—The disease is spread by means of the body-louse, *Pediculus corporis de Geer* (1778). The virus is apparently present in the blood of a patient from the fifth to the twelfth day, but in greatest abundance from the fifth to the seventh day. The louse requires approximately eight days interval before it becomes infective, and probably remains infective for the rest of its life, but it is not certain whether it passes the virus on to the next generation or not. When an infected louse bites a non-immune human being, a period of six days to ten days elapses before symptoms appear. The virus was reported by Nicolle to be filterable, but more recent investigation has shown this to be doubtful. The guinea-pig and the monkey are susceptible. As regards the nature of the virus, innumerable bacteria and protozoa have been described. In 1921 most authorities favoured de Rocha Lima's theory, viz. that the causative agent is an organism which he has called *Rickettsia prowazeki*. Rocha Lima has given this name to some peculiar, minute, gramme-negative, oval bodies often showing polar staining when stained by Giemsa's method, and found in the epithelial cells of the alimentary canal of lice which have fed on the blood of typhus patients. Attempts at cultivation have so far failed. Brumpt and others do not give any etiological importance to these bodies, as, according to them, they are found also in lice which have not fed on typhus patients. Rocha Lima contends, however, that there are two forms of the parasite, one non-pathogenic, *Rickettsia pediculi*, found only in the lumen of the alimentary canal of lice; and the other, pathogenic, *Rickettsia prowazeki*, which multiplies in the cells of the insect's alimentary canal.

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Plotz has described an anaërobic, gramme-positive, bacillus which he now identifies with *Rickettsia prowazeki*. (For similar disease-carrying by body-lice, *see* TRENCH FEVER.)

Morbid Anatomy.—There are no specific anatomical lesions. A certain amount of oedema of the lungs and hypostatic pneumonia is often present. The spleen is enlarged, usually of a dark red colour and juicy red pulp. The liver and kidney show cloudy swelling, and punctate haemorrhage may be present. In the intestine there are no changes in Peyer's patches, and the mesenteric glands are not enlarged. The heart muscle may show cloudy swelling and fatty degeneration. The cerebral spinal fluid may present a slight lymphocytosis.

Symptomatology.—Incubation varies from 4 to 21 days, but is usually about 10 to 12 days. The onset is usually sudden, being characterized by severe headache, pains in various parts of the body, often rigours, marked rise of the temperature, quick pulse, flushed face and suffused eyes, and quickened respirations. The patient complains of extreme weakness. The duration of the fever on an average is 14 to 15 days. During the first 2 or 3 days the temperature continues to rise at night, with remission in the morning, to a maximum of 104 to 105 on the second to fourth day. During this time the tongue becomes dry, swollen, and coated with a thick brown deposit on the dorsum, while the tip and sides of the organ are red. The patient quickly becomes apathetic, drowsy, with dull expression. As the disease progresses, the rapidity of the pulse increases and may reach 140 a minute, and is usually small and of low tension. The respirations are generally quickened and there are usually signs of laryngitis and bronchitis and occasionally bronchial pneumonia. Delirium is known, especially at night.

Definite preliminary rashes are rare. What one generally sees the first two or three days of the disease is a very marked flushing of the face, neck and upper portion of the chest, with a subcuticular mottling of the skin of the lower part of the chest and abdomen (*cutis marmorata*). It should be noted at once that this symptom is far from being specific, a similar flushing being very often noticeable in many cases of Pappataci fever. The true typhus rash appears generally on the fourth or fifth day in the form of small roseolar spots, indistinguishable from typhoid roseola but often more abundant. According to some of the old authorities, it appears first on the arms and legs, but, in the writer's experience of Serbian and Polish epidemics, the rash generally starts on the abdomen and then spreads to the chest, arms and legs. The spots are at first roseolar and disappear completely on pressure, then some of the spots slowly fade away, while others become of darker hue and do not disappear completely on pressure, becoming petechiae, though it is rare for them to develop the dark blue appearance of petechiae in such eruptions as those of purpura. The rash, in a few cases, may remain purely roseolar-like, without any of the spots becoming petechial. In exceptional cases, the rash may be absent altogether: *typhus exanthematicus sine exanthema*. The medical man with little experience of typhus should be on his guard not to mistake for true typhus rash a petechial rash, the so-called Balkanic rash, due to bites of innumerable fleas, composed of numerous perfectly circular dark red petechiae, which is extremely common in the Balkans and in Galicia in peasants and soldiers. Anyone who has not been to those countries can hardly believe how profuse this rash can be. The whole body, with the exception perhaps of the face, is completely covered with it, while the shirt of the sufferer may be absolutely black from the number of living fleas upon it. With a little practice one soon learns to distinguish the two rashes. Each flea-bite shows at first a central haemorrhagic spot surrounded by a hyperemic circular zone, which disappears on pressure. This peripheral hyperemic zone fades away spontaneously within a day or two, while the central haemorrhagic spot remains as a petechial area, which is, as a rule, perfectly circular, not raised, and of a dark red, sometimes copper-like, colour which does not disappear on pressure. In the blood there is often a marked leucocytosis, and a differential count shows a large increase of polymorphonuclears. An interesting feature is the complete absence of eosinophiles in practically every case.

Termination.—On or about the fifteenth day, the temperature generally falls by crisis, or, much more frequently, by rapid lysis which may extend through three to five days.

Convalescence may be slow, and fairly frequently there is danger during this stage, as the general condition may not improve after the cessation of the fever, and death may occur some two to three weeks after defervescence. In certain cases, while the temperature has become normal, the pulse does not improve, and the patient becomes weaker and weaker until he dies.

Complications and Sequelae.—The most usual complications are: parotitis, ending often in suppuration, gangrene of feet and polyarthritis; neuritis, hemiplegia, severe mental depression amounting almost to melancholia (seen during convalescence) may be mentioned, also bubonic swellings; otitis media, abscesses and boils occur, while jaundice, endocarditis, and meningitis are rare, but myocarditis is fairly common.

It is interesting to note that different epidemics of typhus have been reported as being characterized by special features in regard to complications and sequelae; thus, the Serbian epidemic in 1914–5 showed a great tendency to gangrene of the feet, while those of Ireland have generally been associated with bronchial and pneumonic complications. On the other hand, in the recent epidemics in Poland and Galicia, complications have been comparatively rare.

Diagnosis.—The principal data on which to base the diagnosis are as follows:—

(*a*) *Incipient Typhus.*—(1) The sudden onset, often with headache, rigours, and vomiting. (2) The congested eyes and face and the subcuticular mottling of the skin over the chest. (3) The mental confusion and stupor, associated with the log-like attitude of the whole body. (4) The increased percentage of polymorphonuclear in the differential count.

(*b*) *Fully Developed Typhus.*—(1) The typical rash. (2) The history of the sudden onset, etc. (3) Leucocytosis and increased polymorphonuclear percentage. (4) The *Weil-Felix reaction*, viz., the blood of typhus patients agglutinates a proteus-like germ, isolated from the urine of some cases of typhus by Weil and Felix and called by them Proteus X19.

Prognosis.—The case mortality may be from 10 to 50% and greatly varies in different epidemics. It is low in the young and very high in the old. The malady is slightly more fatal in males than in females, while alcoholism and kidney disease are bad prognostics.

Treatment.—This is merely palliative. Patients suffering from typhus should be placed, whenever possible, in airy, well-ventilated wards, and in the summer months tents may be used with advantage. Cleanliness and good nursing are essential. During the febrile attack the diet should consist of broths and milk and soft solids, while plenty of water is allowed to be drunk. The temperature should be controlled by cool sponging and the nervous symptoms by ice to the head, hyoscin, bromides or morphine, while the heart is supported by hypodermic injections of strychnine and digitalin. Special attention should be paid to the mouth and throat. The legs and feet should be kept warm and pressure on the feet, even from the bed-clothes, should be avoided, lest it contribute to the production of gangrene. Prostration is extreme in most typhus cases, and a most striking fact is the occurrence of many deaths after the period of defervescence, even when severe complications have not developed. To combat this extreme exhaustion, the administration of alcohol in moderate doses is sometimes useful.

Attempts at specific medication have been made by various authors, and Nicolle has prepared a serum, by injecting horses with emulsions of spleen and adrenals of guinea-pigs artificially inoculated, said to have good results, the dosage being 20 c.c. daily.

Prophylaxis.—This consists in taking every possible measure for the destruction of lice. There is no doubt that heat, whenever it can be employed, is the most satisfactory means for the destruction of lice and their eggs in clothes, blankets, bedsheets, etc. When dry heat is used, a temperature of 68° C. for 15 minutes is the safe standard for routine practice. When steam is used, articles should be submitted to a temperature of 100° C. for 30 minutes to allow the steam to thoroughly penetrate all parts of the clothing. For disinfestation of rooms, barracks, etc., sulphur fumigation is probably the most satisfactory routine method. The rooms, whenever possible, should be sealed and rendered approximately airtight, and then the sulphur fumigation is carried out, using 5 to 8 lb. of sulphur per 1,000 cub. ft., the rooms remaining sealed up for a period of not less than 12 hours.

With regard to the usual chemical insecticides, their utility is somewhat limited; among the liquid ones, petrol is, in practice, probably the best; guaiacol is a powerful licecide but is expensive. Among solid insecticide substances, naphthalene is the most useful and convenient. It is interesting to note that according to Jackson's and the writer's experiments in Serbia insecticide chemicals do not act equally well on lice, bugs and fleas; for instance, pyrethrum (many patent insecticide powders are merely pyrethrum) acts powerfully on bugs while its action on lice is very slight; on the other hand, iodoform, which will kill lice in 10–15 minutes, has no action on bugs and very little on fleas. When an insecticide for general use is required therefore, several chemical substances should be combined, and the following powder has been found fairly efficacious, viz., naphthalene, previously soaked in guaiacol or creosote ℥ij pyrethrum ℥ij zinc oxide ad. ℥. The wearing of undergarments made liceproof by soaking in crude carbolic acid and soft soap, as recommended by Bacot and others, has been found useful.

In badly infected districts a large number of bathing and disinfecting stations should be established and a general disinfection of people should be carried out. The following procedure, as adopted by the American Typhus Commission with most satisfactory results in the Serbian epidemic of 1914–5, is recommended. The infested person goes into a room, takes off the clothes, which are steamed or boiled, passes into another room where he is bathed, then into a third room where he is sprayed with petrol, and finally into a fourth room in which he receives clean or sterilized clothes. The sterilization of the clothes may be conducted by boiling, but better still by making them into lightly packed bundles and placing them in a truck or room into which steam is blown.

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TYRRELL, ROBERT YELVERTON (1844–1914), Irish classical scholar, was born at Ballingarry, co. Tipperary, Jan. 21 1844. He was educated at Trinity College, Dublin, where he subsequently became a fellow in 1868 and professor of Latin in 1871. From 1880 to 1898 he was Regius professor of Greek at Dublin, and from 1900 to 1904 professor of ancient history. He was a Commissioner of Education for Ireland and one of the original fellows of the British Academy. Amongst his published works were an edition of Cicero's *Letters* (7 vols., the later vols. with Dr. Purser, 1879–1900); *Latin Poetry* (1893); *Sophocles* (1897); *Terence* (1902), and *Essays on Greek Literature* (1909). He died in Dublin Sept. 19 1914.

TYRWHITT, SIR REGINALD YORKE, 1ST BART. (1870–), British Admiral, was born at Oxford May 10 1870, the youngest son of the Rev. Richard St. John Tyrwhitt. He entered the navy in 1883, was promoted lieutenant (1892), commander (1903), captain (1908), commodore (1914) and rear-admiral (1919). He was in charge of a landing party at Nicaragua in 1894. During the World War he commanded destroyer flotillas in actions in Heligoland Bight (Aug. and Dec. 1914) and off the Dogger Bank (1915). He was created K.C.B. in 1917, and in 1919 received a baronetcy, a grant of £10,000 and the thanks of Parliament.

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UGANDA (*see* 27.557*).—The area of the protectorate, after taking into account an exchange of certain districts with the Anglo-Egyptian Sudan in 1914, is some 110,300 sq. m., including 16,000 sq. m. of water (chiefly those parts of lakes Victoria and Albert Nyanzas within its limits). The pop., given as 2,843,325 at the 1911 census, was in 1919 officially estimated at 3,318,190 of whom 847 were Europeans and 3,516 Asiatics (mostly Indians). The most numerous races are the Baganda and Banyoro.

Industries, Trade and Communications.—The economic resources of the protectorate greatly increased in the decade 1910–20. This period was marked by the rapid development of cotton-growing—an industry entirely in the hands of the natives—and by the acquisition of numerous plantations by Europeans, who engaged chiefly in the production of coffee and Para rubber. These, with ox-hides, goat-skins and ivory formed the chief exports. Sesame seed, red chillies (which grow wild) and ground nuts were fluctuating crops. Cocoa, tea, tobacco and other plantations were started and a beginning was made in the export of timber. Ghee (clarified butter), in considerable quantities, was sold in Kenya Colony (British E. Africa).

At first the cotton produced was mainly ginned in the E. Africa Protectorate, but by 1919 ginneries established at Kampala, Entebbe, Jinja and other centres by European companies ginned and baled all the cotton exported. The value of the cotton exported (most of it taken by Indian merchants for the Bombay market), £165,000 in 1910–1, had increased to £965,000 in 1918–9. The last-named figure was, however, due to the inflation of prices and represented an export of 4,909 tons; in 1914–5 when 6,866 tons were exported the value was only £351,000. In 1919 a tax of 4 cents per pound on all cotton exported was imposed, the proceeds to be devoted wholly to the development of the industry. In 1920 the tax was reduced to 3 cents per pound, and was to so continue for three years. Progress made in the rubber plantations was shown in the increase of exports from 9 tons in 1914 to 113 tons in 1919. Coffee exports increased from 13 tons in 1910 to 2,716 tons (valued at £106,000) in 1919.

External trade is almost wholly through Kenya Colony by rail to Mombasa. The value of the imports, chiefly textiles and hardware, rose from £347,000 in 1910–1 to £744,000 in 1916–7, exclusive of Government stores, specie and goods in transit. (The transit trade is almost entirely with the north-eastern part of Belgian Congo and consists largely in bullion from the Kilo gold mines.) In the same period the value of exports of domestic produce rose from £306,000 to £637,000. The Customs Depts. of the two protectorates were amalgamated in 1917, and since that date no separate statistics have been kept, except in regard to domestic produce. The value of such produce in 1918–9 was £1,247,000.

The development of trade and the work of administration was aided by a well-planned system of metalled roads suitable for motor traffic. A railway 61 m. long from Jinja (by the Ripon Falls) to Namasagali, the first navigable point on the Nile, was begun in 1910 and opened on Jan. 1 1912. It was built entirely by Busoga natives and is called the Busoga Railway. It connects with a line of steamers which serves Lake Kioga and the Bukedi district, where a rich soil and well defined dry season provide excellent conditions for cotton growing. Besides the Busoga Railway there is a 7-m. railway (opened 1915) connecting Kampala, the capital of Buganda, with Port Bell on Victoria Nyanza. It was designed as the first stage in a main line to connect the Victoria and Albert Nyanzas; that is, Uganda and the Belgian Congo. Mechanical transport, introduced in 1908, is much developed. In 1919 Jinja became a station on the Cape to Cairo air route, and the first machines to use its aerodrome arrived in Feb. 1920, coming from Cairo.

The chief towns are Kampala (or Mengo), the capital of Buganda (pop. approx. 40,000); Entebbe, on Victoria Nyanza, the seat of government and 24 m. from Kampala (pop. 12,000); Jinja, chief town of Busoga and headquarters of the cotton industry; Masindi, capital of Bunyoro; Mjanji, a port at the mouth of the Sio river. Kampala, the headquarters of the Buganda Government and of the chief missionary societies, has a number of fine buildings; a new Anglican cathedral, a brick-built domed building with massive stone pillars, was consecrated in Sept. 1919.

Revenue, Administration and Education.—The revenue in 1909–10 was £165,000 against an expenditure of £240,000, the balance being met by an Imperial grant in aid. In that year a poll tax was substituted for a hut tax, and the revenue thus increased. By 1915–6 the revenue had risen to £287,000, while the expenditure was £285,000. This was the first year in which income exceeded outgoings and in which no grant in aid was needed. In 1918–9 the revenue was £351,000 and the expenditure £323,000. The chief source of income is a poll tax on the natives; since April 1919 a poll tax has also been levied on Europeans and other non-natives. An *ad valorem* duty of 10% on imports and an export duty on certain commodities are other sources of revenue.

The administration is on the line of a British Crown Colony. An Order in Council passed in 1911 provided, in effect, that the criminal law should be the Indian Penal code, the civil law generally that in force in England. Much of the protectorate consists, however, of native states governed by chiefs (four of whom bear a title equivalent to king) with the aid of a *lukiko* (council or Parliament). This system of local self-government was extended from 1910 onwards as new districts were brought under control.

Education is entirely in the hands of the missionaries, Anglican and Roman Catholic. The Native Anglican Church (formed by the efforts of the Church Missionary Society) had in 1918 some 40,000 scholars. There are elementary, secondary, high and medical schools as well as theological colleges. The Mill Hill (R. C.) Mission had over 18,000 children in its schools, the White Fathers Mission nearly 20,000. Education is most advanced among the Baganda, the majority of whom (400,000 out of 676,000) profess Christianity. The kings of Buganda, Bunyoro, Toro and Ankole, and their prime ministers, are all Anglicans.

History.—The history of the protectorate since 1910 was one of steady development, in which the missionaries continued to play a leading part. The World War of 1914–8, though it entailed a serious drain on the man-power of the country, only temporarily checked (and that not to a great extent) its progress. In March 1911 Mr. (afterwards Sir) F. J. Jackson became governor, holding that post till April 1917. During his governorship some few hundreds of planters and commercial men were added to the European residents, hitherto almost entirely Government servants and missionaries, but as Uganda is not, and can never be, a "White Man's Country," the problems presented in lands where large numbers of whites and blacks live side by side did not arise.

The readjustment of the south-western and western frontiers in accordance with agreements made in 1910 and 1911 with Belgium and Germany was completed in 1912. The western shores of Albert Nyanza with the adjacent strip of territory were transferred to the Belgian Congo, while to Uganda was added the district of Kigezi (2,056 sq. m.), a highland region (much of it over 6,000 ft.) containing some of the peaks of the Mfumbiro range of active volcanoes. The northern part of Ruanda lies within the district. The formal transfer of the part of Kigezi which had belonged to German E. Africa took place in Jan. 1912. Two years later Kabale was chosen as headquarters of the district.

In April 1914 another territorial change was effected when the northernmost part of the protectorate E. of the Nile was transferred to the Sudan Government, whose administration was extended S. to Nimuli, this giving the Sudan control of the whole of the stretch of the Nile navigable from Khartum. In return the Sudan surrendered to Uganda some 4,000 sq. m. W. of the Nile and N. of Albert Nyanza, an area which had been part of the Lado enclave, leased to Leopold II. of Belgium. These arrangements tended to make the Uganda Protectorate more compact and manageable. By 1915 effective control had been established over the whole protectorate except the district lying W. of Lake Rudolf—an arid region sparsely inhabited by Turkana and other warlike nomads who owned no paramount chief. This remote district was the scene of an extensive gun-running trade with Abyssinians and Somalis, and of raids on peaceful tribes, involving punitive measures. The most important of these expeditions was carried out during April–June 1918 by a combined force from British E. Africa, Uganda and the Sudan. The operations showed the Turkana that though supported by Abyssinian marauders they could not escape punishment, but they were inconclusive, as neither the Sudan Government nor that of Uganda was prepared effectively to administer their portions of the disturbed area.

The outbreak of the World War found Uganda wholly unprepared. At that time, Aug. 1914, the protectorate troops (4th Batt. King's African Rifles) were engaged against the Turkana. For 180 m. W. of Victoria Nyanza the Uganda

** These figures indicate the volume and page number of the previous article.*

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frontier marched with that of German E. Africa, and for some time it was defended only by a few policemen and mobs of undisciplined spearmen. The Germans, however, let the opportunity pass, and only outpost actions were fought. With the launching of the Belgian offensive in April 1916 Uganda ceased to be in the sphere of active operations. The chief service rendered by Uganda in the E. Africa campaign was the raising of over 10,000 African soldiers, the formation of a native medical corps—this corps was formed through the efforts of Sir Apollo Kagwa, prime minister of Buganda—the supply of over 60,000 trained carriers and some 100,000 "job porters" (*see* EAST AFRICA CAMPAIGN).

The Baganda, Banyoro, Busoga and other races, throughout, gave the British authorities prompt and continuous aid. The Buganda Government at once mobilized every militarily-fit man. This was done by direction of the Kabaka (King) Daudi Chwa (b. 1896), who "came of age" four days after war began.

During the war some trouble was caused in the Kigezi district by the Nabingi, an anti-white society, which took a sheep as totem, put 2,000 warriors in the field and attacked impartially British, Belgian and German troops. The trouble originated in Ruanda, then under German rule. It was temporarily stopped by the sacred sheep being captured, shot and burnt, but in 1920 the Nabingi, with a new leader and a new sacred sheep, again gave trouble. This society was the only instance of anti-white feeling in Uganda, and affected only a minute part of the protectorate.

On Sir F. J. Jackson's retirement after 23 years' service in E. Africa, Mr. (afterwards Sir) R. T. Corydon was appointed governor (Nov. 1917). A notable event in 1920 was a visit by the Rev. John Roscoe, the chief authority on Baganda ethnology, to study the lesser known tribes of the protectorate.

The problems with which Sir R. T. Corydon had to deal were largely economic and social. The rise in the value, in 1919, of the rupee and the decision of the Colonial Office in 1920 to fix its exchange at 2s. sterling affected Uganda less perhaps than Kenya Colony, but caused a disturbance of trade, while the great fall in the price of cotton from the middle of 1920 onward seriously affected the industry. The introduction by order of the Colonial Office of the differential treatment of Indians enforced in Kenya was another disturbing influence. (*See* KENYA COLONY.) A step forward in the political status of the protectorate was the creation of a Legislative Council, to which various sections of the community nominated members. The first session of the Council was held on March 23, 1921. The Indian community, in view of the action of the Colonial Office, declined to send a representative to the Council.

See H. R. Wallis, *The Handbook of Uganda* (2nd ed. 1920), an excellent monograph, by a former chief secretary to the Uganda Government, with bibliography; Maj. E. M. Jack, *On the Congo Frontier* (1914); Rev. J. Roscoe, *The Northern Bantu* (1915); R. Kmunke, *Quer durch Uganda* (1913); R. Lorimer, *By the Waters of Africa* (1917). (F. R. C.)

UHDE, FRITZ KARL HERMANN VON (1848–1911), German painter (*see* 27.563), died at Munich Feb. 26 1911.

UKRAINE (*see* 27.564).—In its more recent application the name of Ukraine refers to a region of south-eastern Europe, embracing districts of South Russia and former Austria-Hungary which are said to be predominantly Ukrainian-speaking and which should, it is claimed, for this reason form an autonomous State. The boundary of this territory was in 1921 undefined, but, broadly speaking, the claim was that it extended from the mouth of the river Dniester in a north-westerly direction to the neighbourhood of Cracow, thence running roughly N. towards Byelostok, then E. slightly by S. to the Volga, then S.S.W. to near Rostov, S.E. to the Caspian Sea and W. to the Black Sea. The independence of Russian Ukraine, the eastern section of this territory, was proclaimed in Nov. 1917, and that of Austrian (western) Ukraine in Nov. 1918; and in Jan. 1919 eastern and western Ukraine united as a "Republic of the Ukrainian People."

The total pop. of this "ethnographic Ukraine," according to the census estimate of Jan. 1914, was 46,012,000, giving a density of 62.3 per sq. km.; of these 32,662,000 were classified as Ukrainians, 5,376,800 Russians, 2,079,500 Poles, 3,975,760 Jews, 871,270 Germans, 435,240 Rumanians and 32,960 Hungarians; or, according to religion, Ukrainian-Orthodox Church 30,653,000, Greek Catholic 6,847,000, Russian Orthodox 4,500,000, Jewish 3,976,000, Roman Catholic 2,000,000 and Protestant 800,000.

The accompanying table shows in fuller detail the area and pop. of the various districts composing the territory, in which, according to the 1914 estimate, the Ukrainian-speaking people are claimed to be in a majority, either absolutely or relatively.

Country.	Province (Government).	Area in sq. km.	Population. Total.	Ukrainian-speaking.	Percentage.
Russia	Chelm (Kholm)	10,455	841,800	447,650	53
	Grodno	13,701	715,600	443,370	62
	Minsk	19,953	469,700	355,920	76
	Volhynia	71,735	4,189,000	2,936,080	69
	Podolia	42,016	4,057,300	3,282,680	80
	Kiev	50,957	4,792,500	3,746,310	78
	Chernigov	38,334	2,234,700	2,050,350	90
	Poltava	45,893	3,792,100	3,523,720	92
	Kharkov	54,492	3,416,800	2,743,710	80
	Kursk	10,531	780,250	440,190	56
	Voronezh	28,890	1,519,950	1,150,310	76
	Don (territory of)	20,861	1,196,600	580,970	48
	Stavropol	17,397	492,500	248,100	50
	Kuban	53,160	1,763,800	1,078,460	61
	Taurida	35,064	1,763,800	805,900	46
	Ekaterinoslav	63,392	3,455,500	2,366,280	68
	Kherson	70,798	3,774,600	1,977,030	53
Rumania	Bessarabia	11,988	787,700	319,210	40
Austria-Hungary (former)	Galicia	54,577	5,378,650	3,415,000	64
	Bukovina	5,276	460,430	301,150	65
	Hungary	6,347	568,490	440,630	78
Total, Ethnographic Ukraine	.....	739,162	46,012,000	32,662,000	71%

Language.—The Ukrainians claim to have a national language of their own, distinct from the Russian and Polish languages. Mr. Ralph Butler, in his *New Eastern Europe* (1919), says: "Whether Ukrainian is a dialect of Russian or a separate language is a vexed question. But if Ukrainian was a dialect in 1914 it is a separate language now: for whatever may be the ultimate destiny of the two great divisions of the Russian people the events of 1917–8 have carved lines which are beyond effacement in the ethnical development of the Ukrainian race. As written by the Nationalists, Ukrainian differs considerably in appearance from Russian; it discards six of the Russian letters and uses three which Russian has not got. The Nationalists have purposely made the orthography as different from the Russian as possible. They have created a neo-Ukrainian literary language from which they have excluded as far as possible all Great-Russian technical terms." The people furthermore claim to have a national culture of their own.

The Ukrainian Movement.—Briefly the history of the Ukrainian Movement down to 1914 is to all intents and purposes the history of the Ruthenians (*see* 23.939), inhabiting the eastern parts of Galicia, of which province they constituted slightly less than half the population. Though subservient to the Polish majority in Galicia, the Ruthenians constituted the intellectual centre for the Ukrainian Movement. The books which were not allowed to be published in Russia were published in Lemberg and Cernowitz, and eastern Galicia became the chief centre of Ukrainian propaganda.

By the Treaty of Pereyaslavl, 1654, the Ukraine received independence, but acknowledged the Tsar as protector of the republic. By this treaty the Ukraine retained complete self-government and the right of maintaining its own diplomatic representatives abroad. By degrees, however, its autonomous

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privileges withered, and by 1847 the Ukrainians saw their national existence in danger of being merged, in spite of ethnographic differences between the two races, in the general subjection of the Russians. A society called the "Cyril-Methodius Brotherhood" was started to keep the national tradition alive, having not only the literary object of promoting the Ukrainian language (till then only in oral use among the peasants) but also a far-reaching political programme. A federation of autonomous Slavonic states was aimed at.

In 1900 the various Ukrainian political parties began to organize themselves. Of these the most important was that of the National Democrats, founded to fight for equal rights to those of the Poles in Galicia and for the autonomy of the Russian Ukraine as a federated Russian State. In the same year the first Revolutionary Ukrainian party was organized in Lemberg, and in 1905 assumed the name of the Ukrainian Social Democratic Working-men's party. Gradually the efforts of these societies were rewarded by the resurrection of the Ukraine as a result of the break-up of the Russian Empire.

The Ukrainians claim that the relation between them and Russia was purely dynastic, inasmuch as the Tsar was, by treaty, Protector of their State, and that when there was no more a Tsar of Russia they declined to permit the Russian people to succeed to the rights and privileges of their deposed sovereign. They therefore resumed their long dormant autonomy and founded a provisional Government in the summer of 1917. This Government, supported by the Ukrainian National Congress and the Central Rada appointed by this body, refused to recognize the Bolshevist regime under which Kerensky was supplanted in Oct. 1917. Accordingly, the independence of the Russian Ukraine was proclaimed on Nov. 21 1917, and accredited representatives from France and Great Britain entered into relations with it in Dec. 1917 and Jan. 1918.

Then came the Brest Litovsk meeting and the Treaties of Feb. 9 and 11 1918, between the Central Powers and the "Ukrainian People's Republic," treaties which were interpreted by the Rada as a formal recognition of Ukrainian independence, but in effect meant annexation by the Germans. In April 1918 a German *coup d'état* overthrew the constitutional Government. Skoropadski was appointed nominally as Hetman but in reality Dictator, and, until the collapse of the Germans on the western front, spared no effort to destroy Ukrainian independence.

After the signing of the Armistice the succeeding steps in the evolution (and subsequent disintegration) of a Ukrainian State were as follows: In Nov. 1918 came the proclamation of the State of the Ukraine of the West (Ruthenian Ukraine), and the conflict of this State with Poland. On Dec. 14 1918 the old Rada of Russian Ukraine was reorganized into a "Directory," with Vinnitchenko and Petlura at its head. On Jan. 3 1919 the union of the Russian and Ruthenian Ukraines was announced, with Hetman Petlura as recognized head of the constitutional Government of the joint republic, having its seat at Kiev.

Subsequently the Ukrainians with varying fortunes resisted in turn or simultaneously the attacks upon their territory made by the Bolshevists on the one hand and by Gen. Denikin's "White" volunteers on the other.

In Feb. 1920 the nominal Government of the Ukraine presented a note to the Peace Conference asking for recognition as being a *de facto* Administration on the same footing with other states which have arisen amid the ruins of Russia. The note pointed out that the population was firmly opposed to Bolshevistic theories and intent upon independence. It asked for the moral support of "Western Civilization" in its task of overthrowing anarchy, and appealed for material assistance to enable it to reorganize its immense resources. Not only did the Ukraine remain unrecognized, but, by the Peace Treaties, large tracts that were claimed as "Ukrainian" (Galicia, Grodno, Minsk, Volhynia, a part of Podolia, Bukovina, Bessarabia) had been previously assigned to Poland, Lithuania, Czechoslovakia, or Rumania. Against the delivery of eastern Galicia, in particular, to Polish rule, the "Ukrainian Republic" made a strong protest to the United States in Dec. 1919. At about the same date the country was described as dotted with a number of miniature republics consisting of a dozen or so towns and villages fortified for defence, each having its own armed force. Gen. Petlura was in Warsaw, and M. Mazeppa, his prime minister, with the nucleus of the Ukrainian National Government and an army of about 6,000 strong, at Kamenets Podolskiy, and the Government was proving itself totally incapable of organizing the country.

In April understandings were reached with Poland and Rumania, and the Ukrainian army was coöperating with the Poles against the Bolshevist army. On April 27 the Polish Government formally recognized the Ukraine—or what remained of their claim—as an independent State, and accepted the provisional National "Directory," with Petlura as head, as the Government of the country. In May it was officially stated by Mr. Bonar Law in the British Parliament that conditions in the Ukraine had not been settled enough to warrant the recognition by the Allied Powers of any government set up there. Later in the year Petlura's Ukrainian Government was temporarily housed at Reshoff, W. of Lemberg, and in Oct. Gen. Wrangel had temporarily become a power in the Ukraine. By Oct. 23 Petlura had reëstablished his Government at Kamenets Podolskiy, and his troops were pushing on towards Kiev. On Nov. 4, in a written reply to a question in the House of Commons the Government stated that the Ukraine had not been recognized either as a *de jure* or *de facto* Government. By the Treaty of Riga between Soviet Russia and Poland, in Oct. 1920, a further large part of the Ukrainian claim passed to Poland.

Reports of happenings in the Ukraine during 1921 were extremely meagre. The defeat and withdrawal of Wrangel's army had no tranquillizing effect on the region, but was, on the contrary, followed by a crop of serious peasant risings. Petlura and the "Ukrainian People's Government" had their headquarters in southern Poland, at Tarnow.

Resources, Industry and Trade.—The resources of the Russian Ukraine are naturally very great: covering an area nearly equal to that of France, Italy and England combined, this region contains the best part of the Black Earth zone (the granary of eastern Europe), most of the coal and iron, 80% of the beet, 70% of the tobacco and one-third of the live stock of pre-war Russia. According to figures available during peace-time the total national wealth derived from the different branches of industry in this region was over £265,000,000, of which agricultural products amounted to 158, live stock 26·5, metallurgy and mining 37·5, manufactures 30·5, poultry 4·5, forestry 4·5 and other sources 5 millions of pounds.

Of the land, 65% is arable, 10% forests, 12% pasturage, 6% other products and 6% sterile. The grain crop is the main source of agricultural wealth and normally represents 32% of the total production of grain of the whole Russian Empire. The sugar industry occupies second place: in 1910–1 there were 580,000 ac. under sugar-beet cultivation. The manufacture of sugar is by far the chief manufacturing industry and 143 out of the 238 sugar factories in the whole of Russia were situated in Podolia, Volhynia and Kiev. The tobacco industry is also of importance, including the cultivation of Turkish, American and other lower-grade varieties. At the beginning of the war the census of the live stock of the region was as follows: horses 8,000,000; horned cattle, sheep and goats 27,600,000; and pigs 6,300,000; and the export of stock, meat and animal products, mostly through the ports of Odessa and Nikolayev, was approximately:—cattle (horned), 240,000; horses, 15,000; pigs, 130,000; beef, 9,000 tons; pork and dressed poultry, 12,000 tons; eggs, 65,000 tons; hides, 6,500 tons.

The coal-mining industry is located in the Donets-Basin district, which comprises an area of some 8,000 sq.m. the larger part of which falls within the Ukrainian "claim." The better kinds of coal (anthracite, steam and coke) are obtained in the governments of Ekaterinoslav and Kharkov. Taking the percentage of production in 1915, the Don district amounted to 85·6%, other parts of former Russia 14·4%, and the average production in the years 1913–5 was 20 millions of tons annually. The export is normally carried on at Berdyansk and Mariupol. The output of mercury, found in the district of Ekaterinoslav, increased during the war as follows: 64·5 tons in 1913, 115 tons in 1915, and 100 tons in 1917.

The total exports from nine of the Ukrainian governments between 1909 and 1913 averaged £76,000,000 and the total imports £52,000,000. The exports were, cereals 64% and sugar 22 per cent. Commerce is much facilitated by the navigability of the Ukrainian rivers, that of the Dnieper being 1,250 m., the Desna 537 m. and the Dniester 521 miles. (H. W. M.)

UNDERWOOD, OSCAR WILDER (1862–), American politician, was born at Louisville, Ky., May 6 1862. He studied at

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the university of Virginia (1881–4), was admitted to the bar in 1884, and practised law thereafter in Birmingham, Ala. From 1895 to 1915 he was a member from Alabama of the National House of Representatives, and during his last two years chairman of the Committee on Ways and Means. After the Democrats came into power in 1913 he had a large share in framing the tariff bill passed the same year; but his attempt to establish a House Budget Committee was defeated. In 1914 he opposed the Panama Canal Tolls Repeal bill, but supported the resolution authorizing the President to use armed force in Mexico. He was opposed to the woman suffrage amendment to the Federal Constitution, holding that the question was a state issue. He also opposed the national prohibition amendment. In 1914 he was elected to the U.S. Senate, and in 1920 reëlected. In 1919 he favoured the anti-strike clause of the Cummins railway bill. He was a strong supporter of the Peace Treaty of Versailles without changes; but when its ratification had been blocked by the Republicans, he attempted to bring about a compromise. In Dec. 1919 he offered a resolution in the Senate providing that the president of the Senate should appoint a committee of 10 senators to work out some acceptable plan for adopting the Peace Treaty; but this was blocked by Senator Lodge. In April 1920 he was chosen Democratic leader in the Senate. He was one of the four U.S. delegates at the Washington Conference on the Limitation of Armament which assembled in Nov. 1921.

UNEMPLOYMENT (*see* 27.578).—Subsequently to 1910 the provision made in the United Kingdom for the remedy of unemployment was further fortified and extended. The Unemployed Workmen Act, 1905, was included each year after its enactment in the annual Expiring Laws (Continuance) Act.

The Act empowers local authorities to form distress committees consisting of their own members, of representatives of boards of guardians and of coöpted members possessing special knowledge of problems of distress. Their functions are to maintain a register of unemployed persons, to assist such persons to obtain work, to provide relief works and to assist unemployed persons to emigrate. Funds are provided by Government grants, from charitable money and from a ½d. rate. Hitherto, Government grants have been made to cover the difference between the actual value of the relief work done and the cost of doing it. The annual amount of Treasury grants never exceeded £300,000 (1908), and from 1911 was £100,000, which was not in any year fully expended. No grant had been made from 1913 to 1921. It proved impossible to provide relief work of a kind to which many of the unemployed applicants were accustomed, and consequently workpeople were employed upon work, generally approximating to navvy's work, for which they were unfitted. A heavy financial loss was incurred in almost every case. It proved impossible to obtain anything like a reasonable standard of work or output upon relief works, and employment upon such works was found to be demoralizing to workpeople of a good type. This method of providing for unemployment is discredited.

Labour Exchanges.—Under the Labour Exchanges Act (1909), 61 labour exchanges were opened in Feb. 1910, and this number was increased to 175 in Feb. 1911 and to 272 in Feb. 1912. As the result of the operation of Part II. of the National Insurance Act of 1911, the number of exchanges was further increased to 425 in Feb. 1913, and in June 1920 there were 395 exchanges.

The organization established by the Board of Trade consisted of a central office in London—the Labour Exchanges Branch—and 11 divisional offices, to which areas covering the whole of the United Kingdom were attached. The number of the divisional offices was subsequently reduced to ten and Scotland, Ireland and Wales each formed a division. Labour exchanges were opened in practically all towns with a population of 15,000 or more. Responsibility for this service was transferred to the Ministry of Labour upon its creation in Jan. 1917, central control being exercised through the Employment Department of the Ministry. The facilities provided by the labour exchanges (whose name was changed to "Employment Exchanges" in Oct. 1916) were made available without charge to all employers and workpeople with the exception of "private" domestic servants over 17 years of age. This exception was suspended during the World War and had not been reimposed up to 1921.

It is an important function of the exchanges to bring together unemployed applicants and suitable vacancies which may exist in different districts, when it has been found that the vacancies cannot be filled by applicants from the immediate locality. Arrangements are made, therefore, for the prompt circulation of particulars of vacancies which cannot be filled by local applicants, provided that the vacancies are of a character for which it is probable that applicants from a distance can be obtained. Such vacancies are notified as a rule by telephone to neighbouring exchanges within a defined "Clearing Area," and should this fail, the particulars are circulated more widely. Up to 1914 a system of divisional clearing houses was used. Particulars of unfilled vacancies were sent by each exchange to the divisional office to which it was responsible, and a classified list of all the vacancies so received was issued daily by the divisional office to all exchanges in the division. Lists of unfilled vacancies were also exchanged each week as between the divisions. In Aug. 1914, the system was superseded by the institution of a "National Clearing House" in London. While the immediate circulation of particulars within the "Clearing Areas" was retained, the circulation of lists of vacancies by the divisional offices was abandoned in favour of the circulation of a classified list for the whole kingdom. The information for this publication is received direct at headquarters from the various exchanges; a complete printed list of vacancies is issued once a week to all exchanges, and the list is kept up-to-date by the daily issue of a statement of vacancies to be added to the list and of cancellations of vacancies which have appeared upon it and are no longer open.

In order to enable workpeople who have, through the exchanges, found employment at a distance of more than 5 m. from their homes, the exchanges are empowered to advance the amount of the travelling expenses. Such advances are as a rule recovered through the employer by small weekly deductions from wages. During the World War, and until the Unemployment Insurance Act (1920) came into operation (Nov. 8 1920), tickets for railway journeys, etc., were issued at less than the normal rates by the exchanges to all workpeople for whom the exchanges had found employment. The cost was borne by exchequer funds. Under the Unemployment Insurance Act (1920), the exchanges are enabled in the case of insured workpeople who have found work through the exchanges to remit (at the cost of the unemployment fund) one half of the amount by which railway and other fares exceed 4s. for a single journey.

In cases of strikes and lock-outs it was decided not to deny the use of the exchanges to the employers and workpeople concerned. In such cases the officials of the exchanges are bound to accept from an employer the notification of a vacancy created by the dispute and are further bound to bring to the notice of any unemployed applicant, with the particulars of such a vacancy, the fact that a trade dispute exists at the establishment of the employer concerned. As a rule formal notification of the existence of a trade dispute is made to the exchanges either by employers or workpeople and when this occurs the terms of the notification are laid before unemployed applicants. Travelling expenses cannot be advanced to enable workpeople to travel to vacancies caused by a trade dispute, and particulars of such vacancies are rarely, if ever, circulated to other exchanges.

The Labour Exchanges Act authorized the formation of advisory committees to assist in the management of the employment exchanges. The intention of this provision was to secure the coöperation of representatives of industry in the administration of the exchanges. From 1912 onwards advantage was taken of this provision to form 17 advisory trade committees consisting of representative employers and workpeople in equal numbers; the number of the members of each committee varied from 12 to 36, and the usual number was rather more than 20. The chairman was chosen by the committee itself or, in default of agreement between the two sides of the committee, by the Board of Trade. The areas covered by the advisory trade committees were as a rule large, consisting of as many as five counties. It was the duty of the committees to advise the Board of Trade upon matters referred to them, and the matters so referred were as a rule questions of policy arising in the administration of the labour exchange service, *e.g.* the attitude which should be adopted by the exchanges towards employers and workpeople concerned in trade disputes and the extent to which "references" should be taken up by the exchanges in respect of applicants for employment. It was found that the areas assigned to the committee were too wide to permit of any close association with the current work of individual exchanges, and the restriction of the functions of the committees to the consideration of matters referred to them prevented the development of a sense of responsibility for the conduct of the exchanges. When, therefore, it became evident (in 1917) that upon the conclusion of the World War the exchanges would be faced with tasks of special difficulty in every area, the Minister of Labour, to whom responsibility for the exchanges was transferred upon the creation of that office in Jan. 1917, decided to replace the advisory trade committees by a larger number of local employment committees, associated much more closely with the work of each exchange. Three hundred and two local employment committees were formed in connexion with the 395 exchanges. As a rule, therefore, each committee is associated with a single exchange, and with more than one exchange only in some cases in the provinces where several are situated within a single industrial area.

Members of the local employment committees are appointed by the Minister of Labour, as a rule upon the nomination of local organizations of employers and of workpeople. The chairman of the com-

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mittee is chosen and appointed by the minister. The committees are responsible for advising the minister upon every phase of the work of the exchanges with which they are associated. They are free to initiate their business and to carry it out through sub-committees. Two hundred and forty-six committees have formed women's departments at the exchanges. Consisting of representatives of every industrial interest of importance in the locality, the committees are in a position to indicate precisely in what ways each exchange should be adapted to local needs so as to be of most service, and further, the committees have since their formation undertaken much detailed work on behalf of individual workpeople upon the books of the exchanges.

Exchange Statistics.—The scale and character of the work done is shown in Table I.

TABLE I.—*Employment Exchanges.*

	Year	Registrations	Individuals Registered	Vacancies Notified	Vacancies Filled	Individuals Found Work
Men	1910	920,000	740,221	261,560	219,069	
	1911	1,323,162	978,211	446,035	362,670	268,794
	1912	1,594,236	1,025,332	626,756	513,649	336,341
	1913	2,088,735	1,267,077	714,270	566,150	390,141
	1914	2,316,042	1,381,694	909,383	706,458	507,538
	1915	1,512,335	1,072,213	1,004,970	716,816	577,206
	1916	1,229,171	954,172	909,721	636,095	539,564
	1917	1,167,864	938,725	906,627	623,830	539,396
	1918	1,363,590	1,119,905	977,999	669,732	582,899
	1919	3,601,393	2,897,333	900,970	658,836	598,658
	1920	2,392,553	1,699,924	581,406	454,624	393,623
Women	1910	290,000	232,106	103,007	81,846	
	1911	414,459	307,641	178,446	136,409	97,598
	1912	518,775	360,873	226,276	168,555	118,650
	1913	532,060	351,755	270,325	199,395	133,424
	1914	707,071	476,926	312,344	232,935	160,145
	1915	1,232,891	920,638	493,515	385,101	306,192
	1916	1,921,826	1,501,260	846,196	695,631	615,920
	1917	1,873,706	1,487,728	814,785	706,034	636,269
	1918	1,815,691	1,478,934	808,490	624,220	547,412
	1919	1,927,143	1,568,625	731,320	408,033	341,773
	1920	1,015,113	767,037	469,068	284,451	212,895
Boys	1910	110,000	90,084	62,233	46,728	
	1911	185,108	138,684	106,920	77,881	64,752
	1912	200,403	146,434	130,601	88,086	70,565
	1913	186,574	137,668	143,715	90,387	74,535
	1914	211,898	157,093	157,278	103,280	85,068
	1915	194,864	150,559	161,459	106,716	90,237
	1916	241,314	184,443	148,091	116,900	100,053
	1917	265,668	204,283	146,103	120,525	105,547
	1918	296,673	234,285	148,158	122,054	106,429
	1919	355,547	285,603	155,978	117,166	103,237
	1920	286,003	218,365	133,662	106,938	93,386
Girls	1910	80,000	65,036	32,143	26,670	
	1911	117,718	88,833	57,208	44,450	38,066
	1912	151,890	110,948	78,941	57,940	48,153
	1913	158,524	115,171	94,518	65,921	54,206
	1914	207,441	148,310	100,019	74,236	61,320
	1915	246,047	183,393	137,702	99,506	84,701
	1916	266,378	203,909	145,010	108,609	95,869
	1917	268,142	206,914	131,927	104,834	93,986
	1918	263,110	212,139	132,570	98,706	88,003
	1919	313,570	252,225	163,096	105,928	94,207
	1920	290,931	220,972	127,997	95,695	84,265
Total	1910	1,400,000	1,127,447	458,943	374,313	
	1911	2,040,447	1,513,369	788,609	621,410	469,210
	1912	2,465,304	1,643,587	1,062,574	828,230	573,709
	1913	2,965,893	1,871,671	1,222,828	921,853	652,306
	1914	3,442,452	2,164,023	1,479,024	1,116,909	814,071
	1915	3,186,137	2,326,803	1,797,646	1,308,137	1,058,336
	1916	3,658,689	2,843,784	2,049,018	1,557,235	1,351,406
	1917	3,575,380	2,837,650	1,999,442	1,555,223	1,375,198
	1918	3,739,064	3,045,263	2,067,217	1,514,712	1,324,743
	1919	6,197,653	5,003,786	1,951,364	1,289,963	1,137,875
	1920	3,984,600	2,906,298	1,312,133	941,708	784,169

During the World War and the period of demobilization (Aug. 1914 to the end of 1919) much work of a special kind (see below) was undertaken by the exchanges, and in order to judge the extent to which they are used by employers and workpeople in normal years attention should be directed to the non-war periods.

It should be noted that at the end of 1918 the age-limit for "boys and girls" was raised from 17 to 18. The table shows that the work of the exchange system increased steadily and reached its maximum in the latter years of the World War. The figures for 1920 indicate a return after the exceptional war conditions to a normal scale of work. It appears that the exchanges may anticipate roughly the receipt each year of 3,000,000 registrations by unemployed workpeople, of notifications by employers of 1½ million vacancies and the filling of 1,000,000 of those vacancies. It should be remembered that the latter half of 1920 was a period of industrial decline.

Casual Labour.—Schemes intended to lead up to the regularization of employment were devised at the Liverpool docks, the Goole docks, the South Wales ports (ship repairers), and at Manchester (cloth porters). Of these, the Liverpool dock scheme is the most interesting. Managed by a joint committee of employers and workpeople in the docks, the scheme has led, through a system of tallies issued to approved dock workers, to some limitation in the number of the dockers employed in or about the port. The scheme also provides for a single weekly payment of wages to each man employed, irrespective of the number of separate employers for whom he may have worked. The wage-paying arrangements at Liverpool have not been copied elsewhere, but the method of controlling dock labour by the issue through a joint committee to dock workers of tallies, has become almost universal in British ports and provides a basis upon which it is possible to build schemes to regularize the employment of dockers.

Juvenile Employment.—Since 1910 a separate system of committees for dealing with the employment of juveniles (under 17 years of age to Dec. 1918 and under 18 years of age thereafter) has been in operation (*see* JUVENILE EMPLOYMENT). These committees are either formed by the Ministry of Labour under the Labour Exchanges Act, or by the local education authorities under the Choice of Employment Act, 1910. Their work is, in coöperation with the employment exchanges, to supervise the finding of employment for children; to advise children as to the most promising openings, and generally to take such local action as is calculated to improve the conditions of juvenile employment.

Unemployment Insurance.—On May 4 1911, Mr. Asquith's Government introduced in the House of Commons, as the second part of the National Insurance Bill, proposals for the compulsory insurance upon a contributive basis of 2½ million workpeople. The bill received the royal assent, Dec. 16 1911. This measure, to the extent to which it brought the employed population within the scope of unemployment insurance, completed the policy for dealing with unemployment which had been begun in 1909 by the passage of the Labour Exchanges Act. Part II. of the National Insurance Act also contained provisions intended to encourage voluntary provision for unemployment in the industries which were not included under the compulsory scheme.

All workpeople employed in the "Insured Trades" as defined by a schedule to the Act were compelled to be insured against unemployment. Contributions were payable as from July 15 1912, and benefit was paid from Jan. 8 1913. The trades concerned were building, construction of works, shipbuilding, engineering, construction of vehicles, ironfounding, together with saw-milling in connexion with, or of a kind commonly done in connexion with, any of the insured trades. Questions as to the precise limits of the insured trades were settled by an umpire appointed by the Crown to act for the whole kingdom. An unemployment fund was created out of contributions from workpeople employed in the insured trades and from the employers of such workpeople. The rate of contributions was 2½d. each from employer and workman for each period of employment up to a week, with reduced rates for workmen below 18 years of age and for periods of employment of adults for two days or less, viz. a joint contribution of 2d. for a week's employment of a juvenile worker or for the employment of an adult for a period not exceeding two days. To the amount so collected the State contributed an amount equal to one-third of the joint contributions of employers and workpeople. It was the duty of an employer to affix to an unemployment book each week, or at the earlier termination of the employment, a stamp of the value of his own and the workmen's contributions, the employer thereafter deducting the amount of the workman's contribution from wages paid to him. The scheme provided unemployment benefit at the rate of 7s. a week during unavoidable unemployment subject to a maximum of 15 weeks' benefit in any 12 months and to the limitation of payment to one week's benefit for every five full contributions paid by the workman. Benefit was not payable to persons under 17 years of age and was payable at half the adult rates between the ages of 17 and 18. The principal statutory conditions for the receipt of benefit were application for benefit in the prescribed manner, namely at a Board of Trade labour exchange or other local office of the unemployment fund; proofs, secured mainly by daily attendance at the labour exchange, that unemployment had been continuous since the date of application; capacity for work, and inability to obtain suitable employment. Proof that the last condition had been satisfied was obtained mainly by an examination of the register of vacancies at the labour exchange in order to see whether suitable employment was available and the offer to the applicant of any apparently suitable work. A workman was dis-

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qualified for benefit if he had lost his employment as the result of a stoppage of work due to a trade dispute at the premises at which he was employed, and in such a case the disqualification lasted during the continuance of the stoppage or until the workman had obtained fresh employment in an insured trade. Disqualification for six weeks from the date of losing employment was involved in discharge through misconduct or in leaving employment voluntarily without just cause. Claims to unemployment benefit were decided in the first instance by a statutory "Insurance Officer." From the decision of this officer the workman had a right of appeal to the court of referees consisting of an employer, a workman and an impartial chairman. Further, the insurance officer had the right to refer the decisions of courts of referees to the umpire for final settlement.

Associations of insured workmen were entitled (Section 105, Nat. Ins. Act) to undertake the payment to their own members of unemployment benefit due to them out of the unemployment fund. Such an arrangement involved the payment of the State benefit by the association together with supplementary benefit out of the association's own funds to the value of at least one-third of the amount to be recovered from the State. In order, however, to establish a claim for the repayment of State benefit already paid, the association was bound to satisfy the Board of Trade that the benefit in question had been paid in circumstances which entitled the individual member to receive State benefit. This involved an approximation of the procedure upon claims to receive benefit through an association, to the procedure upon claims to receive benefit direct from a labour exchange.

The insured workman upon becoming unemployed lodges a claim for unemployment benefit at a labour exchange or other local office of the unemployment fund, viz. at one of the 1,048 branch employment offices which have been established in less populous districts for the administration of the unemployment insurance scheme. In lodging his claim the workman indicates whether he wishes to receive his benefit through an association or direct from the office of the unemployment fund. His claim is then examined, and when a favourable decision has been given, benefit is paid to him by the association or at the office at which he made his claim according to his choice. If the workman has chosen to receive his benefit from an association he will sign the "Vacant Book," provided by his association, as a rule each day. Many of the associations concerned have found it convenient to keep their vacant books at the labour exchanges. In July 1913 over 2,000 vacant books of associations having arrangements for the payment of unemployment benefit were lodged at labour exchanges. At that date arrangements had been made by 105 associations with nearly 540,000 members in the insured trades.

In Nov. 1920, immediately before the operation of the Unemployment Insurance Act (1920), when the number of insured workpeople had been increased from 2¼ million to 3¾ millions, some 5,180 vacant books, out of a total of about 8,600 maintained by the trade unions concerned, were lodged at employment exchanges. At that date arrangements had been made by 92 associations with an approximate membership of 1,341,000. The reduction in the number of associations was due to the amalgamation of certain trade unions.

Voluntary Insurance.—Part II. of the National Insurance Act, (1911), also contains (in Section 106) a provision intended to encourage voluntary insurance against unemployment, both in the insured trades and in other trades. The arrangement here was based upon the successful experiment made over a number of years at Ghent, and involved the payment of a subsidy to trade unions or other associations of workpeople which make a voluntary provision for unemployment. Under Section 106, the Board of Trade was empowered in such cases to repay out of moneys provided by Parliament, an amount not exceeding one-sixth of the sum spent by the association out of their own funds upon unemployment benefit, with a limit to the amount so repaid of 2s. per head per week in respect of members who have received benefit from the association. By July 1913, 275 associations with a membership of 1,104,000 had been admitted by the Board of Trade as satisfying the required conditions (as to the methods of proving unemployment, etc.) for receiving the grant. During the 12 months ending in March 1914, a total sum of £15,167 was paid under the section to 347 associations with a membership of 1,401,000, and during the 12 months ending March 1920 £1,678 was paid to 397 associations with a membership of 2,608,273. Considerable difficulty was experienced in the administration of the section in obtaining evidence which would satisfy the Government auditors that the payments upon which the associations based their claims for a grant had been properly made. This difficulty was due solely to the varying standards of clerical competence maintained by the associations in keeping their accounts. The section was allowed to lapse in the revision and general extension of unemployment insurance which was undertaken in 1920.

Rates of Contribution.—The requirements governing the payment of unemployment insurance contributions were devised so as to charge a higher rate of contribution for engagements of less than a week's duration than for engagements for more than a week. At the same time provision was made (Section 99) for an employer, and, subject to the extent to which employers made use of the section, for workmen, to escape this higher charge by engaging workpeople through the labour exchanges and by handing over to the exchanges the work of affixing insurance stamps. When employers entered into an arrangement of this kind they were not charged the higher rate of contribution otherwise appropriate in respect of very short engagements, and as a further inducement to make such arrangements, employers were allowed to hand over to the labour exchanges the work of stamping the health insurance cards as well as the unemployment insurance cards. The intention of this section was to induce employers to give the labour exchanges an opportunity of regularizing employment by "dovetailing" a series of casual jobs so as to afford a reasonable livelihood for a limited number of workmen. Up to July 1913, arrangements under the section had been made by 592 employers in respect of 138,500 workpeople; in July 1914 by 899 employers in respect of 162,192 workpeople and in Nov. 1920 by 124 employers in respect of 29,334 workpeople.

Finally the Act of 1911 contained provisions for reducing the cost of unemployment insurance in respect of workmen who had experienced little unemployment. Thus (Section 94) employers were entitled to obtain a refund of one-third of their contributions in respect of workmen continuously employed by them for 12 months and (Section 96) a refund of the whole of their contributions in respect of periods during which short time was worked. Section 95 enabled workmen who had paid 500 contributions to recover at the age of 60 the amount by which the value of their contributions exceeded the value of unemployment benefit received by them.

Amending Acts.—On Aug. 10 1914, the royal assent was given to an Act amending Part II. of the National Insurance Act upon a number of points, none of them of first-class importance, upon which experience of the administration of the scheme had shown weakness in the principal Act. Thus changes were made in the machinery for the determination of claims to benefit and the arrangements for refunding contributions paid by employers and workmen. The Board of Trade was empowered to exempt workmen upon short time from the payment of unemployment insurance contributions, and associations undertaking the payment of State benefit to their members were definitely required to provide from their own funds benefit equal to one-third more than the amount of the State benefit. The Act of March 16 1915 allowed unemployment insurance contributions to be paid in respect of workmen engaged upon war work abroad.

Extension of Insurance.—In July 1916, the scope of unemployment insurance was extended to include workmen employed upon munitions work, and particularly in the chemical, metal, rubber, and brickmaking industries and in the leather industry. This extension was made in order to bring substantially the whole working population employed in war industries within the scope of insurance, and the operation of the Act was to cease after 5 years or at the end of 3 years after the war, whichever was the later date. As the result of this extension the number of workpeople insured against unemployment became approximately 3¾ millions.

In Feb. 1918 the Minister of Labour was empowered by order to exclude from unemployment insurance any branch of trade which had been brought into insurance by the Act of 1916.

Experience proved that the calculations, upon which were based the rates of contribution and benefit contained in the Act of 1911, erred upon the side of caution. From this cause, but also as the result of the period of good trade which followed 1911, of the practical absence of unemployment during almost the whole of the war period, and of the Out-of-work Donation Scheme during 1919, under which unemployed persons were entitled to a much higher rate of weekly payment than they could obtain under the Unemployment Insurance Act, the unemployment fund stood at £18,030,356 in July 1919. In view of this large reserve fund and of the increasing cost of living, a short Act was passed in Dec. 1919, increasing the weekly rate of unemployment benefit under the Unemployment Insurance Act from 7s. to 11s. The requirements as to the amount of benefit to be provided out of their own funds by associations undertaking to pay State benefit to their members were not affected.

Insurance Act of 1920.—On Dec. 23 1919, Sir Robert Horne, as Minister of Labour, introduced on behalf of Mr. Lloyd George's Government an Unemployment Insurance bill containing proposals for a general extension of compulsory and contributory unemployment insurance. These proposals were approved by Parliament, and the bill received the royal assent on Aug. 9 1920. This Act superseded the previous Unemployment Insurance Acts, but the general character of the scheme of unemployment insurance remained unaltered.

The scope of unemployment insurance was extended to include all persons of the age of 16 and upwards employed under a contract of service or apprenticeship with the following principal exceptions:—persons employed in agriculture and private domestic service; established servants of the Crown; persons employed otherwise than by way of manual labour at a rate of remuneration exceeding £250 a year; persons casually employed otherwise than for the purpose of the employer's trade or business, and persons employed by public authorities and by corporations whose status approximates to that of a public authority, upon the certificate of the Minister of Labour that the persons in question are not subject to dismissal except for misconduct or unfitness to perform their duties, and that the conditions of their engagement make insurance unnecessary.

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The rates of joint contributions by employers and employed persons were fixed at 8d. for men; 6½d. for women; 4d. for boys between 16 and 18 years of age; 3½d. for girls between 16 and 18 years of age. Out of these amounts the employed person's contribution is 4d. for men; 3d. for women; 2d. for boys between 16 and 18 years of age and 1½d. for girls between 16 and 18 years of age. To the unemployment fund formed by these contributions the State contributes 2d. for each man's contribution; 1½d. for each woman's contribution; 1½d. for each boy's contribution, and 1d. for each girl's contribution. The weekly rate of unemployment benefit was fixed at 15s. for men, 12s. for women, 7/6 for boys and 6s. for girls. Payment of benefit is limited to 15 weeks' benefit in any period of 12 months ending early in July each year, and to the payment of one week's benefit in respect of every 6 weekly contributions paid. In general the conditions for receiving benefit and the rules governing disqualification for receiving benefit follow the lines of Part II. of the National Insurance Act, 1911. The Act of 1920 requires, however, that the applicant shall have not less than 12 contributions standing to his credit, and requires him to show that he has attended an approved course of instruction if he has been called upon to do so. By a special temporary provision the Act allows all insured persons who have paid 4 contributions to draw up to a maximum of 8 weeks' benefit during the first 12 months. This temporary arrangement was modified by the Unemployment Insurance (Temporary Provisions Amendments) Act of Dec. 1920 which permitted any person to draw up to a maximum of 8 weeks' benefit during the first year of the operation of the Act upon proving that he had been employed during 10 weeks in the course of the year 1920, or during 4 weeks since July 4 1920 in any employment which is within the scope of unemployment insurance. Arrangements for deciding disputes follow the scheme of 1911.

Special Schemes.—Provision is made in the Act for the management by separate industries of the unemployment insurance of workpeople employed therein. Section 18 of the Act enables the Minister of Labour to approve a "Special Scheme" submitted to him by employers and employees in any industry to which compulsory unemployment insurance applies. The main conditions governing the formation of special schemes are that: (1) The scheme must cover all persons employed in the industry either throughout the country or over some defined area. (2) The benefits, which may include payment for short time as well as unemployment benefit, must be, on the whole, not less favourable than those provided under the general scheme. (3) The State contribution to a special scheme will be limited to an amount not exceeding $^3/_{10}$ of the contribution the State would have made if the members had remained under the general scheme. (4) The scheme will be administered not by the Ministry of Labour, but by a joint body of employers and employed in the industry specially set up for this purpose.

The Act contemplated the formation of such special schemes before July 1921, and provided for the payment to the responsible body of contributions collected from members of the industry before the scheme is launched. The provisions as to special schemes went far to meet a body of opinion that industries should bear the burden of their own unemployment. When the Act was passed, the Government actually contemplated the formation of special schemes in respect of rather less than 4 million out of a total of some 12¼ million insured workpeople. The event seemed likely to prove that this was a generous estimate.

Provision was also made (Section 20) for the creation of supplementary schemes of unemployment insurance by any industry which did not form a special scheme. Such supplementary schemes might, out of special contributions, provide additional benefits including provision for short time or for unemployment not covered by the general scheme. When approved by the Minister of Labour, supplementary schemes have statutory effect.

The Act of 1920 (Section 17) reproduces Section 105 of the Act of 1911, which enables associations of insured workpeople to undertake the payment to their members of unemployment benefit due from the State fund. Of the various provisions made in the Act of 1911 for the refund or reduction of contributions in certain circumstances, the provision for the refund to workmen at the age of 60 of the amount of the value of their contributions over the amount of benefit received is alone reproduced (Section 25). The Minister of Labour is enabled (Section 31) to arrange for keeping and stamping at an employment exchange the insurance contribution cards and books of workpeople engaged through the exchanges.

Statistics of Insurance.—Table II. shows the extent to which unemployment benefit was drawn in the industries covered by the unemployment insurance scheme since Jan. 1913, when unemployment benefit was first payable. During the operation of the out-of-work donation scheme for civilians (Nov. 25 1918 to Nov. 24 1919) unemployed workpeople as a rule availed themselves of their rights under that scheme, and were debarred from drawing unemployment benefit concurrently.

War Work of the Exchanges.—With the outbreak of the World War, the character of the work done at the employment exchanges was necessarily altered to meet the exceptional conditions, and it continued to change with the development of events until the restoration of more or less normal conditions at the end of 1919. Immediately upon the declaration of war, the exchanges were called upon to assist the war departments in mobilization by the supply of large numbers of skilled and unskilled civilian workmen. Up to Aug. 14 1914, nearly 30,000 workmen were supplied through the exchanges for this purpose. In the earlier months of the war, unemployment upon a large scale was anticipated and was experienced in certain industries, particularly in the textile industries. To meet this situation, the exchanges coöperated in the collection of information as to the extent and character of unemployment with the local representative committees which were formed by local authorities at the suggestion of the Government. The exchanges also assisted in the distribution of special grants in aid of unemployment benefit paid by trade unions, upon the lines of Section 106 of the National Insurance Act, 1911. From Aug. 1914 to March 1915, the amount of such special grants was £74,926. Unemployment decreased rapidly with the progress of recruiting and the development of war industries, and from early in 1915 to the end of the war, the employment exchanges were engaged upon a series of schemes to use the man-power of the nation to the best advantage.

Enrolment Schemes.—In order to obtain a body of mobile skilled labour for munitions work, and in order also to make it possible to put pressure upon employers to make full use of the skilled workmen in their establishments, several enrolment schemes were set on foot whereby selected workmen undertook, in return for guaranteed minimum pay and a subsistence allowance, to work at any place at which they might be required (*see* LABOUR SUPPLY AND REGULATION). Thus enrolment of volunteers was begun in 1916.

Priority of Labour.—From 1916 to the end of the war, a system of controlling the available supplies of labour for civilian war work of all kinds was developed apart from the enrolment schemes. As early as April 1915, certain classes of the employers, mainly those engaged

TABLE II.—*Unemployment Benefit.*
Number of unemployment books remaining lodged at the end of the month.

Month	Year							
	1913	1914	1915	1916	1917	1918	1919	1920
January	115,152	121,267	54,723	19,155	20,273	32,063	Out-of-work donation in operation; unemployment insurance returns suspended.	127,476
February	103,332	97,636	43,257	16,021	21,221	32,445		97,932
March	82,822	81,667	30,085	14,415	21,070	36,873		82,843
April	68,151	74,546	24,517	13,095	21,973	36,412		67,255
May	66,910	73,589	19,009	11,264	23,556	33,079		66,897
June	69,175	80,461	18,607	11,100	25,305	30,080		67,410
July	63,832	83,412	20,730	11,264	25,213	26,442		77,901
August	63,866	145,194 *a*	18,997	11,290	25,006	26,024		82,406
September	73,124	128,038	17,766	10,589	25,682	26,208		103,075
October	75,996	99,282	16,654	13,044	27,487	24,505		120,114 *e*
November	88,493	81,341	17,724	15,944	28,799	33,634 *c*	102,684 *d*	189,916
December	101,712	68,815	22,275	17,612 *b*	28,382		123,344	324,674 *f*

a Outbreak of war.
b Unemployment insurance extended to cover 3¾ million workpeople (in place of 2¼ million).
c Armistice Nov. 11.
d Out-of-work donation for civilians ceased Nov. 25.
e Coal-miners' strike Oct. 15.
f Unemployment insurance extended to cover total of about 12 million workpeople.

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in engineering and shipbuilding, were restrained from enticing workpeople to their establishments from employers elsewhere, and were prohibited from seeking to engage workmen from a distance of more than 10 m. otherwise than through the employment exchanges. In 1916, arrangements were made to reach agreement between the various departments responsible for production as to the order in which demands for labour should be met. In their fully developed form, these arrangements involved frequent periodical consultation between the producing departments, and the grading of current demands for labour according to their importance. The labour needs of employers in war industries were graded as entitled to "Super-Priority," "First" or "Second Class Priority," or as not deserving special treatment. Decisions of this character were given upon the demands of employers as notified to the employment exchanges. Such demands from the whole kingdom were brought together in the central clearing house of the unemployment department, and the classified lists of labour demands issued upon this basis were circulated to all employment exchanges. A general list of vacancies was issued by the clearing house in the manner already described, and a special list known as the "Munition Workers' Gazette," relating especially to the most important labour demands in the engineering industry, was issued by the clearing house upon the authority of the Ministry of Munitions. The employment exchanges working upon the information so supplied, were able to influence appreciably the distribution of any local surplus of labour.

War Employment of Women.—With the development of war production, the demands for women's labour became far greater than the supply which was available immediately. In order to obtain control of the distribution of the available supplies of women's labour, Government and controlled factories were required to engage all women through the employment exchanges. Further, a large proportion of the women employed in other factories engaged upon war work was supplied through the exchanges. The exchanges carried out a continuous campaign for recruiting women for these purposes, the total number supplied by the exchanges amounting to more than 1,086,000. Recruiting for the Women's Service Corps was also undertaken by the exchanges. Forty-three thousand seven hundred women were recruited by the exchanges for Queen Mary's Army Auxiliary Corps (W.A.A.C.), 5,700 for the Women's Royal Naval Service (W.R.N.S.) and 16,300 for the Women's Royal Air Force (W.R.A.F.).

Labour from Abroad.—In order to avoid difficulties with British workmen, employers were compelled to arrange the engagement of alien workpeople required for munition work through the employment exchanges. The principal work in this connexion was finding employment for about 65,000 Belgian workpeople.

Release from the Forces.—In the early stages of the war, large numbers of workmen, possessing skill which was of great value upon civil war work, joined the army. Arrangements were made subsequently for the release from the army of a number of these men. The staff of the employment exchanges were largely employed in selecting such men for release.

Substitution.—During 1917 and 1918, the employment exchanges, and the local employment committees from their formation at the end of 1917, were largely occupied upon endeavouring to obtain substitutes for men in civil life who had been certified as available for military service upon the supply of a substitute. This work was one of great difficulty and was carried out with the National Service Department, subsequently the Ministry of National Service.

Work for Demobilization.—Before the conclusion of the war, an elaborate scheme for the demobilization of the forces according to industrial requirements had been elaborated (*see* DEMOBILIZATION AND RESETTLEMENT). The employment exchanges and the local employment committees were responsible for preparing and applying the original scheme of demobilization upon its civil side, and upon the introduction of the "Contract" scheme they continued to assist in the work and were responsible for dealing with the increasing numbers of unemployed ex-service men. The local employment committees performed a very valuable service in pressing upon employers in every area the obligation to reëngage the men who had been employed by them before the war.

The employment exchanges assisted in the redistribution of workpeople which followed upon the conclusion of war contracts. They endeavoured to arrange with employers for discharges to be regulated with a view to fresh employment which seemed likely to be available. Workpeople about to be discharged from war work were invited to supply the exchanges with particulars of their industrial experience with a view to fresh employment being found for them, and some 130,000 workpeople took advantage of this arrangement. The exchanges also supplied free railway passes to munition workers who were returning to their homes or were going to fresh employment. Discharges from war work were at their maximum towards the middle of 1919, that is to say at the time when demobilization of the forces was proceeding most rapidly. The effect of this double stream of workpeople seeking employment is to be seen in the particulars of the payment of out-of-work donation.

Throughout the resettlement period, the work of the local employment committees was of the greatest value. In order to strengthen their organization, divisional councils were formed consisting of representatives of the committees in each division.

Out-of-Work Donation.—Early in the war it had been decided that members of H.M. forces should be entitled to certain payments during unemployment following their discharge at the conclusion of the war. Proposals to extend compulsory and contributory unemployment insurance to the bulk of workpeople engaged upon civil work had not fructified during the war. When, therefore, the end of hostilities was in view, the Government decided that the out-of-work donation scheme should apply to civilian workpeople as well as to all non-commissioned members of H.M. forces. The scheme came into operation on Nov. 25 1918.

In the first instance donation was granted to ex-service men at the rate of 29s. a week with allowances for dependent children under the age of 15 at the rate of 6s. for the first child and 3s. each for other children, for 26 weeks, and at the rate of 20s. a week with unreduced allowances for dependent children for a further period of 13 weeks. The period during which this 39 weeks' donation could be drawn was the period of 12 months following the end of a man's demobilization furlough. Civilian workers were entitled to donation for a maximum period of 13 weeks in respect of unemployment occurring during the six months ending May 24 1919, and the donation was at the rate applicable to the first 26 weeks of the donation paid to ex-service men. In order to be entitled to donation, civilian workers were required to show that they had become employed contributors under the National Health Insurance scheme at least 3 months prior to Nov. 25 1918, or if they were under 16 or over 70 years of age, to produce equivalent evidence of employment. Donation was paid at half rates to persons under 18. Persons who were entitled to out-of-work donation applied to the local employment exchange upon becoming unemployed, and produced evidence that they were qualified to receive donation under the conditions of the scheme. Thereafter the procedure approximated to that adopted in the administration of unemployment insurance; that is to say, donation was refused if it appeared that the applicant had left his previous employment without just cause or as the result of misconduct or of a trade dispute, and donation was withdrawn if suitable work was refused. Disputed claims were dealt with by a local court of referees.

The out-of-work donation scheme was modified in respect of civilians in May 1919 by a postponement until Nov. 24 1919 of the date up to which a total of 13 weeks' donation could be drawn. At the same time the rate of donation for civilian workers was reduced to 20s. for men and 15s. for women, together with unaltered allowances for dependents, and the conditions for the receipt of donation were made more stringent by requiring the applicant to prove employment in 20 weeks during 1918 and by a review by the local employment committees of all applications for donation with a view to their rejection unless the committee were satisfied that the applicant was (*a*) normally in employment; (*b*) genuinely seeking work, and (*c*) unable to obtain it. The donation to civilian workers was also extended by the grant in March 1919 of donations for a further maximum period of 13 weeks (making 26 weeks in all) at the rates and under the conditions applied in May 1919 to the original grant of donation. Out-of-work donation ceased to be payable to civilian workers on Nov. 24 1919. Out-of-work donation to ex-service men was extended in respect of all ex-service men who had exhausted their rights under the original scheme by the grant of a further maximum of the 12 weeks' donation at the rate of 20s. a week without children's allowances during the period Nov. 25 1919 to March 21 1920, a further 12 weeks' donation between April 1 1920 and July 31 1920, and a further 14 weeks' donation between July 31 and Nov. 6 1920. By a further extension, donation was granted to ex-service men up to a maximum of 14 weeks during the period ending March 31 1921. The local employment committees were entrusted with a review of the individual grants of donation upon the occasion of each extension. This review involved very heavy work in all localities, as will be realized from the number of donation policies upon which payment was being made in successive months. There were, for civilians (up to Nov. 1919, when their donation ceased):—in 1918, Dec. 356,707; in 1919, Jan. 625,149; Feb. 782,363; March 753,982; April 689,933; May 384,290; June 233,282; July 177,221; Aug. 141,132; Sept. 100,731; Oct. 135,185. For ex-service men the figures were:—1918, Dec. 23,988; 1919, Jan. 53,554; Feb. 166,257; March 306,263; April 403,467; May 386,921; June 372,843; July 363,663; Aug. 336,952; Sept. 302,272; Oct. 344,242; Nov. 358,823; Dec. 370,610; 1920, Jan. 377,116; Feb. 293,144; March 240,508; April 219,226; May 196,508; June 174,224; July 139,866; Aug. 143,186; Sept. 158,759; Oct. 172,834; Nov. 192,144; Dec. 244,061.

In June 1920, the Minister of Labour appointed an independent committee, under the chairmanship of Mr. G. N. Barnes, M.P., "to examine the working and administration of the employment exchanges in Great Britain and to advise as to their future." The committee presented a report signed by all but one of their number in Nov. 1920 (Cmd. 1054). They found that the employment exchanges are a necessary corollary to the State

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system of unemployment insurance and they made a number of recommendations designed to insure that the exchanges should be fully effective for their purpose. The committee recommended that the facilities of the employment exchanges should be available to all persons, whether or not they were liable to compulsory unemployment insurance. (J. S. Nc.)

United Kingdom Statistics.

The statistics of unemployment most commonly used—indeed the only statistics available over a long series of years without a special, and laborious, inquiry—are those of unemployment among members of certain trade unions. The principal trade-union statistics of unemployment are therefore given here in Table III. accompanied by some observations as to the limitations of their utility.

It should be remarked at the outset that the figures in Table III. cannot be taken as necessarily an accurate measure of general unemployment; all that can safely be assumed is that they give a fairly trustworthy indication of the *direction* of the curve of rising or falling employment, and some indication of the severity of each successive depression, and of the high-water mark reached by the intervening period of good trade. For this purpose the exaggeration of the fluctuations, due to the preponderance of the metal, engineering, and shipbuilding trades, is no great disadvantage; but it is always necessary to remember that the fluctuations *are* exaggerated by the use of these figures.

It should also be remembered that the figures relate to members of trade unions, and to those only in certain trades, and are almost confined to (i.) men, as distinguished from women or young persons, and (ii.) to skilled men, as distinguished from labourers. It is instructive to examine the constitution of those sections of the work not covered by the trade-union percentages of unemployment given above. These include:—

(i.) All those workpeople, whether in the trades covered or not, who do not belong to any trade union.

(ii.) The great majority of labourers, or of semi-skilled men, whether in the trades covered or not.

(iii.) Practically the whole of the mining industry and of the textile industries; and *the whole* of the railway, tramway, and omnibus services; the gas, water, and electricity services; dock and wharf labour; agriculture; the mercantile marine and sea fishing; the clothing and the boot and shoe trades; commerce, banking, and insurance; retail trade; the Post Office, and other branches of the civil service and of the municipal services; and many other industries and services.

It will be observed that many of the industries and services mentioned are less subject to fluctuations in employment than the metal, engineering, and shipbuilding trades, which preponderate in the trade-union figures. The industries or occupations mentioned may, for the present purpose, be roughly grouped under three headings:—

(i.) Industries or services which are subject to relatively slight fluctuations in employment. Examples are the Post Office, and other branches of the civil service and of the municipal services; agriculture; the railway, tramway, and omnibus services; the gas, water, and electricity services; employment in banks, insurance offices, and commercial businesses.

(ii.) Unskilled or semi-skilled occupations. The men and women employed in these occupations generally either do not belong to any trade union, or else their trade unions are not in a financial position to pay unemployment benefit.

(iii.) Industries which meet fluctuations in trade by other means than the discharge of workpeople. Mining and the textile trades are good examples of this group.

The third group is deserving of somewhat detailed consideration, as helping to define, by contrast, the term "unemployment"—a term which does not, as is sometimes supposed, cover a perfectly definite and clear-cut conception.

The most frequent alternative to the discharge of workpeople is "short time." A factory, for example, may be entirely closed on Saturday, and work only seven hours (instead of eight or nine) on the other days of the week. It is important to observe, however, that, when the time worked is reduced (say) to three days in each week, the worker is entitled, under the present system of unemployment insurance, to unemployment benefit for the remaining days when he is not working (after the first

TABLE III.—*Percentage of Trade Union members unemployed.*

Year	In Metal, Engineering and Shipbuilding trades	In other trades making returns	Mean of columns (2) and (3)[1]
(1)	(2)	(3)	(4)
1860	1·9	1·8	1·85
1861	5·5	1·9	3·70
1862	9·0	3·1	6·05
1863	6·7	2·7	4·70
1864	3·0	0·9	1·95
1865	2·4	1·2	1·80
1866	3·9	1·4	2·65
1867	9·1	3·5	6·30
1868	10·0	3·5	6·75
1869	8·9	3·0	5·95
1870	4·4	3·1	3·75
1871	1·3	2·0	1·65
1872	0·9	1·0	0·95
1873	1·4	0·9	1·15
1874	2·3	0·9	1·60
1875	3·5	0·9	2·20
1876	5·2	1·6	3·40
1877	6·3	2·5	4·40
1878	9·0	3·5	6·25
1879	15·3	6·1	10·70
1880	6·7	3·8	5·25
1881	3·8	3·3	3·55
1882	2·3	2·4	2·35
1883	2·7	2·5	2·60
1884	10·8	3·5	7·15
1885	12·9	4·2	8·55
1886	13·5	5·6	9·55
1887	10·4	3·9	7·15
1888	6·0	2·3	4·15
1889	2·3	1·8	2·05
1890	2·2	2·0	2·10
1891	4·1	2·7	3·40
1892	7·7	4·7	6·20
1893	11·4	4·0	7·70
1894	11·2	3·2	7·20
1895	8·2	3·8	6·00
1896	4·2	2·5	3·35
1897	4·8	2·1	3·45
1898	4·0	1·9	2·95
1899	2·4	1·7	2·05
1900	2·6	2·3	2·45
1901	3·8	2·9	3·35
1902	5·5	2·9	4·20
1903	6·6	3·4	5·00
1904	8·4	4·4	6·40
1905	6·6	3·9	5·25
1906	4·1	3·3	3·70
1907	4·9	3·0	3·95
1908	12·5	4·8	8·65
1909	13·0	4·4	8·70
1910	6·8	3·4	5·10
1911	3·4	2·7	3·05
1912	3·6	2·7	3·15
1913	2·2	2·0	2·10
1914	3·3	3·2	3·25
1915	0·6	1·4	1·00
1916	0·3	0·6	0·45
1917	0·2	1·0	0·60
1918	0·2	1·2	0·70
1919	3·3	1·8	2·55
1920	3·2	1·9	2·55
1921			
End of Jan.	8·6	5·8	7·2
Feb.	10·9	7·0	9·0
March	14·0	7·3	10·7
April	20·0	14·7	17·4
May	28·8	16·5	22·7
June	30·8	16·9	23·9
July	27·3	10·1	18·7

[1] It should be observed that this is not necessarily identical with the percentage of trade union members unemployed in *all* trade unions making returns, *taken together*. In the early years of the period the metal, engineering, and shipbuilding trades, which are subject to much more violent fluctuations of employment than most other industries, are over represented. By taking the mean of the fluctuating engineering and shipbuilding figure and of the relatively stable "other trades" figure—in other words, by giving the metal, engineering, and shipbuilding trades a constant "weight" equal to one-half of the total—this source of error is corrected.

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TABLE IV.—*Percentage of Insurance Workpeople in receipt of Unemployment Benefit or Out-of-Work Donation.*[1]

Trade	1913	1914	1915	1916	1917	1918	1919	1920[5]
Building	5·1	5·2	2·1	1·2	0·8	0·8	6·4	2·8
Works of Construction				0·4	0·4	0·6		
Shipbuilding	3·5	3·8	0·8	0·4	0·4	0·4	4·8	3·9
Engineering and Ironfounding	2·4	3·4	0·6	0·4	0·6	1·2	8·1	4·9
Construction of Vehicles	2·5	3·5	0·8	0·5	0·4	0·5	4·4	2·2
Sawmilling[1]	2·4	3·3	1·0	0·6	0·6	0·7	5·6	8·4
Other Insured Workpeople[2]	1·2	1·8	0·4	0·2	0·1	0·1	Included below	0·8
Total Insured under Act of 1911	3·6	4·2	1·2	0·6	0·6	1·0	..	3·9
Iron and Steel Manufacture					0·3	0·3	3·5	1·3
Tinplate Manufacture					0·4	0·4	4·1	2·2
Miscellaneous Metals					0·5	0·9		2·2
Ammunition and Explosives					1·4	2·9	5·1	5·3
Chemicals					0·7	1·2	3·2	2·0
Leather and Leather Goods					0·5	0·8	Included below	3·6
Bricks, Tiles and Artificial Building Materials					0·4	0·6	3·4	1·3
Sawmilling[3]							Included with 1911 Act Sawmilling	
Machined Woodwork and Wooden Cases					1·3	2·1		2·8
Rubber and Manufactures thereof					1·0	1·1	Included below	2·7
Other Insured Workpeople					1·3	3·5	3·5[4]	4·6
Total Insured under Act of 1916					0·9	1·7	..	2·7
Total, Insured Industries	3·6	4·2	1·2	0·6	0·7	1·2	6·1	3·5
Number of workpeople insured in the month of July	2,071,000	2,326,000	2,075,000	2,029,000	3,632,000	3,922,000	3,721,000	4,188,000

[1] Sawmilling "of a kind commonly done in connexion with other insured trades." Workpeople engaged in sawmilling actually done "in connexion with" other insured trades are included with the other workpeople in those trades. Other sawmilling was not included at all, prior to the Act of 1916.

[2] These are workpeople engaged in insurable occupations in businesses whose main work is not insurable, *e.g.* engineering operatives on the maintenance staff of a cotton factory.

[3] Sawmilling other than that covered by the Act of 1911.

[4] Includes "other workpeople insured under the Act of 1911"; also leather workers and rubber workers.

[5] Based on the first nine months of 1920, Oct. details not being available owing to the coal strike, and Nov. and Dec. owing to the extension of Unemployment Insurance under the 1920 Act.

three, which constitute "the waiting period").[1] Thus "unemployment" and "short time" are not as is sometimes supposed, mutually exclusive terms. The same applies, of course, in the very common case where workers, during a time of depression, are employed in alternate weeks.

A depression is sometimes met, however, by other devices, entirely different from either "unemployment" or "short time." In the weaving section of the cotton industry, for example, it is a very common practice in times of depression to give a weaver (say) two or three looms to mind, instead of the usual four or six. Again, a common complaint among weavers (by no means confined to periods of acute depression) is that of "playing for warps," *i.e.* of being kept waiting for a supply of the "warp," through which the "weft" threads are woven.

Some term is clearly needed to describe all forms of partial unemployment, whereby a worker's production is reduced, and his or her earning power with it. The useful term "under-employment" is coming into use to an increasing extent for this purpose; it is more scientific than the term "short time" and covers a wider ground. It might properly be used, for example, to describe the state of employment of a dock labourer, who presents himself for work at the beginning of each 4-hour spell of work during the week, but is only taken on for three of them. This cannot, with strict accuracy, be called either "unemployment," or "short time"; but it is a very good example of "under-employment."

Table IV. shows the percentages unemployed among persons insured against unemployment under Part II. of the National Insurance Act, 1911, and the various amending Acts. Under the original Act, compulsory insurance was confined to the building trades and construction of works; the engineering, ironfounding, and shipbuilding trades; the construction of vehicles; and sawmilling "in connexion with or of a kind commonly done in connexion with" any of the other insured trades. Under the Amending Act of 1916, however, compulsory insurance was extended to a number of the "munition" trades. Apart from the difference in the trade constitution of the workpeople covered, these figures differ from the trade-union percentages given in Table IV. chiefly in including the labourers and semi-skilled men, who are almost entirely excluded from the trade-union figures. The numbers insured under the Act in July of each year, 1913–20, are shown at the foot of Table IV.

Under the Unemployment Insurance Acts, 1920 and 1921, substantially all persons liable for Health Insurance contribution, except outworkers and persons employed in agriculture and private domestic service, were required to be insured against unemployment. Employees of local authorities, railways and certain other public utility undertakings, members of the police forces, and persons with rights under a statutory superannuation scheme might, in certain circumstances, be excepted. Persons employed otherwise than by way of manual labour at a rate of remuneration exceeding in value £250 per annum were excepted, as were also juveniles under 16 years of age. The number of persons insured under the Act at May 31 1921 was estimated at 12,190,790, of whom 8,829,320 were males and 3,361,470 were females.

Payment of unemployment benefit was made subject to certain statutory conditions and disqualifications. The procedure required the "lodging" of an unemployed person's unemployment book, and the records of books lodged thus afford a measure of the extent to which unemployment was prevalent in the insured industries. As a by-product of the administration of

[1] Statistics of short time workers are kept separate from those of persons entirely unemployed and are not used in the calculation of the percentage unemployed given in Table IV. Alternate week working is counted as short time.

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TABLE V.—*Unemployment in Insured Trades: July 29 1921.*

Industry	Estimated No. of Insured Workpeople			No. of Unemployment Bks. and O.W.D. Policies remaining lodged at July 29 1921			Percentage Unemployed at July 29		
	Males	Females	Total	Males	Females	Total	Males	Females	Total
Building and Works of Construction	1,020,430	9,030	1,029,460	158,065	456	158,521	15·49	5·05	15·40
Shipbuilding	340,160	6,280	346,440	112,767	726	113,493	33·15	11·56	32·76
Engineering and Ironfoundring	1,163,530	101,460	1,264,990	276,107	14,396	290,503	23·73	14·19	22·96
Construction and Repair of Vehicles	294,960	26,440	321,400	31,490	6,059	37,540	10·68	22·88	11·68
Sawmilling and Machined Woodwork	210,610	44,290	254,900	32,224	6,573	38,797	15·30	14·84	15·22
Ammunition, Explosives, Chemicals, etc.	214,500	96,050	310,550	36,849	8,054	44,903	17·18	8·39	14·46
Metal Trades	628,310	203,450	831,760	198,839	43,281	242,120	31·65	21·27	29·11
Rubber and Leather Trades	103,820	65,300	169,120	13,854	8,950	22,804	13·34	13·71	13·48
Bricks, Tiles, etc.	73,100	12,100	85,200	10,507	2,394	12,901	14·37	19·79	15·14
Pottery, Earthenware, etc.	30,040	31,440	61,480	4,102	3,658	7,760	13·66	11·63	12·62
Glass Trades (Excl. optical, scientific, etc.)	32,580	7,770	40,350	10,388	2,104	12,492	31·88	27·08	30·96
Hotel, College, Club, etc., Service	99,150	198,100	297,250	9,737	25,440	35,177	9·82	12·84	11·83
Laundry Service	16,810	85,730	102,540	852	5,281	6,133	5·07	6·16	5·98
Commercial, Clerical, Insurance and Banking	175,660	131,480	307,140	8,006	4,496	12,502	4·56	3·42	4·07
Transport Services	769,500	35,090	804,590	141,306	3,319	144,625	18·36	9·46	17·97
Mining Industry	1,235,780	11,220	1,247,000	120,615	909	121,524	9·76	8·10	9·75
Printing and Paper Trades	205,760	139,630	345,390	18,304	15,407	33,711	8·90	11·03	9·76
Textile Trades	485,770	782,130	1,267,900	59,424	110,338	169,762	12·23	14·11	13·39
Dress	230,530	436,400	666,930	25,208	47,573	72,781	10·93	10·90	10·91
Food, Drink and Tobacco	289,960	195,840	485,800	24,731	21,473	46,204	8·53	10·96	9·51
Miscellaneous Trades and Services	1,208,360	742,240	1,950,600	132,693	46,750	179,443	10·98	6·30	9·20
Total	8,829,320	3,361,470	12,190,790	1,426,068	377,628	1,803,696	16·15	11·23	14·80

these Acts, reliable statistics of unemployment in respect of over 12,000,000 workpeople became for the first time available. At July 29 1921, the number of unemployment books lodged in respect of total unemployment was 1,802,909, while in addition 787 persons were claiming out-of-work donation, making a total of 1,803,696, or 14·80% of the total number insured.

Table V. shows by main industrial groups and by sex the number of persons insured under the Unemployment Insurance Acts, 1920 and 1921, and the number and percentage of persons totally unemployed whose unemployment books or out-of-work donation policies remained lodged at July 29 1921.

Table VI. analyzes the figures in respect of systematic short time working by main industrial groups and by sex.

An applicant for unemployment benefit under the Acts was required to prove continuous unemployment, and it was provided that two periods of unemployment of not less than two days each, separated by a period of not more than two days during which the insured contributor had not been employed for more than 24 hours, or two periods of unemployment of not less than six[1] days each, separated by an interval of not more than six weeks, should be treated as continuous unemployment for this purpose. Persons employed in establishments where, owing to depression in trade, the number of working days had been reduced on a systematic basis in such a manner as to fall within the above provision, were accordingly eligible for benefit. The number of persons claiming benefit in respect of systematic short time working at July 29 1921 was 534,253, or 4·38% of the total number of persons insured. Among males the percentage amounted to 3·15, while among females the percentage was 7·61. (J. H.)

UNITED STATES

There were in 1921 no exact data on the number of unemployed in the United States. Studies made by the Federal Government and by the states were based chiefly on information received from the labour unions, and represented unemployment among organized labour only. For some years Massachusetts published a *Quarterly Report on Employment*, which combined reports from the trade unions and the employment offices, and later also from Boards of Trade, Employers' Associations and editors of trade journals, as well as statistics of building operations in the cities. The publication is continued from March 1920 in the quarterly *Massachusetts Industrial Review*. In 1915 New York State inaugurated the practice of compiling statistics on unemployment from reports received from representative manufacturers of the state. These statistics are published monthly in *The Bulletin and Labor Market*. The Wisconsin Industrial Commission has adopted the New York plan of employment records for statistical studies covering the period since 1915. Other states do not publish regular records.

[1] Prior to June 30 1921, a period of three days was admitted.

TABLE VI.—*Short Time: July 29 1921.*

Industry	Number of Short Time Workers claiming U. I. Benefit and Donation, July 29 1921			Percentage on Systematic Short Time July 29 1921		
	Males	Females	Total	Males	Females	Total
Building and Works of Construction	5,930	25	5,955	0·58	0·28	0·58
Shipbuilding	8,945	97	9,042	2·63	1·54	2·61
Engineering and Ironfounding	68,141	2,968	71,109	5·86	2·93	5·62
Construction and Repair of Vehicles	5,310	785	6,095	1·80	2·97	1·90
Sawmilling and Machined Woodwork	4,846	1,701	6,547	2·30	3·84	2·57
Ammunition, Explosives, Chemicals, etc.	8,653	2,779	11,432	4·03	2·89	3·68
Metal Trades	36,954	12,183	49,137	5·88	5·99	5·91
Rubber and Leather Trades	3,731	2,886	6,617	3·59	4·42	3·91
Bricks, Tiles, etc.	655	71	726	0·90	0·59	0·85
Pottery, Earthenware, etc.	261	87	348	0·87	0·28	0·57
Glass Trades (excl. Optical, Scientific etc.)	1,725	388	2,113	5·29	4·99	5·24
Hotel, College, Club, etc., Service	151	262	413	0·15	0·13	0·14
Laundry Service	33	269	302	0·20	0·31	0·29
Commercial, Clerical, Insurance and Banking	178	100	278	0·10	0·08	0·09
Transport Service	6,489	325	6,814	0·84	0·93	0·85
Mining Industry	4,665	20	4,685	0·38	0·18	0·38
Printing and Paper Trades	6,047	8,725	14,772	2·94	6·25	4·28
Textile Trades	91,696	174,893	266,589	18·88	22·36	21·03
Dress	10,716	36,558	47,274	4·65	8·38	7·09
Food, Drink and Tobacco	2,310	7,207	9,517	0·80	3·68	1·96
Miscellaneous Trades and Services	10,868	3,620	14,488	0·90	0·49	0·74
Total	278,304	255,949	534,253	3·15	7·61	4·38

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Studies made by H. Hornell Hart of the Russell Sage Foundation show that while the industrial pop. of the United States increased from approximately 19,500,000 workmen in 1902 to about 30,200,000 in 1917, the demand for labour did not increase at the same ratio. In 1902 an average of 2,750,000 workers was out of employment at all times during the year; in 1903, 1906, 1907, 1910, 1917, the annual average fell below 2,000,000; in the depression of 1908 it was 3,500,000 and in that of 1914–5 it was 4,500,000. Throughout the 16 years 1902–17 the unemployed constituted, on the average, 9·9% of the labour force; but it reached 14·1% in 1902, 14·8% in 1908; 15·8% in 1914 and 16% in 1915. On the other hand it fell to 5·5% in 1906, 7·1% in 1916 and 4·7% in 1917. The other years saw fluctuations between these extremes. In 1903, 1906, 1907, 1910 and 1917 the demand for labour was strong; in 1908, 1914 and 1915 it was weak. In the other nine years it varied less, with a little more than 2,000,000 out of work all the time. No such percentages have been calculated for the years since 1917. Common experience was that the interruption of commerce with Europe in 1914 caused sudden business depression. But as the months passed, and especially after Jan. 1915, war contracts called into industry the "reserve army of the unemployed," and led to a labour shortage, acute in some trades, from 1917 until the signing of the Armistice. Then, in the late fall of 1918, contracts were cancelled and workers were laid off. The public continued to buy, however, and men laid off from war work were absorbed in other industries. There continued to be a demand for labour until Feb. and March 1920, then industry in general began to lay off men. By the end of the year the volume of employment in the factories of New York State had dropped off 20% since March, in Wisconsin it had dropped off 22·5% in the same period, but was 13% greater than in Jan. 1915. In New York State employment in Dec. 1920 was 9% greater than in Dec. 1914, and about equal to that in June 1914. In Jan. 1921 employment in Wisconsin declined 11·3%, the greatest decline in any single month since July 1920, making the total decline since the first quarter of 1920, 29.5% and bringing the number employed to the same as in the first quarter of 1915. The number increased 1·6 in Feb. 1921, the first increase in manufacture as a whole since July; the number decreased 4·5% in March, making a total decline since July 1920 of 32·4 per cent. Metal industries suffered most. The climax of unemployment in New York State came in Jan. 1921, but the increase of employment during that month may have been due to seasonal changes rather than to improvement in business conditions. Between Feb. 1920 and Feb. 1921 the number employed in New York State factories had decreased 23 per cent.

In Jan. 1921 an unemployment survey made by the U.S. Employment Service for 35 states and the District of Columbia showed 9,402,000 employed in Jan. 1920 and 6,070,648 employed Jan. 1921, and estimated 3,473,446 as unemployed in the country as a whole. The greatest reduction in employment during this period was that of 82% in Michigan, 50% in Ohio and Indiana, 44% in Illinois, 43% in Connecticut, 38% in Massachusetts, 28% in New York, 32% in Wisconsin, 22% in New Jersey. In establishments studied by the U.S. Bureau of Labor Statistics, the greatest decreases between Feb. 1920 and Feb. 1921 were 44·2% in hosiery and underwear, and 41% in automobile manufactures; the smallest decreases were 2% in bituminous coal-mining and 0·1% in cotton manufacturing.

According to statistics in the *Industrial Employment Survey Bulletin* for Dec. 1921, 1,428 firms, employing each over 500 persons, located in 65 principal industrial centres of the country, were employing 1,567,374 workers on Nov. 30 1921 as against 1,506,614, on Jan. 1 1921, an increase of 60,760, or 3·7%. Of the 14 industrial groups recognized by the U.S. Census, 9 reported an increase in employment in Nov. 1921 over Oct. 1921, viz.: paper and printing; lumber; vehicles for land transportation; tobacco manufactures; iron and steel; chemicals; stone, clay and glass; textiles; and metals and metal products. A decrease was reported by 5, viz.: liquors and beverages; railway repair shops; food products; leather and its products; and miscellaneous industries. Of 65 cities, 40 reported an increase in employment, 24 a decrease, and 1 no change, since Oct. 31 1921; total net increase reported for the month was 7,219.

See: Don D. Lescohier, *The Labor Market;* and Sumner Slichter, *The Turnover of Factory Labor.* (J. R. Co.)

UNITED KINGDOM OF GREAT BRITAIN AND IRELAND.—Information as regards earlier years than those here dealt with will be found in 27.598 *seq.*, and as regards England in 9.408 *seq.*; and similarly in the articles in the earlier volumes on counties and towns in the United Kingdom. See also ENGLISH HISTORY, ENGLISH FINANCE, IRELAND, SCOTLAND, BRITISH EMPIRE, COAL, SHIPPING, RAILWAYS, etc.

Population.—A census of the United Kingdom was taken in April 1911, and one of Great Britain on June 19 1921. On the latter date no census of Ireland could be taken owing to its disturbed condition, and the census in Great Britain was postponed from the customary month of April owing to the coal dispute and attendant industrial troubles. The postponement had certain effects upon the returns, such as enhancing the apparent population of holiday resorts. Preliminary returns for England and Wales, with total figures only for Scotland and other parts of the United Kingdom excluding Ireland, were issued in Aug. 1921 and are utilized in the following tables. Where administrative areas are given, these are for the year 1921, and the population figures for 1911 are adjusted to them.

TABLE 1.—*Population 1911, 1921.*

	Area	Population		Pop. per sq. m. 1921 (or +1911)	Increase (+) or decrease (−) %		1921 (or +1911)	
	sq. m.	1911	1921		1901–11	1911–21	Males	Females
England	50,890	34,045,290	35,678,530	701	+10·5	+ 4·8	16,984,087	18,694,443
Wales	7,434	2,025,202	2,206,712	298	+17·7	+ 9	1,098,133	1,108,579
Scotland	30,405	4,760,904	4,882,288	160	+ 6·5	+ 2·5	2,348,403	2,533,885
Ireland	32,360	4,390,219	..	(+135)	− 1·5	..	(+2,192,048)	(+2,198,171)
Isle of Man	227	52,016	60,238	265	− 5	+15·8	27,321	32,917
Channel Islands	75	96,899	89,614	1,194	+ 1·3	− 7·7	41,264	48,350

The preliminary figures for 1921, for England and Wales, reveal an increase in the decennial period of 4·93%, a figure proportionately much lower than ever recorded before. The effect of the World War is clearly seen in the analysis, which gives, for the intercensal period: births registered 8,275,400; deaths registered in England and Wales, 5,266,900; loss due to excess of outward over inward emigration 1,193,750, of which 560,000 is estimated as representing deaths of non-citizens outside the United Kingdom; leaving a net intercensal increase of 1,814,750. The increase % in intercensal periods is given thus for major divisions:—

	1901–11	1911–21
Wales	18·1	9
Midland counties	11·2	5·9
Northern counties	10·3	4·9
London and adjacent counties	11	4·4
Southern counties	9·5	3·9
Eastern counties	7·6	3

The urban pop. of England and Wales is given as 78·1% of the whole in 1911 and 79·3% in 1921; the rural as 21·9% in 1911 and 20·7% in 1921. A future effect of the World War is seen in the increased preponderance of females over males, which, for England and Wales, was as 1,064 to 1,000 in 1901, 1,068 to 1,000 in 1911, and 1,095 to 1,000 in 1921.

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TABLE II.—*English and Welsh Counties.*

Name	Area in Statute Acres (Land and Inland Water)	Population 1911	Population 1921	Increase (+) or decrease (−) between 1911 and 1921
England:—				
Bedford	302,942	194,588	206,478	+11,890
Berkshire	454,725	193,101	202,533	+9,432
Buckingham	479,360	219,551	236,209	+16,658
Cambridge	315,168	128,322	129,594	+1,272
Isle of Ely	238,073	69,752	73,778	+4,026
Cheshire	640,791	597,771	625,001	+27,230
Cornwall	868,167	328,098	320,559	−7,539
Cumberland	968,598	213,521	220,437	+6,916
Derbyshire	645,097	560,013	584,703	+24,690
Devonshire	1,660,948	433,162	440,023	+6,861
Dorsetshire	625,612	223,266	228,258	+4,992
Durham	633,058	871,886	943,670	+71,784
Essex	964,443	857,688	918,111	+60,423
Gloucester	785,088	328,964	329,277	+313
Hereford	538,924	114,269	113,118	−1,151
Hertford	404,523	311,284	333,236	+21,952
Huntingdon	233,985	55,577	54,748	−829
Kent	971,990	1,020,965	1,118,129	+97,164
Lancashire	1,054,741	1,699,938	1,746,418	+46,480
Leicester	524,197	249,331	260,332	+11,001
Lincoln:				
Holland	263,355	82,280	85,225	+2,945
Kesteven	469,142	107,832	108,237	+405
Lindsey	963,800	237,843	260,294	+22,451
London	74,850	4,521,685	4,483,249	−38,436
Middlesex	148,692	1,126,465	1,253,164	+126,699
Monmouth	345,048	312,028	358,331	+46,303
Norfolk	1,303,568	321,721	322,914	+1,193
Northants	581,679	213,733	211,507	−2,226
Soke of Peterborough	53,464	44,718	46,954	+2,236
Northumberland	1,278,691	371,474	407,397	+35,923
Nottingham	529,188	344,197	378,476	+34,279
Oxfordshire	474,501	136,435	132,506	−3,930
Rutland	97,273	20,346	18,368	−1,978
Shropshire	861,800	246,307	242,959	−3,348
Somerset	1,032,442	388,836	397,034	+8,198
Southampton	935,195	404,541	410,223	+5,682
Isle of Wight	94,146	88,186	94,697	+6,511
Stafford	707,177	670,380	711,003	+40,623
Suffolk, East	549,241	203,223	211,623	+8,400
Suffolk, West	390,916	116,905	108,982	−7,923
Surrey	452,821	676,027	739,500	+63,473
Sussex, East	517,040	242,146	261,253	+19,107
Sussex, West	401,916	176,308	195,795	+19,487
Warwick	557,527	300,867	342,449	+41,582
Westmorland	504,917	63,575	65,740	+2,165
Wiltshire	864,101	286,822	292,213	+5,391
Worcester	451,144	287,456	301,120	+13,664
Yorkshire:				
E. Riding	741,073	154,768	173,704	+18,936
N. Riding	1,357,899	299,636	325,209	+25,573
W. Riding	1,652,647	1,415,248	1,508,610	+93,362
Wales:				
Anglesey	176,630	50,928	51,695	+767
Brecknock	469,281	59,287	61,257	+1,970
Cardigan	443,189	59,879	61,292	+1,413
Carmarthen	588,472	160,406	175,069	+14,633
Carnarvon	366,005	125,043	131,034	+5,991
Denbighshire	426,080	144,783	154,847	+10,064
Flintshire	163,707	92,705	106,466	+13,761
Glamorgan	474,607	713,664	814,717	+101,053
Merioneth	422,372	45,565	45,450	−115
Montgomery	510,110	53,146	51,317	−1,829
Pembroke	393,003	89,960	92,056	+2,096
Radnorshire	301,165	22,590	23,528	+938
Total for 62 counties	36,700,304	24,150,992	25,302,076	+1,152,132

TABLE III.—*English and Welsh County Boroughs.*

82 County Boroughs	640,034	11,919,500	12,583,166	663,666
[1]Barnsley	2,385	50,614	53,670	+3,056
Barrow-in-Furness	11,002	63,770	74,254	+10,484
Bath	5,152	69,173	68,648	−525
Birkenhead	3,909	130,794	145,592	+14,798
Birmingham	43,601	840,202	919,438	+79,236

TABLE III.—(*Continued*).

Name of Towns	Area in Statute Acres	Population 1911	Population 1921	Increase (+) or decrease (−) between 1911 and 1921
Blackburn	7,420	133,052	126,630	−6,422
Blackpool	5,189	60,746	99,640	+38,894
Bolton	15,280	180,851	178,678	−2,173
Bootle	1,947	69,876	76,508	+6,632
Bournemouth	6,545	79,183	91,770	+12,587
Bradford	22,881	288,458	285,979	−2,479
Brighton	2,545	131,237	142,427	+11,190
Bristol	18,436	357,114	377,061	+19,947
Burnley	4,620	106,765	103,175	−3,590
Burton-upon-Trent	4,203	48,266	48,927	+661
Bury	5,925	59,040	56,426	−2,614
Canterbury	3,975	24,626	23,738	−888
[1]Carlisle	4,488	52,225	52,600	+375
Chester	2,863	39,028	40,794	+1,766
Coventry	4,147	106,349	128,205	+21,856
Croydon	9,012	169,551	190,877	+21,326
[1]Darlington	4,614	57,328	65,866	+8,538
Derby	5,272	123,410	129,836	+6,426
[1]Dewsbury	6,720	53,351	54,165	+814
Dudley	3,546	51,079	55,908	+4,829
[1]Eastbourne	6,474	52,542	62,030	+9,488
East Ham	3,324	133,487	143,304	+9,817
Exeter	4,705	59,092	59,608	+516
Gateshead	3,132	116,917	124,514	+7,597
Gloucester	2,318	50,035	51,330	+1,295
Great Yarmouth	3,598	55,905	60,710	+4,805
Grimsby	2,868	74,659	82,329	+7,670
Halifax	13,984	101,553	99,129	−2,424
Hastings	4,496	61,145	66,496	+5,351
Huddersfield	11,875	107,821	110,120	+2,299
Hull	9,042	277,991	287,013	+9,022
Ipswich	8,112	73,932	79,383	+5,451
Leeds	28,090	454,155	458,320	+4,165
Leicester	8,582	227,222	234,190	+6,968
Lincoln	6,128	61,346	66,020	+4,674
Liverpool	21,242	753,353	803,118	+49,765
Manchester	21,690	714,385	730,551	+16,166
Middlesbrough	4,159	119,910	131,103	+11,193
Newcastle-upon-Tyne	8,452	266,603	274,955	+8,352
Newport (Mon.)	4,504	83,691	92,369	+8,678
Northampton	3,469	90,064	90,923	+859
Norwich	7,898	121,490	120,653	−837
Nottingham	10,935	259,901	262,658	+2,757
Oldham	4,735	147,483	145,001	−2,482
Oxford	4,719	53,048	57,052	+4,004
Plymouth	5,711	207,449	209,857	+2,408
Portsmouth	7,964	233,573	247,343	+13,770
Preston	3,964	117,088	117,426	+338
Reading	9,105	87,693	92,274	+4,581
Rochdale	6,446	91,428	90,807	−621
Rotherham	5,957	62,483	68,045	+5,562
St. Helen's	7,284	96,551	102,675	+6,124
Salford	5,202	231,357	234,150	+2,793
Sheffield	24,930	460,183	490,724	+30,541
Smethwick	1,929	70,694	75,757	+5,063
Southampton	9,192	145,096	160,997	+15,901
[1]Southend-on-Sea	7,082	70,676	106,021	+35,345
Southport	9,728	69,643	76,644	+7,001
South Shields	2,399	108,647	116,667	+8,020
Stockport	7,063	119,870	123,315	+3,445
Stoke-on-Trent	11,142	234,534	240,440	+5,906
Sunderland	3,357	151,159	159,100	+7,941
Tynemouth	4,372	58,816	63,786	+4,970
[1]Wakefield	4,060	51,511	52,892	+1,381
[1]Wallasey	3,324	78,504	90,721	+12,217
Walsall	7,483	92,115	96,964	+4,849
Warrington	3,057	72,166	76,811	+4,645
West Bromwich	5,859	68,332	73,761	+5,429
West Ham	4,683	289,030	300,905	+11,875
West Hartlepool	2,684	63,923	68,689	+4,766
Wigan	5,083	89,152	89,447	+295
Wolverhampton	3,525	95,328	102,373	+7,045
Worcester	3,662	49,153	48,848	−305
York	3,730	82,282	84,052	+1,770
Wales				
Cardiff	6,489	182,259	200,262	+18,003
Merthyr Tydfil	17,760	80,990	80,161	−829
Swansea	21,600	143,997	157,561	+13,564

[1] County boroughs created since 1911.

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TABLE IV.—*Chief Municipal Boroughs and Urban Districts (England and Wales).*

Name	Area in Statute Acres	Population 1911	Population 1921	Increase (+) or Decrease (−)
Aberdare	15,184	50,830	55,010	+4,180
Accrington	3,427	45,029	43,610	−1,419
Ashton-under-Lyne	1,345	45,172	43,333	−1,839
Barry	3,726	33,763	38,927	+5,164
Bedford	2,223	39,183	40,247	+1,064
Cambridge	5,457	55,812	59,262	+3,450
Chatham	4,356	42,250	42,665	+415
Cheltenham	4,726	48,942	48,444	−498
Chesterfield	8,474	55,309	61,236	+5,927
Colchester	11,333	43,452	43,377	−75
Crewe	2,184	44,960	46,477	+1,517
Darwen	5,959	40,332	37,913	−2,419
Doncaster	4,831	48,455	54,052	+5,597
Dover	1,948	43,645	39,985	−3,660
Eccles	2,057	41,944	44,237	+2,293
Enfield	12,602	56,338	60,743	+4,405
Finchley	3,304	39,419	46,719	+7,300
Gillingham	4,988	52,252	54,038	+1,786
Hendon	8,382	38,806	56,014	+17,208
Heston and Isleworth	6,851	43,313	46,729	+3,416
Hornsey	2,875	84,592	87,691	+3,099
Hove	1,543	42,173	46,519	+4,346
Ilford	8,496	78,188	85,191	+7,003
Keighley	3,902	43,487	41,942	−1,545
Lancaster	3,482	41,410	40,226	−1,184
Llanelly	2,069	32,071	36,504	+4,433
Leigh	6,359	44,103	45,545	+1,442
Leyton	2,594	124,735	128,432	+3,697
Lowestoft	3,327	37,886	44,326	+6,440
Luton	3,132	49,978	57,077	+7,099
Peterborough	1,878	33,574	35,533	+1,959
Poole	7,964	38,885	43,661	+4,776
Rhondda	23,886	152,781	162,729	+9,948
Scarborough	2,727	37,224	46,192	+8,968
Stockton-on-Tees	5,465	58,521	64,150	+5,629
Stratford	3,240	42,496	46,535	+4,039
Swindon	4,265	50,751	54,920	+4,169
Torquay	3,906	38,771	39,432	+661
Tottenham	3,014	137,418	146,695	+9,277
Wallsend	3,420	41,461	43,013	+1,552
Walthamstow	4,343	124,580	127,441	+2,861
Watford	2,238	40,946	45,910	+4,964
Wimbledon	3,221	54,966	61,451	+6,485
Willesden	4,385	154,214	165,669	+11,455
Wood Green	1,626	49,369	50,716	+1,347

TABLE V.—*Scottish Counties.*

Name	Area in Statute Acres (exclusive of Inland Water, Tidal Water and Foreshore)	Population 1911	Population 1921	Increase (+) or Decrease (−)
Aberdeen	1,261,521	312,177	300,980	−11,197
Argyll	1,990,472	70,902	76,856	+5,954
Ayr	724,523	268,337	299,254	+30,917
Banff	403,053	61,402	57,293	−4,109
Berwick	292,535	29,643	28,395	−1,248
Bute	139,658	18,186	33,711	+15,525
Caithness	438,833	32,010	28,284	−3,726
Clackmannan	34,927	31,121	32,543	+1,422
Dumbarton	157,433	136,233	150,868	+14,635
Dumfries	686,302	72,825	75,365	+2,540
East Lothian (Haddington)	170,971	43,254	47,487	+4,233
Fife	322,844	267,733	292,902	+25,169
Forfar	559,037	281,417	270,950	−10,467
Inverness	2,695,094	87,272	82,446	−4,826
Kincardine	244,482	41,008	41,779	+771
Kinross	52,410	7,527	7,963	+436
Kirkcudbright	575,832	38,367	37,156	−1,211
Lanark	562,821	1,486,118	1,539,307	+53,189
Midlothian (Edinburgh)	234,325	507,666	506,378	−1,288
Moray (Elgin)	304,931	43,427	41,561	−1,866
Nairn	104,252	9,319	8,790	−529
Orkney	240,847	25,897	24,109	−1,788
Peebles	222,249	15,258	15,330	+72
Perth	1,595,802	124,342	125,515	+1,173
Renfrew	153,332	279,066	298,887	+19,821
Ross and Cromarty	1,977,248	77,364	70,790	−6,574
Roxburgh	426,028	47,192	44,989	−2,203
Selkirk	170,793	24,601	22,606	−1,995
Shetland	352,319	27,911	25,520	−2,391
Stirling	288,842	160,991	161,726	+735
Sutherland	1,297,914	20,179	17,800	−2,379
West Lothian (Linlithgow)	76,861	80,161	83,966	+3,805
Wigtown	311,984	31,998	30,782	−1,216
	19,070,466	4,760,904	4,882,288	+121,384

TABLE VI.—*Scottish Burghs, over 30,000 inhabitants.*

Burgh	Population 1911	Population 1921	Increase (+) or Decrease (−)
Glasgow	784,455	1,034,069	+249,614
Edinburgh	320,315	420,281	+99,966
Dundee	165,006	168,217	+3,211
Aberdeen	163,084	158,969	−4,115
Paisley	84,477	84,837	+440
Greenock	75,140	81,120	+5,980
Motherwell and Wishaw	65,895	68,869	+2,974[1]
Clydebank	37,547	46,515	+8,968
Coatbridge	43,287	43,909	+622
Dunfermline	29,213	39,886	+10,673[2]
Kirkcaldy	39,600	39,591	−9
Hamilton	38,644	39,420	+776
Kilmarnock	34,729	35,756	+1,027
Ayr	32,985	35,741	+2,756
Falkirk	33,569	33,312	−257
Perth	35,851	33,208	−2,643

[1] Motherwell and Wishaw were united in 1920.
[2] Boundary altered 1911.

TABLE VII.—*Irish Provinces and Counties.*

Provinces and Counties (including County Boroughs)	Population 1911	Inc. or Dec. per cent on 1901	Provinces and Counties (including County Boroughs)	Population 1911	Inc. or Dec. per cent on 1901
Connaught:			Munster:		
Galway	181,686	−5·6	Clare	104,064	−7·4
Leitrim	63,557	−8·3	Cork, E. R.	267,472	−1·9
Mayo	191,969	−3·6	Cork, W.R.	123,718	−6·2
Roscommon	93,904	−7·7	Kerry	159,268	−3·9
Sligo	78,850	−6·2	Limerick	142,846	−2·2
			Tipperary, N. R.	63,958	−5·7
Total Province	609,966	−5·7	Tipperary, S. R.	87,993	−4·8
			Waterford	83,766	−3·9
Leinster:			Total Province	1,033,085	−4·0
Carlow	36,151	−4·2			
Dublin	476,909	+6·4	Ulster:		
Kildare	66,498	+4·6	Antrim	478,603	+3·7
Kilkenny	74,821	−5·5	Armagh	119,625	−4·6
King's	56,769	−5·7	Cavan	91,071	−6·6
Longford	43,794	−6·2	Donegal	168,420	−3·1
Louth	63,402	−3·7	Down	304,589	+5·2
Meath	64,920	−3·8	Fermanagh	61,811	−5·5
Queen's	54,362	−5·3	Londonderry	140,621	−2·6
Westmeath	59,812	−2·9	Monaghan	71,395	−4·3
Wexford	109,287	−1·7	Tyrone	142,437	−5·4
Wicklow	60,603	−·4			
Total Province	1,160,328	+0·7	Total Province	1,578,572	−0·3

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TABLE VIII.—*Largest Irish Towns.*

	Population 1911	Inc. or Dec. per cent on 1901 Rate per cent		Population 1911	Inc. or Dec. per cent on 1901 Rate per cent
Dublin and Suburbs: Dublin City	309,272	+6·4	Belfast	385,492	+10·4
			Cork	76,632	+0·7
			Londonderry	40,799	+2·3
Rathmines & Rathgar	38,190	+17·1	Limerick	38,403	+0·7
			Waterford	27,430	+2·5
Pembroke	29,260	+13·4	Galway	13,249	−1·3
Kingstown	17,227	−0·9	Dundalk	13,128	+0·4
Blackrock	9,081	+4·2	Drogheda	12,425	−2·6
			Lurgan	12,135	−3·0
			Lisburn	12,172	+6·2
Total	403,030	+7·4			
Newry	11,956	−3·6			
Portadown	11,727	+16·2	Sligo	11,163	+2·7
Wexford	11,455	+2·6	Kilkenny	10,513	−0·9
Ballymena	11,376	+4·5	Clonmel	10,277	+1·1

Vital Statistics.—In the separate section below (*Medical Examination of the Nation*) the results of the physical census held during the war are discussed. The birth-rate, death-rate, and marriage-rate for the United Kingdom are given in Table IX. for various years down to 1919. The figures per thousand, for 1916 and following years, are based upon estimates of the population in which allowance is made for conditions of military service, and, in the case of the death-rate, upon the deaths and presumed total number of civilians.

TABLE IX.—*Birth-rate.*

	1910	1914	1916	1918	1919
England	25·1	23·8	20·8	17·7	18·5
Scotland	26·2	26·1	22·8	20·2	21·7
Ireland	22·6	22·6	20·9	19·9	20·0

TABLE X.—*Death-rate.*

	1910	1914	1916	1918	1919
England	13·5	14·0	14·4	17·6	13·7
Scotland	15·3	15·5	14·6	16·0	15·4
Ireland	17·1	16·3	16·13	18·0	17·9

TABLE XI.—*Marriage-rate.*

Year	England and Wales		Scotland		Ireland		United Kingdom	
	Total	per 1000	Total	per 1000	Total	per 1000	Total	per 1000
1910	267,721	15·0	30,902	13·0	22,112	10·1	320,735	14·3
1912	283,834	15·6	32,506	13·7	23,283	10·6	339,623	14·9
1914	294,401	15·9	35,028	14·8	23,695	10·8	353,124	15·3
1916	279,846	14·9	31,483	13·1	22,245	10·2	333,574	14·2
1918	287,163	15·3	34,594	14·2	22,570	10·3	344,327	14·7
1919	369,411	19·7	44,137	18·0	27,193	12·2	440,741	18·9

Emigration.—Table XII. shows the number of emigrants, distinguishing English and Welsh, Scottish, and Irish, who left the United Kingdom in 1910 and 1913. During the war emigration decreased, and full particulars for years during and since the war were not available in 1921.

TABLE XII.—*Emigration.*

Year	English and Welsh	Scottish	Irish	Total
1910	241,767	78,040	50,810	370,617
1913	285,899	59,047	44,662	389,608
In 1915, 104,919 British subjects left for places outside Europe.				

Occupations.—Table XIII. shows the occupations of the people (excluding children under ten years old), as distinguished in six great groups, or unoccupied and unspecified, according to the census of 1911.

TABLE XIII.—*Occupations.*

	England & Wales	Scotland	Ireland
Government Defence	299,599 / 205,817	47,408	..
Professional	714,621	81,675	131,035
Domestic	2,121,717	201,066	219,418
Commercial	2,214,031	283,465	97,889
Agricultural and Fishing	1,260,476	227,111	876,062
Industrial	9,468,138	1,226,242	639,413
Unoccupied and Unspecified	12,234,914	1,647,434	2,494,958

Pauperism.—Table XIV. gives particulars in regard to the number of persons receiving poor relief in England and Wales on Jan. 1 in each year.

TABLE XIV.—*Pauperism.*

Jan. 1st	Institutional	Domiciliary	Lunatics & Casuals	Total
1914	264,292	388,917	108,509	761,718
1915	258,962	394,843	108,255	762,060
1916	226,466	354,325	103,758	684,549
1917	215,283	321,813	100,231	637,327
1918	198,493	296,104	92,188	586,785
1919	183,110	287,244	84,263	554,617
1920	186,273	305,822	84,323	576,418

In Scotland, on May 15 1916, the figures for paupers were 95,857, and on the same day in 1917, 89,779. Figures for Ireland, on Mar. 31 in each year, were: 1914, 76,093; 1915, 73,508; 1916, 68,864; 1917, 67,522.

Agriculture.—(*See* also the article AGRICULTURE). The depression in British agriculture, which set in in 1879 and culminated in 1894, continued to show some abatement down to 1914, although in that year arable land in the United Kingdom amounted only to 19,414,166 ac. against 24,092,075 ac. in 1870, and wheat production only to 7,804,041 quarters against 13,419,496 quarters. British agriculture had turned away from the cultivation of cereals and towards the raising of stock. At the outbreak of the World War, therefore, Britain, as a country importing the vastly greater proportion of its food-stuffs, was faced with the possibility of a shortage and of an adverse effect upon exchanges owing to compulsory importation, at enhanced prices, while countervailing exports necessarily diminished. The researches of various Royal Commissions, the efforts of the Government and public bodies, and the effect of high prices, resulted, from the early part of 1917, in a large extension of arable cultivation, 1,497,293 ac. being added to the area under tillage in Great Britain in 1917–8.

Tables XV. and XVI. show the total area of arable land and of permanent grass in the four divisions of the United Kingdom for each year 1912–20.

TABLE XV.—*Arable Land.*

June 4th	England acres	Wales acres	Scotland acres	Ireland acres
1912	10,596,843	738,433	3,325,027	4,988,420
1913	10,361,849	696,384	3,301,954	4,978,580
1914	10,306,467	691,787	3,295,487	5,027,082
1915	10,272,673	693,034	3,289,902	4,998,903
1916	10,302,153	748,948	3,303,741	5,050,234
1917	10,454,149	791,957	3,360,562	5,046,008
1918	11,463,679	934,961	3,453,495	5,271,830
1919	11,412,353	896,523	3,408,479	..
1920	11,180,322	839,423	3,380,237	..

TABLE XVI.—*Permanent Grass.*

June 4th	England acres	Wales acres	Scotland acres	Ireland acres
1912	13,817,650	2,021,764	1,496,307	9,685,358
1913	14,012,946	2,058,203	1,495,965	9,712,567
1914	14,061,042	2,054,708	1,490,694	9,715,684
1915	14,038,071	2,049,322	1,491,495	9,720,785
1916	14,015,840	2,007,143	1,471,765	9,664,043
1917	13,868,721	1,966,654	1,415,761	9,308,546
1918	12,798,361	1,790,511	1,307,606	9,121,145
1919	12,656,945	1,782,132	1,342,996	..
1920	12,667,104	1,820,162	1,358,809	..

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Table XVII. shows the production, for the United Kingdom, of certain principal crops.

TABLE XVII.—*Principal Crops.*

June 4th	Wheat Quarters	Barley Quarters	Oats Quarters	Potatoes Tons	Hops (England) Cwt.
1912	7,175,288	7,275,900	20,600,079	5,726,342	373,438
1914	7,804,041	8,065,678	20,663,537	7,476,458	507,258
1915	9,239,355	5,862,244	22,308,395	7,540,240	254,609
1916	7,471,884	6,612,550	21,333,782	5,468,881	307,856
1917	8,040,352	7,184,843	26,020,909	8,603,820	220,719
1918	11,643,000	7,760,000	31,196,000	9,223,000	130,000
1919	8,665,000	7,213,000	25,495,000	6,312,000	189,000
1920	7,104,000	8,211,000	22,609,000	6,374,000	281,000

Fisheries.—The war had a profound effect upon British fisheries. They were restricted not merely by military operations, but also by the diversion of so many fishermen and vessels to naval service. The figures in Table XVIII. illustrate the limitation of production and the increase of prices.

TABLE XVIII.—*Fisheries.*

Year	Wet Fish Landed				Value of Wet Fish £	Value of Shell Fish £
	Eng. & W. Cwt.	Scotland Cwt.	Ireland Cwt.	U. K. Cwt.		
1910	13,117,681	8,709,655	1,041,351	22,868,687	11,382,740	357,314
1913	16,152,374	7,828,350	676,392	24,657,116	14,229,311	463,642
1914	10,124,809	7,440,321	589,996	18,155,126	11,228,829	401,812
1915	5,785,233	2,319,390	550,194	8,654,817	9,776,729	389,174
1916	4,244,181	3,412,030	566,137	8,222,348	10,815,569	437,804
1917	4,051,613	3,079,768	662,755	7,794,136	13,442,654	453,984
1918	4,681,000	3,313,228	760,986	8,755,214	21,132,924	590,211

Minerals and Mining.—Tables XIX. and XX. show the output and value of minerals raised and metals manufactured in the United Kingdom in 1910, 1914, 1917 and 1919, and illustrate the inflation of prices during and since the war. The figures for 1917 also indicate the effect of the war upon output, but at the same time demonstrate that coal production, in spite of all difficulties, was not permitted to decline to the extent that is seen in other cases.

For coal production and statistics see COAL. Iron ore raised in the various counties of the United Kingdom and in the most productive counties in England is shown in Table XXI. in tons for the years 1910, 1915, and 1919.

TABLE XXI.—*Iron Ore Production.*

	1910 Tons	1915 Tons	1919 Tons
England			
Cumberland	1,334,751	1,323,408	982,143
Lancashire	408,090	338,086	231,534
Leicester	560,410	685,137	534,595
Lincoln	2,128,161	2,806,989	2,787,322
Northampton	2,649,539	2,517,150	2,202,177
Stafford	913,006	703,231	704,376
York	6,198,411	4,821,465	3,732,476
England (including other counties)	14,471,108	13,729,146	11,863,597
Wales	41,455	91,299	65,974
Scotland	648,415	375,241	308,721
Ireland	65,037	39,326	15,903

The home production of tin ore (almost exclusively in the S.W. of England) is shown in Table XXII. to have had some revival in 1910–14, with a marked increase in world prices in and about 1912, and a further increase during the war, followed by a decrease at its close.

TABLE XXII.—*Tin Ore Production.*

Year	Tin Ore Tons	Value £
1910	7,572	655,871
1912	8,166	1,012,290
1914	8,085	661,865
1916	7,893	712,142
1917	6,573	784,493
1919	5,156	678,823

Textile Industries.—The quantities of raw cotton imported, exported and retained for consumption are given in Table XXIII. for 1910, 1912, 1914 and subsequent years. The restriction of export imposed by war conditions is most clearly illustrated by the figure for 1918. The figures for wool are given in Table XXIV. on the following page.

TABLE XXIII.—*Cotton.*

Year	Imported lb.	Exported lb.	Retained lb.
1910	1,972,741,120	256,100,768	1,716,640,352
1912	2,805,817,800	323,801,100	2,482,016,700
1914	1,864,133,300	216,263,500	1,647,869,800
1915	2,647,616,100	343,638,000	2,303,978,100
1916	2,171,002,200	237,472,800	1,933,529,400
1918	1,489,083,000	352,000	1,488,731,000
1919	1,958,286,700	121,131,600	1,837,155,100

TABLE XIX.—*Mining Production.*

Description of Metal	1910		1914		1917		1919	
	Tons	Value £	Tons	Value £	Tons	Value £	Tons	Value £
Coal	264,433,028	108,377,567	265,664,393	132,596,853	248,499,240	207,786,894	229,779,517	314,113,160
Iron Ore	15,226,015	4,022,269	14,867,582	3,921,683	14,845,734	6,429,620	12,254,195	7,428,366
Clay and Shale	14,090,320	1,761,410	13,124,361	1,731,779	5,842,675	1,393,858	7,765,965	2,358,522
Sandstone	4,386,281	1,300,705	3,464,528	1,057,096	1,613,379	563,119	1,699,853	971,329
Slate	416,324	1,063,994	318,912	806,196	121,524	366,124	164,098	844,394
Limestone (not chalk)	12,512,736	1,296,169	12,158,441	1,295,512	10,454,717	1,722,199	9,537,495	2,431,627
Igneous Rocks	6,608,705	1,263,410	7,135,243	1,369,242	4,239,405	1,049,121	4,387,703	1,720,932
Oil Shale	3,130,280	860,827	3,268,666	837,249	3,117,658	1,280,007	2,763,875	1,567,050
Tin Ore (dressed)	7,572	655,871	8,085	661,865	6,576	784,493	5,156	678,823
Salt	2,050,630	581,504	2,069,989	560,893	2,013,388	1,318,944	1,908,080	2,079,011

TABLE XX.—*Output of Metals.*

Description of Metal	1910		1914		1917		1919	
	Tons	Value £	Tons	Value £	Tons	Value £	Tons	Value £
Iron	4,975,735	17,008,812	4,786,090	17,953,057	4,688,063	43,271,614[1]	3,808,095	51,511,064
Tin	4,797	738,025	5,056	800,547	3,936	935,407	3,272	842,485
Lead	21,522	283,194	19,378	371,977	11,250	337,500	10,277	289,769
Zinc	4,168	99,823	5,208	121,585	2,735	142,699	2,436	102,951
Copper	449	27,570	341	22,777	187	25,141	144	14,176
Gold Bar	2,427 oz.	8,088	99 oz.	333	..	..	..	..
Silver	136,665 oz.	14,058	146,444 oz.	15,445	75,472 oz.	12,854	68,414 oz.	16,266

[1] Calculated on the value of pig iron exported.

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TABLE XXIV.—*Wool.*

Year	Imports lb.	Exports of Imports—lb.	Retained lb.
1910	803,295,083	335,222,545	468,072,538
1912	810,494,862	337,941,504	472,553,358
1914	717,122,475	295,487,373	421,635,102
1915	934,495,242	122,990,049	811,505,193
1916	624,823,286	45,381,652	579,441,634
1918	420,559,105	20,500,264	400,058,841
1919	1,046,704,166	169,474,718	877,229,448

Commerce.—Table XXV. shows the value of imports from other countries to the United Kingdom, and of exports to other countries from the United Kingdom, in 1910, 1915 and 1919; and Tables XXVI. and XXVII. (p. 845) show the chief imports into, and exports from, the United Kingdom.

TABLE XXV.—*Imports and Exports.*

		1910 £	1915 £	1919 £
I. BRITISH POSSESSIONS:—				
India and Ceylon	Imports	48,751,021	74,411,031	124,982,208
	Exports	48,320,012	47,560,290	73,328,775
Straits Settlements, Malaysia and Hong-Kong	Imports	13,692,223	20,925,355	30,665,036
	Exports	8,190,185	6,380,438	11,976,007
Africa	Imports	16,186,605	48,325,974	115,648,393
	Exports	26,566,138	34,840,681	54,281,137
Canada and Newfoundland	Imports	26,238,649	42,206,548	117,843,141
	Exports	20,606,889	13,636,894	16,521,681
West Indies, Bermudas, Honduras and Guiana	Imports	3,232,433	5,707,326	13,486,215
	Exports	3,265,706	2,773,380	3,109,863
Australia	Imports	38,584,370	45,190,148	111,403,971
	Exports	27,652,367	28,965,698	26,306,421
New Zealand	Imports	20,943,142	30,407,581	52,703,816
	Exports	8,652,716	9,373,843	9,593,153
Other	Imports	2,821,823	4,651,264	15,827,859
	Exports	4,048,929	4,888,460	10,503,277
II. FOREIGN COUNTRIES:—				
France	Imports	46,692,355	34,528,585	52,259,323
	Exports	24,930,142	72,119,948	155,593,536
Germany	Imports	62,094,634	526,886	3,202,516
	Exports	37,432,603 [1]	155,673	549,575
Belgium	Imports	19,195,974	2,931,025 [2]	10,110,373 [2]
	Exports	10,886,704	624,207	49,202,523
Holland	Imports	18,527,965	23,418,757	21,658,430
	Exports	12,695,074	18,036,837	34,315,945
Denmark, Faeroe, Iceland, Greenland	Imports	19,671,884	22,894,308	9,791,098
	Exports	5,580,865	8,008,689	34,972,425
Norway	Imports	6,630,746	13,690,481	17,067,379
	Exports	4,033,195	7,286,938	27,437,672
Sweden	Imports	11,825,079	19,801,659	35,583,568
	Exports	6,697,967	6,278,672	24,483,000
Austria-Hungary	Imports	7,511,865	48,531	505,813
	Exports	4,001,053	..	1,459,448
Rumania	Imports	3,184,414	5,276	2,742
	Exports	1,826,652	492,378	5,585,085
Greece	Imports	2,286,871	3,934,622	10,440,500
	Exports	1,545,863	2,467,439	6,914,713
Italy	Imports	6,458,736	11,258,452	14,635,183
	Exports	12,530,583	13,929,053	27,756,885
Spain	Imports	15,351,086	20,764,004	39,010,162
	Exports	6,231,797	7,261,540	12,668,021
Portugal	Imports	3,470,873	5,318,000	13,879,719
	Exports	6,328,622	4,703,533	9,579,873
Russia	Imports	43,644,648	21,424,998	16,370,377
	Exports	12,252,556	13,432,172	12,993,681
Turkey	Imports	4,668,076	1,303,348	9,284,659
	Exports	8,636,666	433,087 [3]	22,160,138 [3]
Japan	Imports	4,327,299	9,379,432	23,871,012
	Exports	10,121,919	4,876,655	12,913,373
China	Imports	5,529,530	7,034,852	23,052,935
	Exports	9,171,672	8,545,505	20,969,728
Netherlands India	Imports	4,029,389	14,474,398	22,394,183
	Exports	4,075,825	6,162,284	9,029,752
Other Countries in Asia	Imports	1,238,856	2,562,891	3,113,541
	Exports	1,312,710	1,757,576	3,411,910
Egypt	Imports	21,004,468	.. [4]	.. [4]
	Exports	8,717,330	..	..
U.S.A.	Imports	117,607,435	237,773,576	541,553,171
	Exports	31,446,730	26,167,551	33,913,239
Mexico and Central American States	Imports	3,582,859	4,520,801	8,641,032
	Exports	3,342,446	771,452	2,313,059
Brazil	Imports	17,496,568	8,256,879	10,821,100
	Exports	16,426,985	5,151,470	10,741,637
Argentina	Imports	29,009,738	63,876,814	81,730,319
	Exports	19,097,985	11,516,158	21,217,210
Chile	Imports	5,181,737	9,585,247	7,344,655
	Exports	5,479,556	1,791,131	4,779,253
Africa	Imports	1,413,642	1,974,844	3,581,519
	Exports	1,747,570	1,999,297	6,063,998
South America	Imports	9,131,443	11,247,707	25,874,754
	Exports	7,200,996	4,481,388	9,556,626
Other Countries	Imports	17,038,588	27,541,750	39,804,960
	Exports	9,330,539	7,998,131	17,738,366
Total for British Possessions	Imports	170,450,266	271,825,227	582,570,639
	Exports	147,302,942	148,419,684	205,620,314
Total for Foreign Countries	Imports	507,806,758	580,068,123	1,043,585,573
	Exports	283,081,830	236,448,764	593,015,062
Grand Total	Imports	678,257,024	851,893,350	1,626,156,062
	Exports	430,384,772	384,868,448	1,798,635,376

[1] From German possessions in W. Africa.
[2] Includes Belgian Congo after 1914.
[3] To territory formerly Turkish, now occupied by other Powers.
[4] Included under British possessions from 1915.

The proportion of imports and exports per head of population of the United Kingdom was approximately as follows:—

Year	Imports £ s. d.	Exports £ s. d.
1910	15 2 0	9 11 8
1912	16 7 3	10 14 2
1914	15 2 4	9 6 11
1915–1919 Average	25 3 6	11 15 0

Parliamentary Representation.—Under the Representation of the People Act, 1918, there was a complete redistribution of seats. Tables XXVIII. to XXXV. show the new Parliamentary arrangements for England, Wales and Scotland.

TABLE XXVIII.—*London Parliamentary Boroughs.*

Name of Borough	No. of Members	Name of Borough	No. of Members
Battersea	2	Lambeth	4
Bermondsey	2	Lewisham	2
Bethnal Green	2	Paddington	2
Camberwell	4	Poplar	2
Chelsea	1	St. Marylebone	1
City of London	2	St. Pancras	3
Deptford	1	Shoreditch	1
Finsbury	1	Southwark	3
Fulham	2	Stepney	3
Greenwich	1	Stoke Newington	1
Hackney	3	Wandsworth	5
Hammersmith	2	Westminster	2
Hampstead	1	Woolwich	2
Holborn	1		
Islington	4	Total	62
Kensington	2		

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TABLE XXVI.—*Imports into the United Kingdom.*

Imports	1910 £	1912 £	1914 £	1916 £	1919 £	1920 £
Grain and flour	77,298,383	88,496,284	79,636,269	133,253,132	154,801,757	231,712,529
Meat	48,878,947	49,079,559	63,215,056	94,050,999	173,861,571	141,557,025
Other principal articles of food and drink:						
Butter	24,493,450	24,354,193	24,014,276	18,964,002	19,854,427	24,634,294
Sugar	24,554,209	25,149,661	32,118,170	37,367,675	53,927,868	72,958,737
Tea	11,381,056	13,125,689	14,221,496	17,745,317	33,050,853	26,928,953
Wine	4,248,814	4,287,426	3,630,313	3,511,822	18,167,077	13,147,753
Coffee	2,305,555	2,518,521	3,549,038	4,727,426	5,982,804	4,522,327
Fish (preserved)	3,371,565	2,887,767	4,584,321	9,290,131	12,177,696	11,127,603
Cocoa and chocolate	1,169,530	1,604,274	1,523,630	2,300,731	2,323,484	5,032,532
Principal fruits:						
Apples	2,189,309	2,507,024	2,046,824	2,741,102	6,245,874	9,324,700
Oranges	2,267,474	2,348,375	2,323,235	3,087,175	9,445,154	8,017,095
Bananas	1,698,556	1,964,200	2,434,751	2,211,245	3,908,393	6,468,719
Tobacco	4,624,782	6,359,115	7,463,068	7,364,308	41,653,708	33,584,169
Raw materials:						
Cotton	71,711,908	80,238,960	55,350,626	84,729,677	190,771,416	256,765,237
Wool	37,332,470	36,567,818	34,246,722	39,730,623	104,753,205	93,957,397
Oils	37,548,960	37,418,767	41,332,056	63,356,728	130,994,512	151,905,135
Wood and timber	26,207,329	28,357,158	25,343,111	40,163,994	72,306,469	82,164,620
Textile materials, excluding cotton and wool	12,803,327	18,578,100	15,367,670	23,840,128	28,818,186	36,798,326
Hides and skins	12,882,326	13,690,265	12,727,066	13,784,590	29,508,074	31,976,823
Metallic ores, excluding iron	8,970,272	9,059,505	9,533,465	13,679,870	12,343,018	17,711,627
Iron ore, etc.	6,261,471	6,219,050	5,487,344	12,136,066	11,983,278	20,799,861
Manufactured articles:						
Yarns and textile fabrics	32,049,602	44,870,344	37,767,686	33,584,048	45,029,820	87,562,067
Metal, excluding iron and steel	24,699,194	31,197,428	29,604,332	39,048,339	35,215,276	39,221,892
Leather	11,824,741	14,342,926	13,478,148	16,188,901	37,362,572	19,715,078
Chemicals	11,259,685	12,545,758	12,064,430	28,622,052	23,068,847	35,315,326
Iron and steel (not machinery)	9,086,214	12,961,991	10,877,249	11,214,097	11,309,908	29,005,826
Paper	6,413,718	7,234,437	6,791,191	8,327,405	13,014,623	30,252,181
Machinery	4,470,898	6,820,683	6,712,499	7,988,039	15,066,659	19,961,401

TABLE XXVII.—*Exports of Home Produce.*

	1910 £	1914 £	1916 £	1918 £	1919 £	1920[1] £
Cotton yarn and manufactures	105,871,208	103,266,538	118,307,992	118,307,992	240,977,605	401,682,535
Iron and steel manufactures	42,976,671	41,667,830	56,673,705	36,843,078	63,484,265	128,942,618
Woollen yarn and manufactures	37,516,397	31,499,885	46,905,649	49,865,941	98,431,697	134,969,462
Coal	37,813,360	42,202,128	50,670,604	52,416,330	92,297,685	99,627,146
Machinery	29,271,380	31,363,093	20,217,598	16,120,463	32,670,013	63,457,987
Chemicals	18,568,136	19,508,061	27,565,087	22,663,148	29,502,610	40,729,760
Textiles (not cotton or wool)	13,481,198	12,982,261	15,817,943	11,126,189	21,253,385	45,037,326
Metal manufactures (not iron)	10,352,354	10,283,283	12,720,016	9,003,158	15,337,212	25,867,965
Clothing	12,717,587	14,531,674	16,941,093	11,818,335	17,562,933	48,887,862
Leather and leather goods	4,686,485	4,685,015	4,897,503	1,551,378	7,360,317	11,672,599
Ships	8,770,204	6,932,554	1,290,585	1,047,334	2,328,331	2,306,267

[1] From preliminary returns.

TABLE XXIX.—*Provincial English Parliamentary Boroughs.*

Name of Borough	No. of Members	Name of Borough	No. of Members
Accrington	1	Dudley	1
Ashton-under-Lyne	1	Ealing	1
Barnsley	1	East Ham	2
Barrow-in-Furness	1	Eccles	1
Bath	1	Edmonton	1
Batley and Morley	1	Exeter	1
Birkenhead	2	Gateshead	1
Birmingham	12	Gloucester	1
Blackburn	2	Great Yarmouth	1
Blackpool	1	Grimsby	1
Bolton	2	Halifax	1
Bootle	1	Hartlepools, The	1
Bournemouth	1	Hastings	1
Bradford	4	Hornsey	1
Brighton	2	Huddersfield	1
Bristol	5	Hull (Kingston-upon-Hull)	4
Bromley	1	Hythe	1
Burnley	1	Ilford	1
Bury	1	Ipswich	1
Cambridge	1	Kingston-upon-Thames	1
Carlisle	1	Leeds	6
Cheltenham	1	Leicester	3
Coventry	1	Leigh	1
Croydon	2	Leyton	2
Darlington	1	Lincoln	1
Derby	2	Liverpool	11
Dewsbury	1		

TABLE XXIX.—(*Continued*).

Name of Borough	No. of Members	Name of Borough	No. of Members
Manchester	10	Smethwick	1
Middlesbrough	2	Southampton	2
Morpeth	1	Southend-on-Sea	1
Nelson and Colne	1	Southport	1
Newcastle-under-Lyme	1	South Shields	1
Newcastle-upon-Tyne	4	Stockport	2
Northampton	1	Stockton-on-Tees	1
Norwich	2	Stoke-on-Trent	3
Nottingham	4	Sunderland	2
Oldham	2	Tottenham	2
Oxford	1	Tynemouth	1
Plymouth	3	Wakefield	1
Portsmouth	3	Wallasey	1
Preston	2	Wallsend	1
Reading	1	Walsall	1
Richmond (Surrey)	1	Walthamstow	2
Rochdale	1	Warrington	1
Rochester (with Chatham and Gillingham)	2	Wednesbury	1
Rossendale (incl. Bacup, Haslingden and Rawtenstall)	1	West Bromwich	1
Rotherham	1	West Ham	4
St. Helens	1	Wigan	1
Salford	3	Willesden	2
Sheffield	7	Wimbledon	1
		Wolverhampton	3
		Worcester	1
		York	1
		Total	193

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TABLE XXX.—*Welsh Parliamentary Boroughs.*

Name of Borough	No. of Members	Name of Borough	No. of Members
Cardiff	3	Merthyr Tydfil	2
Carnarvon District (Bangor, Carnarvon, Conway, Pwllheli, Criccieth, Llandudno, Llanfairfechan, Penmaenmawr, Nevin)	1	Newport	1
		Rhondda	2
		Swansea	2
		Total	11

TABLE XXXI.—*Scottish Parliamentary Boroughs.*

Name of Borough	No. of Members	Name of Borough	No. of Members
Aberdeen	2	Kirkcaldy District (Kirkcaldy, Buckhaven, Methil, Innerleven, Burntisland, Dysart, Kinghorn)	1
Ayr District (Ayr, Ardrossan, Irvine, Prestwick, Saltcoats, Troon)	1	Leith	1
Dumbarton District (Dumbarton, Clydebank)	1	Montrose District (Montrose, Arbroath, Brechin, Forfar, Inverbervie)	1
Dundee	2	Paisley	1
Dunfermline District (Dunfermline, Cowdenbeath, Inverkeithing, Lochgelly)	1	Stirling and Falkirk (with Grangemouth)	1
Edinburgh	5		
Glasgow	15	Total	33
Greenock	1		

TABLE XXXII.—*English County Divisions.*

Name of County	No. of Divs. and Members	Name of County	No. of Divs. and Members
Bedford	3	Leicester	4
Berks	3	Parts of Lindsey (Lincolnshire)	4
Bucks	3	Middlesex	10
Cambridge	1	Norfolk	5
Chester	9	Northampton (with Soke of Peterborough)	4
Cornwall	5	Northumberland	3
Cumberland	4	Nottingham	5
Derby	8	Oxford	2
Devon	7	Salop	4
Dorset	4	Somerset	6
Durham	11	Stafford	7
Essex	8	Suffolk, East	3
Gloucester	4	Suffolk, West	2
Hants	6	Surrey	7
Hereford	2	Sussex, East	4
Hertford	5	Sussex, West	2
Holland with Boston (Lincolnshire)	1	Warwick	4
Huntingdon	1	Westmorland	1
Isle of Ely	1	Wilts	5
Isle of Wight	1	Worcester	4
Kent	11	York, East Riding	3
Parts of Kesteven (Lincolnshire) and Rutland	2	York, North Riding	4
Lancaster	18	York, West Riding	19
		Total	226

TABLE XXXIII.—*Welsh County Divisions.*

Name of County	No. of Divs.	Name of County	No. of Divs.
Anglesey	1	Glamorgan	7
Brecon and Radnor	1	Merioneth	1
Cardigan	1	Monmouth	5
Carmarthen	2	Montgomery	1
Carnarvon	1	Pembroke	1
Denbigh	2		
Flint	1	Total	24

As compared with the former distribution of seats, London boroughs, in the Act of 1918, gained 3 members; other boroughs gained 33 (31 new boroughs were created and 44 old boroughs were abolished); the counties lost 5 members; the universities gained 6 members, the newer universities being represented for the first time. Membership of the House of

TABLE XXXIV.—*Scottish County Divisions.*

Name of County	No. of Divs. and Members	Name of County	No. of Divs. and Members
Aberdeen and Kincardine	3	Lanark	7
Argyll	1	Linlithgow	1
Ayr and Bute	3	Midlothian and Peebles	2
Banff	1	Moray and Nairn	1
Berwick & Haddington	1	Orkney and Shetland	1
Caithness & Sunderland	1	Perth and Kinross	2
Dumbarton	1	Renfrew	2
Dumfries	1	Roxburgh and Selkirk	1
Fife	2	Stirling and Clackmannan	2
Forfar	1		
Galloway	1	Total	38
Inverness and Ross and Cromarty	3		

TABLE XXXV.—*University Constituencies.*

Name of County	No. of Divs. and Members	Name of County	No. of Divs. and Members
Oxford	2	St. Andrews, Glasgow, Aberdeen, Edinburgh	3
Cambridge	2		
London	1		
Wales	1		
Durham, Manchester, Liverpool, Leeds, Sheffield, Birmingham, Bristol	2	Total	11

Commons totalled 707:—England 492 (an addition of 31), Wales 36 (addition of 2), Scotland 74 (addition of 2), Ireland (the Act did not cover Irish redistribution), 105. On the extension and revision of the franchise under the Act, *see* ENGLISH HISTORY.

Local Government.—Some important changes were made in the municipal status of towns in England and Wales in the years preceding 1920. Barnsley, Carlisle, Darlington, Dewsbury, Eastbourne, East Ham, Southend-on-Sea, Stoke-on-Trent, Wakefield and Wallasey became county boroughs. Aylesbury, Buxton, Devonport, Fowey, Llanelly and Stourbridge became municipal boroughs. The following were created urban districts:—Ardwick-le-Street, Axminster, Beddington and Wallington, Bedwas and Machen, Bentley with Arksey, Bletchley, Bungay, Chorleywood, Coulsdon and Purley, Cwmamman, Haslemere, Letchworth, Leyland, Long Benton, Market Drayton, Mitcham, Oadby, Prudhoe, Seaton Delavel, Spenborough, Stratford and Wolverton, Tilbury, Yiewsley. The following urban districts changed their names:—Ynseynhaiarn to Portmadoc, Ystradyfodwg to Rhondda, Merton to Merton and Morden, New Shoreham to Shoreham-by-Sea, Preesall with Hackensall to Preesall, Hunstanton to New Hunstanton, Hucknall Torkard to Hucknall, Newbold and Dunstan Whittington to Whittington and Newbold. The Greater Birmingham scheme, which came into operation Nov. 9 1911, included in the city of Birmingham the former borough of Aston Manor and certain urban districts. (O. J. R. H).

MEDICAL EXAMINATION OF THE NATION

In order to appreciate the nature and scope of the physical census of men of military age carried out in the United Kingdom by the Ministry of National Service during the last years of the World War, it is necessary to recapitulate briefly the phases through which the recruiting arrangement for the British army passed during the earlier stages of the war.

Before the war the British army was a voluntary army, and only men between 18 and 30 years of age of good physique and free from any physical defect were accepted for enlistment. It was laid down that the height and chest measurements of each recruit should accord with each other and with his age in conformity with the official table of standards. Each recruit whose physical condition did not conform to these standards was re-

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garded as unfit and not accepted. In short, the army accepted for service only the best human material.

At the outbreak of war in Aug. 1914, there was a tremendous rush of recruits to the colours, and perforce attempts were made to deal, on the same simple plan, with the tens of thousands of men who besieged the recruiting offices. The need for soldiers was clamant, irresistible, and there was no time to devise another method. The result was inevitable—the army was flooded with men who after a few weeks or months of service broke down and proved useless. The authorities then saw that in this war they were confronted with a new problem—men had to be provided on a scale never before contemplated and the man-power resources of the country were to be strained to the utmost. The army needed would have to employ men of different degrees of physical fitness, since the available number of perfectly fit men would not be adequate for all the needs of the country. It was therefore necessary to classify recruits according to their fitness for the very varied duties for which the army required men—the old simple division into "fit" and "unfit" was no longer sufficient: recruits must be classified or graded so that as far as possible every man called up for service should be allotted to the particular occupation in the army for which he was fitted by his training and degree of physical fitness. Accordingly, a system of categories was introduced whereby recruits were classified by medical boards as being fit for general service, field service at home, garrison service, labour or sedentary work; as experience of this system accumulated various modifications and sub-divisions of these categories were subsequently introduced to meet the difficulties which arose in their application in practice.

Meantime, on Jan. 27 1916, the first Military Service Act, which provided for the compulsory service of unmarried men between the ages of 18 and 41, came into operation, and on May 26, a like obligation was imposed on the married between those ages. By this time, the difficulty of categorization was becoming painfully evident; it consisted essentially of the fact that the category was not a purely medical classification but rather a kind of administrative shorthand founded upon medical information. In other words, medical boards were required to perform the functions of a posting board, as well as their proper medical function of assessing the degree of physical fitness of the men examined. The attempt to combine these functions failed, as in the light of experience we can see it was bound to fail, and was in fact the cause of the growing volume of dissatisfaction which became steadily more general and more emphatic during the latter half of 1916 and the early months of 1917. The examination of men called up under the Review of Exceptions Act in April 1917 caused a storm of hostile criticism; this led to the appointment of the Shortt Committee, which, in Aug. 1917, recommended to the House of Commons that the whole organization and administration of examination should be transferred from the War Office to civilian control. Accordingly, the Ministry of National Service—the Department entrusted with this work—assumed these duties as from midnight Oct. 31 1917.

The immediate medical duties of the Department were: (1) To introduce a new system of grading—the grade of each man to be determined by physical considerations alone—to replace the system of categorization in which administrative as well as medical considerations were taken into account; (2) to lay down definite standards of physical efficiency for the guidance of members of examining boards; (3) to establish National Service Medical Boards for the examination of men of military age.

As regards the personnel of the boards, great care was taken to select suitable chairmen who were generally whole-time medical officers. Members of the boards (1 chairman and 4 members constituted a board) were drawn from a panel of local civilian doctors of good standing—a system which made for efficient work, economized the medical man-power of the country and was at the same time elastic. These boards were established at convenient centres all over Great Britain. At first they numbered 97 and were soon examining some 80,000 men per month. The number of boards steadily increased to cope with the increasing work. In April 1918 285,631 men were examined, in May 456,999, and in June 475,416; by this time the number of boards was 209. After this the pressure relaxed somewhat, and the numbers in succeeding months were July 371,923, Aug. 158,544, Sept. 97,694, Oct. 110,255.

From the outset instructions were issued to boards that they were to grade all men brought before them according to their physical fitness at the time of examination in conformity with the following standards:—

Grade I.—Those who attain the full normal standard of health and strength and are capable of enduring physical exertion suitable to their age. Such men must not suffer from progressive organic disease, nor have any serious disability or deformity. Minor defects which can be remedied or adequately compensated by artificial means will not be regarded as disqualifications.

Grade II.—Those who for various causes, such as being subject to partial disabilities, do not reach the standard of Grade I. They must not suffer from progressive organic disease. They must have fair hearing and vision, be of moderate muscular development, and be able to undergo a considerable degree of physical exertion of a nature not involving severe strain.

Grade III.—Those who present marked physical disabilities or such evidence of past disease that they are not considered fit to undergo the degree of physical exertion required for the higher grades. Examples of men suitable for this grade are those with badly deformed toes, severe flat-foot, and some cases of hernia and of varicose veins (others are indicated later under the headings of the various diseases and disabilities). The third grade will also include those who are fit only for clerical and other sedentary occupations, such as tailoring and bootmaking.

Grade IV.—All those who are totally and permanently unfit for any form of military service.

In order to assist the boards in their task of grading, and to insure uniformity as far as possible through the country, instructions were also issued to them indicating the effect of some 60 common disabilities and diseases upon the grading. Thus, in the Ministry of National Service, a department was created with the administrative machinery requisite not only to supply the armed forces with recruits, but also to survey the physical fitness of the male population of military age and so provide a physical census of the human material at the disposal of the country for all its needs. It is evident that, until categorization with its administrative factors was abandoned and grading by physical considerations alone introduced, true inferences as to the health and fitness of the male population could not be drawn from the statistical returns of recruiting. With the introduction of the new system on Nov. 1 1917, the statistical returns at once became of great value, and provided for the first time a physical census of part at least of the population.

The number of examinations completed during this last year of the war with the numbers placed in each grade is shown in the accompanying table:—

Medical Examinations (Period Nov. 1 1917 to Oct. 31 1918).
No. of Examinations and Reëxaminations.

Grade I.	871,769	(36·0%)
Grade II.	546,276	(22·5%)
Grade III.	756,859	(31·3%)
Grade IV.	250,280	(10·2%)
Total	2,425,184	

It will be noted that of the 2,425,184 examinations 871,769 resulted in the man being placed in Grade I., 546,276 in Grade II., 756,859 in Grade III., and 250,280 in Grade IV. In other words 36% were placed in Grade I., *i.e.* were judged to have attained the full normal standard of health and strength, and to be capable of undergoing physical exertion suitable to their age; 22% were placed in Grade II., *i.e.* were judged to be capable only of undergoing such physical exertion as did not involve severe strain; 32% were placed in Grade III., *i.e.* presented marked physical disabilities or such evidence of past disease that they were not considered fit to undergo the degree of exertion required for the higher grades; 10% were placed in Grade IV., *i.e.* were judged to be totally and permanently unfit for any form of military service. This result may be summarized by saying that of every 9 men of military age in Great Britain in the year under review 3 were perfectly fit and healthy, 2 were definitely below the normal standard of health, 3 were unfit to undergo any-

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thing but the most moderate degree of exertion, and the remaining man was a chronic invalid.

Exception has been taken to these inferences on the ground that these grading results are not a true reflection of the health of the nation for two reasons:—

First, that the grading was inaccurate. In reply to this criticism it is to be observed that men dissatisfied with their grading had the right to appeal to an independent tribunal against their grading, and that the number of men whose grading was altered on appeal was less than 0·4% of the total number of examinations, in other words an independent tribunal only altered the finding of the board in between 3 and 4 cases out of every 1,000. Further, though we do not know to what extent grading was found by actual experience in the army (the only real criterion) to represent truly the degree of physical fitness, it is certain that any conclusions we may reach from the grading results will, if anything, lead us to overrate the physical fitness of our manhood, since every factor in the situation contributed toward grading men too high rather than too low.

Secondly, that the men examined were the dregs of a population exhausted by 3 years of war. This criticism, though natural and self-evident at first sight, is inadmissible principally for the reason that it is made in ignorance of the extent to which fit men of military age were employed in such industries and occupations as agriculture, mining, shipbuilding, and munition works, and protected from recruitment by law during the earlier years of the war, remaining in civil life until in the fourth year of the war these industries had to be "combed-out" in response to the increasing strain upon the diminishing reserve of man-power. Analysis shows that the men examined during the year under review belonged to one of the five following groups:—

(1) Men in the protected industries, which in the nature of things employed a high proportion of the physically fit, and this group was numerically much the largest.

(2) Men who were now refused further exemption by tribunals owing to the urgent demand for men caused by the military situation.

(3) Lads who attained the age of 18 years during this year; in number 261,137.

(4) Men who had been previously rejected when the need for soldiers was less urgent.

(5) Men between 41 and 51 who became liable for military service under the Military Service No. 2 Act of April 1918.

Inasmuch as group (1), the largest, comprised an abnormally high proportion of the physically fit, group (4) an abnormally low, and group (2) an average proportion, while groups (3) and (5) were a "virgin soil," we can hardly escape the inference that in the aggregate the men examined during the year under review represented the manhood of military age from the standpoint of health and physique, and that therefore the observations made at their medical examinations form a trustworthy criterion of the national health.

With this general picture before us, we may well and rightly ask what are the causes of this great mass of physical inefficiency which low grading means and to what extent is it preventable. After all, the large majority of babies are born healthy, and the conditions and environment subsequent to birth are created by mankind and are capable of a large range of modification. It will be readily understood that such a mass of records and observations require full and detailed analysis before complete conclusions as to the lessons obtained can be reached. While a complete analysis was not yet available in 1921, the matter had been sufficiently explored to reveal several striking results.

First, as to the causes for which such a large proportion of men were placed in Grades III. and IV., viz., 1,007,139 or 41·5% of the total number of examinations. Men placed in these grades, it must be remembered, presented such marked physical disabilities or such evidence of past disease that they were only considered fit to undergo the most moderate degree of exertion, and some were so incapacitated as to be totally and permanently unfit for any form of military service. The reasons for 2 out of every 5 men of military age being so physically unfit clearly requires explanation. The largest group of men in these two grades which has been analysed is 160,545 men, examined in the London region during the period Jan. to Oct. 1918; of these 82,645 were placed in Grades I. and II., the balance of 77,900 (48·5%) falling to Grades III. and IV., namely 60,031 (37·4%) in Grade III. and 17,869 (11·1%) in Grade IV. In the case of the Grade III. and Grade IV. men in this large group the accompanying table shows the disease or disability on account of which they were so graded.

Broadly speaking, this table shows that of this large group of men of military age half were found to be suffering from organic

Disease or disability	No. of men placed in Grades III. & IV.	Percentage of numbers examined	Percentage placed in Grade IV.	Percentage placed in Grade III.
1. Valvular disease of heart	12,562	7·9	1·6	6·3
2. Deformities, congenital and acquired (including flat-foot, hammer toe, kyphosis, etc.)	8,605	5·3	·0	4·3
3. Diseases of circulatory system (other than V. D. H.) including varicose veins	6,275	3·9	·6	3·3
4. Diseases of lungs and bronchi (other than tuberculosis) and of respiratory system	6,188	3·8	·6	3·2
5. Pulmonary tuberculosis	4,327	2·6	2·0	·6
6. Functional diseases of heart	3,385	2·1	·1	2·0
7. Wounds, injuries, etc., including traumatic deformities, amputations, etc.	3,335	2·0	·3	1·7
8. Diseases of ears	3,162	1·9	·3	1·6
9. Diseases of nervous system (other than insanity and epilepsy)	3,066	1·9	·5	1·4
10. Poor physique	2,967	1·8	·2	1·6
11. Defective vision	2,620	1·6	·2	1·4
12. Rheumatism	2,445	1·5	·1	1·4
13. Hernia	2,179	1·3	·2	1·1
14. Diseases of digestive system	2,170	1·3	·2	1·1
15. Diseases of eyes	1,886	1.1	·5	·6
16. Deafness	1,708	1·0	·2	·8
17. Epilepsy	1,265	·7	·5	·2
18. Hæmorrhoids	1,140	·7	·05	·65
19. Skin diseases	1,053	·6	·15	·45
20. Diseases of generative organs and of genito-urinary system (other than venereal disease, albuminuria and glycosuria)	983	·6	·075	·525
21. Albuminuria	951	·5	·3	·2
22. Tuberculosis (other than pulmonary)	911	·5	·3	·2
23. Insanity	656	·4	·3	·1
24. Syphilis	556	·3	·1	·2
25. Glycosuria	214	·1	·1	..
26. Venereal disease (other than syphilis)	162	·1	·02	·08
27. Other diseases	3,129	1·9	·375	1·525
	77,900	48·5	11·1	37·4 11·1
				48·5

disease of one kind or another of a severity sufficient at least to render them incapable of a normally active life. It will be observed that diseases of the heart were the most frequent disability. Valvular disease 12,562 (7·9%) and functional disease 3,385 (2·1%) made up 15,947 cases of heart disease in all, or 10·0% of the number examined. There had been no previous opportunity of gauging the frequency of heart disease among the population, but it can be safely stated that such an incidence as one in ten among men in the prime of life would never have been expected. It indicates the importance that should be attached to insuring that adequate treatment is given to all cases, and to the infections such as rheumatism in which it frequently originates especially in the earlier years of life.

Another figure which naturally attracts attention is that for tuberculosis; 4,327 had pulmonary tuberculosis, 911 had tuberculosis of other organs, 5,238 in all, or 3·1% of the number examined. Of these 3,874 (2·3% of the number examined) were cases sufficiently advanced or sufficiently active to warrant the boards in relegating the men to Grade IV., *i.e.* totally and permanently unfit for any form of military service. Great doubt and difficulty have always attended all attempts to estimate the frequency of tuberculosis; a disease of many manifestations, it is often impossible to prove its existence in a given case and frequently impossible to exclude it. It is rather striking to find that 2·3% of this large group of men presented sufficiently

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definite evidence of its existence to enable the examiners to reject them as useless for any form of military service. This experience was not limited to London, for we find that in Liverpool among 20,704 men the incidence was 2·15% and in Yorks, in a group of 24,281 men, 2·37%. The close correspondence of the incidence found among these 3 large groups of men in different parts of the country suggests very strongly that the figures are trustworthy, and represent with accuracy the frequency of active or established tuberculosis in men in the 3rd, 4th and 5th decades of life.

Apart from specific diseases another feature of this table which invites comment is the 2,967 men (1·8% of the number examined) who were found fit only for the lower grades on account of poor physique. Now the physique of an individual is to be regarded as the effect upon him of his inheritance and environment—it is the net result of all the factors which combine to make him what he is physically. In the absence of evidence of actual racial degeneration poor physique must be attributed to the environment of the individual—to the conditions of life to which he has been subjected. Any evidence that indicates the standard of physique prevailing among men of military age will therefore afford a valuable criterion of the extent to which modern conditions of life do or do not permit of healthy bodily development. Measurements of the height, weight and chest girth are commonly accepted as the practical criteria of physique, and the records of these measurements provide us with an opportunity of investigating and comparing the physique of the men examined.

Now, though the anthropometrical observations made as part of the physical examination of men of military age had not in 1921 been fully worked out, the figures already available are of interest and importance; thus in a group of 71,000 men of all ages between 18 and 41 in the W. Midland region it is shown that at 18 years the average height was 65·6″, at 25 years 66·1″, at 35 years 65·9″, and at 40 years 65·8″. On comparing these figures with those of the report of the Anthropometrical Committee of the British Association in 1883, it is found that they are in every case well below the averages then found which were, at 18 years 66.6″, at 25 years 67·5″, at 35 years 68·0″, and at 40 years 67·9″. Indeed, these recent W. Midland figures are less favourable than those of Group IV. (the poorest class in the Anthropometrical Committee's report), viz. artisans in towns, and much less favourable than those of Group I., the professional classes in the same report.

Height in Inches.

Age	18 years	25 years	35 years	40 years
W. Midland	65·6″	66·1″	65·9″	65·8″
Group IV.	66·6″	67·5″	68·0″	67·9″
Group I.	68·2″	69·1″	69·1″	69·6″

On the average, therefore, the W. Midland heights are about 1½″ below the average stature quoted in the anthropometrical report of 1883.

Turning to the weight tables for the same group of W. Midland men the salient feature is that in no age group in any of the constituent areas (Birmingham, Burslem, Dudley, Worcester, Coventry, Shrewsbury, Hertford, Leamington, Walsall and Wolverhampton) is there a higher average than 137½ lb. Among all the 240 groups in the series only 71 show an average weight of 130 lb. or over, while in all the 24 age groups in Birmingham (which include nearly 20,000 men) there are only 5 groups of 130 lb. and upwards, and no age group under 30 years reaches an average of 130 lb. Comparing the Birmingham figures with those of the Anthropometrical Committee's report (with a deduction of 9 lb. for clothes) it is found that the Birmingham figures are lower throughout to the following extent: at 18 years 11½ lb., at 20 years 14 lb., at 25 years 13¼ lb., at 30 years 21 lb., at 35 years 27·5 lb., at 40 years 21·6 lb. The other industrial communities (Burslem, Dudley, Walsall, Wolverhampton and Coventry) show similar deficiencies. The agricultural communities (Worcester and Shrewsbury) show the best weights, but still below those found by the Anthropometrical Committee to the extent shown in this table:—

Weight in Pounds.

Age	18 years	25 years	30 years	35 years	40 years
Worcester	10 lb.	11 lb.	20¾ lb.	22 lb.	21 lb.
Shrewsbury	2½ lb.	9 lb.	19¼ lb.	24 lb.	23 lb.

These comparisons speak for themselves.

The average stature and weight of individuals furnish a valuable criterion of the health and physical capacity of a community, and these figures clearly indicate the deleterious effect of modern conditions of life upon the population. This conclusion is further borne out by an investigation of the principal measurements of groups of Grade I. men from every area in Great Britain, which show that the average for a Grade I. man is as follows:—

Height	Weight	Chest girth
5 ft. 6 in.	127·2 lb.	35 in.

Due precautions were taken to insure that these groups were as far as possible representative of the whole, and the results in different parts of the country showed surprisingly small variations from the average. We must therefore conclude that a man presenting the above measurements is to be regarded as an average specimen of the male Briton, who has attained the full normal standard of health and physique—a conclusion which can hardly be regarded with satisfaction. With regard to Grade I. youths of 18 years, similar data for all areas are unfortunately not available, but the average for a considerable group in the N.W. region worked out as follows:—

Height	Weight	Chest girth
5 ft. 5 in.	117·3 lb.	33·4 in.

If we accept this group of youths as representative (and there is no reason to think it is not so) and compare these figures with the corresponding measurements of the Grade I. men, we find that the average increase between 18 years and full development is 1 in. in stature, 9·9 lb. in weight, and 1·6 in. in chest girth. Now we know from the experience of the army, both in peace-time and during the war, that much better results can be obtained by making youths and young men live a hygienic life, with proper food and attention to their physical development. The present figures therefore show clearly that the average conditions of life to-day have produced and are producing physical results on the rising generation which are greatly to be deplored.

One other table printed in the report is of special significance—comment is superfluous.

Average Measurement of 36 Youths of 18 Years Rejected for Poor Physique.

Height	Weight	Chest girth
4 ft. 9 in.	84 lb.	29·9 in.

In conclusion let us consider the main facts of this physical census in the light of the method of comparisons suggested by Prof. Arthur Keith. He shows that on theoretical grounds it is to be expected that the complex quality of physical fitness is distributed among a healthy population in the same proportions as has been found for the distribution of other physical attributes. If this reasoning is correct we ought to find in a healthy population that the numbers of men in each grade of fitness bear a constant relation to each other in the following proportions:—

Grade I.	70 %
Grade II.	20 %
Grade III.	7·5 %
Grade IV.	2·5 %

Actual experience testifies to the truth of this inference: thus a "comb-out" of miners (a group of the community known to enjoy a good standard of health and physique) in the summer of 1918 yielded the following result:—

Grade I.	76 %
Grade II.	12 %
Grade III.	10 %
Grade IV.	4·2 %

Another group of miners yielded Grade I. 76%, Grade II. 19%, Grade III. 11%, Grade IV. 3%. Results such as these

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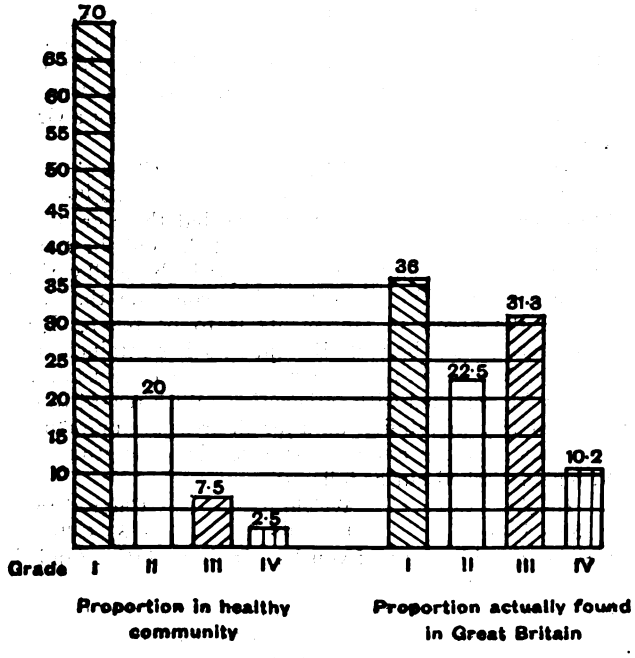
(and there are numerous other examples) prove the soundness of Prof. Keith's reasoning, and show that in healthy sections of the community his standard is reached and even exceeded.

This standard may be represented graphically, and it is instructive to place alongside this representation of what we may regard as the normal standard for a healthy community a similar graph representing the proportions actually found in the total gradings during the whole year's work in Great Britain (the figures have been given above).



These two diagrams show graphically the differences between the relative proportions of men of the four grades of fitness actually found and the standard relative proportions in a healthy community. In actual numbers the difference works out as follows: Among the 2½ million examinations there was in Grade I. a deficiency of 825,000, in Grade II. an excess of 61,000, and the alarming excess of no less than 575,000 in Grade III., and 190,000 in Grade IV.

With such results before them the committee which presented the report express surprise that with human material of such physical quality it was found possible to create the invincible armies which overthrew the Germans. We may well share their surprise, and indorse their opinion that the spirit of the race, which alone made this possible, deserves that no effort should be spared to ameliorate the conditions which had brought about such deplorable effects upon the national health and physique.

(H. W. K.)

The Post-War Army

The development of British military organization from 1910 to the end of the World War is treated under the heading Army, section *British Army*. The period immediately following a war of any importance usually sees many changes in army organization based upon the experiences gained during the war, and the years directly following the War of 1914–8 were no exception in this respect. The years 1919–21 were devoted to incorporating into the British army organization various essential innovations which a war of such magnitude was bound to produce.

Generally speaking, the war had shown that the broad framework of army organization, as it existed in 1914, had been built upon sound lines. In certain respects, it is true, defects had been found in this organization, *e.g.* an inelasticity in the system which failed adequately to provide for the expansion entailed when a nation is absorbed into military service; but these defects were connected more with details than with broad principles. Army reorganization had still to provide for an expeditionary force, trained garrisons for maintaining the various parts of the Empire, and home defence. To make provision for carrying out these duties, therefore, the after-war army was organized, in its main outlines, similarly to what it had been in 1914. This organization may be described as an expeditionary force, formed almost entirely of regular soldiers with their reserves, backed up and supplemented by the militia; whilst the territorial army, composed of troops which would require several months' training on mobilization to fit them to take their place in the field, would be available for expanding the expeditionary force, should a state of national emergency arise.

It may be noted that the old name "militia" once again found a place in army nomenclature (although this force had not yet been finally reconstituted by the end of 1921); when organized its functions were to remain identical with those of the Special Reserve in 1914. Briefly, these may be enumerated as completing the establishment of the expeditionary force on mobilization and providing drafts for the regular units during the first few months of war, after those provided from the regular reserves have become exhausted. The militia is also required to produce on mobilization certain technical personnel, whose work in war, being akin to that performed in peace, would need but little military training to fit them to take their place in regular units in the field. The rôle of the reorganized militia, therefore, may be considered as the definite one of being a reserve to the regular army, without any idea of its units being employed as a separate force. It may further be noted that the name of the old territorial force has been changed to that of "Territorial Army." The special functions of this army remain the same as they were in 1914; but the organization to enable those duties to be carried out has been altered in conformity with the lessons learnt during the war. The after-war territorial formations, in fact, have been shaped into an exact counterpart of their prototypes in the regular army, and this has entailed certain units, which had existed in 1914, becoming surplus to requirements; such units had either to be merged into new ones or disbanded. It was on this account that many of the old mounted yeomanry regiments became surplus to the actual needs of the army, and were offered conversion into other arms of the service which the war had shown to be necessary for modern war, but which had no place in the pre-war territorial organization, *e.g.* army field artillery brigades and armoured car companies. Similarly surplus infantry battalions were asked to convert into other arms of the service in which the pre-war territorial army organization was deficient. The establishment of the territorial force in 1914 was some 314,000, all ranks. The establishment of the reconstituted territorial army in 1921–2 was some 220,000, all ranks.

Whilst the broad outlines of army organization remained in 1921 practically identical with what existed in 1914, the organization of the various formations for war underwent some modifications. Notably was this the case in the additions made to the Royal Artillery and Royal Engineers, both in army and divisional troops, and the new units were added as a result of war experience, *e.g.* Tank Corps, Signal Corps. But whilst changes naturally had to take place, the infantry allotted to formations still remained unchanged; for instance a division comprised 3 infantry brigades as formerly, and infantry brigades once again were composed of 4 battalions, as in 1914, instead of the 3-battalion brigades which force of circumstances had imposed towards the latter part of the war.

Broadly speaking, the greatest changes which have been made in army organization may be attributed to two main causes:—necessity for increased firepower and improved mechanical science. As coming under the former heading, first and foremost may be cited the artillery. Yearly, as the war had progressed, heavier and still heavier calibres of artillery had been brought into the field; and the number of guns which had been considered sufficient in 1914, had been multiplied several times by the end of the war. The reorganization of the artillery, therefore, had to take into account, and make provision for, this increased need of artillery.

The peace organization of the artillery includes not only horse and field artillery but also medium artillery as well. On the other hand the horse-drawn 60-pdr. battery, which formed part of the divisional artillery in 1914, no longer exists. In pre-war days the heaviest mobile gun or howitzer figuring in the British artillery organization was the 6-in. howitzer. During the war ordnance of heavier calibre

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was introduced into the field, and the new peace organization provides for this. Provision is also made for anti-aircraft artillery.

Not only in the artillery has the war led to changes in organization, but practically all arms have undergone some modifications as its result. During the war Hotchkiss guns were introduced into the cavalry, and Lewis guns into the infantry; both these weapons still remain as part of the peace organization of these two arms. The machine-gun also continues to find a place in their organization, as was the case in 1914. In this connexion it may be noted that during the war a Machine-Gun Corps was built up. Shortly after the war ended, however, this corps ceased to form part of the peace organization, because the machine-gun was considered to be a weapon of not sufficiently distinctive type to justify its being considered a separate arm of the service when its rôle was obviously ancillary to both cavalry and infantry.

Under the heading of improved mechanical science, the outstanding feature is the tank. Its success during the war had insured it a place in the army reorganization. It was now incorporated as the Tank Corps. This corps, which is capable of expansion, consists in peace of 4 tank battalions, a depot and an artificer-training battalion. In addition there is an experimental establishment. In peace the organization of a tank battalion consists of 3 companies, each of which is split up into 3 sections. Another product of the war, somewhat akin to the tank and consequently incorporated as part of its organization, is the armoured-car. Armoured-cars are organized in companies. During the war armoured-cars proved so highly efficient for use in some of the outlying portions of the Empire, that their inclusion as part of the peace organization was indicated. But it remained uncertain in 1921 how far the Tank Corps organization might develop.

Another corps which has arisen in the application of science to war, is the Signal Corps. Before the war the Signal Service was in its infancy. The whole service then consisted of 66 officers and 1,534 other ranks, who formed part of the Corps of Royal Engineers. The war showed the need for rapid, accurate and alternative methods of communication, and the result was the formation of the Signal Corps. This corps is so organized as to be capable of division into several self-contained units; thus a divisional signal company not only controls all the signal communications at divisional headquarters, but it detaches a section for work with each infantry brigade, and other sections for work with the divisional artillery. The corps is responsible for dealing with all forms of communication, both visual, airline, cable and wireless, also for despatch riding.

Mechanical science has also led to a much greater use of mechanical transport than had ever been contemplated in pre-war days. The reliability maintained by M.T. vehicles has had the effect of gradually lessening the numbers of horse-drawn vehicles in the army. This can be seen by the increased number of M.T. units now forming part of the peace organization of the R.A.S.C. compared with the number existing before the war.

The war also showed that the 1914 organization included an insufficient number of Royal Engineers allotted to divisions. In 1914 the number of field companies with divisions was two. This new peace organization makes provision for an additional one, and provides as well for the carrying out of the larger R.E. services required by divisions, *e.g.* electric lighting of divisional headquarters, water supply, accommodation, etc. Moreover, as a result of the war, the Royal Engineers make provision for electrical and mechanical companies. The special rôle of these companies is the repair and construction of electrical installations, mechanical plant and installation of workshops.

It was not only in organization that the war led to changes, but it also had the effect of causing improvements to be made in the education of the soldiers. It was felt that greater advantage might be taken of the age at which the majority of youths entered the army to continue their education. For this reason a new corps, called the Army Educational Corps, was included as part of the army organization. This is a small corps composed mainly of officers, which took the place of the pre-war army schoolmasters. Both at home and abroad officers of the Army Educational Corps are distributed among the various units whose chief duty it is to coördinate the education in the various units and to set out the lines on which it is to be carried out.

Yet another addition was made to the peace organization of the army shortly after the war in the shape of the Corps of Military Accountants. This is a completely new corps, by which is meant that it had no counterpart of any description in the pre-war organization. It is a small corps with an establishment of approximately 1,000, all ranks. The purposes for which it was formed was for the compilation of cost accounts.

The development of aerial navigation caused a separate Air Ministry to be set up during the war. This arrangement was continued in the after-war organization; so that whereas in 1914 the Royal Flying Corps formed part of both the navy and army organization, this is no longer the case; the Royal Air Force being almost entirely divorced from army administration.

Shortly after the war alterations and additions were made to the rates of pay of both officers and other ranks throughout the army. In pre-war days the rates of pay varied in different corps; this procedure ceased and a universal rate for all corps was substituted. The additions were based on the high cost of living existing at the date of alteration, and were subject to revision after five years. As an example, the pay per annum of a second lieutenant and a private in the infantry in pre-war days was approximately £96 and £24 respectively. Their respective rates of pay under the new rates worked out at £237 and £59.

Before the war the total peace establishment of the regular army, exclusive of India, comprised some 9,500 officers and 163,000 other ranks. In 1921–2 the establishments of the regular army, again exclusive of India, made provision for 15,000 officers and 186,000 other ranks. (B. B.-H.)

UNITED STATES, THE (*see* 27.612*).—This article describes the development of the United States from the close of the first decade of the 20th century, as shown roughly by the census of 1910 and the Congressional elections of that year, to the close of the Washington Conference early in 1922. This period of 12 years, covering the World War and America's part in it, the shifting of the United States from the position of a debtor to that of a creditor nation, a vast increase in wealth and world influence, and many other changes scarcely less important, is from an international as well as a domestic point of view one of the most important in American history. The main facts of the period are outlined in this article, but for many of the details other articles must be consulted; and the reader who would consider the full perspective should read those as well as this, as should also the reader who desires detailed information on any one point. The articles on the various states contain details of their respective population, agriculture, manufactures, education and political history; data more local appear in articles on the more important cities. A full list of the articles relating to the United States will be found in the Classified Table of Articles which precedes the List of Contributors at the end of Vol. XXXII., but we may name here the leading articles in the more important divisions of the subject. Details of population, supplementing the various summaries contained in the first section, *Statistics*, of the present article, will be found in the articles on separate states and in the articles NEGRO and PUBLIC ASSISTANCE. Many economic questions are treated fully in such articles as BANKING, FEDERAL RESERVE BANKING SYSTEM, FEDERAL FARM LOAN BOARD, EXCESS PROFITS DUTY, INCOME TAX, CITY GOVERNMENT, INTERSTATE COMMERCE, CONSERVATION POLICY, INSURANCE, COST OF LIVING, FOOD SUPPLY, RATIONING, MARKETING, PRICE CONTROL, PROFITEERING, PROFIT-SHARING, SAVINGS MOVEMENT, ETC. For industrial development see also the articles SHIPPING, RAILWAYS, TELEGRAPH, TELEPHONE, and ELECTRICITY SUPPLY, as well as those on important industries such as COAL, COPPER, COTTON AND COTTON INDUSTRY, DYEING, PETROLEUM, IRON AND STEEL. Various phases of labour are discussed under ARBITRATION AND CONCILIATION IN LABOUR DISPUTES, LABOUR LEGISLATION, LABOUR SUPPLY AND DEMAND, STRIKES AND LOCKOUTS, TRADE UNIONS, UNEMPLOYMENT and WAGES. For social and welfare work, read also HOUSING; HOSPITALS; JUVENILE EMPLOYMENT; CHILDREN, LAWS RELATING TO; LIQUOR LAWS; PROHIBITION; and PUBLIC ASSISTANCE. For recent developments in education, arts and letters, see besides the articles on HARVARD, YALE, PRINCETON, ETC., the articles EDUCATION, MEDICAL EDUCATION, ARCHITECTURE, ARTS AND CRAFTS, PAINTING, SCULPTURE, AMERICAN LITERATURE. For recent changes in the status of women, see further WOMAN SUFFRAGE; WOMEN; WOMEN'S EMPLOYMENT; WOMEN POLICE; WOMEN, LEGAL STATUS OF. The section *History* of the present article may be supplemented by articles such as ARMY, SHIP AND SHIPBUILDING, WORLD WAR, LIBERTY LOAN PUBLICITY CAMPAIGNS, MUNITIONS OF WAR, WOMEN'S WAR WORK, WASHINGTON CONFERENCE, and by the biographies of political leaders and public officials. The present article has eight sections: *Statistics, Agriculture, Finance, Taxation, Social and Welfare Work, The American Labour Movement, Military Law*, and *History*, in the order named.

I.—STATISTICS

In 1920 the pop. of the United States (excluding all outlying possessions) was 105,710,620, as compared with 91,972,266 in 1910. The rate of increase between these two dates, 14·9%,

**These figures indicate the volume and page number of the previous article.*

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was considerably less than in the preceding decades. Never before in a 10-year period had the rate of increase fallen below 20 per cent. The decline was due to the large falling off of immigration in the last half of the decade, and in some slight degree to the epidemic of influenza in 1918, as well as to the casualties resulting from the World War. It was estimated that the pop. of the outlying possessions was 12,148,875, of which the Philippine Is. furnished more than 10,000,000. The total pop. of the United States with its outlying possessions in 1920, therefore, numbered 117,859,495. Excluding the outlying possessions, the total addition to the pop. in the decade 1910–20 was 13,738,354 as compared with nearly 16,000,000 in the previous decade.

The accompanying table shows the pop. by territorial divisions and component states, with changes between 1910 and 1920.

Increase of Population

	1920	1910	Increase	Increase per cent
NEW ENGLAND				
Maine	768,014	742,371	25,643	3·5
New Hampshire	443,083	430,572	12,511	2·9
Vermont	352,428	355,956	−3,528	−1·0
Massachusetts	3,852,356	3,366,416	485,940	14·4
Rhode Island	604,397	542,610	61,787	11·4
Connecticut	1,380,631	1,114,756	265,875	23·9
	7,400,909	6,552,681	848,228	12·9
MIDDLE ATLANTIC				
New York	10,385,227	9,113,614	1,271,613	14·0
New Jersey	3,155,900	2,537,167	618,733	24·4
Pennsylvania	8,720,017	7,665,111	1,054,906	13·8
	22,261,144	19,315,892	2,945,252	15·2
EAST NORTH CENTRAL				
Ohio	5,759,394	4,767,121	992,273	20·8
Indiana	2,930,390	2,700,876	229,514	8·5
Illinois	6,485,280	5,638,591	846,689	15·0
Michigan	3,668,412	2,810,173	858,239	30·5
Wisconsin	2,632,067	2,333,860	298,207	12·8
	21,475,543	18,250,621	3,224,922	17·7
WEST NORTH CENTRAL				
Minnesota	2,387,125	2,075,708	311,417	15·0
Iowa	2,404,021	2,224,771	179,250	8·1
Missouri	3,404,055	3,293,335	110,720	3·4
North Dakota	646,872	577,056	69,816	12·1
South Dakota	636,547	583,888	52,659	9·0
Nebraska	1,296,372	1,192,214	104,158	8·7
Kansas	1,769,257	1,690,949	78,308	4·6
	12,544,249	11,637,921	906,328	7·8
SOUTH ATLANTIC				
Delaware	223,003	202,322	20,681	10·2
Maryland	1,449,661	1,295,346	154,315	11·9
District of Columbia	437,571	331,069	106,502	32·2
Virginia	2,309,187	2,061,612	247,575	12·0
West Virginia	1,463,701	1,221,119	242,582	19·9
North Carolina	2,559,123	2,206,287	352,836	16·0
South Carolina	1,683,724	1,515,400	168,324	11·1
Georgia	2,895,832	2,609,121	286,711	11·0
Florida	968,470	752,619	215,851	28·7
	13,990,272	12,194,895	1,795,377	14·7
EAST SOUTH CENTRAL				
Kentucky	2,416,630	2,289,905	126,725	5·5
Tennessee	2,337,885	2,184,789	153,096	7·0
Alabama	2,348,174	2,138,093	210,081	9·8
Mississippi	1,790,618	1,797,114	−6,496	−0·4
	8,893,307	8,409,901	483,406	5·7
WEST SOUTH CENTRAL				
Arkansas	1,752,204	1,574,449	177,755	11·3
Louisiana	1,798,509	1,656,388	142,121	8·6
Oklahoma	2,028,283	1,657,155	371,128	22·4
Texas	4,663,228	3,896,542	766,686	19·7
	10,242,224	8,784,534	1,457,690	16·6

Increase of Population—(Continued)

	1920	1910	Increase	Increase per cent
MOUNTAIN				
Montana	548,889	376,053	172,836	46·0
Idaho	431,866	325,594	106,272	32·6
Wyoming	194,402	145,965	48,437	33·2
Colorado	939,629	799,024	140,605	17·6
New Mexico	360,350	327,301	33,049	10·1
Arizona	334,162	204,354	129,808	63·5
Utah	449,396	373,351	76,045	20·4
Nevada	77,407	81,875	−4,468	−5·5
	3,336,101	2,633,517	702,584	26·7
PACIFIC				
Washington	1,356,621	1,141,990	214,631	18·8
Oregon	783,389	672,765	110,624	16·4
California	3,426,861	2,377,549	1,049,312	44·1
	5,566,871	4,192,304	1,374,567	32·8

There was no change beween 1910 and 1920 in the relative rank of the territorial divisions, and only minor shiftings for most of the states, California rising from 12th to 8th place. The territorial divisions may be further condensed into geographic sections—north (comprising New England, Middle Atlantic states, and the two North Central divisions), south (comprising the South Atlantic and South Central divisions) and west (including the Mountain and Pacific states). This gives the following distribution:—

	1920	Per cent of total	Increase over 1910	Rate of increase
North	63,681,845	60·2	7,924,730	14·0
South	33,125,803	31·3	3,736,473	12·7
West	8,902,972	8·5	2,077,151	30·4
Total U.S.	105,710,620	100·0	13,738,354	14·9

More than one-half the increase in pop. was found in the north, and the rate of gain in this section was greater than in the south, but less than in the west represented by the Mountain and Pacific Coast states.

Sex.—By sex the pop. in 1920 was divided: males 53,900,376; females, 51,810,244. This gives 104 males to 100 females. The excess of males is attributable in part to immigration, for in the foreign-born pop. the males greatly outnumber the females. In a few states the females are in excess of males; in Massachusetts the number of males was 96·3 to 100 females; in Rhode Island, 97. This is probably due to the inflow of female operatives to the textile factories. In some of the far-western states the proportion of males to females runs very high, as in Nevada, 148·4; Wyoming, 131·3; Arizona, 121·9. The mining industry accounts for these differences. The two sexes in these sections, however, are nearer in numbers than in 1910. In the earlier year the ratio of males for the Mountain states was 128 to 100 females, while in 1920 it fell to 115·7. In the Pacific states the ratio dropped from 130 to 114. This is evidence that these sections are rapidly approaching the standard forms of family life which obtain in the older portions of the country.

Negroes.—The negro pop. in 1920 was nearly 10% of the total pop.—10,463,131 in a total of 105,710,620. This was an increase of 635,368 or 6·5% since 1910, as compared with 11·4% in the previous decade, and 13·8% between 1890 and 1900. The percentage of negroes in the total pop. is diminishing; in 1900 it was 11·6%; in 1910, 10·7% and in 1920, 9·9%. The number of negroes per 1,000 whites was 132 in 1900; 120 in 1910 and 110 in 1920. Although complete data are not available, it is believed that the birth-rate of negroes declined between 1900 and 1920 while the death-rate did not greatly change. The negro element in the south barely held its own in the 10 years 1910–20, numbering 8,912,259 in 1920 as compared with 8,749,427 in 1910. This was a gain for this section of less than 2 per cent. In the south as a whole the percentage of negroes in the total pop. declined from 29·8 to 26·6. In 1920, in South Carolina and Mississippi the negroes still outnumbered the whites; in Kentucky, Tennessee, Alabama, Mississippi and Louisiana, however, there was an actual falling off in the negro population. There was a marked gain in the number of negroes in the north, 9·43%, showing that negroes were migrating in considerable numbers to the industrial centres of that section. The negro pop. of Michigan increased from 17,000 in 1910 to over 60,000 in 1920. (*See* NEGRO.)

The number of Indians declined from 265,683 in 1910 to 242,959 in 1920. This apparent decrease, however, is probably due to the fact that in 1910 persons with only slight traces of Indian blood were enumerated as Indians, and in 1920 were classified as whites.

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The Chinese also decreased in number, as might be expected from the policy of exclusion; in 1910 there were 71,531 and in 1920 61,686. The number of Japanese, however, increased from 72,157 to 111,025, or 53·86 per cent. About 30,000 of this increase is credited to California and a little over 4,000 to the state of Washington.

Foreign-born.—The foreign-born white pop., owing to the check in immigration resulting from the World War, increased but slightly, from 13,345,545 to 13,712,754, or 2·7% between 1910 and 1920, as against an increase of 30·7% between 1900 and 1910. The numerical increase in this group of the pop., 367,209, was much smaller than in any preceding decade since 1850. This element increased between 1910 and 1920 in 20 states and the District of Columbia, and decreased in 28 states: in the previous decade there was a gain in every state except five. Arizona and Texas showed the largest rate of increase, 67% and 50% respectively, due to Mexican immigration. Table 1 shows the foreign-born whites for the four states having over 1,000,000 of this element in 1920. In 1910 the foreign-born whites constituted 14·5% of the total pop. of the United States and in 1920, 13 per cent. The nativity of the white pop. in

TABLE 1. *Foreign-born Whites.*

State	1920	1910	1900	Per cent increase 1910–20	Per cent increase 1900–10
Illinois	1,204,403	1,202,560	964,635	0·2	24·7
Massachusetts	1,077,072	1,051,050	840,114	2·5	25·1
New York	2,783,773	2,729,272	1,889,523	2·0	44·4
Pennsylvania	1,387,298	1,438,719	982,543	−3·6	46·4

1920 is shown in Table 2. Little over one-half of the total white pop., 55·3%, was native-born with native-born parents. In New England only 30·8% were in this group; and in Massachusetts less than one-third, 31·9%. According to the post-war map, the countries from which had come the largest numbers of foreign-born whites who were in the United States in 1920, were Germany, 1,686,102; Italy, 1,610,109; Russia, 1,400,489; Poland, 1,139,978; Canada, 1,117,878; Ireland, 1,037,233; England, 812,828; Sweden, 625,580; Austria, 575,625.

TABLE 2. *Nativity of Whites, 1920.*

	Number	Per cent
Native parentage	58,421,957	55·3
Foreign parentage	15,694,539	14·8
Mixed parentage	6,991,665	6·6
Total native-born	81,108,161	76·7
Foreign-born white	13,712,754	13·0
Total white	94,820,915	89·7
Negro	10,463,131	9·9
Other non-white races	426,574	0·4
Total pop.	105,710,620	100·0

The following figures show the total number of foreign-born whites in certain states, with the foreign country which had furnished the largest number in that state: California, 681,662 (Italy, 88,502); Illinois, 1,204,403 (Germany, 205,491); Massachusetts, 1,077,534 (Ireland, 183,171); Michigan, 726,635 (Canada, 164,502); Minnesota, 486,164 (Sweden, 112,117); New Jersey, 738,613 (Italy, 157,285); New York, 2,786,112 (Italy, 545,713); Ohio, 678,697 (Germany, 111,893); Pennsylvania, 1,387,850 (Italy, 222,764); Texas, 360,519 (Mexico, 249,652); Wisconsin, 460,128 (Germany, 151,250).

In connexion with the problems of Americanization the statistics of citizenship of the foreign-born whites are of interest. In 1920 12,498,334, or 94% of this element, were 21 years of age and over; 6,928,027 were men and 5,570,307 were women. Table 3 shows the number in 1920 naturalized, those who had taken out first papers, aliens and those for whom no reports were obtained.

TABLE 3. *Naturalizations, 1920.*

	Men		Women	
	Number	Per cent	Number	Per cent
Naturalized	3,314,577	47·8	2,893,785	52·0
First papers	1,116,698	16·1	77,558	1·4
Alien	2,138,205	30·9	2,226,690	40·0
No reports	358,547	5·2	372,274	6·7

In 1910, 45·61% of the men were naturalized as compared with 47·8% in 1920, and only 8·6% had taken out first papers, as compared with 16·1% in 1920.

Statistics of immigration are often inaccurately used, no allowance being made for departures. Increasing facilities in ocean transportation, and the higher wages received by immigrants, enabling them to travel, led to a constant stream of departures in the decade 1910–20. In order to determine the net increase of pop. by immigration, it is necessary, therefore, to determine both arrivals and departures. Table 4 compiled by the Bureau of Immigration, shows the changes for the 11 years 1910–20.

TABLE 4. *Immigrants, in thousands.*

	Admitted			Departed			
	Immigrant	Non-immigrant	Total	Emigrant	Non-emigrant	Total	Added to pop.
1910	1,042	156	1,198	202	178	380	818
1911	878	152	1,030	296	222	518	512
1912	838	179	1,017	333	282	615	402
1913	1,198	229	1,427	308	304	612	815
1914	1,218	185	1,403	303	330	634	769
1915	327	107	434	204	180	384	50
1916	299	68	367	130	111	241	126
1917	295	67	363	66	80	146	216
1918	111	101	212	94	99	193	19
1919	141	96	237	123	93	216	21
1920	430	192	622	288	140	428	194

Beginning with 1915 there was a marked decline in immigration, due to the World War. In the five years 1910–4, the total number of immigrants was 5,174,000, and in the succeeding five years ending in 1919, only 1,173,000.

Immigrants may be classified (1) as to race or people and (2) as to country of last residence. The first is of importance as an index of the contribution of ethnic traits and characteristics; and the second as throwing light upon previous training of immigrants in social and political institutions. Tables 5 and 6 show immigration by race and by countries, for a few of the most important groups, for the years 1910 and 1920.

TABLE 5. *Immigrant Aliens, by Race.*

Race or people	1920		1910	
	Number	Per cent of total	Number	Per cent of total
Croatian and Slovenian	493	—	39,562	4
Dutch and Flemish	12,730	3	13,012	1
English	58,366	14	53,498	5
French	27,390	6	21,107	2
German	7,338	2	71,380	7
Greek	13,998	3	39,135	4
Hebrew	14,292	3	84,260	8
Irish	20,784	4	38,382	4
Italian, North	12,918	3	30,780	3
Italian, South	88,882	21	192,673	19
Lithuanian	422	—	22,714	2
Magyar	252	—	27,302	3
Mexican	51,042	12	17,760	2
Polish	2,519	—	128,348	13
Portuguese	15,174	4	7,657	7
Ruthenian	258	—	27,907	3
Scandinavian	16,621	4	52,037	5
Scotch	21,180	5	24,612	2
Spanish	23,594	5	5,837	—

TABLE 6. *Immigrant Aliens, by Country.*

	1920		1910	
	Number	Per cent of total	Number	Per cent of total
Austria	268	—	135,793	13
Hungary	84	—	122,944	12
Germany	1,001	—	31,283	3
Greece	11,981	3	25,888	2
Italy	95,145	22	215,537	21
Russia	995	—	186,792	18
England	27,871	6	46,706	5
Ireland	9,591	2	29,855	3
Norway	4,445	1	17,538	2
Portugal	15,472	4	8,229	1
Sweden	5,862	1	23,745	2
Turkey in Europe	1,933	—	18,405	2
Turkey in Asia	5,033	1	15,212	1
British North America	90,025	21	56,555	5
Mexico	52,361	12	18,691	2

It will be observed that in 1920 there was a change in the racial composition of immigration as compared with 1910. The proportion of Italians was about the same, but immigration from eastern European stocks fell off. Immigration from Austria, Hungary, Germany and Russia practically stopped after 1917. Immigration from the northern border, of both English and French Canadians, and from the southern part of Mexico, had greatly increased. Until the World War, Europe was the chief source of immigration to the United States, furnishing 90% of the total. The percentage coming from Europe fell, however, to 60% in 1915, 50% in 1916, 45% in 1917, 28% in 1918 and 17% in 1919. In 1920 it rose to 57%. After the war the return movement to Europe increased, and in 1920 emigration to that continent was in excess of immigration from it. This excess was due to emigration to south-eastern Europe rather than to the northern and western sections. The proportion

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of females among the immigrant aliens in 1920 was 42·4%, as compared with 33·4% in the years 1910–4. For Greeks the female percentage increased from 9 to 20, and for Italians from 5 to 48. This suggests that the immigration of these peoples might prove to be more permanent than in the past.

In 1917 a literacy test was imposed upon immigrants, exemptions being made in certain cases, as for example, to those who came to the United States to join relatives or who would have been subject to religious persecution at home. As a result only 15,094 illiterate immigrants 16 years of age and over, or 4·4%, were admitted in 1920. During the years 1908–17, 1,617,000 illiterate immigrants 14 years of age and over were admitted. Undoubtedly the new restriction should show in the course of the decade 1920–30 a marked effect upon the degree of illiteracy in the United States. By the Immigration Act passed in 1921 the number of immigrants admitted from any one country in the year July 1 1921 to June 20 1922, was restricted to 3% of the persons of that nationality resident in the United States in 1910. Only 358,000 immigrants, therefore, could be eligible for admittance during the year 1921–2. The United Kingdom was limited to 77,200; Germany to 68,000; Italy to 42,000; Russia to 34,200 and Poland to 25,800.

Urban and Rural Population.—The tendency of the population to concentrate in towns and cities continued unabated. In 1910 the percentage of the pop. living in urban territory (that is, in cities and other incorporated places of 2,500 inhabitants or more, and in towns of that size in Massachusetts, New Hampshire and Rhode Island) was 46·3 per cent. In 1920 the percentage was 51·4, showing that more than one-half of the pop. was then living in urban territory as defined by the Census Bureau.

Table 7 shows the pop. of cities having 50,000 inhabitants or more in 1920 with comparison for 1910.

TABLE 7. *Cities with 50,000 Inhabitants or More.*

Rank		1920	1910	Percentage increase
1	New York, N. Y.	5,620,048	4,766,883	17·9
2	Chicago, Ill.	2,701,705	2,185,283	23·6
3	Philadelphia, Pa.	1,823,779	1,549,008	17·7
4	Detroit, Mich.	993,678	465,766	113·3
5	Cleveland, O.	796,841	560,663	42·1
6	St. Louis, Mo.	772,897	687,029	12·5
7	Boston, Mass.	748,060	670,585	11·6
8	Baltimore, Md.	733,826	558,485	31·4
9	Pittsburgh, Pa.	588,343	533,905	10·2
10	Los Angeles, Cal.	576,673	319,198	80·7
11	Buffalo, N. Y.	506,775	423,715	19·6
12	San Francisco, Cal.	506,676	416,912	21·5
13	Milwaukee, Wis.	457,147	373,857	22·3
14	Washington, D. C.	437,571	331,069	32·2
15	Newark, N. J.	414,524	347,469	19·3
16	Cincinnati, O.	401,247	363,591	10·4
17	New Orleans, La.	387,219	339,075	14·2
18	Minneapolis, Minn.	380,582	301,408	26·3
19	Kansas City, Mo.	324,410	248,381	30·6
20	Seattle, Wash.	315,312	237,194	32·9
21	Indianapolis, Ind.	314,194	233,650	34·5
22	Jersey City, N. J.	298,103	267,779	11·3
23	Rochester, N. Y.	295,750	218,149	35·6
24	Portland, Ore.	258,288	207,214	24·6
25	Denver, Col.	256,491	213,381	20·2
26	Toledo, O.	243,164	168,497	44·3
27	Providence, R. I.	237,595	224,326	5·9
28	Columbus, O.	237,031	181,511	30·6
29	Louisville, Ky.	234,891	223,928	4·9
30	St. Paul, Minn.	234,698	214,744	9·3
31	Oakland, Cal.	216,261	150,174	44·0
32	Akron, O.	208,435	69,067	01·8
33	Atlanta, Ga.	200,616	154,839	29·6
34	Omaha, Neb.	191,601	124,096	54·4
35	Worcester, Mass.	179,754	145,986	23·1
36	Birmingham, Ala.	178,806	132,685	34·8
37	Syracuse, N. Y.	171,717	137,249	25·1
38	Richmond, Va.	171,667	127,628	34·5
39	New Haven, Conn.	162,537	133,605	21·7
40	Memphis, Tenn.	162,351	131,105	23·8
41	San Antonio, Tex.	161,379	96,614	67·0
42	Dallas, Tex.	158,976	92,104	72·6
43	Dayton, O.	152,559	116,577	30·9
44	Bridgeport, Conn.	143,555	102,054	40·7
45	Houston, Tex.	138,276	78,800	75·5
46	Hartford, Conn.	138,036	98,915	39·6
47	Scranton, Pa.	137,783	129,867	6·1
48	Grand Rapids, Mich.	137,634	112,571	22·3
49	Paterson, N. J.	135,875	125,600	8·2
50	Youngstown, O.	132,358	79,066	67·4
51	Springfield, Mass.	129,614	88,926	45·8
52	Des Moines, Ia.	126,468	86,368	46·4
53	New Bedford, Mass.	121,217	96,652	25·4
54	Fall River, Mass.	120,485	119,295	1·0
55	Trenton, N. J.	119,289	96,815	23·2
56	Nashville, Tenn.	118,342	110,364	7·2
57	Salt Lake City, Utah	118,110	92,777	27·3
58	Camden, N. J.	116,309	94,538	23·0
59	Norfolk, Va.	115,777	67,452	71·6
60	Albany, N. Y.	113,344	100,253	13·1
61	Lowell, Mass.	112,759	106,294	6·1
62	Wilmington, Del.	110,168	87,411	26·0
63	Cambridge, Mass.	109,694	104,839	4·6
64	Reading, Pa.	107,784	96,071	12·2
65	Fort Worth, Tex.	106,482	73,312	45·2
66	Spokane, Wash.	104,437	104,402	
67	Kansas City, Kan.	101,177	82,331	22·9
68	Yonkers, N. Y.	100,176	79,803	25·5
69	Lynn, Mass.	99,148	89,336	11·0
70	Duluth, Minn.	98,917	78,466	26·1
71	Tacoma, Wash.	96,965	83,743	15·8
72	Elizabeth, N. J.	95,783	73,409	30·5
73	Lawrence, Mass.	94,270	85,892	9·8
74	Utica, N. Y.	94,156	74,419	26·5
75	Erie, Pa.	93,372	66,525	40·4
76	Somerville, Mass.	93,091	77,236	20·5
77	Flint, Mich.	91,599	38,550	137·6
78	Jacksonville, Fla.	91,558	57,699	58·7
79	Waterbury, Conn.	91,715	73,141	25·4
80	Oklahoma City, Okla.	91,295	64,205	42·2
81	Schenectady, N. Y.	88,723	72,826	21·8
82	Canton, O.	87,091	50,217	73·4
83	Fort Wayne, Ind.	86,549	65,933	35·4
84	Evansville, Ind.	85,264	69,647	22·4
85	Savannah, Ga.	83,252	65,064	28·0
86	Manchester, N. H.	78,384	70,063	11·9
87	St. Joseph, Mo.	77,939	77,403	0·7
88	Knoxville, Tenn.	77,818	36,346	114·1
89	El Paso, Tex.	77,560	39,279	97·5
90	Bayonne, N. J.	76,754	55,545	38·2
91	Peoria, Ill.	76,121	66,950	13·7
92	Harrisburg, Pa.	75,917	64,186	18·3
93	San Diego, Cal.	74,683	39,578	88·7
94	Wilkesbarre, Pa.	73,833	67,105	10·0
95	Allentown, Pa.	73,502	51,913	41·6
96	Wichita, Kan.	72,217	52,450	37·7
97	Tulsa, Okla.	72,075	18,182	296·4
98	Troy, N. Y.	72,013	76,813	−6·2
99	Sioux City, Ia.	71,227	47,828	48·9
100	South Bend, Ind.	70,983	53,684	32·2
101	Portland, Me.	69,272	58,571	18·3
102	Hoboken, N. J.	68,166	70,324	−3·1
103	Charleston, S. C.	67,957	58,833	15·5
104	Johnstown, Pa.	67,327	55,482	21·3
105	Binghamton, N. Y.	66,800	48,443	37·9
106	East St. Louis, Ill.	66,767	58,547	14·0
107	Brockton, Mass.	66,254	56,878	16·5
108	Terre Haute, Ind.	66,083	58,157	13·6
109	Sacramento, Cal.	65,908	44,696	47·5
110	Rockford, Ill.	65,651	45,401	44·6
111	Little Rock, Ark.	65,142	45,941	41·8
112	Pawtucket, R. I.	64,248	51,622	24·5
113	Passaic, N. J.	63,841	54,773	16·6
114	Saginaw, Mich.	61,903	50,510	22·6
115	Springfield, O.	60,840	46,921	29·7

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TABLE 7—(*Continued*).

Rank		1920	1910	Percentage increase
116	Mobile, Ala.	60,777	51,521	18·0
117	Altoona, Pa.	60,331	52,127	15·7
118	Holyoke, Mass.	60,203	57,730	4·3
119	New Britain, Conn.	59,316	43,916	35·1
120	Springfield, Ill.	59,183	51,678	14·5
121	Racine, Wis.	58,593	38,002	54·2
122	Chester, Pa.	58,030	38,537	50·6
123	Chattanooga, Tenn.	57,895	44,604	29·8
124	Lansing, Mich.	57,327	31,229	83·6
125	Covington, Ky.	57,121	53,270	7·2
126	Davenport, Ia.	56,727	43,028	31·8
127	Wheeling, W. Va.	56,208	41,641	35·0
128	Berkeley, Cal.	56,036	40,434	38·6
129	Long Beach, Cal.	55,593	17,809	212·2
130	Gary, Ind.	55,378	16,802	229·6
131	Lincoln, Neb.	54,948	43,973	25·0
132	Portsmouth, Va.	54,387	33,190	63·9
133	Haverhill, Mass.	53,884	44,115	22·1
134	Lancaster, Pa.	53,150	47,227	12·5
135	Macon, Ga.	52,995	40,665	30·3
136	Augusta, Ga.	52,548	41,040	28·0
137	Tampa, Fla.	51,608	37,782	36·6
138	Roanoke, Va.	50,842	34,874	45·8
139	Niagara Falls, N.Y.	50,760	30,445	66·7
140	East Orange, N. J.	50,710	34,371	47·5
141	Atlantic City, N. J.	50,707	46,150	9·9
142	Bethlehem, Pa.	50,358	12,837	292·3
143	Huntington, W. Va.	50,177	31,161	61·0
144	Topeka, Kan.	50,022	43,684	14·5

The cities with increases of over 100% were Detroit, Mich., due to the development of the automobile industry; Akron, O., the home of several large rubber factories which manufacture tires for automobiles; Flint, Mich., also an automobile city; Tulsa, Okla., a centre of oil activity; Gary, Ind., a city recently built up by the U.S. Steel Corp.; Bethlehem, Pa., also a steel city; Knoxville, Tenn.; and Long Beach, Cal. With the exception of Bethlehem, no one of these cities is in the east.

Nearly one-fourth of the gain in the total pop. was due to the growth of the 12 largest cities, which in 1920 all had more than 500,000 inhabitants each. In 1910 there were only eight cities with a pop. of 500,000 or over. In the earlier year 12·5%, or one-eighth of the total pop., lived in cities of this size; in 1920 the proportion was 15·5%. In 1910 there were 42 cities with a pop. between 100,000 and 500,000; in 1920 there were 56.

Occupations.—The proportion of the pop. engaged in gainful occupations increased from 38·3% of the total pop. in 1900 to 41·5% in 1910. This was largely due to the greater number of females receiving wages. In 1900 the percentage of females 10 years of age and over in gainful occupations was 18·8; in 1910, 23·4, a gain of 4·6 per cent. The percentages for males for the two dates respectively were 80 and 81·3, a gain of only 1·3 per cent. Table 8 classifies those engaged in industry according to the principal divisions of occupations.

TABLE 8. *Industrial Occupations.*

Occupation	Number		Per cent.	
	1910	1900	1910	1900
Males:—				
Agricultural pursuits	10,760,875	9,404,429	35·8	39·6
Professional service	1,151,709	827,941	3·8	3·5
Domestic and personal service	2,740,176	3,485,208	9·1	14·7
Trade and transportation	6,403,378	4,263,617	21·3	17·9
Manufacturing and mechanical pursuits	9,035,426	5,772,641	30·0	24·3
All occupations (male)	30,091,564	23,753,836	100·0	100·0
Females:—				
Agricultural pursuits	1,807,050	977,336	22·4	18·4
Professional service	673,418	430,597	8·3	8·1
Domestic and personal service	2,620,857	2,095,449	32·5	39·4
Trade and transportation	1,202,352	503,347	14·9	9·5
Manufacturing and mechanical pursuits	1,772,095	1,312,668	21·9	24·7
All occupations (female)	8,075,772	5,319,397	100·0	100·0

Table 8 does not include all those engaged in economic services. Many children and wives work for their parents or husbands; technically they do not receive wages and consequently are not recorded as engaged in gainful occupations, but in reality they contribute to the household economy. If these be included, approximately two-thirds of the pop. was engaged in some degree of creating wealth or in services which might be valued in economic terms. Nearly one-third of all the workers were engaged in agricultural and allied industries, and a little over one-fourth in manufacturing and in tool industries. If we divide the pop. of the United States into groups according to age, the following were the percentages of each age-group engaged in gainful occupation in 1910:—10 to 13 years, males 16·6% and females 8·0%; 14 to 15, 41·4% and 19·8%; 16 to 20, 79·2% and 39·9%; 21 to 44, 96·7% and 26·3%; 45 years and over, 85·9% and 15·7%; 10 years and over, 81·3% and 23·4%. There was a slight decrease between 1900 and 1910 in the two lower age-groups for males and a slight increase for females. More than 8 out of 10 of the gainful workers in the United States as a whole in 1910 were 21 years of age and over, and about 95 out of 100 were 16 years of age and over.

Education.—In 1918 there were 20,853,516 children enrolled in the public schools, constituting 70% of the pop. from 5 to 18 years of age. There were 650,709 teachers in the public schools, or one to every 32 pupils. Of the teachers 16% were males. The total expenditure for public schools was $763,678,089 or about $37 per pupil. The above enrolment of pupils includes 1,735,619 attending public high schools. In addition there were 158,745 pupils in private high schools and academies. There were over 300 public and private normal schools with an enrolment of nearly 140,000. Universities, colleges and schools of technology numbered 672 in 1918, having 44,600 students of preparatory grade, 239,707 students of collegiate grade, and 14,406 graduate students. Nearly one-half of the students of collegiate grade were female. Professional schools in 1918 numbered 424, as follows: theology 141, with 9,354 students; law 101, with 11,820 students; medicine 72, with 13,802 students; dentistry 37, with 8,314 students; pharmacy 54, with 4,053 students; and veterinary medicine 19, with 1,250 students. (*See* EDUCATION, section *United States.*)

The statistics of illiteracy for 1920 showed a diminution compared with those for 1910. The Census Bureau classifies as illiterate any person 10 years of age or over who is unable to write in any language, regardless of ability to read. Illiterates in 1920 numbered 4,931,905, or 6% of the pop. at least 10 years of age, as compared with 7·7% in 1910. The proportion of illiteracy for the individual states in 1920 ranged from 1·1% in Iowa to 21·9% for Louisiana. Illiteracy is very marked in those states in which the colored pop. or the foreign-born pop. is relatively large. In 1910 nearly one-third (30·4%) of the negroes were recorded as illiterate, but this showed a marked decrease from 44·5% in 1900. Of the native whites of native parentage only 3·7% in 1910 were illiterate, but in six of the southern states the percentage ran over 10%.

Vital Statistics.—In 1915 the Census Bureau began the annual analysis and publication of birth statistics based upon data obtained from state registration records. In 1919 the birth registration area covered nearly three-fifths (58·6%) of the total population. The birth-rate varied in the five-year period 1915–9 from 25·1 per 1,000 in 1915 to 22·3 per 1,000 in 1919. The ratio of male births was 1,057 to 1,000 female births. The fecundity of foreign-born mothers was much greater than that of native mothers. For example, in Connecticut, although the white married women of foreign birth, age 15 to 42, constituted only 46% of the total pop. of white married women of that age group, they gave birth to 57% of the children. In Massachusetts 49% of foreign-born mothers gave birth to 53% of the children; and in New York 43% of foreign-born mothers gave birth to 49% of the children. The first and second children formed 50% of all children born to native white mothers, while only 34% born to foreign-born mothers were first and second children.

The registration area for mortality statistics covers more than three-fourths of the population. Between 1900 and 1921 the death-rate varied from a minimum of 13·5 per 1,000 in 1915 to 18 per 1,000 in 1918. This latter high rate was due largely to the great influenza pandemic. The rate of infant mortality (the number of deaths of infants under one year of age per 1,000 born alive) for the registration area in 1918 was 83 for the white pop.; for negro pop., 131; and for the total pop., 87.

A third nation-wide compilation of statistics of marriage and divorce was made by the Bureau of Census, covering the year 1916. There were 1,040,778 marriages, or 10·5 per 1,000 of the population. In some of the southern states the rate ran as high as 11·9 per 1,000. There were 112,036 divorces. The statistics were not analyzed to show ratios of divorce to marriage, but only the ratios to population. For the whole country the ratio of divorce was 112 per 100,000 population. In New England the ratio was 80, Middle Atlantic states 43, Southern states 59, and Pacific states 210. Of the divorces 31·1% were granted to the husband and 68·9% to the wife.

Religious Bodies.—For statistics of Christian churches, see the article CHURCH HISTORY: section *United States.* Statistics of membership in Jewish churches are unsatisfactory for purpose of comparison with other denominations, for they are restricted to heads

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of families. In 1920, according to returns published in the *Year Book of Churches* by the Federal Council of Churches, there were 2,960 Jewish congregations with a membership of 260,000; 784 Sunday-schools with a membership of 108,534. These figures may be compared with the report of the Bureau of Census which gives 1,901 congregations and 357,135 members for the year 1916. According to the *American Jewish Year Book* for 1920 there were in 1918 3,390,300 Jews as against 1,777,185 in 1907. According to the same authority nearly one-half, or 48·6%, of the Jews resided in the state of New York in 1918, and 45% in New York City. It is estimated that 26% of the total pop. of New York City is Jewish. Between 1907 and 1918 the Jewish pop. of New York state increased from 905,000 to 1,603,923; Pennsylvania, from 150,000 to 322,406; and Illinois, from 110,000 to 246,637. It was also estimated that the Jewish pop. constituted about 3·2% of the total pop. of the United States; in New York it was 15%; in Connecticut and Massachusetts 5% and in Maryland 4·5%. Jewish immigration 1899–1919 numbered 1,551,315, or 10·4% of the total number of immigrants.

Agriculture.—During the decade 1910–20, the number of farms showed a slight gain, 1·4%. In 1920 there were 6,448,343 as compared with 6,361,502 in 1910. A comparison of these numbers with the total pop. shows that in 1910 there was one farm for every 14 of the pop., and in 1920 one farm for every 16. The decrease in the number of farms was particularly marked in states east of the Mississippi; for example, in Connecticut 15·5%; Massachusetts 13·4%; New York 10·5%; Ohio 5·6%; and Illinois 5·8%. In New England the number of farms decreased by 32,238, giving in 1920 one farm for every 47 persons. The total farm acreage increased somewhat more rapidly than the number of farms, from 878,798,325 ac. to 955,883,715 ac., nearly 8·8%. The greater portion of this increase was due to the use of land for dry farming in the arid states of the Rocky Mountain section and also to the enclosure of large areas for grazing. In 1919 there were 507,000,000 ac. under cultivation. One half of the total land area of the United States was in 1920 included in farms, as compared with 46·2% in 1910. Of the 956,000,000 ac. included in farms, 88,000,000 in 1919 was devoted to corn; 73,000,000 to wheat; 73,000,000 to hay; 38,000,000 to oats; and 33,000,000 to cotton. Nearly one-third of the farm area and nearly one-sixth of the total land area is used for the growing of these five products. The average size of farms slightly increased between 1910–20, from 138·1 ac. to 148·2 acres. Notwithstanding the small increase in the number of farms, and of acreage in farms, the value of all farms, lands and buildings increased from $35,000,000,000 in 1910 to $66,000,000,000 in 1920, or 90%. This increase, however, was due largely to the abnormally high prices prevailing in 1920, rather than to new investments and improvement of property. For the same reason the average value of land and buildings per farm for the United States as a whole greatly increased, rising from $5,471 in 1910 to $10,284 in 1920. In 1910 62·1% of farms were owned by their cultivators and in 1920 60·9%. In New England, New Jersey, New York and Pennsylvania, there was a decline in tenancy but there was a marked increase in the Mountain and Pacific states. During the decade 1910–20 native white farmers increased from 4,721,063 to 4,917,386; foreign-born white farmers decreased from 669,556 to 581,068; coloured farmers increased from 920,883 to 949,889. The countries furnishing the greater number of foreign-born farmers were, in 1920, Germany (140,667), Sweden (60,461), Norway (51,999), Canada (48,688), Russia (32,388), Austria (30,172), England (26,614), Denmark (25,565), Italy (18,267), Poland (17,352), Ireland (16,562), Holland (15,589), Finland (14,988), Switzerland (13,051), Mexico (12,142), Scotland (7,605), Hungary (7,122), France (6,119).

The United States is an agricultural country, but the question is frequently asked whether agriculture is keeping pace with the growth of the population. A comparison of the annual crop for the three-year period 1907–9 with that for the period 1917–9 for corn, wheat, and oats gives the following:—

	Average 1917–9 bushels	Average 1907–9 bushels
Corn	2,828,000,000	2,678,000,000
Wheat	833,000,000	679,000,000
Oats	1,459,000,000	856,000,000

A comparison of these figures with the population at the respective dates shows that the *per capita* product of corn is slightly less, that of wheat and oats greater.

Table 9 shows the estimated annual crop of some of the most important agricultural staples for each of the 10 years, 1910–9.

TABLE 9. *Annual Crops; in millions.*

	Corn (bus.)	Wheat (bus.)	Oats (bus.)	Cotton (bales)	Irish potatoes (bus.)	Tobacco (lb.)	Wool (lb.)
1910	2,886	635	1,186	11·6	349	1,103	321
1911	2,531	621	922	15·7	293	905	319
1912	3,125	730	1,418	13·7	421	963	304
1913	2,447	763	1,122	14·2	332	954	296
1914	2,673	891	1,141	16·1	410	1,035	290
1915	2,995	1,026	1,549	11·2	360	1,062	286
1916	2,567	636	1,252	11·4	287	1,153	288
1917	3,065	637	1,593	11·3	442	1,249	282
1918	2,503	921	1,538	12·0	412	1,439	299
1919	2,346	945	1,055	11·3	290	1,372	307

The annual production of cotton did not greatly change in the 10 years 1910–9, running about 11,000,000 bales (500 lb.). Domestic consumption, however, slowly increased, leaving a smaller amount for export. During the five-year period, 1910–4, the average annual export was 8,811,000 bales, and in the five years 1915–9, 6,310,000 bales, a decline of 28 per cent. The production of wool also remained fairly constant, approximating 300,000,000 lb. annually. Imports in the years 1915–9 were greater than ever before and the total consumption therefore larger, as exports were insignificant. The average annual consumption, domestic and foreign, 1910–4, was 509,000,000 lb., and 1915–9 690,000,000 lb. Since 1914 the United States has been dependent upon foreign countries for more than one-half its wool consumption as compared with two-fifths, or even only one-third in the earlier years of the century.

Strenuous efforts were made during the World War period, even before the entry of the United States, to increase the production of wheat. In 1916 the average farm value per bus. for the first time since the decade following the Civil War, was above $1. A record crop was produced in 1915, amounting to over a thousand million bushels. The average annual production for the five years 1910–4 was 697,000,000 bus., and in the succeeding five years 1915–9, 822,000,000, giving an average annual increase of 125,000,000; on the basis of an annual *per capita* consumption of five bus. this provided bread for 25,000,000 people. In the years 1910–4 the average annual export was 125,000,000 bus., and in 1915–9, 240,000,000 bushels.

The domestic beet-sugar industry during the 10 years 1910–9 became firmly established. Until 1907 the volume of beet-sugar production was less than that of cane sugar; in later years it has been far in excess. The production, in millions of pounds, was 1,775 in 1910 (cane 750, beet 1,025); 1,937 in 1915 (cane 493, beet 1,444); and 2,091 in 1919 (cane 569, beet 1,522). The outlying possessions of the United States (Porto Rico, Hawaii and the Philippine Is.) provide an amount of sugar approximately equal to that produced at home. This, however, does not meet the demands of domestic consumption, and the United States is still dependent upon foreign countries for half its needs. The annual *per capita* production of sugar was approximately 80 lb. in 1920 as compared with 70 lb. in 1900.

The crops of hay, sweet potatoes, rye, barley, and rice, as estimated by the Department of Agriculture for 1910 and 1919, are seen in Table 10.

In 1919 the production of apples was 26,174,000 bar., of which one state, Washington, yielded one-fourth (6,440,000 bar.). The peach crop amounted to 50,690,000 bus. valued at a little over $100,000,000. In 1918 1,525,792 ac. were devoted to truck crops.

The number of cattle on farms in 1920 was 66,652,559, as compared with 61,803,866 in 1910. This increase did not keep pace with the growth in population. The number of swine was 59,346,409 as compared with 58,185,676 in 1910, and again the increase was not in proportion to population. The number of sheep as estimated by the Department of Agriculture in 1920 was 48,615,000 as against 52,447,861 in 1910. The wool product in 1919 was 307,459,000 lb. as compared with 321,363,000 lb. in 1910. In 1919 the product of Wyoming was 33,415,000 lb.; Idaho, 22,145,000 lb.; Montana, 17,750,000 lb.; Utah, 15,800,000 lb.; New Mexico, 15,076,000 lb.

The Department of Agriculture in its *Year Book* of 1918 estimates that 350,000,000 ac., or nearly one-fifth of the land area of the United States, is too rough or hilly for the successful cultivation of crops. It may, however, be adapted to the growth of forests or used for grazing purposes. Nearly one-third of the land area, or 600,000,000 ac., receives insufficient rainfall for the profitable production of

TABLE 10. *Hay and other Crops.*

	1919		1910	
	Amount	Farm Value	Amount	Farm Value
Hay (short tons)	91,326,000	$1,839,967,000	60,978,000	$747,769,000
Sweet potatoes (bus.)	78,091,000	124,844,000	59,938,000	40,216,000
Rye "	88,478,000	119,041,000	34,897,000	24,953,000
Barley "	165,719,000	200,419,000	173,832,000	100,426,000
Rice "	41,059,000	109,613,000	24,510,000	16,624,000

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crops at normal prices and affords no possibility of irrigation. A total of 40,000,000 ac. is absolute desert. It is estimated that 200,000,000 ac. of forest, "cut-over" land, and woodland including that in farms, could be used for crops after clearing. This, if divided into farms averaging 160 ac., would provide 1,250,000 farms, or an addition of about 20% to the number of farms in the country. Moreover, 60,000,000 ac. of swamp land can be drained, and 30,000,000 ac. of potentially irrigable land can be converted into farms if available sources of water supply are fully utilized. In all there are about 850,000,000 ac. of land at present in crops and potentially available. A little over 1,000,000,000 ac. of non-arable land consist of 360,000,000 ac. of absolute forest land, 615,000,000 ac. of grazing land, 40,000,000 ac. desert land and 40,000,000 ac. in cities, roads and railway rights of way. It is also estimated that 360,000,000 ac. of forests will not be sufficient to supply a population of 150,000,000, but that 450,000,000 ac. will be needed for that number. To provide food, therefore, more intensive methods of farming will be required. For corn the average yield per ac. in the five years 1900–4 was 24·2 bus., and in 1915–9, 26·3 bushels. The yields for wheat were 13·4 and 14·3 bus.; for oats 31 and 33·7 bus.; and for barley 25·7 and 25·6 bus., respectively, for the two periods. (*See* also the section *Agriculture.*)

Manufactures.—A census of manufactures was taken for 1914 and another for 1919. The results of the latter had not been fully published by Jan. 1922. The manufacturing industries as a whole did not increase so rapidly in the five-year period 1909–14 as in the previous five years, but showed great increase in the next five, ending in 1919 (preliminary figures). This is seen from Table 11.

TABLE 11. *Manufactures.*

	Establishments	Wage-earners	Value of products	Value added by manufacture
1904	216,180	5,468,383	$14,793,903,000	$6,293,695,000
1909	268,491	6,615,046	20,672,052,000	8,529,261,000
1914	275,791	7,036,337	24,246,435,000	9,878,346,000
1919	288,376	9,103,200	62,910,202,000	..
	Increase	Increase	Increase	Increase
1904–9	24·0%	21·0%	39·7%	35·5%
1909–14	2·8%	6·4%	17·3%	15·8%
1914–9	5·0%	29·4%	159·0%	..

Arranged by the 14 general groups of industries according to the classification of the Bureau of Census, Table 12 shows numbers of wage-earners and capital invested.

TABLE 12. *Groups of Industries.*

Group	Wage-earners		Capital in millions of dollars	
	1914	1909	1914	1909
Food and kindred products	496,234	411,575	2,174	1,697
Textiles and their products	1,498,664	1,438,446	2,811	2,488
Iron and steel and their products	1,061,058	1,026,553	4,282	3,579
Lumber and its remanufactures	833,529	911,593	1,723	1,570
Leather and its finished products	307,060	309,766	743	659
Paper and printing	452,900	415,990	1,433	1,134
Liquors and beverages	88,152	77,827	1,016	874
Chemicals and allied products	299,569	267,261	3,034	2,167
Stone, clay and glass products	334,702	342,827	987	858
Metals and metal products other than iron and steel	262,154	249,607	1,014	867
Tobacco manufactures	178,872	166,810	304	246
Vehicles for land transportation	263,076	202,719	803	521
Railway repair shops	365,902	304,592	418	277
Miscellaneous	594,465	489,480	2,048	1,490
All industries	7,036,337	6,615,046	22,791	18,428

The industrial group having the largest number of wage-earners in 1914 was the textile, but the iron and steel was first in capital invested; although the chemicals and allied products group had only 4% of the wage-earners, it was credited with 13% of the total capital; leather and its finished products, which employed 4% of the wage-earners, had less than 4% of the capital.

Table 13 shows the distribution of manufactures in 1909 and 1914 by the three geographic divisions—North (New England, Middle Atlantic, and East and West North Central states), South (South Atlantic, and East and West South Central states), and West (Mountain and Pacific states).

TABLE 13. *Geography of Industries.*

Section	No. of wage-earners		Capital (millions of dollars)		Value of product (millions of dollars)		Per cent increase
	1914	1909	1914	1909	1914	1909	
North	5,558,049	5,197,138	18,122	14,278	19,555	16,827	16·2
South	1,161,660	1,129,307	3,046	2,502	3,186	2,637	20·8
West	316,628	288,601	1,623	1,197	1,505	1,208	24·7

In 1914 the North manufactured 81·2% of the product according to value; the South, 12·8%; and the West, 5·9%. New York retained in 1914 first place among the states in manufactures, producing 15·7% of the total value of the product; Pennsylvania was second with 11·7%, followed by Ohio and Massachusetts. Manufacturing establishments as a rule are in large cities. In 1914 cities with a pop. of 100,000 and over, having 24% of the total pop., had 40% of the wage-earners who manufactured 43% of the value of the total production. Ten cities, New York, Chicago, Philadelphia, Detroit, St. Louis, Cleveland, Boston, Buffalo, Pittsburgh, and Milwaukee, with a combined pop. of approximately 13,473,000, or nearly 14% of the total pop., manufactured 25% of the total product value. Districts outside cities having a pop. of 10,000 or over and having 61% of the total pop., had only 33% of the wage-earners, and manufactured only 30% of the total production. Some manufacturing industries tend toward local concentration: for example in 1914, measured by value of product, Michigan produced 62·9% of all the products of the automobile industry in the United States; Massachusetts 43% of the boot and shoe industry; Connecticut 43% of brass, bronze and copper products, and 62% of fire-arms and ammunition; California 25% of canning and preserving products; Illinois 40% of the agricultural implement industry; New York 43% of men's clothing, 73% of women's clothing, 96% of men's collars and cuffs, and 59% of leather gloves and mittens.

Preliminary figures for the census of 1919 showed for value of product an increase of nearly 160% over 1914. This remarkable gain is far in excess of that of any previous five-year or even that of any 10-year period. Table 14 shows the specific industries, which in 1919 manufactured a product valued at more than $500,000,000.

Complete data were not yet available in Jan. 1922 to show how far the increases shown in Table 14 were due to higher prices and how far due to greater volume of production. To illustrate this distinction the following figures are taken from the preliminary bulletins of the Bureau of Census, to show quantity production in 1914 and 1919 with respective values at each date. In the silk industry there was manufactured in 1914 242,000,000 yd. of broad silk, and in 1919, 307,000,000 yd.; the value more than trebled in the period, from $137,720,000 to $435,935,000. Pig-iron production increased in quantity from 23,269,000 tons to 30,543,000 tons, or 31%, and in value 151%; coke from 22,788,000 tons to 30,097,000 tons and in value more than doubled, from $304,234,000 to $770,101,000; window glass decreased in quantity from 401,000,000 sq.ft. to 369,000,000 sq.ft., but the value more than doubled, increasing from $17,496,000 to $41,106,000. Oil-cloth and linoleum also decreased in quantity from 127,038,000 sq.yd. to 125,448,000 sq.yd., but increased in value from $25,598,000 to $68,110,000. Fertilizers decreased in quantity from 8,432,000 tons to 8,291,000 tons, but gained in value from $153,000,000 to $280,000,000. In quantity, sole leather increased from 18,075,500 sides to 19,715,800 sides, and in value from $116,188,000 to $218,830,000. In food products lard increased in quantity from 1,119,189,000 lb. to 1,372,550,000 lb., and in value more than trebled, $120,414,000 to $415,817,000; condensed and evaporated milk increased from 884,647,000 lb. to 2,096,973,000 lb., and in value from $59,375,000 to $293,569,000; beet sugar decreased in quantity from 1,486,948,000 lb. to 1,426,890,000 lb., but increased in value from $58,590,000 to $138,100,000; cleaned rice increased in quantity from 674,872,000 lb. to 1,062,813,000 lb. and in value from $21,655,000 to $83,462,000; wheat flour increased from 116,403,770 bar. to 132,478,513 bar. and in value from $543,840,000 to $1,436,589,000. The growing demand for automobiles greatly expanded not only their manufacture but also the refining of petroleum, and the rubber industry. The number of passenger cars manufactured in 1919 was 1,657,000 as compared with 569,000 in 1914 for all motor vehicles. The petroleum refining industry showed a phenomenal development. The output of gasoline increased in five years from 1,195,000,000 gal. to 3,637,000,000 gallons. The increase in quantity was 204% and in value 540%. In 1919 the refineries used 358,000,000 bar. of crude petroleum of which 38,000,000 was of foreign origin and 320,000,000 domestic. The manufacture of rubber goods greatly expanded. Two-thirds of the value in 1919 was represented by tires. The maximum production of lumber was reached in 1908, 42,000,000,000 ft.; in 1918 it was 32,000,000,000 ft., the decline being due to the

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TABLE 14. *Individual Industries; dollars in millions.*

	1919	1914	Per cent. increase
Automobile bodies and parts	674	130	418
Automobiles	2,388	503	373
Boots and shoes	1,152	502	129
Bread and other bakery products	1,406	492	186
Butter	583	243	140
Cars and general shop construction and repairs by steam railway companies.	1,278	514	149
Cars, steam railway, not including operations of railway companies	540	195	176
Chemicals	695	200	242
Clothing, men's	1,158	458	153
Clothing, women's	1,184	474	150
Confectionery and ice cream	637	210	203
Cotton goods	1,878	677	177
Electrical machinery, apparatus and supplies	1,014	335	203
Flour-mill and grist-mill products	2,193	878	152
Food preparations not elsewhere specified	663	219	203
Foundry and machine-shop products	2,321	867	167
Furniture	574	266	116
Iron and steel, blast furnaces	794	318	118
Iron and steel, steel works and rolling-mills	2,813	919	206
Knit goods	686	259	165
Leather, tanned, curried and finished	929	367	150
Lumber and timber products	1,401	715	96
Lumber, planing-mill products, not including planing-mills connected with saw-mills	561	308	82
Oil and cake, cottonseed	570	212	169
Paper and wood pulp	794	332	139
Petroleum refining	1,645	396	315
Printing and publishing, book and job	601	307	96
Printing and publishing, newspapers and periodicals	892	496	80
Rubber goods, not elsewhere specified	980	224	338
Shipbuilding, steel	1,454	66	2,103
Silk goods	685	254	170
Slaughtering and meat-packing, wholesale	3,714	1,454	155
Smelting and refining, copper	633	444	42
Sugar, refining, not including beet sugar	731	289	153
Tobacco, cigars and cigarettes	886	315	181
Worsted goods	676	276	145

fact that readily available timber was becoming less and less accessible. Portland cement is manufactured in larger amounts and has a wide use in the building industry. During the years 1900–9 the average production was 33,000,000 bar.; in 1916 it reached 95,000,000 barrels. The production of tin plates, terne plates, and taggers tin showed a steady development; in 1910 the production amounted to 1,370,788,000 lb. and in 1919 to 3,301,624,000 lb. An export trade was developed, the export of domestic product rising from 26,168,000 lb. to 527,462,000 lb.; import of this product has practically disappeared.

The cost of new buildings in the principal cities is estimated by the U.S. Geological Survey as follows:— 1910, $726,437,000; 1911, $687,507,000; 1912, $738,990,000; 1913, $673,221,000; 1914, $619,752,000; 1915, $700,413,000; 1916, $839,706,000; 1917, $569,011,000; 1918, $344,622,000; 1919, $1,019,491,000. The figures show that, although the war checked building, the total value of the buildings constructed in 1919 was much greater than in any preceding year; the cost for 1919 was swollen by high prices and does not accurately represent the volume of new building, measured by physical units.

After 1909 there was but a slight increase in the number of manufacturing establishments, notwithstanding the gain in the number of wage-earners and value of product. In 1914 there were 275,791 establishments, with 7,036,337 wage-earners, and products valued at $24,246,000,000, or $87,916 per establishment; in 1919, 288,376 establishments with $62,588,000,000, or $217,000 per establishment. In 1914, 2,476,006 wage-earners, or more than one-third (35·2%), were in 3,819 establishments, an average of nearly 650 workers per establishment; nearly one-half (48·6%) of the value of the product was manufactured in this small group of establishments. Of the 8,263,153 persons engaged in manufactures in 1914, 6,613,466, or 80%, were males, and 1,649,687, or 20%, were females.

Minerals.—The value of mineral products, as estimated by the U.S. Geological Survey, increased from $1,992,406,000 in 1910 to $5,543,456,000 in 1918. Nearly three-fourths was represented in 1918 by five products, as follows (in millions of dollars):—pig-iron 1,181 (412 in 1910); bituminous coal 1,492 (469 in 1910); anthracite 336 (160 in 1910); copper 471 (137 in 1910); petroleum 704 (128 in 1910). Lead increased in value from $30,855,000 in 1910 to $76,667,000 in 1918; zinc from $27,268,000 to $89,618,000; aluminum from $8,956,000 to $41,159,000; natural gas from $70,756,000 to $157,000,000; and cement from $68,752,000 to $113,555,000. Platinum had a remarkable development, the product increasing from 8,665 oz., valued at $478,688, in 1915 to 59,753 oz., valued at $6,417,980, in 1918.

The production of iron ore increased from 56,889,734 long tons in 1910 to a maximum record of 77,870,553 tons in 1916. In 1918 the production was slightly less, 72,021,202 tons. In the latter year this was manufactured into 39,054,644 tons of pig-iron. More than half of the iron ore produced is mined in Minnesota amounting to 43,263,240 tons, followed by Michigan 17,587,416 tons; Alabama mined 6,121,087 tons. In 1912 the National Conservation Commission estimated the total supply of iron ore profitable to mine at 4,784,930,000 long tons, and 75,000,000,000 tons not worth mining. According to this estimate the profitable ore deposits might be exhausted in 60 years, allowing for no increase in annual rate of production. The ore deposits being worked in 1921 were for the most part on the surface in the region of the Great Lakes. (*See* IRON AND STEEL.)

The production of anthracite coal in 1910 was 75,433,246 tons (of 2,240 lb.); in 1919 78,653,751 tons, an increase of 4 per cent. The bituminous coal production in 1910 was 417,111,142 short tons as compared with 459,971,070 tons in 1919 (preliminary estimate of the Geological Survey), a gain of 52 per cent. About two-thirds of the coal consumed goes into the production of power, about equally divided between the industries and transportation; about one-sixth is used as a raw material, for making products employed industrially, as coke, gas, and coal-tar products; and about one-sixth for heating homes and other buildings. (*See* COAL.)

The mining of copper does not follow a regular ascending curve of production. It reached the high point in 1906, 409,735 long tons; declined in 1907; rose to 487,925 tons in 1909; again declined in 1910; rose to 555,031 tons in 1912; fell to 513,454 in 1914; and again advanced to 860,648 tons in 1916. In 1916 more than one-third was produced in Arizona, which has become the principal producing state. In the same year it was estimated by *The Mineral Industry* that the world's production was 1,373,200 long tons. After 1916 there was a marked decline in production. (*See* COPPER.)

The increased demand for gasoline for automobiles raised the price and led to vigorous efforts to discover new supplies of petroleum. During 1908–19 the production in California more than doubled; in Texas trebled; in Oklahoma more than doubled; in Wyoming new oil-fields were opened. The total production in 1920 was 443 million barrels, as against 281 millions in 1915 and 179 millions in 1908. For details *see* PETROLEUM. The Director of the U.S. Geological Survey estimated in 1920 that the country's oil resources were over 40% exhausted, and that the supply at the existing rate of consumption would be exhausted within 20 years (*see* FUEL). Between 1908 and 1916, when active exploration was carried on, the reserve was enlarged by only 1,200 million barrels. Attention has been turned to the possibility of extracting petroleum from the oil shales of Utah, Colorado and Wyoming.

The volume of natural gas produced has risen steadily since the beginning of the century. In 1910 the production was 509,000 million cub. ft., and in 1919, 1,726,000 million cubic feet. Natural gas is found in 23 states, but chiefly in West Virginia, Pennsylvania, Ohio, Oklahoma, and California. Some 2,100 cities and towns are supplied. One-third is used for domestic purposes and two-thirds for industrial plants. The production in 1910 and 1918 is shown in Table 15. The average value in 1910 was 13·9 cents per 1,000 ft. giving a total value of the product, $70,800,000; in 1918, 21·3 cents per 1,000 ft. and $154,000,000 total value. About 15,444,000 ac. of land were controlled by natural gas producers in 1917.

TABLE 15. *Natural Gas Production; in million cub. ft.*

	1918	1910
West Virginia	265,000	191,000
Pennsylvania	123,000	127,000
New York	8,000	6,000
Ohio	61,000	48,000
Louisiana and Texas	49,000	8,000
Illinois	4,000	7,000
Oklahoma	124,000	59,000
Kansas	28,000	59,000
California	40,000	3,000
Other states	19,000	10,000
	721,000	509,000

The production of gold reached its maximum in 1915, valued at $101,035,700; during the war it declined owing to advancing prices of materials and labour and the decreased purchasing power of gold (*see* GOLD). In 1919 the production was valued at $58,488,800, less than in any year since 1897. California furnished $17,398,000; Colorado $9,736,400; Alaska $9,036,000. Silver likewise reached its maximum in 1915, amounting to 74,961,075 fine Troy oz., valued at $37,397,300. In 1919 the bullion produced was less,

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55,285,196 oz., but owing to the high price the production was worth $61,966,412. Montana and Utah seemed to be forging ahead as the great silver-producing states, Nevada remaining stationary.

Fisheries.—According to an estimate made by the Bureau of Fisheries the annual fishery product during the decade 1910–9 amounted to 2,500,000,000 lb., for which about $80,000,000 was paid to the fishermen. The industry employs about 200,000 persons. The total quantity of fish landed at Boston and Gloucester, Mass., and Portland, Me., the three principal fishing ports in New England, amounted in 1919 to 196,481,000 lb. having a value to the fishermen of $7,548,000. Cod represented $2,332,000 and haddock $2,788,000. The product of the fisheries of the Great Lakes in 1917 was 104,269,000 lb., valued at $6,295,000. One-half of the product, 53,529,000 lb., was ciscoes (whitefish). The product of the fisheries of the Gulf states in 1918 was 130,924,000 lb., valued at $6,510,000. The principal products were: mullet, 28,641,000 lb.; shrimp, 27,143,000 lb.; and oysters, 23,754,000 lb. At Seattle, Wash., the fishing fleet landed in 1919 13,651,000 lb., valued at $1,530,000. The principal product was halibut. The total catch of salmon and steelhead trout on the Pacific coast in 1919 including Alaska was 767,000,000 pounds. It is estimated that the annual yield of oysters for the whole United States is about 30,000,000 bus. giving a return to the fishermen of nearly $15,000,000. About one-sixth, 5,942,000 bus., come from the New England coast, and over one-half, 18,906,000 bus., from the coast of the Middle Atlantic states.

Production.—Professor Edmund E. Day of Harvard has made an ingenious statistical study of the physical volume of production in the United States for the period 1888–1919, published in *The Review of Economic Statistics* (Harvard University, Sept. 1920–Jan. 1921). His conclusions are shown in Table 16. With 1899 as the base (100) index numbers for subsequent years were calculated for agriculture, representing 12 important crops; for mining, representing 10 minerals; and for manufacturing, representing 12 groups, covering 34 branches of manufacture. The indices for pop. are added in order to compare the growth of production.

TABLE 16. *Index Numbers of Production.*

	Population	Agriculture	Mining	Manufacture
1899	100·0	100·0	100·0	100·0
1900	101·8	100·6	105·7	101·0
1901	103·8	89·3	114·6	112·4
1902	106·0	113·7	122·7	123·5
1903	108·1	105·0	135·0	125·5
1904	110·3	116·0	136·3	123·2
1905	112·4	117·5	161·6	144·4
1906	114·5	125·0	169·9	155·0
1907	116·7	112·4	185·9	156·3
1908	118·9	118·8	154·2	132·7
1909	121·0	118·1	189·4	163·4
1910	123·1	123·2	201·6	166·0
1911	125·3	117·0	194·4	158·3
1912	127·4	138·1	216·7	181·4
1913	129·6	122·1	227·2	187·1
1914	131·6	135·0	202·6	171·4
1915	133·2	141·0	227·6	187·2
1916	134·8	124·9	267·0	218·6
1917	136·5	135·0	277·2	215·2
1918	138·1	133·2	279·6	214·0
1919	139·7	137·6	228·4	195·3

Table 16 shows that the physical volume of agricultural production has closely followed the growth of population. As Prof. Day points out, "Mining output, on the other hand, completely outdistanced population growth. Since 1897 the development of mining has been phenomenal. . . . Crops are an annual harvest from a soil the fertility of which scientific cultivation carefully preserves; mineral production is a continuing exhaustion of irreplaceable natural deposit. Mining typically lives upon its capital; agriculture upon its income. The rate of production in mining is consequently open to an acceleration which in agriculture is altogether impossible. . . .The fluctuations of manufacturing output appear to be much more cyclical than the variations in agricultural production. In general the fluctuations of production in manufacture resemble closely those in mining."

Commerce, Foreign and Domestic.—Extraordinary movements in foreign commerce, due to the World War, began with 1915. During the years 1900–9, inclusive, the excess of exports over imports of merchandise varied in value from a maximum of $666,000,000 in 1908 to a minimum of $351,000,000 in 1909. Beginning with 1915 the annual excess was over a thousand million dollars, reaching in 1919, $4,016,000,000. Table 17 shows the movement by years, and the excess of exports over imports in each year. The excess of exports over imports in trade with European countries was even greater than the balance from total trade with all countries, amounting in 1919 to $4,437,000,000. Trade with South America uniformly showed an excess of imports over exports, ranging from $66,000,000 in 1911 to $308,000,000 in 1918; and trade with Asia also gave

TABLE 17. *Foreign Trade; in millions of dollars.*

	Exports	Imports	Excess
1910	1,745	1,557	188
1911	2,049	1,527	522
1912	2,204	1,653	551
1913	2,466	1,813	653
1914	2,365	1,894	471
1915	2,769	1,674	1,094
1916	4,333	2,198	2,136
1917	6,290	2,659	3,631
1918	5,920	2,946	2,974
1919	7,920	3,904	4,016
1920	8,228	5,278	2,950

adverse balances ranging from $121,000,000 in 1911 to $408,000,000 in 1918. The figures given here relate to values of exports and imports, and do not, even approximately, reflect the changes in the physical volume of foreign commerce. For some of the commodities recorded in official statistics of exports and imports it is possible to give quantities as well as values; for others only values. In order to illustrate the influence of prices on abnormal values of commodities entering into foreign trade, quantities are given in Table 18 of exports for five commodities: wheat, cotton, bacon, mineral oil and tobacco; for other principal commodities only values are stated.

It will be observed from Table 18 that the quantity of wheat increased six times, while the value increased nearly fifteen times, and the quantity of cotton was less in 1919 than in 1910, but its value more than doubled. High prices also influenced imports, as seen in Table 19. The quantity of coffee imported increased a little over 50%, while the value more than trebled; and the quantity of sugar 67%, but its value 245%.

The enormous excess of exports of merchandise over imports, which began to be so marked in 1915, resulted in unprecedented gold transfers to the United States. In 1916 the import of gold exceeded the export by $403,760,000, and in 1919 by $685,255,000. Thus in two years the gold holdings were increased by $1,089,000,000. In the years 1918–9 $366,000,000 of this gold was exported, leaving a net additional balance of $723,000,000. This was in large part reflected in the increase of gold money in circulation, which rose from $590,000,000 in 1915 to $1,112,000,000 in 1919.

Railways and Canals.—There was but little new railway construction in the years 1910–21. In the five years 1915–9 less than 5,000 m. of new railway was built, not as much as was constructed in one year in the period 1902–7. In 1919 the miles of track in operation were 253,350 as compared with 242,107 in 1910, a gain of less than 5 per cent. The railways, however, did more work. Passenger-miles increased from 32,338 millions in 1910 to 39,477 millions in 1917, or 22%, and freight-ton-miles from 255,017 millions in 1910 to 394,465 millions in 1917, or 54 per cent. The average tons per freight train increased from 380 to 597. In 1917 1,264 million tons of freight (excluding duplications) were moved by the railways as against 968 millions in 1910. More than one-half of the tonnage carried was the products of mines, coal being by far the largest item. The average number of passengers carried per train rose from 56 to 65. The number of railway employees increased but slightly, from 1,699,420 in 1910 to 1,833,732 in 1917. Electric railways, mostly used for passenger service, have been extended more rapidly than steam railways. In 1907 there were 25,547 m. of electric line and in 1917, 32,548. The number of employees rose from 221,429 to 294,826 and the number of revenue passengers from 7,441 millions to 11,305 millions. (*See* RAILWAYS.)

In 1916 the Bureau of Census made a study of transportation by water. According to this report the tonnage employed on the Great Lakes and the St. Lawrence river in 1916 was 2,737,491 tons as compared with 2,392,863 tons in 1906, a gain of 14·4 per cent. The freight carried was 125,384,000 tons as against 75,610,000 tons in 1906, a gain of 65·8 per cent. Of this, 73,000,000 tons was iron ore, 30,000,000 tons coal, and 6,000,000 tons grain. The freight handled by the Lakes fleet represented nearly one-half, 48·6%, of the water-borne freight shipments reported for the United States as a whole in 1916 as against 42·6% in 1906. Tonnage on the Mississippi river and tributaries declined greatly, from 4,412,000 tons in 1906 to 1,621,000 tons in 1916. Vessels operating on canals declined both in number and in tonnage. In 1906 the number of such vessels was 2,140 with a tonnage of 259,491; in 1916 the number was 2,049 with a tonnage of 196,426. The decline was on the canals of New York state, where the tonnage dropped from 209,152 tons in 1906 to 115,290 in 1916, showing that the efforts to develop canal transportation in that state had not been successful. The freight carried on the Sault Ste. Marie Canal, connecting lakes Superior and Huron, fluctuated during the decade 1910–9, between 53,477,000 tons in 1911 and 91,888,000 tons in 1915; in 1919 it was 68,236,000 tons.

Mails, Telephone and Telegraph.—Postal statistics show a slight extension of post routes, exclusive of rural delivery routes, from 435,488 m. in 1910 to 455,498 m. in 1919; the number of city carriers from 29,168 to 35,024; the mileage of rural delivery service from 993,068 to 1,143,467; and the number employed in railway mail service from 16,795 to 19,683. The telephone was rapidly

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TABLE 18. *Exports of Principal Commodities, 1910–9.*

	Wheat		Cotton, raw		Bacon		Mineral Oil		Tobacco, unmanufactured	Wheat Flour	Copper	Lard	Automobiles and parts, not including engines and tires	Cotton manuf.	Iron and steel manuf.	Leather, and manuf. of
	Bushels (mil.)	Dollars (mil.)	Bales (mil.)	Dollars (mil.)	Lbs. (mil.)	Dollars (mil.)	Gallons (mil.)	Dollars (mil.)	Lbs. (mil.)	Dollars (mil.)	Dollars (mil.)	Dollars (mil.)	Dollars (mil.)	Dollars (mil.)	Dollars (mil.)	Dollars (mil.)
1910	24	23·5	7·1	530·8	128	17·9	1,502	94·1	329	36·1	43·0	90·4	45·9	13·2	35·6	195·0	53·5
1911	33	30·4	8·6	517·1	198	24·2	1,769	105·9	370	42·2	52·8	98·2	54·5	19·2	45·7	242·5	57·0
1912	62	59·6	10·7	623·1	192	23·5	1,883	124·2	411	46·9	49·3	123·0	52·2	23·8	52·5	290·5	64·4
1913	100	95·1	8·6	575·5	213	28·0	2,137	149·3	444	52·9	56·9	143·4	60·7	33·3	55·5	295·4	60·0
1914	174	187·2	6·3	343·9	184	25·6	2,240	139·9	347	43·9	62·4	116·0	48·6	34·2	50·1	201·3	67·9
1915	206	282·6	8·4	417·0	524	69·8	2,329	142·9	434	32·5	96·2	117·3	48·3	111·6	95·8	390·9	156·1
1916	150	226·7	7·0	545·2	593	87·1	2,607	201·7	484	62·8	86·5	204·9	56·0	120·7	129·3	871·3	159·7
1917	106	245·8	4·8	575·3	578	123·1	2,651	253·0	252	45·6	138·4	333·7	75·4	120·3	158·8	1,242·0	122·5
1918	111	260·6	4·1	674·1	1,105	316·0	2,715	344·3	407	122·9	244·7	195·1	144·9	96·7	181·0	1,035·3	91·7
1919	148	356·9	6·6	1,137·4	1,190	373·9	2,493	343·7	777	260·0	293·5	117·3	238·0	151·7	273·1	968·5	303·2

TABLE 19. *Imports of Principal Commodities, 1910–9.*

	Coffee		Hides and Skins		Silk, manuf.		Sugar		Wool, manuf.	India-Rubber, manuf.	Cotton, manuf.	Fibre, manuf.	Vegetable expressed oils	Wood, and manuf. of
	Pounds (mil.)	Dollars (mil.)	Pounds (mil.)	Dollars (mil.)	Pounds (mil.)	Dollars (mil.)	Pounds (mil.)	Dollars (mil.)	Pounds (mil.)	Dollars (mil.)	Dollars (mil.)	Dollars (mil.)	Dollars (mil.)	Dollars (mil.)
1910	804	73·7	461	86·1	—	70·1	4,195	113·9	180	36·1	110·4	67·0	28·9	27·3	54·5
1911	800	97·2	425	81·5	—	69·3	4,134	100·4	156	25·5	87·9	65·8	30·6	23·9	51·8
1912	943	130·5	615	121·1	30	79·8	4,317	118·5	238	42·2	111·2	67·0	44·5	24·5	57·7
1913	853	104·7	498	105·9	34	92·8	4,762	97·1	152	28·8	84·9	65·4	50·7	26·7	60·6
1914	1,011	104·8	556	112·3	31	92·6	5,418	127·2	260	58·3	74·7	60·3	49·1	24·5	63·2
1915	1,229	113·8	646	127·4	37	94·8	5,286	179·2	423	95·0	115·5	42·2	44·8	21·0	59·8
1916	1,167	118·8	726	172·6	41	149·8	5,532	227·6	449	125 5	164·5	53·8	65·5	37·5	77·2
1917	1,287	122·6	631	209·7	43	189·8	4,944	222·5	421	171·6	239·5	53·8	95·8	63·4	98·6
1918	1,052	99·4	362	108·0	49	194·2	5,171	242·3	454	251·8	149·2	39·8	114·4	107·6	98·3
1919	1,334	261·3	745	306·5	56	341·9	7,024	394·3	446	216·8	221·6	52·6	81·8	123·0	111·6

extended. In 1917 there were 28,827,000 m. of single wire in this service as compared with 12,999,000 in 1907. The number of employees nearly doubled during this period, increasing from 144,000 to 244,000. The Bell telephone system operated in 1919 23,281,000 m. of wire, of which 3,334,000 was for long-distance toll service. The number of daily exchange messages of this system alone was 30 millions and of toll messages one million. The telegraph systems made but little extension between 1907 and 1917. In the former year there were 239,646 m. of pole line and in the latter year 241,012. The number of messages sent increased over 50%, from 101 millions to 155 millions; and the number of employees from 26,827 to 49,608. (*See* TELEGRAPH and TELEPHONE.)

The automobile became an important factor in terminal transportation. Motor-car registration increased nine times between 1912 and 1920, numbering (not allowing for duplicate registration) in the latter year 9,211,295. This represents a motor car for approximately every 11 of the population. (*See* MOTOR VEHICLES.)

Shipping.—Owing to the great activity in shipbuilding during the World War the tonnage of the American merchant marine showed a marked increase between 1910 and 1919, rising from 7,508,100 tons in 1910 to 16,324,000 tons in 1920. Nearly one-fifth, or 3,138,700 tons, was employed on the Great Lakes. The tonnage on the western rivers continued to decline, being only 120,230 tons in 1920. Sailing vessels decreased both in number and tonnage, and steam vessels declined in number from 12,452 to 8,103, but increased in size. The average tonnage of a steam vessel in 1910 was 394 tons, and in 1919, 1,359 tons. During the five years, 1910–4, the tonnage of new steam vessels built was 1,106,000 tons; and in the next five years ending in 1919, 4,948,400 tons, or more than four times as much. In 1920 new construction amounted to 3,880,639 tons. American shipping is engaged in two distinct branches of trade: coastwise trade between domestic points, and foreign trade. The tonnage in foreign trade increased from 1,076,152 tons in 1914 to 9,928,595 tons in 1920. Coasting tonnage remained about the same. It is estimated that the new tonnage, constructed under the emergency of the war, represented an expenditure of $3,000,000,000, a sum greater than the book value of all the world's merchant shipping in 1914, aggregating 49,000,000 tons. (*See* SHIPPING.)

A notable change has taken place in the nationality of shipping entering and clearing from American seaports. Until 1916 the tonnage of vessels sailing under foreign flags for many years was approximately three times as great as that under U.S. registry; in 1920 U.S. tonnage (26,242,332) equalled foreign tonnage (26,178,328).

The total tonnage of vessels entering at all ports from foreign countries increased from 40,235,800 tons in 1910 to 52,420,600 tons in 1920, and the tonnage cleared from 39,705,900 tons to 56,072,300 tons. The tonnage of British shipping entering at seaports of the United States fell from a maximum of 20,416,000 tons in 1914 to 11,237,000 tons in 1919. German tonnage entering in 1915 was 5,035,000 tons, and in the years 1916–9 was practically nil.

National Wealth.—In 1912 the Bureau of Census made an estimate of the wealth of the United States shown in Table 20, amounting to $187,700,000,000.

This gave an average of $1,965 for each person as compared with $1,165 in 1900. More than one-half the wealth consisted of real estate and improvement, largely due to the increase in value of urban real estate. In 1916 the value of taxable real estate in New York City alone was nearly $8,000,000,000.

Unofficial estimates of the national wealth have been made by statistical experts for dates later than 1912. That of W. R. Ingalls, of the U.S. Bureau of Mines, published in the *Annalist*, Sept. 13 1920, gives $216,600,000,000 for the year 1916. Other estimates run as high as $400,000,000,000. These figures, however, have little significance as evidence of domestic welfare. High prices increased appraised valuation; and high valuation, *e.g.* of real estate, may be a burden upon the productive efforts of the community.

The income-tax statistics published by the Commissioner of Internal Revenue throw light upon the distribution of wealth. In 1918 the number of personal income-tax returns was 4,425,114. The net income reported was $15,924,639,000; the tax collected on this income was $1,127,722,000; 34·3% of those making returns reported an income of from $1,000 to $2,000; 33·8% an income of $2,000 to $3,000; 21·1% an income from $3,000 to $5,000; and 7·2% an income of from $5,000 to $10,000. Incomes of $1,000,000 or more were reported by 67 persons. Of the total tax, New York state paid $354,000,000, or 31·4%; Pennsylvania, $138,000,000, or 12·2%; Illinois, $85,000,000, or 7·5%; and Massachusetts paid

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TABLE 20. *National Wealth, 1912.*

Items of Wealth	Total Value (in thousands of millions of dollars)	Per cent of Total	Amount *Per Capita*
Real property and improvements	110·7	59·0	1,150
Live stock	6·2	3·3	65
Farm implements and machinery, etc.	1·4	0·7	14
Manufacturing machinery, tools and implements	6·1	3·2	63
Gold and silver coin and bullion	2·6	1·4	27
Railway and equipment including Pullman and private cars	16·2	8·7	171
Street railways	4·6	2·4	47
Telegraphs	·2	·1	2
Telephones	1·1	·6	12
Shipping and canals	1·5	·8	16
Irrigation enterprises	·4	·2	4
Privately owned waterworks	·3	·1	3
Privately owned electric light and power stations	2·1	1·1	22
Agricultural products	5·2	2·7	53
Manufactured products	14·7	7·8	153
Imported products	·8	·4	8
Mining products	·8	·4	8
Clothing and personal adornments	4·3	2·3	45
Furniture, carriages, etc.	8·5	4·5	88
Total	187·7	100·0	1,965

$81,000,000, or 7·2%. Of the personal income, 73% was from personal service and 27% from property. Corporations reported a net income of $8,362,000,000, of which those connected with metals and metal products returned $2,053,000,000 and those connected with transportation and other public utilities $1,054,000,000. The income, war profits and excess-profits taxes from corporations amounted to $3,159,000,000 of which those connected with metals and metal products paid 31·76%, or $1,003,000,000. (*See* INCOME TAX and EXCESS PROFITS TAX.)

Public Finance.—The two main sources of Federal revenue are customs duties and internal revenue duties. Revenue from customs although nearly as large in 1920 as in 1910 was relatively unimportant; in 1910 it yielded $333,683,000 as compared with $289,934,000 from internal revenue. After that year internal revenue was the larger. Receipts were as follows:—

	Customs	Internal Revenue
1910	$333,683,000	$ 289,934,000
1911	314,497,000	386,875,000
1912	311,322,000	380,456,000
1913	318,891,000	405,120,000
1914	292,320,000	442,350,000
1915	209,787,000	415,670,000
1916	213,186,000	512,702,000
1917	225,962,000	809,366,000
1918	182,759,000	3,696,043,000
1919	183,429,000	3,840,231,000
1920	323,537,000	5,399,149,000

On account of the war new taxes were levied, the personal income tax was increased, and excess-profits tax added. The income from these two sources was, in 1918, $2,839,028,000; in 1919, $2,600,784,000; and in 1920, $3,958,000,000. Transportation taxes in 1919 yielded $238,000,000. Tobacco duties yielded in 1910 $58,118,000 and in 1919 $206,003,000; spirits and fermented liquors in 1910, $209,000,000 and in 1918, $483,000,000. The total ordinary receipts in 1910 were $675,512,000, or $7.48 *per capita*, and in 1919 $4,647,604,000, or $43.79 *per capita*. Total ordinary expenditures increased from $660,000,000 in 1910 to $15,365,000,000 in 1919, a *per capita* increase from $7.30 to $144.77. Expenditures for the War Department increased from $158,000,000 in 1910 to $9,273,000,000 in 1919; for the Navy Department from $124,000,000 to $2,019,000,000. The interest on the public debt increased from $24,742,000 in 1917 to $1,024,024,000 in 1920. Until 1917 the net public debt remained fairly stationary for many years. In 1916 it was about $1,000,000,000; in 1917 it rose to $1,909,000,000; in 1918 $10,924,000,000, and in 1919 $24,331,000,000. For the Fourth Liberty Loan, the subscriptions were $6,959,000,000 from 22,777,680 subscribers, or 21·9% of the total population. Of the subscriptions 53% were for $50, the total in this class making 10% of the total amount subscribed.

The net cost of government, distinguishing between the United States, states, and cities having a pop. of over 30,000, as tabulated by the Bureau of Census for 1919, was:—United States, $15,740,133,000 ($149.78 *per capita*); states, $635,370,000 ($6.05 *per capita*); cities over 30,000 $1,202,324,000. Of the $635,000,000 representing the cost of state Governments, $543,000,000 was devoted to current expenses of the general departments, the balance representing payments for outlays and interest on state debts. Of the $543,000,000 for general departmental services, $183,000,000 was expended for schools, $134,000,000 for charities, hospitals and corrections, and $62,000,000 for highways. The revenue receipts of states were $675,000,000, of which $237,000,000 came from the general property tax; $104,000,000 from special property taxes, as $46,000,000 inheritance tax, and $43,000,000 corporation stock taxes; $123,000,000 was derived from business taxes; and $48,000,000 from licences other than business, for the most part from the use of motor vehicles. The net indebtedness of states in 1919 was $520,000,000 or $4.95 *per capita*. With this may be compared the net indebtedness of the Federal Government amounting to $24,331,000,000, or $232.95 *per capita*, and for cities having a pop. of over 30,000, $2,698,000,000.

Of the total governmental-cost payments for cities having a pop. of over 30,000, 754 millions was for current expenses of general departments; 238 millions was expended for schools, 72 millions for highways; 61 millions for sanitation, 65 millions for fire departments, 81 millions for police departments, and 65 millions for charities, hospitals and corrections. In addition 67 millions was expended for public service enterprises, two-thirds of which was for water-supply systems; 157 millions for interest on debt; and 256 millions for outlays; representing costs of new property and equipment. The governmental-cost payments of 10 large cities for 1919 were as follows:—New York, $232,061,926 (*per capita*, $42.28); Chicago, $93,515,758 (*p.c.*, $35.66); Philadelphia, $67,027,257 (*p.c.*, $37.64); Detroit, $34,738,091 (*p.c.*, $36.86); Cleveland, $29,617,643 (*p.c.*, $38.84); St. Louis, $24,188,963 (*p.c.*, $31.75); Boston, $37,042,131 (*p.c.*, $50.13); Baltimore, $16,372,941 (*p.c.*, $25.12); Pittsburgh, $25,527,430 (*p.c.*, $44.09); Los Angeles, $24,716,666 (*p.c.*, $44.81). (*See* also the section *Finance.*)

Army.—On June 30 1920 the enlisted strength of the army was composed of 15,451 officers and 184,904 men, making a total of 200,355. Of the total 149,869 were on duty in the United States, 19,319 in the Philippine Department, 4,519 in Hawaii, and the remainder were scattered in China, Panama, Alaska, Porto Rico, and Siberia, with the U.S. army in Europe, and at sea. By branches of service the army was composed of Infantry, 52,560; Cavalry, 16,777; Coast Artillery, 16,145; Field Artillery, 15,757; Air Service, 9,358; Corps of Engineers, 4,877; Signal Corps, 4,948; Staff Corps and Departments, 47,165; General Officers and aids, 195; Philippine Scouts, 7,149; and miscellaneous, 25,368. As a result of service in the World War it was estimated by the Chief of Staff of the War Department in 1919 that there were nearly 4,000,000 men and 200,000 officers fit and trained for war. (*See* ARMY.)

Navy.—Owing to the war with Germany, the navy, both in vessels and men, was greatly increased. In 1912 there were 323 vessels fit for service, and 42 under construction; in 1920 the respective numbers were 795 and 165. The principal classes of vessels in 1920, fit for service, were:—battleships 37, armoured cruisers 8, cruisers 26, destroyers 249, submarines 98. In addition there were under construction, 11 battleships, 24 cruisers, 70 destroyers and 50 submarines. In 1910 the number of officers in the regular service was 2,645 and enlisted men 45,076; in 1920 the respective numbers were 8,765 and 116,760. In addition the marine corps contained in 1910 9,659 and in 1920 19,685. (*See* SHIP AND SHIPBUILDING.)

BIBLIOGRAPHY.—Relating to the *Thirteenth Census of the United States, 1910* are the following volumes: I. *Population, General Report and Analysis* (1913); II–III. *Population, Reports by States* (1913); IV. *Occupation Statistics* (1914); V. *Agriculture, General Report and Analysis* (1913); VI–VII. *Agriculture, Reports by States* (1913); VIII. *Manufactures, General Report and Analysis* (1913); IX. *Manufactures, Reports by States* (1912); X. *Manufactures, Reports for Principal Industries* (1913); XI. *Mines and Quarries, 1909* (1913). Much of the material in these volumes is summarized in the *Abstract* (1913), and is graphically represented in the *Statistical Atlas of the U.S., 1914.*

The Census of Manufactures, 1914, appeared in 2 vols. in 1918–9. Important volumes on special topics have been recently published by the Bureau of the Census: *Negro Population 1790–1915* (1918); *Indian Population in the United States and Alaska, 1910* (1915); *Religious Bodies, 1916:* part I, *Summary and General Tables* (1919), part II, *Separate Denominations* (1919); *Insane and Feeble-Minded in Institutions, 1910* (1914); *Benevolent Institutions, 1910* (1913); *Deaf Mutes in the United States, 1910* (1918); *Paupers in Almshouses, 1910* (1915); *Prisoners and Juvenile Delinquents, 1910* (1918); *Statistical Directory of State Institutions for Defective, Dependent and Delinquent Classes* (1919); *Wealth, Debt and Taxation, 1913* (3 vols. 1915); *Central Electric Light and Power Stations and Street and Electric Railways 1912* (1915); *Telephones and Telegraphs, 1912* (1915); *Transportation by Water, 1916* (1920). The Bureau of the Census has also published a series of volumes on *Financial Statistics of Cities* and on *Financial Statistics of States* and continues the annual compilation on *Mortality Statistics*, begun in 1900. As the registration area is constantly enlarged, these latter statistics are of increasing value.

The Federal Department of Agriculture issues many statistical bulletins relating to crops, supplies and stocks of staple commodities.

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The most important of these are summarized in the *Year Book of the Department of Agriculture*. The U.S. Geological Survey of the Department of the Interior issues frequent bulletins on mineral products and stocks which are annually gathered together in the volume *Mineral Resources of the United States*. Statistics of commerce are compiled by the Department of Commerce and published in an annual volume, *Foreign Commerce and Navigation*.

The U.S. Tariff Commission has also published several volumes in which commercial statistics are rearranged for use in tariff discussion, as *The Wool-Growing Industry*. Price statistics both for retail and wholesale trade are gathered and published by the Federal Bureau of Labor Statistics. A valuable series of studies on price statistics of different groups of commodities during the World War was published under the editorship of W. C. Mitchell by the War Industries Board, under the titles *History of Prices during the War* and *Government Control over Prices*. The Bureau of Labor Statistics also issues frequent bulletins showing wages in different trades in different parts of the country. The Interstate Commerce Commission issues an annual report, *Statistics of Railways*. Shipping statistics are published in the *Annual Report of the Commissioner of Navigation*. Immigration statistics are published in the *Annual Report of the Commissioner of Immigration*. Statistical tables in regard to the Federal finances are to be found in the *Annual Report of the Secretary of the Treasury*, sometimes known as the *Finance Report*. This contains abstracts of the reports of the Comptroller, Treasurer, Commissioner of Internal Revenue and Director of the Mint. Of especial value for recent years are the annual reports and the monthly bulletins of the Federal Reserve Board. The bulletins contain a great variety of commercial and trade statistics collected by the 12 different reserve banks. More detailed statistical data may be found in the monthly bulletins issued by the several district banks.

The most serviceable single source-book is the annual volume, *Statistical Abstract of the United States*, first issued in 1878, published by the Department of Commerce. This assembles data on area and population, including census returns, immigration, and vital statistics; education and school statistics; agriculture, forestry and fisheries; manufactures and mines; occupations, labour, and wages; internal communication and transportation; merchant marine and shipping; foreign commerce; consumption estimates; prices; money, banking, and insurance; public finance and national wealth; army, navy, civil service, pensions, and election statistics. Most of the statistics are derived from official publications, but when they are wanting, reliance is placed upon private statistical agencies.

A useful statistical handbook relating to finance, crops, railways, trade and commerce is *The Financial Review*, an annual published by the *Commercial and Financial Chronicle* (New York).

In addition to Government statistics the following volumes should be noted: W. I. King, *The Wealth and Income of the People of the United States* (1917), a scholarly analysis and interpretation of official statistics; Raymond Pearl, *The Nation's Food* (1920), a volume growing out of the author's work as chief of the Statistical Division of the U.S. Food Commission during the war. The Committee on Economic Research of Harvard University has published an important work, *Indices of General Business Conditions*, by W. M. Persons (1919). (D. R. D.)

II. Agriculture

For the conditions of agriculture in the United States before 1910 *see* 1.414; for recent statistics *see* the section *Statistics* of the present article; for general progress since 1909 in biological, chemical and bacteriological research *see* article Agriculture 30.71; for development in any one state *see* the article on that state. For various aspects of progress *see* also, in vol. 32, the index-heading Agriculture and the other index-headings naming the various crops, products, processes, machines, etc.

The main characteristics—economic rather than technical—of agricultural activities in the United States during 1910–20 were the result of significant changes which must be traced through a period of more than one decade. The ten years ending with 1920 witnessed the close of an important epoch and the opening of a new epoch in the agricultural history of the United States. The closing epoch might well be called the pioneer epoch, that of agricultural expansion, or of agricultural exploitation. The new epoch might be called that of agricultural readjustment, development, or utilization. The names by which these two epochs are known are of little importance, but it is of great importance that all who are interested in the development of American agriculture get clearly in mind the fact to which all other facts in this connexion are subsidiary, namely, that ever since the beginning of American agriculture and down to the decade 1910–20 there was ample and fertile field in the West for the expansion of agriculture, but that during 1910–20 virtually the last of the arable part of the public domain passed into private ownership. There was no longer land available for homes for the surplus population from the older portions of the country. The western agricultural migration, which began almost with the first settlements on the Atlantic coast, was, owing to natural barriers and the absence of adequate transportation systems and other causes, more or less sporadic and irregular until about 1860.

The Agricultural Frontier in 1859.—In 1859 the frontier of agricultural development as determined by density of population of 6 or more to the sq. m., or the production of 100,000 bus. of wheat per county per annum had been pushed westward to include portions, varying in size, of the states of Michigan, Wisconsin, Minnesota, Iowa, Nebraska, Missouri, Kansas, Arkansas, Louisiana and Texas. For the next 50 years there was a steady western and northern agricultural movement, until in 1910 virtually the only agriculturally unoccupied territory in the great plains was in Montana, Wyoming, western South Dakota, northwestern Nebraska, southwestern Kansas, New Mexico and western Texas. During the following decade 1910–20 virtually all the agricultural land that remained in the above described regions went into private ownership. By 1921 all the public domain suited to agriculture without irrigation, east of the Rocky Mountains, had ceased to be open to homestead claims and was undergoing agricultural development.

The Agricultural Frontier in 1920.—The 5,000-ft. contour on the eastern slope of the Rocky Mountains is generally considered the western boundary of the great plains, but to simplify computation the great plains may be regarded as including four-fifths of the area of Montana, one-third of Wyoming, one-half of Colorado, one-half of New Mexico, and all of Texas. The tract which came into agricultural production during 1860–1920 includes four-fifths of Montana; one-third of Wyoming; one-half each of Colorado and New Mexico; all of North and South Dakota, and Oklahoma; about seven-eighths of Minnesota; over one-half of Wisconsin; over two-thirds of Michigan; nearly one-half of Iowa; all but six counties (2,494 sq. m.) of Nebraska; all but 10 counties (4,684 sq. m.) of Kansas; all but 25 counties (19,356 sq. m.) of Texas; 14 counties (10,607 sq. m.) in Missouri; 28 counties (20,939 sq. m.) in Arkansas, and all but 27 counties (16,212 sq. m.) of Louisiana; the entire area amounting to no less than 1,096,607 sq. m., or 701,828,480 acres. Not all of this is arable land, but a higher percentage of it is arable than that of any other equal area on the North American continent, and contains at least 250,000 sq.m. of the richest agricultural land on the continent. More than half the total wheat crop of the United States for 1920 was grown in this area.

Coincident with the settlement of this plains region east of the Rocky Mountains was that of the inter-mountain and basin region and of much of the Pacific slope. The percentage of arable land west of the Rocky Mountains is much less than in the plains of the Mississippi Valley and the Lake region, but in the aggregate an immense area of land was brought into cultivation west of the Rockies during 1860–1920. There, as in the plains, practically all the land suitable for agriculture was appropriated and developed. There remained only small valleys and isolated areas and some Indian reservations that were to be soon thrown open to settlement. New reclamation projects were expected to develop, but if all the potentially agricultural land west of the Rocky Mountains were to be developed during 1920–30 the area would be small in comparison with that developed in each decade during 1860–1920. And it is probable that during 1920–30 as much land classed as farm land may be found unfit for that purpose and be devoted to other purposes, such as grazing and forestry, as will be brought into cultivation.

The significance of these facts does not seem to impress as it should either the public or the farmers. The habit of western migration, bred into the American people, during three centuries of practice is about to be broken.

The exhaustion of the public domain means that there is no longer available each year, as there was during 1860–1920, an area of virgin land in the Mississippi Valley, averaging 18,277 sq. m., or 11,697,280 ac., that is to say an area equal to one-third of the state of Iowa. It means that increased agricultural production by the simple process of breaking up virgin prairie is virtually at an end, so that future increases in food production must be attained by a more effective utilization of the land already occupied as farms.

The Increase of Agricultural Production and of Population for 60 Years.—The accompanying tables have been prepared from data contained in the 1920 Yearbook of the Department of Agriculture and the 1920 Census Reports. The yields of grain stated in these tables are not those of the Census Reports, but are the averages of the yields given in the Yearbook for each of the 10 years in each decade, except those for 1860 which represent the single year 1859, and for 1870 which represents the average for four years, 1866–9 inclusive. It is believed that this gives a better expression of the facts than using for each decade a single year's yield, such as is given in the Census Reports.

The two crops, wheat and corn, are chosen as an index of the general agricultural production for each decade since 1860. It is believed that they will serve the purposes of this discussion as well as or better than the more complex indexes used for more detailed investigation.

It will be seen that the proportionate increase by decades in population has been declining, having been 26·6% for 1860 and 14·9% for 1920, the greatest decrease in any decade having been between 1910 and 1920. There has been no such progressive decrease in production of either wheat or corn. The highest proportionate increase in the production of wheat was in 1880, when it was 49·3% over that of 1870. The highest proportionate increase in the yield of corn was also in 1880, when there was an increase of 41·9% over

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1870. The percentages of increase of both wheat and corn for 1870 are not very trustworthy, because, as has been said, the yields used in the census of 1860 were the yields of the single year 1859 and those for the year 1870 were the averages of four years—1866–9 inclusive. From 1880 to 1920 there was a general decline in the average increase in production of wheat. In the case of corn its regularity was broken by reason of the very low rates of increase for the decade reported in the census of 1900. This was due to a succession of crop years with unfavourable weather conditions and to a general business depression. The production in bushels per capita of both wheat and corn has been quite constant. There has, therefore, been a regular increase in the bushels per capita of wheat from 5·5 bus. in 1870 to 7·4 bus. in 1920, and an increase in corn from 22·2 bus. in 1870 to 26·2 bus. in 1920. Dividing the percentages of increases for decades by 10 to give the annual percentage of increase shows that the average annual increase in the production of wheat in the United States for a period of 60 years (from 1860–1920) is to the annual increase in population as 2·91 is to 2·25 and that of corn for the same period is as 2·28 is to 2·25.

Both population and production have been increasing at a lessening rate. The retardation in the increase in population has been somewhat greater than that of production, as is indicated by the increase in the per capita production of wheat from 5·5 bus. to 7·4 bus. and of corn from 22·2 to 26·2 bus.

The proportionate rate of increase in production of wheat for the decade ending with 1920 was 13·9% and for corn 11·2%, and for population 14·9%.

TABLE I.—*Wheat Production and Population.*

Years.	Population.	Production.	Increase in Production Bus.	Percentage Increase of Production.	Percentage Increase of Population.	Bushels Per Capita.
1860	31,443,321	173,105,000	—	—	—	—
1866 to 1869	38,558,371	212,156,000	39,051,000	22·6	26·6	5·5
1870 to 1879	50,155,783	316,820,000	104,664,000	49·3	26·0	6·3
1880 to 1889	62,947,714	444,078,000	127,258,000	40·2	25·5	7·1
1890 to 1899	75,994,575	556,674,000	112,596,000	25·4	20·7	7·3
1900 to 1909	91,972,266	684,434,000	127,760,000	23·0	21·0	7·4
1910 to 1919	105,710,620	779,560,000	95,126,000	13·9	14·9	7·4
			Averages	29·1	22·5	6·8

TABLE II.—*Corn Production and Population.*

Years.	Population.	Production.	Increase in Production Bus.	Percentage Increase of Production.	Percentage Increase of Population.	Bushels Per Capita.
1860	31,443,321	838,793,000	—	—	—	—
1866 to 1869	38,558,371	854,278,000	15,485,250	1·8	26·6	22·2
1870 to 1879	50,155,783	1,212,013,000	357,735,000	41·9	26·0	24·2
1880 to 1889	62,947,714	1,692,019,000	480,006,000	39·6	25·5	26·9
1890 to 1899	75,994,575	1,995,190,000	303,171,000	17·9	20·7	26·3
1900 to 1909	91,972,266	2,486,274,000	491,084,000	24·6	21·0	27·0
1910 to 1919	105,710,620	2,765,041,000	278,767,000	11·2	14·9	26·2
			Averages	22·8	22·5	25·5

It becomes evident that the record of the annual production of wheat and corn through a period of 60 years, and its relation to the increase in population as indicated by the figures given in the accompanying tables, is a safe index of the agricultural requirements for the future, the conclusion is that if the general agricultural production of the country can be increased at the rate of 2% per annum for the future, the per capita production of wheat and corn, and probably of most other staple agricultural products, can at least be maintained at the ratio of the decade 1910–19.

The Agricultural Problem of the Future.—Had conditions in all parts of the world remained substantially as they were in 1914, the chief problem in 1921 would have been how to maintain in later years an increase of 2% per annum in the agricultural production of the United States, notwithstanding that virgin land could no longer be counted upon. This is a problem that prior to the World War would have engaged the most earnest effort of American farmers and the various agricultural agencies and organizations, both Federal and state. It would have presented difficulties of adaptation, adjustment, and development. The question of actual field production would have been a minor one as compared with such questions as transportation and distribution, the securing of efficient farm labourers at reasonable wages, and the opportunity for the farmers to purchase at prices comparable with the prices of farm products the things that a farmer has to buy to conduct his business and to live in comfort. Given conditions favourable in these respects, agricultural production undoubtedly could have been increased for many years after 1921 at a rate of 2% per annum. There are many ways in which this increased production could have been brought about: by clearing and bringing into cultivation waste land already included in farms; by draining swamps, and by developing water to enlarge existing irrigation projects; probably most of all by more intensive methods of agriculture. The agriculture of the United States had been and in 1921 still was an extensive, rather than an intensive, agriculture, and properly so. So long as land was plentiful and men were scarce the extensive system was to be encouraged. But as land began to become scarce and men plentiful there came almost unlimited opportunities for the intensifying of agriculture. While this need for closer farming was being discussed the World War brought with it a new set of problems that engaged the attention of the farmers as well as other citizens.

Prices of Farmer's Products and of Commodities He Buys.—The most pressing problem in 1921 was the disproportion between the prices of those things the farmer has to buy and those he has to sell. This difficulty was as great when he paid for labour as when he bought commodities.

Wages of Farm Labour.—The Bureau of Crop Estimates of the Department of Agriculture published in the Yearbook for 1920 a table giving the wages paid farm labourers from 1866 to 1920. Arranging these figures for the different classes of farm labourers as index numbers, and calling the wages of 1913 100 as a base, gives the following results:

Wages—Agricultural Labour.

	1913	1920	1921	Index No. 1920	Index No. 1921
A By the month with board	$21.38	$46.89	$29.48	219	138
B By the month without board	30.31	64.95	42.65	214	141
C Day labourer at harvest, with board	1.57	3.60	2.12	229	135
D Day labourer at harvest, without board	1.94	4.36	2.80	225	144
E Day labourer, not harvest, with board	1.16	2.86	1.60	247	138
F Day labourer, not harvest, without board	1.50	3.59	2.17	240	145

Farm wages declined during 1921. The best information available, Nov. 20 1921, was that wages were about as follows (A) $29.48, (B) $42.65, (C) $2.12, (D) $2.80, (E) $1.60, (F) $2.17. These figures would give an index number about 145, or an increase of about 45% for 1921 over the wages of 1913. In the diagram, fig. 1, the figures for "Day labour, not harvest, without board" have been used as they are considered the most trustworthy. Men of this class are usually married men who either own their own homes or rent them from their employers. They are less inclined to drift than those who are boarded by their employers, and who are usually single and "footloose." The married man who works by the month and boards himself frequently has house, garden, firewood and sometimes milk and pork provided by his employer. This is probably the most stable class of farm labour. It does not, however, yield a conclusive index of the changes in wages because changes in the value of the perquisites above mentioned tend to complicate the calculation.

The index number for the wages of day labourers, not for harvest, without board were as follows:

Year	1913	1914	1915	1916	1917	1918	1919	1920	1921
Index No.	100	97	98	108	135	175	208	240	145

Discussion of Diagram.—Fig. 1 (p. 864) shows the index numbers of farm crops, live stock, commodities and farm labour for each year from 1913 to 1921, inclusive.

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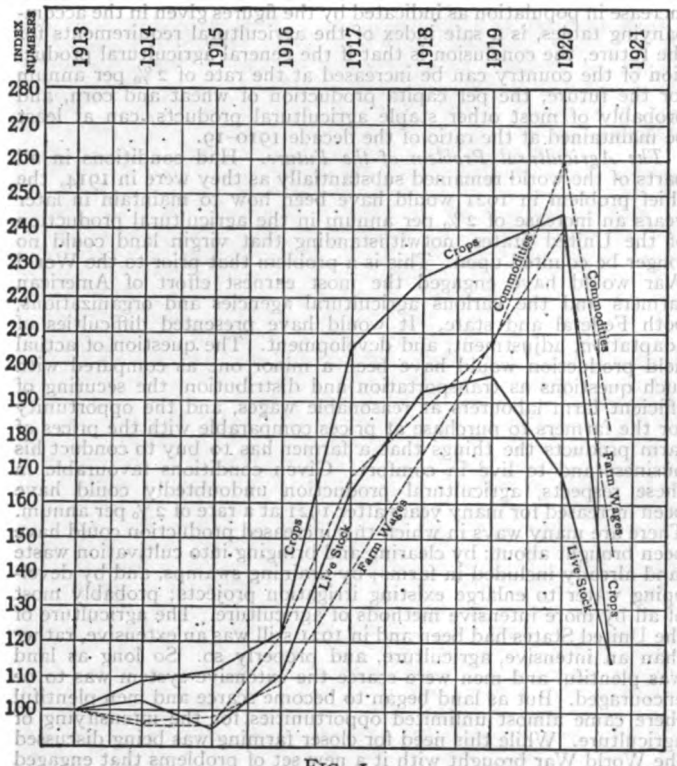

FIG. 1.

Index Numbers of Farm Crops, Live Stock, Commodities and Farm Labour Each Year from 1913 to 1921 Inclusive.

The two outstanding facts are that in every year from 1913 to 1919 the farm crops index stood higher than any of the others, and that from 1913 to 1918 the farm wage index stood as low as or lower than any other.

Tables III., IV., and V. are based upon data prepared by the Bureau of Crop Estimates, and published by authority of the Secretary of Agriculture.

TABLE III.—*Index Numbers of Farm Prices of Crops.*

The index numbers of average prices to farmers of the United States of 10 leading crops (wheat, corn, oats, barley, rye, buckwheat, potatoes, hay, cotton, and flax) represent about four-fifths of the value of all crops and may be regarded as representing the trend of all crop prices. (Base 100=average for 12 months of 1913.)

	1921	1920	1919	1918	1917	1916	1915	1914	1913
Jan. 1 .	129	241	221	214	149	105	103	108	90
Feb. 1 .	123	252	211	220	159	114	114	107	91
Mar. 1 .	120	255	209	234	168	112	117	109	92
Apr. 1 .	113	271	220	234	183	114	117	109	92
May 1 .	104	294	238	229	228	116	122	110	94
June 1 .	109	309	249	221	236	118	120	113	98
July 1 .	106	304	252	222	235	118	113	112	100
Aug. 1 .	109	268	267	228	250	120	113	112	102
Sept. 1 .	109	239	258	238	227	131	108	115	111
Oct. 1 .	—	202	235	235	225	133	104	111	113
Nov. 1 .	—	163	227	219	212	145	101	103	109
Dec. 1 .	—	135	230	215	205	152	98	100	108
Average	112	244	235	226	206	123	111	109	100

TABLE IV.—*Index Numbers of Farm Prices for Live Stock.*

Index numbers of average prices to farmers of the United States, for live stock. (Base 100=average for 12 months of 1913.)

	1921	1920	1919	1918	1917	1916	1915	1914	1913
Jan. 15 .	120	173	192	179	121	92	94	100	91
Feb. 15 .	117	177	192	180	134	100	92	103	95
Mar. 15 .	123	178	200	186	152	107	92	105	101
Apr. 15 .	112	181	214	193	166	112	94	105	104
May 15 .	109	177	218	197	168	114	97	104	101
June 15 .	104	175	213	194	167	114	98	103	102
July 15 .	109	176	222	195	163	114	97	105	103
Aug. 15 .	113	172	221	202	168	114	96	109	102
Sept. 15 .	—	174	191	206	182	119	96	108	102
Oct. 15 .	—	166	174	196	186	114	99	102	102
Nov. 15 .	—	147	169	190	177	115	92	97	99
Dec. 15 .	—	121	164	191	181	116	89	94	98
Average	113	168	197	192	164	111	95	103	100

TABLE V.—*Index Numbers of Commodity Prices, Excluding Farm and Food Products.*

Based upon the Bureau of Labor index numbers of wholesale prices of all commodities from which were deducted the commodities representing the foods, and farm products group. (Base 100 = average for 1913.)

	1921	1920	1919	1918	1917	1916	1915	1914	1913
Jan. . .	205	246	191	173	153	109	94	98	102
Feb. . .	194	257	192	175	152	112	95	97	102
Mar. . .	186	263	186	179	160	115	93	98	100
Apr. . .	180	272	184	182	162	118	93	97	100
May . .	177	278	187	184	170	118	95	96	100
June . .	173	277	196	188	178	120	94	96	100
July . .	171	272	205	192	182	118	96	96	100
Aug. . .	169	271	217	193	177	119	95	95	100
Sept. . .	—	267	221	196	175	124	96	96	100
Oct. . .	—	257	225	195	166	120	98	93	100
Nov. . .	—	234	230	198	168	140	101	92	99
Dec. . .	—	220	237	196	169	148	105	94	97
Average	182	259	206	188	168	122	96	96	100

A study of the diagram (fig. 1) confirms the evidence from many other sources that farmers engaged primarily in crop production were reasonably prosperous from 1913 to 1916 inclusive, and that during 1917, 1918 and 1919 they enjoyed unprecedented prosperity followed by two years of heavy losses; the high prices of the early months of 1920 having broken before the products could be marketed and the cost of commodities and farm wages remaining high. It also shows that the live stock grower was only just able to keep pace with the increasing cost of necessary commodities, and but little ahead of the steadily rising farm wages that he had to pay. The conditions of agriculture on Dec. 1 1921, as shown by Tables I., II., III. and V., and fig. 1, indicate that never before in the history of American agriculture had the farmers been confronted with so serious a situation. Unless the prices of what the farmer must sell could be brought into proper relation with prices of what he must buy—commodities and labour—agricultural production would necessarily be so greatly reduced as to bring about a serious shortage of food and textile products, for farmers cannot continue to produce crops at a loss not only of their time, but also of their money.

When, however, the agricultural situation is more closely studied it becomes apparent that even though a proper relation could be restored between the prices of farm products, farm labour, and the commodities the farmer has to buy, many of the farmers would be still unable to operate their farms profitably.

During the decade 1910–20, throughout the first half of which the farmers enjoyed normal prosperity and throughout the latter half of which their prosperity was the greatest ever enjoyed by American farmers, the rural population increased only 5·4% while the urban population increased at the rate of 25·7%. That is to say urban population increased nearly five times as rapidly as the rural population, increased movement to centres showing that farm life and farming had come to be disliked, notwithstanding their new advantages: improved roads, rural free mail delivery, telephones, automobiles, farm electric lighting plants and modern water and heating systems, all developed rapidly during the ten years in question.

Although there were 86,864 or 1·4% more farms in the United States in 1920 than in 1910, there were 23,627 or ·6% fewer farm owners. Of the 3,925,090 farms operated by their owners in 1920, 41·3% were mortgaged as against only 33·6% in 1910.

The value of the land and buildings of mortgaged farms was $6,330,236,951 in 1910, and in 1920 $13,772,729,610, an increase of 117·6%. In 1910 the mortgaged indebtedness was $1,726,172,851; in 1920 $4,012,711,213, an increase of 132·5%. The increase in value ranged from 21% in New Jersey to 480% in Arizona. The increase in mortgaged indebtedness ranged from 10·2% in Rhode Island to 625·7% in Montana. The increase per cent in mortgaged indebtedness by geographical divisions was as follows: New England 56·8; Middle Atlantic 45·5; East North Central 101·0; West North Central 136·3; South Atlantic 161·8; East South Central 194·6; West South Central 154·0; Mountain 379·4; Pacific 215·6.

The average value of land and buildings on all mortgaged farms in 1910 was $6,289, and in 1920 it was $11,536, an increase of 117·6%. The average debt per farm was $1,715 in 1910 and $3,361 in 1920, an increase of 132·5%. The debt per cent value was 27·3 in 1910 and 29·1 in 1920, the figures being based on 1919 values. These declined and debts increased during 1920 and 1921, and at the end of 1921 it was believed that changes would continue in the same direction, until a shortage of food should increase prices.

There was difference of opinion as to the significance of the heavy increase in mortgaged indebtedness. The published reports of the Bureau of Census do not indicate at what time during the decade this increase took place, nor the purposes for which the money represented by the mortgages was used: whether as purchase money for the land upon which it was placed, for buildings, or other improvements upon the land, for farm equipment, or for the purchase,

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operation, and the incidental expenses pertaining to the ownership of an automobile.

Conditions during 1910–5, unforeseen in the beginning of that period, favoured investors in agricultural land and in farm improvements. Values doubled and in some instances quadrupled during 1910–20. And many of those who borrowed to make such investments were enabled during 1915–20 to repay in what were called "thirty cent dollars," because inflated prices made currency redeemable in gold seem worth less than before. Indeed many farmers thus repaid not only the capital they had borrowed, but also their small floating debts, so that when deflation began in the summer of 1920 they could face without fear the inevitable hard times, in which economic readjustments must be made.

Unfortunately not all farmers were safe. Some, because of local crop failures or other unavoidable circumstances—and others, more numerous, because they had yielded to the spending craze that swept the country in 1918 and 1919—found themselves in the summer of 1920 possessed of much property, both real and personal, some of which had been acquired at war-time prices, but heavily indebted and with credit exhausted. It was largely owing to their difficulties that during the decade the mortgaged indebtedness of farmers so largely increased.

The Internal-Combustion Engine as an Agricultural Factor.—In the decade ending with 1919 there was a great development of the internal-combustion engine and adaptation of it not only to the labour, but also to the health, comfort and enjoyment of the American farmer. (*See* articles: INTERNAL-COMBUSTION ENGINES; TRACTORS; and MOTOR VEHICLES.) It came to be used directly in the automobile, truck, tractor, pumping plant, electric lighting plant; for cutting silage, grinding feed, shelling corn, threshing grain, sawing wood, operating spraying machines and fruit-grading machines; and for many other power purposes. The internal-combustion engine, generating current, also indirectly operates the washing machine, the electric iron, electric fans, the vacuum cleaner, electric heating pads, and (through small portable motors) serves for separating milk, churning, meat grinding and many other household purposes.

A general farm of 150 to 200 ac. growing fruit, a small dairy herd, some truck and general farm crops, was no longer considered well equipped unless it had all the facilities above mentioned and perhaps a milking machine also, if the dairy herd was large. Seven separate internal-combustion engines and an equal number of small electric motors probably would be needed for all these purposes. Such a plant undoubtedly would be a good investment if it were judiciously selected and bought at a fair price, provided always that (1) the farm and the system of farming were adapted to the use of a tractor, (2) that the farmer or some member of his family had the necessary mechanical skill to see that this equipment were properly operated and kept in repair, (3) that the capital of the farmer was sufficient to provide such a plant, and (4) that the income of the farm was sufficient to support such a plant without seriously interfering with the other requirements of the family and the farm business.

Seldom, if ever, are all the above-mentioned conditions fulfilled, but the measure in which they can be approximated will determine the advisability of the purchase of all the above-mentioned equipment, except the automobile. This must be considered apart, for, although any part of a full farm equipment may be misused, the extent to which the privileges conferred by the automobile may be abused is almost without limit. The choice of the make of automobile is a simple matter, so far as mechanical construction is concerned. The buyer gets about what he pays for in any standard make. It is the use to which the car is put rather than its quality which makes it advantageous or harmful. Whether it will contribute to the efficient handling of the farm is not the only question. If the car is used chiefly to take the family away from home and to encourage waste of time and money, then it is a poor investment.

Automotive Statistics, for 1921, published by the Motor List Company of Des Moines, Iowa, states that 3,243,051 automobiles are owned by farmers in the United States. As already mentioned, the increase in the mortgaged indebtedness of the farmer-owned farms of the United States from 1910 to 1920 was $2,286,538,362. If those 3,243,051 automobiles cost $705.06 each, which is a fair estimate, they would nearly equal in value the amount of the increase in mortgaged indebtedness between 1910 and 1920. This correlation is accidental; no one believes that those 3,243,051 automobiles were bought with money secured by executing mortgages aggregating $2,286,538,362 upon farm property. It is nevertheless probable that some of the purchase money would have been better used to pay off mortgages.

Farm Labour.—Mention has been made of the changes in farm wages during and since the World War. The changes in the price paid per day or per month, or in the index numbers, ought to, but do not, fully represent the changes in the costs of units of labour performed. Before the war most farm labourers were willing to give 10 hours of faithful work for a day's pay. The migration of labour during and after the war, by reason of enlistment or employment in cities or in large manufacturing plants, brought many farm labourers into contact with men who preach inadequate work as a duty. Many of the farm labourers were demoralized, and near large cities it became almost impossible to get an honest day's work at any price. For this reason although the figures in the present article indicate that the price of labour is about 50% more than before the war, the actual cost of labour is from two to three times as much as it was. This is a factor of great importance in all readjustments of the cost of farm products.

Farmers and Consumers.—There was little in the agricultural outlook in Dec. 1921 to encourage the farmers to plan even normal production in 1922, for corn was then selling at from 19 to 28 cents on the farms of North and South Dakota, Minnesota, Nebraska, Iowa, and Kansas; much of the 1920 crop remained unsold; and nearly all farm products were selling at much lower prices than in 1913, although both labour and the commodities the farmer had to buy were much higher. It was evident that farmers must retrench in every practicable way, hiring as little labour as possible; reducing the scale of farm operations as nearly as possible to the point where the farmer and his family could do all the work. They must burn corn or any other agricultural product for fuel, whenever the farm price of that product fell below the cost of equivalent coal, wood, gas, or oil—after adding to the price of such fuel, at the railway station or waterside, the cost of hauling the fuel to the farm and the agricultural products from the farm.

Much could be done toward reducing cash outlay by making each farm produce as much as possible of the food for the family. Much, also, might be accomplished by a system of community exchange. With good roads, automobiles and trucks every farm family should be provided with virtually all necessary food products without expenditure for products, freight or middleman's profit.

In respect of food this generation by reason of the ease and rapidity of communications and country road transportation is better able to develop community self-sufficiency than any previous generation. If there were a demand for home spinning and weaving machinery on a large scale, as there is on a small scale, for home knitting machines throughout the country, homespun clothing again would take its place on the farm. As has been said already, good roads, rural mail delivery, the telephone and the internal-combustion engine have removed practically all but one of the objectionable features which drove many from farm life. That objection is that farming does not yield as large a revenue in proportion to the capital invested and the intelligence, business ability, and enterprise possessed by the farmer, as do other business or professional careers. This must cease to be the case, or American farmers will not continue to produce food and clothing for the rest of the population.

There has been and will continue to be much discussion and agitation of this subject in the public press and on the floors of Congress. Some legislation had already been enacted by 1922 for the purpose of helping the farmer, and further measures were in prospect. It is doubtful whether any real headway can be made in solving the producers' problem until there is an actual and very severe shortage of food in the country. When this occurs, the farmers will obtain fair prices for their products, and may then be able to resume the operation of their farms at full capacity, and to take up the great agricultural problem of the future, which is the adaptation, adjustment and development of the fixed agricultural area of the United States, so that it may continue indefinitely to meet the constantly increasing demands of an increasing population.

(E. C. C.)

III. FINANCE

The movement of public expenditures and receipts in the United States during the decade 1910–20 presents as its most important aspect an instructive contrast between conditions of peace and those of war and readjustment. When the decade opened, education was the largest expenditure, taking all divisions of Government into account; and the financial operations of the state and local Governments were twice as large as those of the national Government. Expenditures, taxes and public debt, it is true, had all been increasing for some time both in the aggregate and *per capita*; but the wealth (expressed in money) of the country had more than doubled between 1900 and 1912, the average rate of the general property tax had decreased between 1902 and 1912, the Federal debt *per capita* was decreasing, and Federal expenditures *per capita* were lower between 1910 and 1914 than in 1908 and 1909. There was, of course, constant protest against rising taxes and "extravagant public expenditures," but the total tax burden was probably increasing less rapidly than wealth or income, and this was certainly true of Federal taxes. War changed all this. Education and the developmental functions yielded first place to military activities; Federal finance threw into the background state and city finance; reduction of the aggregate debt ceased and in less than two years of war the interest charge of the Federal Government alone had become greater than the entire cost of running the Federal

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Government before the war. The Federal Government's expenditures and revenues in peace, war and reconstruction are presented in Table I., in which it should be noted that the figures represent net expenditures and net revenues, the expenditures of each department being credited with the earnings of that department and the tax receipts being similarly reduced by the refunds allowed during the same period.

From 1910 to 1916, inclusive, the net expenditures of the Federal Government showed no striking tendency to increase, being only $35,000,000 greater in 1916 than in 1910. The net expenditures for the army and navy were only $23,000,000 greater in the fiscal year 1916 than in the fiscal year 1914, which closed so far as Americans knew to the contrary amid conditions of secure peace—a striking commentary upon the attitude of the Administration in power toward preparedness. Between 1917 and 1919, however, the net expenditures of the army and navy rose from $668,852,948 to $11,192,817,468. It is needless to add that this expansion checked the development of the civil functions. Even before the World War, expenditures for the army, navy, pensions and interest upon old war debt absorbed about two-thirds of the Federal expenditures, leaving less than one-third for the civil functions. But in 1920, at the close of the decade, the expenditures chargeable to war consumed three-fourths of the very much greater aggregate. The total expenditures for primary governmental functions, research, education and development, and for public works, representing the civil functions, were actually less *per capita* in 1919 ($2.21) than in 1910 ($2.24), the principal reductions coming in the expenditures for public works which amounted to $54,332,139 in 1919 as contrasted with $79,503,701 in 1910. In 1920, after the war, the expenditures for civil purposes rose materially; but considering the fall in the purchasing power of money, even the later and higher figures suggest decrease in the equipment, personnel and efficiency of the civil branches of the Government.

The *cost of the war* may be estimated with rough accuracy, defining such cost as the excess of the expenditures which actually occurred over the amounts which probably would have been expended had the war not taken place. The Secretary of the Treasury (*Annual Report*, 1920, p.105), assuming that expenditures on a peace basis during the three fiscal years 1917–9, would have been $1,000,000,000 a year and during the following fiscal year $1,500,000,000, estimated the net war expenditure to June 30 1920 at $33,455,000,000, and the net war-tax receipts, *i.e.* the excess of the annual tax revenue over the normal tax revenue of peace-times, at $10,703,000,000. On this basis, 32 per cent of the special war expense was paid from special war taxes. Mr. E. B. Rosa, in his authoritative analysis, *Expenditures and Revenues of the Federal Government*, makes a more careful estimate, for the four years 1917–20, of the "excess of expenditures over the estimated normal expenditures on a pre-war basis," and reaches a figure of $35,427,730,074, against which he places an estimate of the special war revenue, *i.e.* "the excess of revenue over the estimated cost of government on pre-war basis," $11,818,699,300. Mr. Rosa's estimate agrees with that of the Secretary of the Treasury in indicating that one-third of the special war costs were paid from special war revenues. In both cases loans to foreign Governments, $9,500,000,000 in round figures, are included in the war costs.

Federal revenues during the decade were revolutionized. At its beginning in 1910, customs supplied more than one-half the total receipts; and customs together with the duties on distilled spirits, beverages and tobacco produced more than 95% of the total net revenues. The income tax (special corporation excise tax) was then in the first year of its collection and yielded less than 4% of the total. By the end of the decade, customs and the old duties on alcoholic beverages were subordinate. In the year 1920 customs yielded less than 6%, and the combined duties on imports, distilled spirits, beverages and tobacco yielded only 14% of the total tax revenue; while the income and profits taxes produced $3,956,936,003 or nearly 70% of the total net tax revenue, which was large enough in this year of readjustment to meet the entire current cost of the Government and to create a surplus of more than $1,000,000,000. Other noteworthy developments of this decade from the viewpoint of revenue are found in the introduction in 1916 of the Federal estate or inheritance tax, the development of the excess-profits tax, the loss of one of the most important of the older taxes through the adoption of Federal prohibition, and the reëstablishment of the Tariff Commission. The most significant change, however, was the revolutionary readjustment of taxes by which a system of taxation, predominantly indirect and regressive, gave way to a system predominantly direct and progressive.

Public credit supplied during the war two-thirds of the revenue or receipts. Details concerning the management and yield of the huge war loans are given in the article LIBERTY LOAN PUBLICITY CAMPAIGNS. Here the subject can only be briefly treated in its connexion with the plan of the Government for the financial management of the war. That plan was based upon the policy of sedulously avoiding the use of Government paper money; of raising at least one-third (and, if possible, one-half) of the necessary revenue by taxation; of keeping the inflation which inevitably accompanies war to a minimum, by restricting "non-es-

TABLE I. *Average Annual Net Expenditures and Revenues of U.S. Government for 7 Pre-War Years, 3 War Years, and in 1920.* (*a*)

	Average 1910–6	Average 1917–9	1920
EXPENDITURES (net)			
Primary governmental functions	$ 97,718,290	$ 124,509,073	$ 224,110,594
Research, education and development	25,329,328	33,692,610	57,368,774
Public works	85,408,910	59,857,380	85,071,042
Army and navy	256,971,389	6,302,322,105	1,348,892,747
Pensions and care of soldiers	165,439,944	236,816,982	329,261,746
Obligations arising from World War (*b*)		1,205,255,174	1,634,695,094
Interest	23,605,213	115,853,240	920,131,128
Total expenditures (net)	654,473,074	8,078,306,564	4,599,531,125
REVENUE (net)			
Customs	273,486,931	181,403,815	296,274,230
Internal revenue	368,324,751	2,774,804,615	5,379,353,020
Tax on bank circulation	3,690,489	4,036,586	7,172,598
Post-office war revenue		55,489,500 (*e*)	4,913,000
Total revenue (net)	645,502,171	2,997,238,016 (*e*)	5,687,712,848
PUBLIC DEBT, LOANS AND TRUST FUNDS			
Public debt transactions (*c*)	−11,401,317	−8,085,631,219	1,184,098,321
Loans and trusts (*d*)	− 4,982,411	3,210,794,518	513,885,254

(*a*) Table adapted from E. B. Rosa, *Expenditures and Revenues of the Federal Government*, Table 14.
(*b*) Expenses of Railroad and Administration, Shipping Board and other special war activities.
(*c*) The minus sign indicates an excess of public debt receipts over public debt disbursements.
(*d*) Consists principally of seignorage in 1910–6; and of loans to European Governments in 1917–9 and in 1920.
(*e*) Post-office war revenue given as annual average for the two years collected, but averaged over three years, 1917–9, in computing the total.

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sential" commercial credit, encouraging subscribers to the Liberty and Victory loans to pay for them from current savings; and (in minor degree) by repressing unnecessary consumption through the adequate taxation of personal incomes and the use of luxury taxes. Financial preparation for a long war, perhaps of three years, was made, with due appreciation of the fact that in the early months the most effective contribution of the United States would take the form of generous supplies of goods and credit to the Allies. As stated by R. C. Leffingwell, Assistant Secretary of the Treasury, who more than any other one man guided the credit operations of the Government during the war:—

"The Treasury's war problem was to meet the financial requirements of the Governments of the United States and the Allies promptly and without stint, and to meet them so far as possible from the saved incomes of the people, avoiding avoidable inflation. These objectives must be pursued in such ways as would not interfere with, but on the contrary facilitate, the mobilization of the Nation for war purposes and the production and transportation of munitions."

As the principal credit instrument with which to achieve these ends, the Government used, for the most part, terminable bonds with moderate but adjustable maturities (in no case exceeding 30 years), partially subject to taxation, issued every six months from the beginning of the war to May 1919, at interest rates which because of the conversion privilege varied with the changing credit conditions but were always high enough to stimulate the instinct of saving, yet low enough to utilize fully the patriotic fervour of the people.

In order to avoid credit strain, with its demoralizing effects upon interest rates and business, the huge bond issues were preceded by practically monthly issues of short-dated tax and loan certificates, to be taken up by the payments for taxes or by the subscriptions to Liberty Bonds. When the war debt was at its peak, at the close of Aug. 1919, the gross debt amounted to $26,596,701,648 (or to $25,478,592,113, deducting the net balance in the general fund); of which short-time Treasury certificates constituted $4,201,139,050. As an essential part of the credit machinery, the Treasury adopted as particularly suited to the decentralized character of the country's banking system, upon which the burden of distributing the war loans fell, the device of "payment by credit," by which banks subscribing for Government loans held their subscriptions as a credit to the account of the Government until the Government called for the funds. This reduced the credit strain by preventing the concentration of funds in the Government coffers, and "developed the further advantage that in the difference between the rate borne by the securities and the rate charged on the deposit, banks found some compensation for their time, trouble and the loss of deposits, resulting from the sale of securities to investors" (Leffingwell). This method of payment by credit has been criticized both as paying huge sums to the banks for creating credit which could have been as easily manufactured by the Government itself; and also as productive of inflation. Neither charge will bear analysis. The banks lost rather than gained by the Government's absorption of the investment resources of the people and by the repression of "non-essential industry"; and the device checked rather than stimulated inflation. If the Treasury had actually drawn into the reserve banks and its own offices the proceeds of these great loans, not only would it have demoralized the money market and increased money rates, but after a period of agitation—perhaps panic—there would have been heavy calls for discounts upon the reserve banks and "upon the re-deposit of the proceeds of certificates, depositary banks would be put in possession of loanable funds. . . . It was better to make one bite of the cherry and to avoid the money strain and inflation which would have been inevitable if the money had been first drawn out of the banks and then re-deposited with them" (Leffingwell).

In its decision of the momentous credit questions arising during the war, the Government steered a middle course, avoiding the mistakes which characterized the Civil War financing in the United States and much of the European financing during the World War. One set of critics urged much greater reliance upon short-time debt. Another set urged long-time bonds, "sold over the counter," at interest rates high enough to keep the bonds at par when the inevitable post-war reaction set in. The Government took the intermediate course, utilizing but not abusing the patriotism of the people on the sound assumption that no rate of interest could have been sufficiently high to float these huge issues on a commercial basis alone. And its use of anticipatory short-time certificates was designed not only to prevent money stringency during the war, but to keep some pressing war debt current for extinguishment in the prosperous time which usually follows the termination of a great war. "No administration could have resisted the pressure for reduction of taxes and increase of expenditures if the war debt at its maximum of $25,300,000,000 had been funded, and it had subsequently appeared that taxes and salvage would more than meet current expenditures. The time to pay down a war debt is immediately after the war" (Leffingwell). With the depression that set in in 1921, the Government introduced successfully the device of selling notes running from three to five years along with the more temporary Treasury certificates. And the same middle course was taken, with the results already stated, between the proposals to exempt Government obligations entirely from taxation and to subject them to all Federal taxes at full rates; between those who counselled "conscription of wealth" and those who would have paid practically the whole cost of the war with credit devices of one kind or another. One mistake, the issue of Government paper money, was wholly avoided, and bank credit utilized in its place. But every effort was employed to draw the borrowings from actual savings and to get Government securities as rapidly as possible out of the banks into the hands of investors. These efforts succeeded; on June 1 1921 (according to reports from banks transacting over 40% of the commercial banking business of the country), less than $600,000,000 of the long-time debt of $15,271,000,000 outstanding, only $186,412,000 Victory notes (out of $4,022,000,000 outstanding) and $184,086,000 Treasury certificates (out of $2,572,000,000 outstanding) were pledged with these banks as security for loans and discounts.

The management of the credit operations of the war was not without its shortcomings. The preferential discount rate for loans secured by Government obligations may have been a mistake; perhaps, too, much use may have been made of bank credit and not enough use of taxation—particularly of taxes on the consumption of luxuries and on incomes of the moderately rich; and it seems unquestionable that, owing to inability to gauge the exact time and amount in which the subscriptions to the Liberty loans would be paid, there was an overlapping of Treasury certificates and of bond subscriptions, with the result that the Treasury balance throughout the war was unnecessarily large. But these errors and defects were of secondary importance. The smoothness and efficiency with which the credit machinery worked during the World War—particularly in contrast with its inefficient management during the Civil War—indicate that in essentials the credit policy of the Government was sound and its administration remarkably efficient. The response of the people to the call for bond subscriptions, the cheerfulness with which the heavy war taxes were borne, and the absence of even a temporary breakdown in the credit mechanism with which the war was financed, were all admirable.

State and local finance were affected in unexpected ways by the war. At the beginning of the decade under review, state Government in particular was undergoing an unusually rapid expansion; and both state and municipal expenditures were increasing nearly twice as rapidly as those of the Federal Government. The tax burden, in the case of the state and local Governments, was increasing but not so rapidly as expenditures; increasing deficits were the rule; and the public debt both in total amount and *per capita* was increasing. The situation at the beginning of the decade and the principal financial movements throughout the decade are suggested in Tables II. and III. It should be noted that the Federal expenses or cost payments in Table II. do not include payments made for the purchase of obligations of foreign Governments; and that the *per capita* statistics quoted in Table III. represent net expenditures and revenues after deduction of working credits and tax refunds.

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TABLE II. *Governmental Cost Payments*[1]

Year	States		United States		Cities having a pop. of over 30,000	
	Total	*Per capita*	Total[2]	*Per capita*	Total	*Per capita*
1919	$635,370,153	$6.05	$15,740,132,791	$149.78	$1,202,323,639	$34.67
1918	561,000,635	5.42	9,312,169,079	89.16	1,144,629,589	33.35
1917	513,063,487	5.04	2,405,932,009	23.40	1,081,865,678	32.53
1916	505,399,448	5.05	1,048,225,180	10.36	1,043,594,297	32.34
1915	490,707,827	4.99	1,047,834,967	10.44	1,057,125,696	33.92

[1] Bureau of Census, *Financial Statistics of States*, 1919, p. 30.
[2] Amounts for the United States represent the total payments of the United States less payments for investments (consisting principally of obligations of foreign Governments), payments for reduction of the public debt, and the excess of national bank-notes retired over deposits for their retirement.

TABLE III. *Net Expense and Tax Revenue, Per Capita, for All State Governments and for Municipalities Having a Population of over 30,000: 1910–9.*[1]

Year	States		Municipalities having a pop. of over 30,000	
	Per capita net expense	*Per capita* tax revenue	*Per capita* net expense	*Per capita* tax revenue
1910	..[2]	..[2]	$25.13	$21.64
1911	..[2]	..[2]	26.04	21.76
1912	..[2]	..[2]	26.06	22.32
1913	..[2]	..[2]	26.5	22.16
1914	..[2]	..[2]	..[2]	..[2]
1915	$4.11	$3.74	27.63	23.16
1916	4.10	3.67	26.12	23.84
1917	4.00	4.06	26.10	24.82
1918	4.25	4.48	26.55	25.14
1919	4.73	5.06	27.48[3]	27.22[3]

[1] From E. B. Rosa, *Expenditures and Revenues of the Federal Government*. Tables 18, 19.
[2] Data not available.
[3] Computed and inserted by the writer of this article.

It is evident from the tables that the financial operations of the state and local Governments were affected by the events of the war. That the expansion of their activities would be checked, was to be expected; but that the state and local Governments in the face of the heavy Federal war taxes should seize the occasion to adopt or approach the policy of "pay as you go" was, perhaps, not to be expected. Nevertheless this has taken place. City expenditures *per capita* were not only less in 1919 than in 1915, but the tax revenue which was seriously deficient in the earlier year had in the later year increased almost to the point of meeting governmental costs. And beginning with 1917, the receipts of the state Governments as a whole have exceeded their expenses. In 1919, for instance, 31 states "realized enough from revenue to meet all their payments for expenses, interest and outlays and to have a balance of $50,192,314 for paying debt" (U.S. Census Bureau, *Financial Statistics of States* 1919, p. 30). In 17 states there was a deficit aggregating $15,378,246. Much of the economy has been achieved by discontinuing public works or improvements or refraining from those contemplated, and the cost of those public works which have been undertaken has in increasing degree been met from tax revenue rather than the proceeds of loans. In 146 of the principal cities, for instance, the *per-capita* payment for capital outlays in 1918 was only $7.51 as contrasted with $10.18 in 1909. Despite opinion to the contrary, Government ownership by states and cities has not expanded during recent years. Public-utility enterprises have developed less rapidly than other branches of the Government and far less rapidly than private business. According to official statistics, these public enterprises yield a substantial profit over the costs incurred, more than three-fourths of the net earnings from these sources being credited to the water departments owned by municipal Governments.

Looking to the revenues of the state and local Governments, the general property tax was still preëminent in 1921. Nearly one-half of the total tax receipts of the states and nearly nine-tenths of those of the cities, were derived from this source. Among the states, the relative importance of the property tax was slowly declining; but among the cities, in recent years it had slightly increased. Among the state Governments, taxes on business had been rapidly increasing and yielded more than half as much as the property tax itself. With the repression of public improvements, due to the war, both the absolute and relative yield of special assessments had fallen off. In general, the drain upon the national income created by Federal taxes and loans had forced upon the state and local Governments measures not only of economy but of parsimony, and it is probable that their efficiency had correspondingly suffered.

Budget Procedure.—Methods of financial administration made substantial progress during the decade under review. The old and generally inefficient "state boards of equalization" had in many states given way to central tax commissions charged with the power and duty not only of securing greater equality in the distribution of the tax burden but of supervising the work of local assessors, administering the more important corporation taxes and usually also the state inheritance taxes. The work of the property assessors had noticeably improved in recent years, particularly in the cities. In a majority of the states, some more or less effective budgetary system had been introduced; and in an increasing number of commonwealths the county and local divisions were being required to follow a prescribed budgetary procedure. Tax limit laws, designed to check local expenditures, had in several states been adopted or revived in improved form; and their effectiveness was being studied with great interest by those interested in governmental economy and efficiency. In the state Governments administrative progress had temporarily taken the path of centralization, and the events of the war had greatly centralized the fiscal machinery of the Federal Government. So far as the tax machinery of the Federal Government is concerned, it is apparent that despite heroic efforts the burden of the war taxes had been too heavy to permit its work to be kept current; and here, at least, it was generally conceded that the path of improvement lay in decentralization. The crowning administrative events of recent years had been the self-denying ordinance adopted by the House of Representatives, by which in the future the old appropriation committees would be combined in a single committee on appropriations, and the introduction of a national budget system, by the passage of the Budget and Accounting Act of 1921.

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IV. TAXATION

The movement by which taxation has supplied, with the passage of time, an increasing share of the public revenue of the United States, was accelerated by the events of the decade 1910–20. At its beginning, according to the general financial survey of the national, state and local governments made by the Bureau of the Census for the year 1912–3, public expenditures were met to the extent of approximately 5% from loans, 70% from taxes, 4% from special assessments, and 21% from interest, rentals, departmental or commercial earnings, and miscellaneous sources. During the World War, borrowing took first place, and probably not more than one-half of the aggregate public expenditure was met by taxes. But in the fiscal year 1920, the Federal Government began actively to reduce its short-dated debt; and in that year Federal, state and local revenues were larger than expenditures. Of these revenues (despite the large amounts realized by the Federal Government from salvage and other non-tax sources) taxes supplied over 80% of the total. From the financial standpoint—as a source of revenue compared with

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taxation—Government ownership is not gaining in importance. In the states and cities, the earnings of public service enterprises shrank in relative, though not in absolute, importance during the decade; and in the national budget, postal earnings, Panama Canal tolls and similar receipts have been dwarfed by the huge tax levies necessitated by the war. Federal taxes, which before the war were of smaller amount than city taxes, became after it larger than all state and local taxes combined; and the leading Federal tax, the income tax, displaced the property tax from its old position at the top of American public receipts. In the fiscal year 1913, property taxes supplied over one-half of the revenue receipts of all divisions of Government, while the yield of income taxes was comparatively insignificant. In the fiscal year 1920 property taxes produced less than one-sixth, while income and profits taxes produced at least one-third and possibly as much as 40% of the total taxes collected in the United States.

Federal taxes at the beginning and end of the decade 1910–20 are contrasted in Table I. which portrays statistically the supersession of customs duties by the income and profits taxes; the beginning of the decline of the tax on alcoholic beverages caused by prohibition legislation—a decline which is disguised in the table by the inclusion of new taxes on non-alcoholic beverages, introduced since the beginning of the World War; the introduction of the Federal estate or inheritance tax; and the multiplication of internal taxes on articles of common consumption. In the past it has been customary to contrast "direct taxes" such as income and inheritance taxes, which are supposed to rest in the main where first imposed, with "indirect taxes" such as those on tobacco and beverages, which, however collected in the first instance, are supposed to be paid eventually by the producer or consumer. Interpreted with reservations, the distinction is serviceable. It will be noted that in 1910 customs, liquor and tobacco taxes—regressive taxes on consumers—yielded over 95% of the total tax revenue; while in 1920 the same taxes augmented by similar taxes on "luxuries," attendance at amusements, and transportation and insurance, produced only 25% of the total. Progressive income, profits and inheritance or estate taxes produced over 70% of the total in 1920. It is obvious that the war revolutionized the character of the Federal tax system in the direction of what has been called "liberal democratic finance." However, in July 1921 the income and profits taxes were falling off more rapidly than the indirect taxes on consumption, owing to business depression; there was a recrudescence of protectionism, and a strong movement to introduce a general sales tax. It seemed probable, at that time, that for the fiscal year ending June 30 1922 indirect taxes would supply from 30% to 40% of the total tax collections. The "consumer" would be thus paying no small share of the national tax bill.

State taxes and other receipts during the period 1915–9 for which general statistics could be obtained are analyzed in Table II. The net revenue receipts of all states for the year 1919 amounted to $670,183,918, and the net governmental-cost payments to $635,370,153, from which figures the general meaning of the percentages given in the table may be inferred. In arriving at the "net revenue receipts," there have been excluded the proceeds of bond issues and of sale of investments or supplies, refunds returned by reason of error or otherwise, and bookkeeping items representing transfers between governmental departments. The term "net governmental-cost payments" is applied to actual payments for expenses, interest and outlays, less counterbalancing payments and receipts, refunds received on account of error or otherwise, and departmental transfers. By "outlays" is meant capital outlays for permanent property. With these explanations, the more important developments in the field of state taxation and finance during the latter half of the decade may be inferred from Table II. Taxes increased in the aggregate from $364,543,797 in 1915 to $527,819,167 in 1919, but the relative importance of taxes among the total receipts decreased slightly. As a source of state revenue, property taxes were declining in importance, while business and other licence taxes were increasing. Earnings of public enterprises, together with rents, interest and charges for highway privileges—commercial earnings in their general character—were comparatively speaking stationary. For the three years 1917–9 state receipts exceeded state expenses by a substantial margin.

TABLE I.—*Tax revenues of Federal Government: 1920 and 1910.* (From E. B. Rosa, *Expenditures and Revenues of the Federal Government.*)

	1920	1910
Income and excess profits	$3,956,936,003	$20,959,958(a)
Distilled spirits and beverages	197,332,105	208,601,600
Tobacco	295,809,355	58,118,457
Transportation, insurance, etc.	307,769,841	—
Luxuries, automobiles, candy, furs, etc.	270,971,064	—
Estate or inheritance	103,635,563	—
Capital stock of corporations, brokers, etc.	95,141,732	—
Stamps on legal documents	81,259,365	—
Admissions to amusements	89,710,525	—
Miscellaneous	9,014,694	2,277,204
Total internal revenue	$5,407,580,251	$289,957,220
Customs—net revenue after refunds, etc.	296,274,230	323,519,307
Tax on national bank circulation, net	7,172,598	3,333,011
Postal war revenue	4,913,000	—
Total tax revenue	$5,715,940,080	$616,809,538

(a) Corporations only—excess tax measured by net income.

City taxes and the relative importance of other classes of municipal receipts are analyzed in Table III., which is based upon the revenue receipts of 146 of the larger cities of the United States for which comparative statistics are available for a period of 17 years. The net revenue receipts of these cities increased from $439,126,723 in 1903 to $1,103,665,750 in 1919; and the net governmental cost payments increased from $514,189,206 to $1,113,599,879 in the same interval. The net revenue receipts thus increased 151% while the cost payments increased less than 117%. In 1903 the receipts constituted only 85·4% of the expenditures, but in 1919 the receipts amounted to more than 99% of the expenditures. There is thus no foundation for the current statement that because they may issue bonds "free from taxation," American cities have been led in recent years to borrow unduly.

Table III. describes in figures the more significant movements among city taxes and receipts during recent years; the material increase in the relative importance of the general property tax, the decline of the liquor taxes, the shrinkage in the use of the special assessment since the outbreak of the war, and the slight decrease in the importance of earnings of public service enterprises. Expressed in absolute figures, the total net revenue receipts rose from $21.14 *per capita* in 1903 to $35.26 in 1919; receipts from the general prop-

TABLE II.—*Relative importance (percentage distribution) of net revenue receipts and net governmental cost payments of all states: 1915–9.* (From Bureau of the Census, *Financial Statistics of States*, 1919, p. 33.)

Year	Net revenue receipts: Per cent. obtained from:— Taxes. Property	Special	Poll	Business and non-business licence	Special assessments and special charges for outlays	Fines, forfeits, and escheats	Subventions, grants, donations and pension assessments	Earnings of general departments	Highway privileges, rents, and interest	Earnings of public service enterprises	Per cent. required for meeting:— Expense	Interest	Per cent. available for outlays and other purposes	Per cent. of net governmental cost payments represented by:— Payments for:— Expenses of general departments	Expenses of public service enterprises	Interest	Outlays	Net revenue receipts
1919	50·9	2·0	0·3	25·5	0·7	0·4	2·6	12·3	4·8	0·5	81·3	2·9	15·8	85·3	0·4	3·1	11·2	105·5
1918	50·8	2·1	0·4	25·5	0·5	0·4	2·2	12·4	5·2	0·6	81·5	3·2	15·3	84·4	0·4	3·4	11·8	104·1
1917	53·5	2·6	0·4	22·5	0·6	0·4	2·1	12·0	5·3	0·5	82·6	3·3	14·1	83·0	0·4	3·3	13·2	101·1
1916	55·5	1·7	0·5	21·1	0·6	0·4	2·9	11·5	5·3	0·5	87·6	3·3	9·1	79·8	0·3	3·0	16·8	91·5
1915	58·7	0·5	0·7	20·6	0·5	0·4	1·6	11·1	5·3	0·6	83·9	3·2	12·9	77·2	0·4	2·9	19·4	92·5

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erty tax increased from $12.98 *per capita* in 1903 to $23.29 in 1919; and the earnings of public service enterprises rose from $2.42 *per capita* in 1903 to $3.61 *per capita* in 1919. As stated above, the relative importance of the last class of receipts declined slightly during the period under review.

TABLE III. *Relative importance (percentage distribution) of net revenue receipts of 146 cities for specific years: 1903–19.*

(From Bureau of the Census, *Financial Statistics of Cities*, 1919, p. 55.)

Year	The general property tax	Taxes on the liquor traffic	Licence taxes other than on the liquor traffic	Other taxes	Special assessments	Subventions, grants, gifts, donations and pension assessments	Earnings of public service enterprises	Other revenues
1919	66·0	2·8	1·5	3·3	5·6	4·1	10·2	6·4
1917	64·3	3·6	1·5	2·3	7·8	4·0	9·9	6·6
1915	62·4	4·4	1·4	2·0	8·5	4·2	10·0	6·9
1913	62·4	5·0	1·5	2·0	8·2	4·5	9·9	6·6
1911	61·9	5·2	1·5	2·0	8·4	4·6	10·6	5·8
1909	61·0	5·9	1·5	2·3	8·4	4·9	10·9	5·3
1907	59·4	6·6	1·5	2·5	8·2	4·8	11·2	5·8
1905	61·5	5·9	1·5	2·2	7·9	4·7	11·4	5·0
1903	61·4	6·3	1·3	2·2	7·6	4·3	11·5	5·5

The most important aspects of American taxation during the decade 1910–20 are those connected with the rates and the aggregate burden of taxation. Direct taxes were pushed to a height thought to be impossible before the war. The maximum rate under the Federal income tax is 73%, and this is supplemented in some places by a state income tax which, in Wisconsin for instance, exceeds at the maximum 13 per cent. Corporations have been subject to equally drastic taxes. The war profits tax for 1918 was 80% on profits in excess of a deduction which in the average case only slightly exceeded 10% of the invested capital; and corporations paid in addition a 12% income tax, a capital stock tax, and state or local taxes which frequently exceeded (in theory, at least) 2% of the capital value of the property of the corporation.

In addition there were miscellaneous Federal taxes important enough to have produced over fifteen hundred millions of dollars in the year 1920. This unprecedented taxation placed upon business a serious burden, brought about a complexity of law and procedure hitherto unknown in the United States, and threw upon the administrative machinery tasks difficult enough to cause grave congestion and delay. In July 1921 there was a systematic effort, particularly among business men, to replace the direct taxes in large part by a flat tax at a low rate (1% was usually recommended) upon all sales of goods, wares and merchandise. It was urged primarily in order to "simplify" the tax system, to take the place of the excess profits tax and reduce the rates of the income tax. Its opponents attacked it as an attempt to shift the burden of taxation from those who had income or profits, and were thus "able to pay," to the general class of consumers; and asserted that it would discriminate in favour of the "combination" and against the independent or single-process business. In the United States this controversy assumed an importance worthy of historical record. It marked a reaction from the high tide of direct taxation which during the war supplied more than three-quarters of the entire tax revenue. It was also worthy of record that in the midst of the industrial depression prevailing in 1921 there was no discernible movement in favour of meeting the expenses of Government by the issue of paper money or by borrowing.

In state and local taxation real progress toward the solution of the more important problems was made during the decade. The gradual abrogation of the old "iron rule of constitutional uniformity" (taxation of all classes of property at the same rate) continued. Gradually, but without material setback, law and practice were being modified so as to adapt the general property tax to the peculiar needs of the different classes of property or business, such as forest land, the mining industry, and public service enterprises. Low rates were in a constantly increasing number of jurisdictions applied to money and securities, which go into hiding if an attempt is made to tax them at the rate applicable to real estate and tangible property; or this class of intangible property was exempted from the property tax and subjected to special taxes such as the mortgage registry tax, or the income tax. With three exceptions all American states employ some form of the inheritance tax. With the Federal Government imposing an estate tax which rises to 25% where the net estate exceeds $10,000,000; and the state Governments employing several mutually inconsistent bases of taxation, for example, taxing the transfer of all corporate shares owned by resident decedents and the transfer of all corporate shares in domestic corporations owned by non-resident decedents, problems of double or multiple taxation were becoming particularly serious; and an almost unbearable situation promised to arise unless in some manner state and Federal laws could be made both uniform and consistent. Automobile and hunting licence taxes were rapidly increasing in importance, and together yielded approximately as much as the state inheritance taxes (about fifty million dollars a year). In recent years there has been a marked improvement in the administration of state and local taxes, particularly in the work of assessment. Much of this is attributable to the development of state tax commissions charged usually with the assessment of state-wide corporations, the administration of the income tax where such a tax is in force, the equalization of assessments among local districts, and the supervision of the work of the county or local assessors. It is worthy of note that in recent years the movement for the segregation or separation of state and local taxes has abated. In 1921 there was a marked tendency towards centralization of administration and the collections by state officials or under state supervision of taxes which are later returned in part to the local divisions of government.

BIBLIOGRAPHY.—See H. C. Adams, *Science of Finance;* C. C. Plehn, *Introduction to Public Finance;* E. R. A. Seligman, *Essays in Taxation;* Bureau of the Census, *Wealth, Debt and Taxation* (1913); and the annual publications *Financial Statistics of States* and *Financial Statistics of Cities*. For state and local taxation, see in particular the annual *Proceedings* and the monthly *Bulletin* of the National Tax Association. (T. S. A.)

V. SOCIAL AND WELFARE WORK

The 20th century has seen an extraordinary development in the field of social-welfare work in the United States. The number of persons interested—whether as volunteers, serving on boards and committees, or as contributors of financial support, or as salaried employees—has multiplied manyfold. Appropriations from taxes, annual contributions for the current work of privately supported organizations, and endowments by men and women of wealth, have increased enormously. New forms of social work have come into existence, and the older forms have improved their methods, as well as extended their scope. Principles have been formulated; standards have been set up; training courses have been established; general instruction has been introduced into the colleges and universities, and even to some extent into the secondary schools; a technical literature has been produced; intelligent discussion of social problems in the popular periodicals and the daily press has become common.

Social work in the United States displays certain marked characteristics which distinguish it from corresponding activities in other countries. (1) There is greater variety. In the field of private charity individual initiative has had free play, little hampered by legislative restrictions or by precedents, and comparatively little by the control of church authorities. The administration of public charitable and correctional institutions and welfare legislation are not, as in England or France, national undertakings, but for the most part fall under the jurisdiction of the states, and even within the states the bulk of responsibility lies with local authorities of city, town or county. This situation has favoured experimentation. (2) The relative amount of social work undertaken on private initiative, as compared with that done by the State, is far greater than elsewhere. (3) In private philanthropy, the relative amount carried on under religious auspices is far less. (4) Throughout the whole system of charity and correction, both public and private, there is more hope. In comparison with older countries, there has been little poverty and degeneracy in America at any period. Even in the oldest cities there is no pauper class. (5) In the United States public and private relief, charity and correction, the care of sick, criminal or indigent individuals, and the efforts to improve housing, to provide facilities for recreation, and so on, are coming to be regarded as component parts of a complicated system, not as separate and distinct departments in the economy of the nation. (6) Finally, there is in American social work something of the readiness to "scrap" machinery, processes and plants, which is characteristic of American industry. Indeed, the ultimate object of all social work, from the American point of view, is to make social work unnecessary; and every social agency which is efficiently accomplishing its immediate purpose is more or less consciously working for its own extinction. Social work, therefore, is constantly changing.

Legally, the responsibility for the relief of the poor in America rests ordinarily upon their immediate relatives. Children and

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in some states grandchildren, parents and in some states grandparents, even brothers and sisters, may be compelled by law to furnish, if able, the necessaries of life to the indigent. The laws in American states do not uniformly recognize what in England is called the "right to relief." In New York, for example, an able-bodied man who has no visible means of support and no regular occupation is not, under the law, a "poor person," but is a "vagrant." On his own confession before a magistrate he may be accepted as a public charge, but technically he is punished, not "supported." Harsh as the law sounds when thus stated, it corresponds to the fact that for able-bodied adults in America there is always practically some alternative to starvation besides vagrancy.

Public Relief.—Although a legal right to relief is not formally recognized, there is a tacit assumption that any kind of misfortune which threatens life or physical well-being should be provided for; and that if relatives, friends, or voluntary agencies do not make such provision, the State must, or at least should, do so in some way (*see* PUBLIC ASSISTANCE: section *United States*).

By the end of the 19th century public opinion had recognized that the almshouse was not a suitable place for tramps, vagrants, and disorderly persons; for children; for the insane, feeble-minded, epileptic, blind, and deaf; for confinement cases; cases of acute illness and contagious disease; but that these should be provided for in special institutions. These theoretical conclusions, however, were by no means completely or uniformly embodied in practice. In many of the newer states, with no correctional institutions except gaols and State prisons, the courts still habitually committed certain minor offenders to the almshouse. Seventeen states in 1900 still maintained their dependent children in almshouses. The greatest progress towards specialized care had been made in the case of the insane, but in most of the states institutions for them were overcrowded, while in many a certain number of insane were still to be found in the county poorhouses or even in the gaols; and the horsewhip was still advocated by some of their official guardians for quieting the violent. State schools for blind and deaf children had been generally established, but there was practically no provision for the instruction of persons who became blind, or deaf, or otherwise disabled in adult life. There were only 26 public institutions for the feeble-minded in the country, and special provision for epileptics was rare. Even in so advanced a state as New York there were about as many "idiots," feeble-minded, and epileptic in the almshouses as in the special institutions for their care. There were still many large cities and towns which had no general public hospitals; confinement cases were generally admitted to the almshouse, and as there was almost no public provision, and little under private auspices, for the care of consumptives, many of these also were found in the almshouses. Except in certain northern cities and in some of the southern states, outdoor relief was generally given by local public officials in the form of groceries, fuel, clothing, and sometimes in money. This and the undifferentiated almshouse were still the public provision available for the majority of dependents.

Private Philanthropy.—Parallel with the various public agencies were many which had been established, and were conducted, under church auspices, or by incorporated societies or less formal associations of private individuals. The private institutions which existed in 1900 were chiefly orphan asylums, hospitals, and homes for the aged. Most churches gave charitable assistance on occasion to their own members, and the larger ones had a Ladies' Aid Society, or a St. Vincent de Paul Society, or some other agency for the purpose. In the cities there were "bread lines" and "soup kitchens" and temporary shelters for the homeless. In many places there were non-sectarian general relief societies, such as the New York Association for Improving the Condition of the Poor, and in about 100 cities there was a Charity Organization Society, or Associated Charities, or United Charities. There were also many societies for assisting certain classes in their own homes—widows, for example, or members of a particular nationality; or for giving some particular kind of help, such as legal aid. There were 161 societies for the protection of children from cruelty and neglect; and a considerable number of societies performing one or more of the functions of the pioneer Children's Aid Society of New York—to find homes in families for homeless children, to conduct lodging-houses and reading-rooms for newsboys, and in other ways to promote the welfare of city "waifs." "Fresh-air societies" existed to provide outings for city children. "Visiting nursing associations" had demonstrated the value of such service, and some 40 to 50 had been organized, with an aggregate force of not more than 140 nurses for the entire country. In the larger cities and industrial centres day nurseries had been established for the convenience of wage-earning mothers and to reduce the number of children who were candidates for institutional care.

Treatment of Criminals.—Reformatory schools for juvenile delinquents, which had naturally come into existence much earlier than reformatories for adults, were to be found by 1900 in four-fifths of the states—more of them for boys than for girls, even in proportion to their numbers as delinquents. Juvenile courts were at the beginning of their development. Probation also was only beginning to receive attention. Growing out of the privilege of the court to suspend sentence after conviction, it had been the practice in connexion with adult offenders throughout Massachusetts for 20 years, and was established by statute in New Jersey in 1899, but had not spread farther. As applied to children, it had not yet been tried. Probation, indeterminate sentence, reformatory institutions, special courts for children, and even specialized treatment for women and children offenders, were still novelties. Fixed sentences, determined by the nature of the offence, without reference to the needs of the offender, were the rule; and they were served for the most part under conditions dictated by the theory of retribution rather than of reformation. As the characteristic charitable institution of America is the town or county almshouse, so the characteristic correctional institution was and is the county gaol and town "lock-up." Generally small, with poor sanitation, frequently "fire-traps," they are described by a committee of the National Conference of Charities and Correction in 1900 as "foul dens, infested with vermin, reeking with dirt and filth." Boys and girls arrested for a trivial first offence, professional criminals, prostitutes and innocent persons awaiting trial were "herded together" in idleness, dirt, and bad air.

State Supervision.—To insure a certain standard in the conduct of public charitable and correctional institutions, state boards had been established in over half the states. These were of two main types: (1) advisory boards, with authority to inspect, report, and make recommendations, relying for their influence chiefly on the power of publicity; and (2) boards of control, with full executive powers and executive responsibility. The former type was considerably in the majority.

Preventive Philanthropy.—Of "preventive philanthropy," or "constructive social work" there was very little at the beginning of the 20th century. Interest in providing playgrounds and small parks in congested districts and public baths had been growing for several years. The New York Tenement House Committee had begun work in 1899, and was laying the foundations of the modern housing movement. The Consumers' League had exposed the horrors of sweat-shop work, and was preparing the way for a general concern about industrial conditions. But the conspicuous educational agency at this period was the social settlement. Beginning with the Neighborhood Guild on the lower east side of New York City, the number of settlements had increased to over one hundred.

Twentieth-Century Developments.—One of the ideas which became dominant among social workers early in the 20th century was that "prevention is better than relief." A second, in the picturesque phrase of Jacob A. Riis, was that "a man cannot live like a pig and act and vote like a man." Both these ideas grew out of the experiences of men and women who were engaged in work for the relief or the reformation of individuals, or who were living among the poor in social settlements. Out of these ideas naturally developed the organized social movements

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which are characteristic of contemporary American philanthropy. Conspicuous among them are the movements for the prevention of tuberculosis, for the diminution of infant mortality, to promote the health of children, for the control of cancer, for the reduction of venereal disease, for the prevention of blindness, to abolish extortionate charges for loans secured by salaries and pawnable property, to promote wholesome recreation, to diminish child labour, to further industrial education, to advance the interests of the negro, to reform criminal law and procedure, to prevent insanity, to improve housing conditions, to improve and standardize labour legislation.

Each of these movements is represented by a national organization—some of them by several—and in most of the cases a large number of local societies or committees also exist, more or less closely affiliated with the national body. Their central feature is educational propaganda, based on the study of facts. Millions of dollars were spent to this end in the two decades, 1900–20, and remarkable ingenuity was used in devising effective methods. Simple "literature," presenting clearly the essential facts (about the nature of tuberculosis, for example, and the precautions which should be taken), printed in alluring style and translated into many languages, photographs, lantern slides, posters, motion pictures, standardized exhibits; monologues by clowns, plays, lectures to use on the phonograph; Christmas seals; a press service supplying material to newspapers all over the country; a "tuberculosis day" or a "child labour day" in the churches and in the schools; lectures and motion pictures at county fairs; travelling exhibits touring the countryside—such are some of the methods in use.

Research and Surveys.—Another result of the interest in prevention and in underlying causes was to stimulate research into social conditions. The new organizations which have just been mentioned were obliged to begin operations by collecting data. Charity organization societies, settlements, and others among the older philanthropic agencies, began to delve into their records, or into their unrecorded experiences, for knowledge about social conditions. Several heavily endowed "Foundations" were established—notably the Russell Sage, the Rockefeller, and the Carnegie—with research as one, if not the primary, object. For about a decade, beginning about 1902–4, many studies were made. In 1907 the "Pittsburgh Survey" was undertaken by the committee in charge of the publication then known as *Charities and the Commons* (now *The Survey*), with financial support from the Russell Sage Foundation, and with coöperation from many of the social and sanitary movements of the country and from many citizens and organizations of Pittsburgh. It was an attempt to present a bird's-eye view of the conditions in an industrial wage-earning centre. This survey, published later in six volumes, had immediate practical results in Pittsburgh itself. It had a wider influence—because of the dramatic prominence assumed in it by industrial accidents, the twelve-hour day and the seven-day week—in impressing on America the evils of overwork and of the outworn theory of employers' liability. It also established the "social survey" as a method of research. There have been only one or two other surveys equally ambitious, notably one of Springfield, Ill., conducted by the Russell Sage Foundation's Department of Surveys and Exhibits; but less comprehensive surveys have been made under various auspices in many cities, and although this method has at times been absurdly applied, it has done a great deal to establish the sound principle that plans for improvement should be based on an understanding of actual conditions.

Reaction on Relief and Correction.—The New York Charity Organization Society enlarged its activities (1897–1905) by establishing a Tenement House Committee, a committee on the prevention of tuberculosis, a committee on criminal courts, a school for the training of social workers, and the weekly journal already mentioned, *The Survey*. Other societies created similar committees, or undertook other educational work as an adjunct to their original function. All these new activities, in turn, had a reflex influence on the older forms of social work. As the idea of prevention gained ground, those who were engaged in the relief of the poor found their task growing more complex. In particular, they found themselves obliged by the logic of their new knowledge to examine into the health of each member of the family, to see that physical defects in children were corrected, that the family diet was suitable and sufficient, that the home was decently sanitary, that incipient physical and mental troubles were properly treated; to make it possible for children to stay in school at least as long as the law required, and preferably beyond that age; for mothers and fathers who were ill to have adequate medical treatment and convalescent care; and to supplement the income, if necessary, sufficiently to secure these essential conditions. Hospitals and dispensaries came to see the connexion of their institutions with the homes of their patients, and "hospital social service" was devised. Provision for the insane, for the tuberculous, for delinquent children and adults, was extended in both directions—to reach them at an earlier stage of their difficulties and to watch over them after discharge. Prevention of infant mortality led back to prenatal care and instruction of mothers. Rehabilitation became the conscious goal in philanthropy and correction.

Training Schools.—The Summer School of Philanthropy, begun in 1898 by the Charity Organization Society of New York, was expanded in 1903–4 into a two-year course of special training for graduate students and persons who had had the equivalent of a college course, with instruction which included both study of principles and practice and which was recognized by Columbia University as of graduate standard. Within a few years similar schools, affiliated more or less closely with educational institutions, but, like the New York school, owing their existence to social workers, were established in Boston, Chicago, St. Louis, Philadelphia, and Richmond, while instruction on the same general plan was introduced in a considerable number of colleges and universities. By 1920 such training was offered by most of the leading educational institutions of the country, either as graduate or undergraduate work in the departments of the social sciences. No new independent schools have been established for a decade or more, and one of the most important of them (the Chicago School of Civics and Philanthropy) has recently (1920) been discontinued on the creation of a Graduate School of Social Service Administration in the university of Chicago. Whether or not social work has become a "profession" is a question of merely academic interest, but it has become a recognized occupation, engaging large numbers of men and women with high qualifications, and offering salaries which compare favourably with those available in the teaching profession and the ministry.

Formulation of Standards.—From their study of methods social workers were led to formulate standards, and this has been done with special success in matters of legislation. The Uniform Child Labor law, prepared by the Commissioners on Uniform State laws of the American Bar Association and adopted by the National Child Labor Committee, and the essential features of a Workmen's Compensation law as advocated by the American Association for Labor Legislation, are conspicuous examples, to the influence of which the statute books of most of the states bear witness. National leagues of societies engaged in similar work have been organized and have promoted uniformity of methods in their several fields. Aside from those which are purely legislative, the standards which have had the greatest influence are those formulated by the White House Conference on the Care of Dependent Children, held by invitation of President Roosevelt Jan. 25–6 1909, and by the Conference on Child Welfare Standards, held under the auspices of the Federal Children's Bureau 10 years later. The unanimous recommendations of the White House Conference were adopted as a *quasi* creed or constitution by the child-welfare workers of the country. The Children's Bureau Conference, held in 1919, at the close of the "Children's Year," had a far wider scope. It considered the essentials to child-welfare from every point of view, and drew up minimum standards for children entering employment; for the protection of the health of children and mothers and for the protection of "children in need of special care."

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Coördination.—In recent years social workers have developed a new sense of the interrelations of social agencies. As affecting case-work, this has showed in an increased appreciation of the idea of registration which had been one of the cardinal principles of the charity organization movement. Under the new name of "confidential exchange" or "social service exchange," there has been established in the leading cities a central record of the families known to the various social agencies, so that each society may learn which other agencies may be, or have been, interested in any particular family and may consult with them. Furthermore, social workers began to think of particular agencies and particular methods as elements in the community's equipment, to consider what place each one should occupy, what its appropriate function was, and what was needed to supplement it. In other words, they began to make "programmes": for a comprehensive campaign against tuberculosis; for a charity organization society in a small town; for an adequate system of care for the insane; for State legislation on behalf of children—"children's codes," as they are called, presenting a harmonized plan of desirable laws; and so on. The national associations in the different educational movements not only outlined in a general way the elements in a "campaign" against the particular evil of their concern, but also suggested concrete programmes for local organizations. Councils of social agencies have been organized in some cities to promote mutual understanding and the development of a community programme, while the financial federations which have been developed for joint raising of funds have, as an incident to their main purpose, perhaps been the strongest influence of all in this direction. Since the World War it has become obvious that there is need for coördinating the work of the national agencies also.

Financial Federations.—The financial federations bid fair to establish themselves as an integral feature of social work in America. Before the end of the 19th century bureaux of advice and information had been created by the charity organization societies in several of the large cities, supplying information about organizations and individuals and appealing for contributions. Beginning with Cleveland about 1900, the chamber of commerce in various cities had established a "charity endorsement committee," which made up a list of approved agencies for the convenience of its members, who, with their families, constituted a large part of the giving public. As social agencies multiplied, competition became so intense that protests from harassed contributors led to the idea of financial federation, viz. that all the agencies in a community which depended on voluntary contributions for their support should form an association, agree on a joint budget for the next year, throw into a common pool their contributors' lists and other information about sources of income, present their united needs to the public in a single campaign, and share in the results in proportion to their budgets. Jewish charities were the first to do this successfully, but by 1917 there were general federations in several cities. When the war brought demands from a host of new and old organizations, in sums that had never before even been imagined, a development of the fundamental idea in federations was forced. "War chests" were set up in some 300 cities by the summer of 1918, to raise the money asked for by the American Red Cross, the Y.M.C.A., the Y.W.C.A., the War Camp Community Service, and other "war work" agencies, and in some places the local charities also were included in the chest. The general satisfaction felt with the experiment led a number of the cities to convert their war chests into "peace chests" or "community funds," and by March 1921 at least 30 important cities had adopted this method of raising their funds. A great deal more money is secured in this way than by separate competitive appeals; a much larger proportion of the population contributes (20–30% instead of an estimated 2–10%); less expense is involved and less annoyance to contributors. The strongest argument in favour of financial federations, however, is that through joint budget-making, joint study of community needs, joint planning for community welfare, they tend to dissipate the narrow institutionalism of the agencies concerned; while, on the other hand, they increase the public interest in the social work of the community, and provide a channel through which the public may register its judgments of the social agencies and share in directing their development.

Increased Reliance on Government.—Even before the war there was a noticeable tendency away from the old American individualism and distrust of government. Supervision over private social work has been extended, and there has even been a tendency towards some degree of public control. Recourse has been had to legislation to establish minimum standards of housing, of working conditions, even of wages, to protect women and children in industry, and otherwise to promote social welfare; and such legislation has been increasingly sustained by the courts. The great cost of adequate provision for the sick and adequate hygienic education of the well, together with the growing recognition that, to be adequate, such measures must reach all citizens, have made it inevitable that they should be undertaken largely by public authorities. Boards of health have accordingly extended their control over infectious diseases, established sanatoria and all sorts of clinics, distributed much information, and maintained nurses and physicians to visit the poor in their homes and give them oral instruction. Public schools have added physicians, nurses, psychiatrists, dentists and "visiting teachers" to their staffs, have offered evening classes and vocation schools and public lectures and opened their buildings as "community centres," as well as admitted into the curriculum new subjects. Three-fourths of the states have established bureaux of child welfare or child hygiene.

There has even been an extension of public out-door relief, which had fallen into disrepute during the 19th century. Partly as a result of the new conviction that children were better off with their mothers than in institutions or in foster homes, partly from a sudden appreciation of the service performed to the State in the bearing of children and a determination that the State should recognize this service, most of the states of the Union (beginning with Missouri in 1911) made special provision for payments of "widows' pensions" or "mothers' allowances," "mothers' aid," "funds to parents," or "mothers' compensation," to mothers who without this assistance might be obliged to place their children in institutions.

Reliance on the State has gone so far as to demand assistance in promoting social welfare from the Federal Government. Its taxing power has been invoked to discourage the employment of children in factories, mines and quarries, in order to extend some protection to the children in the more backward states. Financial aid for vocational education and (by a measure passed in 1920) for the reëducation of industrial cripples, has been granted by the Federal Government to the states in proportion to their population and their own appropriations. The Department of Agriculture has done social work on a substantial scale in rural districts. The Bureau of Labor has been erected into a separate department, with corresponding increase in importance. A children's bureau, placed almost by chance in the Department of Labor, was created in 1912, at the instance of the social workers of the country.

The World War and Social Work.—The first effect of the war on social work in America, while the United States was still neutral, was to strengthen and improve it. Sympathy for sufferings in Europe quickened sensitiveness to social problems at home. A little later the appeals for war relief tended to drown those of the familiar everyday agencies at home. This was not an unmixed evil, for it compelled scrutiny of plans within each organization to determine what could be spared with least disadvantage. When the United States entered the war, in April 1917, social work leaped into unprecedented prominence. Many of the wonted social problems were intensified and some new ones created, especially by the operation of the draft and the establishment of training camps; while a new demand for persons with experience in human problems sprang up in government departments and war industries. A fervour developed for service, especially for service to American soldiers and sailors and to the civilian sufferers in the Allied countries. The Red

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Cross organized its Home Service Sections to minister to the needs of the families of men in service; its Bureau of Refugees and Relief in France and other activities on behalf of the civilian populations in European countries. With official encouragement, the seven "*moral*-making agencies," as they were called —Y.M.C.A., Y.W.C.A., Knights of Columbus, Jewish Welfare Board, Salvation Army, American Library Association, War Camp Community Service—undertook to occupy the leisure of the soldiers and sailors, in training at home or on duty abroad. They provided physical, social, and spiritual comforts, mental diversion and entertainment.

The Federal Government, through the system it adopted of allotments and allowances to the families of men in service, compensation for death and disability, reëducation of the disabled, and war-risk insurance; through the Housing Corporation; the Federal Employment Service; the Division of Venereal Disease in the Public Health Service; the thrift campaign of the Treasury Department; the educational work of the Food Administration; and other undertakings, plunged into social work on a gigantic scale. Much of it, unfortunately, though wisely conceived, was badly executed, but it strengthened the demand that the Federal Government should in the future make more substantial direct contributions to social welfare.

The established forms of social work fared badly under the competition of these new activities. Financial support was difficult to secure, and—what was more serious—many agencies saw their staffs sadly depleted by the superior appeal of war work. Young, inexperienced persons were frequently the only ones available for positions of responsibility. On the other hand, many capable men and women who would not otherwise have been attracted to social work have entered it permanently, and many more have had experiences which cannot fail to be of advantage to social work in the future because of the interest and knowledge acquired. Aside from this increase in the popularity of social work and in the general understanding of social problems, a conspicuous effect of the war was to hasten the process of nationalization which had been going on for half a century. This is shown not only in the disposition to expect more active participation by the Federal Government, but in a consciousness of the national character of the problems of education, health, and adequate income; in a prominence accorded to certain elements of the national life, hitherto comparatively neglected, such as the rural population, the negro, the foreign-born. Topics in which interest has been intensified are education, recreation, physical efficiency, venereal disease, mental defects, "community organization," retraining of cripples and other handicapped adults and their restoration to a place of usefulness and self-support in the community.

In general, the effect of the war has been to confirm the principles of social work and to commend them to a larger public. In the treatment of criminals, however, it has been the opposite. For the moment, at least, it seems that much of the progress painfully made in the course of the 19th century has been brushed away. There has been a reversion to the principles of vengeance and retribution in dealing with civilian lawbreakers. A reaction in favour of the death penalty and of severe and even brutal sentences has displaced the sentiment that certainty of punishment is more efficacious as a deterrent than severity.

Practical Advance.—In these 20 years of the 20th century, ideas have far outstripped practice. Both ideals and practice have made great strides in advance, but the gap between generally accepted theories and actual provision is as wide as it was in 1900. By way of summary: what difference have the 20 years made to the individuals whose welfare is at stake?

The task of helping those who are in economic difficulty is done more thoroughly. A larger proportion of those who need assistance receive it; a larger proportion receive a kind and an amount adapted to their needs; individual and family situations likely to produce dependence later are more frequently recognized and corrected. There were in 1920 over 300 "family social work societies," as compared with 100 at the beginning of the century. The home service sections of the Red Cross, continued in many small towns and rural communities after the World War, supply something corresponding to the general relief society or family society in the cities. Public relief has been extended by the all-but-universal provision of "mothers' allowances," which, however, are generally inadequate in amount or incompetently supervised. An organized system for assuring prompt relief in any community visited by a disaster has existed since 1906 under the auspices of the Red Cross. In theory rehabilitation is accepted as the object of the social agencies which have to do with children or with family groups or individuals capable of ultimate self-support, including the public departments which administer outdoor relief. Available resources for recreation and education, for physical and mental examination and treatment, are utilized more fully. Money is spent more freely, especially to ensure adequate food, sanitary homes, the recovery or preservation of health, to keep families together, and to keep children in school. In public institutions diet has improved, and in general the physical conditions are better. Here and there the almshouse has been transformed in accordance with the theories of the 20th century, and through the continued growth of specialized institutions its population is gradually decreasing and it is losing its place of preëminence among the social agencies of the country. It is still, however, much the same institution that it was 20 years ago, and it still affects far too many persons to justify the indifference still shown it. In other respects, too, there has been little advance in provision for those who reach old age without resources and without relatives who can take care of them: accommodations in private homes for the aged have not increased substantially; the plan of placing them in families under supervision has nowhere had much attention; and thus far there has not been much sentiment in any state in favour of old-age pensions, nor much evidence brought forward that they are needed.

Children (the other class of natural dependents), in their character as the most responsive subjects for both preventive and constructive efforts, have aroused a new and scientific interest. The case of the child who must be supported wholly or in part by other than his parents or near relatives has improved more than that of the aged. There are more chances than there were 20 years ago that arrangements will be made for him to stay with his own mother or that he will be placed in some family where he will at least have the training of family life; if the latter, that the home will be chosen with reference to his particular requirements, and that in case of mistake it will be discovered before his future is jeopardized. If he goes to an institution, it is more likely to be one in which he is regarded as an individual, and in which the life is organized for the benefit of the children rather than primarily for ease and economy of administration. The capital invested in old-style congregate institutions and the initial cost of replacing them by a plant on the cottage plan retards the tendency in this direction. Few institutions of the old type have been constructed in recent years, and some old institutions have moved out from the city into a colony of small home-like buildings, permitting better classification of the children and a more nearly normal life, but the process of displacement is slow, the 19th-century city institution still predominates. While in the best institutions, and the best placing-out agencies, physical and mental examinations are given to the children and more careful attention is paid to the correction of defects than in the average family, such skilled professional care is still the exception rather than the rule.

In provision for the cure and prevention of disease and for the promotion of health these 20 years have seen the most marked advance. Ill health as a cause of individual inefficiency, poverty, and even crime; good health as the foundation of individual welfare and happiness; preventable disease as one of the greatest and least excusable social evils; physical efficiency as a national ideal—these ideas have created a large proportion of our current social work, and materially modified most of the rest. General hospital accommodations and dispensary service have increased at a rapid rate, considering the investment required. Although there is not yet suitable provision for more than 20% of the

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tuberculous in need of institutional care, still nearly all of the 60,000 beds in the 689 sanatoria and special hospitals, day camps and preventoria (Jan. 1 1921) have been provided since 1900. This is true also of most of the convalescent homes, the many specialized clinics—prenatal, "baby," dental, venereal disease, psychiatric, etc.—the medical examination of school children, the nursing service of schools and health departments. The level of knowledge about tuberculosis and other preventable diseases and about personal hygiene has risen perceptibly. A new type of agency is now becoming prominent—"health centres" and "well-baby clinics," for example—directed towards the preservation of the health of those who are well.

Provision for the treatment of mental disease also has continued to increase, until in 1920 there were 232,680 patients in institutions; and the tendency already well established in the 19th century towards public care, by the state rather than by local units, has progressed until, in all but 8 states, all insane who are public charges are in state hospitals (*i.e.* not in almshouses or other county or city institutions). In 12 states there were, in 1921, psychiatric hospitals, psychiatric wards in general hospitals, detention hospitals, or other provision for the temporary care of mental cases. The corollary, however, is that in 36 states there is no such provision and in these 12 only a fraction of the population is thus served. The hospitals in most states are sadly overcrowded. Notwithstanding this pressure, the Scotch plan of boarding out selected cases of certain types, which has long been followed with success in Massachusetts, has not been adopted elsewhere. National prohibition, however, has already cut down the number of admissions to the alcoholic wards, and it may be that this influence will enable the states within the next few years to match accommodation with applications. A few institutions undertake to keep watch over the patients discharged as cured or improved, and a few private organizations supplement the work of the public institutions in this way, and also try to avert the development of insanity in incipient or suspected cases brought to their attention. In New York a state system of clinics has been organized under the joint auspices of the state hospitals, the state Department of Health, and the Committee on Mental Hygiene. In general, however, the prevention of mental disease and the promotion of mental hygiene are comparatively rare.

For mental defectives provision has increased rapidly as compared with that at the beginning of the century, but slowly as compared with the need. There were about 40,000 feeble-minded in institutions in 1920, which was twice as many as in 1910, but not more than 6% of the estimated total in the country. There were still, in 1921, 14 states which had no separate institution for such patients. In the conduct of the institutions the tendency is towards making them less custodial in their atmosphere, more medical and educational, less like a poorhouse, more like a combination of hospital and school. Special classes for backward children were maintained in 1921 in over a hundred cities, but the aggregate enrolment of over 20,000 represents only a small portion of such children even in these cities.

In connexion with crime the greatest advance has been made in the case of juvenile delinquents, who are now treated rather like neglected children than like criminals. Nearly three-fourths now come before courts intended especially for children's cases, the best of which have facilities for thorough physical and mental examinations and social investigation, and before judges who are expert in this work. All the states except Wyoming had made by 1919 some provision for probation for juvenile offenders, and about half the juvenile courts had a probation service in operation. Children in small villages and the country are hardly touched by these new methods. The proportion of juvenile delinquents sent to institutions is smaller than 20 years ago, and these institutions have become in some instances excellent schools. They have made more progress than those for dependent children in transforming their plants and their methods to correspond with current theories. The interests of adult criminals have not advanced so much. It is more generally admitted, however, that every correctional institution should be a "reformatory," and more of them are than formerly. There is increased attention to physical conditions and needs, better ventilation, improved sanitation, more physical exercise, and in the reformatories some use is made of psychological tests and some attention paid to the correction of physical defects. The value of academic instruction and of productive occupation is more generally realized in the state prisons, and the reformatories also provide vocational training. The old perplexity of how to prevent prison labour from competing with free labour has ceased to be a practical problem, with the general acquiescence of organized labour on the "state use" system. Contract labour, however, is still found in many state prisons, and there has been little progress in making the work of the man in prison contribute to the support of his family at home. The convict lease system in the South has almost disappeared. A few county gaols have been remodelled, and a few others have been replaced by farm colonies. The use of probation for adult offenders has increased, though less rapidly for juvenile delinquents.

Private enterprise in the field of correction has concerned itself chiefly with furthering the movement for juvenile courts and probation; promoting specialized provision for women offenders, including policewomen and separate detention houses; developing protective work, especially for girls; securing the establishment of night courts and special courts for cases involving family desertion and other domestic relations; and in a few places, intermittent efforts to secure a rational treatment of beggars, drunkards, and other misdemeanants. Interest in 1921 seemed to centre round protective work for young offenders; the need of separating the feeble-minded from those of normal mental powers in reformatories and of distinguishing between them throughout the correctional system; problems of court organization and procedure, including the proposal for merging juvenile courts and the so-called domestic relations courts into "family courts," to deal with all cases involving family life.

While it would be out of the question to review in this place the progress which has been made during the 20th century in the general standard of living and the conditions under which the mass of Americans live and work, still so large a part of the social work of these 20 years has been consciously directed towards this object that it would be equally impossible to omit all reference to it. The contribution of organized social work cannot be definitely disentangled from that of any of the other factors which have been influential in bringing about these improvements, but it is patent to any student of the period that it has been an important factor. The educational social movements, through their research, their programmes, their publicity and their propaganda, have to a large extent enlisted the interest of the other factors, determining which questions should have precedence, and how they should be presented to the public.

"Welfare work" in mercantile and industrial establishments has an obvious historical association with those kinds of social work which deal with health, housing, recreation, and the standard of living. In America, however, it is now generally conceived, not as an expression of altruistic interest on the part of the employer, but rather as a subdivision of personnel administration. Scientific management, industrial medicine, vocational guidance and other factors have influenced its development.

In many instances welfare activities have begun with a rest-room, a lunch-room, first-aid appliances. From these modest beginnings they have expanded to include everything which might directly or indirectly increase the efficiency of the workers. Their home life, savings, investments, education of children, and social opportunities have been included. Industrial goodwill between the management and the workers has come to be looked upon as an asset to be cultivated. The Y.M.C.A., and other agencies which prefer to avoid industrial controversies and to operate within the "zone of agreement," have found here a useful and congenial field. (L. Br.; E. T. D.)

VI. The American Labour Movement

The labour movement in the United States has been distinguished from that in other countries by being less class-conscious,

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more individualistic and opportunist. Although there are Socialist factions, and some leaders favour industrial unionism, the majority of organized labour clings to the tactics of federated crafts, and does not aim further than to increase wages, decrease hours and improve the conditions of employment through agreement with the employer. The American labour movement has not been led by "intellectuals." The leaders have come from the ranks—one explanation of the characteristic opportunism and lack of a social philosophy. The great majority of American working men do not want a Labour party in politics; they do not consider themselves a separate class in the body politic. The American political parties antedate the formation of modern economic classes. Class parties are discountenanced as "un-American." A politician in any party may present himself as a "friend of labour." Moreover, the system of checks and balances of the Government offers resistance to change, and the division of sovereignty between state and Federal Government makes legislative reform measures difficult of passage. More can be accomplished with equal effort by trade-union methods. What part the American Federation of Labor has taken in politics has been to advise the working men to reward their friends and punish their enemies at the polls.

During the World War an attempt was made, without success, by the machinists of Connecticut to form a Labor party. In Nov. 1918 leaders of the Chicago Federation of Labor proposed a Labor party, and suggested 14 planks for the platform, which ranged from the right of labour to organize and bargain collectively to representation of labour as such in all Government departments. Eleven of the planks closely resembled the reconstruction programme of the American Federation of Labor. In Jan. 1919 the Labor party of Cook county (Chicago) was formed, with an official organ *The New Majority*. In April an Illinois state Labor party was formed at the convention of the state Federation of Labor. It elected several mayors and other officials. The same year there sprang up also a Pennsylvania state Labor party, the American Labor party of Greater New York and the Working People's Non-Partisan Political League of Minnesota, which last had the object of coöperating with the farmers' Non-Partisan League. In Nov. a national Farmer-Labor party was organized in Chicago, which aimed to draw together the working man and the farmer. This party nominated a president for the national election; 272,514 votes were polled for him, or 1% of the total votes cast. Other political parties, having as their aim better conditions of labour, are the Socialist party, the Communist party and the Communist Labor party, both of which latter split off from the Socialist party in Aug. 1919, and the Socialist Labor party (organs, *The Socialist*, the *Weekly People*). In the spring of 1920 the Michigan branch of the Communist party became the Proletarian party.

Labour and the World War.—In 1916 when President Wilson established the Council of National Defense he appointed Samuel Gompers, president of the American Federation of Labor, one of the seven members composing the advisory commission, to be in charge of all policies affecting labour. As chairman of a labour committee Gompers appointed about 350 persons, representatives of capital and labour, Government officials and others with technical qualifications, who effected a permanent organization as the full Committee on Labor of the Council of National Defense, April 2 1917. This committee early urged that legislation protecting labourers be not weakened during the war. Such was the sentiment also of labour organizations and civic associations generally. When, in the early spring of 1917, it appeared that the United States would enter the war, Gompers called a conference of the Executive Council of the American Federation of Labor with the presidents of international and national unions, heads of industrial departments and representatives of the railway brotherhoods. Those present at this conference, March 12, offered their services to the country in the event of war, and issued a call to members of their organizations to follow this lead. In order to secure the constant support of the Government by American wage-earners, the conference urged the adoption of trade-union standards for all war work, equal pay for equal work regardless of sex, the representation of organized labour on all committees which fixed policies for war work, and provision that special exertion of workers in war emergencies should not benefit chiefly the employers by increased profits. On April 17, at a meeting of the Council of National Defense and its Advisory Committee, Gompers gave his pledge that organized labour would support the Government to win the war. In the summer of 1917 the American Alliance for Labor and Democracy was formed by trade unionists, social reformers and non-pacifist socialists to counteract the pacifist propaganda of the People's Council of America. But some members of the trade unions opposed the pro-war stand of the leaders, and formed the Workmen's Council for Maintenance of Labor's Rights; this died out during the next year.

In Nov. the national convention of the American Federation of Labor passed a resolution that the United States was in the war for democracy against autocracy. The convention urged that organized labour be represented at the Peace Conference; that there be no reprisals against conquered nations; the independence of all nationalities; a league of free nations to maintain peace; certain labour standards to be accepted by international agreement as a part of the Peace Treaty and a plan for controlling employment during demobilization. In Feb. 1918 the Executive Council of the American Federation of Labor issued a statement that "this is labor's war."

Early in 1918 the War Labor Policies Board was created, to administer the relations with labour of the Federal Government in its capacity as employer. It aimed to secure uniformity of conditions in all Government work and to stabilize the working force. It took a stand for prohibition of child labour and prison labour, in favour of the right of labourers to organize, a living wage, equal pay for equal work, the basic eight-hour day, and some definite system of settling labour disputes. To meet the grievances of employees on Government work, the National War Labor Board was established in April 1918 to serve as a final court of voluntary arbitration. The American Federation of Labor was given representation on the Emergency Construction Board, on the Fuel Administration Board (the president of the United Mine Workers was assistant to the Fuel Administrator), on the Woman's Board, on the Food Administration Board, and on the War Industries Board. In connexion with the administration of the Military Conscription Law organized labour was given representation on each District Exemption Board. Trade unionists were sent to Russia on the Commission of Investigation in the spring of 1917.

The Mooney Case.—Thomas Mooney, a labour organizer, was accused of having placed the bomb which exploded in the street of San Francisco during the "Preparedness Day" parade, July 22 1916, killing six persons instantly, mortally wounding four more, and injuring 40 others. Mooney pleaded not guilty, but he was sentenced to death. Many organizations of labour protested that the trial was not a fair one. Execution was postponed several times. It then appeared that much of the testimony on which he had been convicted was perjured. This was substantiated by the report of the investigation of the U.S. Department of Labor in July 1919, which condemned the conduct of the trial. Request for retrial, however, was refused, as not provided for by the constitution of California. Radical labour urged a general strike May 1 1918, to protest against letting the verdict stand. At Mooney's request the plan was dropped. In Nov. the governor of California commuted the sentence to life imprisonment. A plan for a general strike July 4 1919, to demand a new trial, was not taken up by the conservative unions.

International Relations.—During the war American labour awoke to an interest in international affairs. The American trade unions sent no delegate to the Inter-Allied Labour Conference in London in 1918, but that year the American Federation of Labor sent three small groups to Europe to confer unofficially with trade unionists in the Allied countries. The American Federation of Labor refused to be represented at the international labour conference in Berne held after the signing of the Armistice, on the ground that the conference would not express

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fairly the opinion of labour in the Allied countries. The proposal of American labour for an inter-Allied labour conference at Paris was not accepted. In July 1919, American delegates were present at the International Trade Union Conference in Amsterdam, at which they took issue with the German delegates, and opposed the resolutions passed for the lifting of the Allied blockade of Germany and Russia and those criticizing the labour sections of the League of Nations. Since the United States had not ratified the Peace Treaty, American labour could not be officially represented at the meeting of the Labour Department of the League of Nations held in Washington in the autumn of 1919. The American Federation of Labor Convention of 1919 by a large majority endorsed the labour clauses in the Peace Treaty. The Convention also passed resolutions asking that immigration be stopped for two years, to prevent the underbidding of American labour in the home market.

In 1918 the American Federation of Labor took steps to establish friendly relations with organized labour in Mexico. A conference of trade unionists of the two countries in June urged a conference on the question of the Mexican frontier and a federation of the labour movements of both countries for the protection of workers employed across the border from their homes. In Nov. the conference was held at Laredo, Tex.; 150 delegates were present, representing the United States, Mexico, Central America and Colombia. The U.S. Secretary of Labor was present. A permanent organization was launched. A second conference was held the next year in July in New York.

Reconstruction Programmes.—In July 1919, the national convention of the American Federation of Labor endorsed a programme for reconstruction which advocated first "democracy in industry," that is, workers to have a voice in determining the conditions under which they work "equivalent to the voice which they have as citizens in determining the legislative enactments which shall govern them." The corollary is seen as the right to organize in trade unions. The programme urged better wages to prevent "underconsumption" and consequent unemployment, and to make possible the maintenance and improvement of the American standard of life; the 8-hour day and the 44-hour week; equal pay for equal work regardless of sex; special protection of the health of women; prohibition of labour by children under 16, and compulsory part-time school attendance until the age of 18; the elimination of the middleman; curtailment of the power of the U.S. Supreme Court; Federal supervision and control of corporations; Government ownership or regulation of public utilities; development of waterways and waterpower; a graduated land tax; a special tax on idle lands; progressive taxes on incomes and inheritances; assistance to farmers; the development of Government experiment farms; municipal aid to home-building; workmen's compensation with state insurance; better educational advantages for children and adults; establishment of public employment agencies controlled jointly by capital and labour; and the regulation of immigration so as to facilitate Americanization and to prevent flooding of the labour market in periods of unemployment. The Federation reaffirmed its non-partizan political policy, urged the restoration of freedom of speech and assembly and went on record as opposed to a standing army. At the 1919 convention the Federation voted its support to the "Plumb plan" for Government ownership of the railways and their operation by a board representing equally the executives, the other employees, and the public. The United Mine Workers at their convention in 1919 passed a resolution favouring public ownership of the mines.

Since 1917 the general public has had, as never before, a definite conception of "American" labour standards, endorsed by such Government agencies as the wartime labour boards, the Council of National Defense, and by the consensus of opinion of certain groups in the industrial relations conferences, and of leaders in the national life. These standards include, in general, safety and sanitation in the shop and the home, accident and health insurance, special protection of women and children, abolition of "home work," the eight-hour day and the six-day week, the "living wage," industrial training and a public employment service. The majority of American working men and women have as their aim the attainment of these standards: not ownership or control of business. The labour movement is a struggle for power to gain control of the "job"—not the business—adequate wages, short hours, security of employment, and sufficient responsibility to command respect and sustain interest in the work to be done.

Education in the Labour Movement.—In recent years there has been developed in the United States a movement on the part of working people to further their education, with a double aim: to give to working people a share in the culture which has been largely the possession of the propertied classes, and to fit them to understand and meet the problems of the modern industrial order. The leaders are trade unionists and socialists who resent the control of education by the class that also controls industry, and who wish to teach their own view of society; also impartial educators, idealists, eager to bring to the many the culture of the few, and to extend to adults educational advantages now provided generally for children. The Rand School of Social Science in New York City, established in 1906 by private gifts, is owned by the American Socialist Society. In 1918–9 the enrolment, including correspondence students, was over 5,000. The school has some five or six regularly appointed instructors. Courses are also given by teachers from colleges near by and by trade-union leaders. The Workers' Training Course, from Nov. to May, prepares leaders for the socialist and labour movements. The Department of Labor Research publishes the American Labor Year Book. The school maintains also a reference library and reading rooms and a book store. In 1914 the International Ladies' Garment Workers' Union took up educational work for its members, in coöperation with the Rand School. About 150 members attended classes at the school. Later classes were held in public-school buildings under the auspices of the union. More advanced classes were given under the name of the Workers' University of the I.L.G.W., especially for business agents and union officials. In 1918 under the leadership of the United Cloth Hat and Cap Makers the United Labor Education Committee was organized in New York City by six labour organizations for the promotion of education among their members, about 200,000 in that city. This committee has conducted weekly courses, in different parts of the city, in art, labour, history, science and elementary English and physical training, and has also provided concerts and motion pictures. It has introduced lectures and musical programmes in connexion with the trade-union shop meetings. The committee planned a workmen's theatre where for popular prices a higher class drama will be presented than can be found in the majority of the theatres of the city. In April 1919 the Trade Union College organized by the Boston Central Labor Union opened with 160 students. Courses, open to all members of the American Federation of Labor and their families, are given in the evening in one of the public schools by members of the faculty of Harvard University and other institutions.

Other labour colleges, under the control of local trade or industrial unions or local federations of unions, are: The Workers' Institute, Chicago; The Workpeople's College, Duluth; The Workers' University, Philadelphia; The People's Lyceum, Philadelphia; Trade Union College, Washington, D.C.; The Women's Trade Union College, Chicago; Hobo College, Chicago; Trade Union College, Minneapolis; People's College, Fort Scott, Kan.; The People's Institute, San Francisco; The Proletarian University, Detroit and other cities; Workers' College, Seattle, Wash.; The Amalgamated Textile Workers' School, Paterson, N.J.; Labor College, Tacoma, Wash. The Trade Union College of Pittsburgh has been organized. The Clothing Workers of Rochester maintain an educational director. The Labor Temple at Los Angeles is under the control of the school-board, and the Community School, Baltimore, has a private management.

All these colleges are financed by small tuition fees, by contributions and by guarantee funds. As a rule the teaching force is not permanent, but the courses depend on volunteers from neighbouring colleges or from the labour movement. Classes are usually in the evening, one hour of lecture followed by one of discussion. The subjects taught are various phases of economics: law, civics, history, English, public speaking, psychology, sociology, biology, hygiene, art, music. In connexion with the colleges plays and motion pictures are shown. The Waistmakers' Union of New York City

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has purchased a summer camp near the Delaware Water Gap where members may spend their vacations. The Boston local has built a vacation house on Cape Cod. Bryn Mawr College held a two months' summer school for wage-earning women, which opened in June 1921. Students are supported on scholarships raised by trade unions and other groups of industrial women. It is probable that the education of working men and women will be carried on through coöperation with the extension work of the state universities. Teachers are now sent out from the universities to conduct classes where they have been organized in a community. Correspondence courses offer advantages to isolated students. There has been some public opposition to the labour colleges, where these have been suspected of radical propaganda. In 1918 the Department of Justice conducted raids on the Rand School and on the Proletarian University of Detroit.

The reconstruction programme of the American Federation of Labor included actual universal education, for all ages, in all communities, for which public schools and universities were to be developed. The programme stated: "It is also important that the industrial education which is being fostered and developed should have for its purpose not so much training for efficiency in industry as training for life in an industrial society."

The American Labour Press.—The growth of the American labour press has been rapid. Each international and national union has its official organ, and the trade unions of most large cities publish their local labour papers. Well known are the *Cleveland Citizen*, the *Denver Labor Bulletin* and the *Seattle Union Record*. Some state federations of labour publish bulletins. The monthly *American Federationist* of the American Federation of Labor had a circulation (1920) of 100,000. Among the more important trade union papers are: *The Bricklayer, Mason and Plasterer; Carpenter; Cigarmakers' Journal; Justice* (Ladies' Garment Workers); *Garment Worker; Machinists' Journal; Miners' Magazine; International Molders' Journal; Plumbers, Gas and Steam Fitters' Journal; Seamen's Journal; Shoe Workers' Journal; Textile Worker; Federal Employee*, and the periodicals of the railway brotherhoods. The Chicago Federation of Labor publishes the *New Majority* (circulation 15,000), as national official organ of the Farmer-Labor party. Jewish workers have the *Freie Arbeiter Stimme*, New York, and *Vorwaerts*, of New York, daily circulation about 158,000. The *Chicagoer Arbeiterzeitung* is a German socialist paper. *Zukunft*, a Jewish socialist monthly paper, New York, has a circulation of 65,000. The Amalgamated Clothing Workers publish weekly papers in six languages: English, Yiddish, Italian, Polish, Bohemian and Lithuanian. The Industrial Workers of the World publish the *One Big Union Monthly*, and *New Solidarity* (circulation 10,000), both of Chicago. The Socialist Labor party publishes *The Socialist* and the *Weekly People*, New York, and the *Industrial Worker*, Seattle. The *New York Call*, a socialist daily, has a circulation of 21,800. Radical labour and socialist groups have published many short-lived periodicals of small circulation. During the war the Post Office Department revoked the second-class mail privileges of 25 papers, and held up one or more editions of a number of others.

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(J. R. Co.)

VII. Military Law

The U.S. army is subject to a system of military law which had its origin in, and was at first the same as that of, Great Britain. In the French and Indian Wars the colonists had fought side by side with British regulars and under the same rules and regulations. When they revolted they continued the system of military law with which they were already familiar. So little necessity for change existed that even the antiquated language of the British Articles of War was retained and some of it is still found in the American code. Passing over the earlier enactments of separate American colonies for the government of their respective contingents, such as those adopted in 1775 by the local Legislative Assemblies of Massachusetts Bay, Connecticut, Rhode Island and New Hampshire, we find that the Second Continental Congress in 1775 adopted practically the whole British Code of 1774 and furnished the foundation for the Articles of War as they have been known since then in the United States. Reënacted, with enlargements and modifications, in 1776 and amended in 1786, this code survived the adoption of the Federal Constitution and was continued in force by successive enactments until 1806.

In the United States, under the Constitution, the power of establishing military law rests with Congress. It was not, however, until 1806 that Congress concerned itself much with the military code, the Articles of War. In that year the Articles were redrafted and reënacted though there were no material changes from the Articles as they had existed during the Revolution. Nor did the next large redraft in 1874 include any great changes. Occasionally an Act of Congress would make some change, sometimes, but more frequently not, specifically amending an Article of War. If the effect was that of an amendment the Article was considered as changed. Such Acts were those of 1890 and 1898 establishing the summary court and abolishing the field-officers court; and finally the summary court supplanted the two remaining inferior courts, the garrison court and the regimental court.

In 1910 the Judge-Advocate-General undertook the systematic and logical arrangement of the Articles of War. In 1916 he presented his project to Congress and it became a law. This draft presented no fundamental changes; it was rather a compilation made with the idea of bringing the code to date by incorporating late statutes, by deleting obsolete material and dropping quaint phraseology, and by systematizing the presentation. In short it was a logical up-to-date statement of the greater part of the military law of the nation, rendering it quickly accessible. Not all the statutes, customs or regulations governing rights and procedure were placed in the new code, but by it the President was authorized to prescribe by regulations the procedure, including modes of proof, in cases before military tribunals, so long as such regulations were not inconsistent with the new Articles; and all such prescribed regulations were required to be laid annually before Congress. Under this authority a new manual for courts martial was published by the authority of the President, and in this was embodied so much of custom and regulation that it became a complete exposition of the military laws.

This was the code in effect when the United States entered the World War, and by it its armies were governed during that conflict. Only one important addition was made before the Armistice, and that was by an executive order establishing in fuller detail the power of review of the records and proceedings of general courts martial. Shortly after the Armistice a bill was introduced in the Senate (Sen. 64, 66th Congress, 1st Sess.) which, if enacted, would have made many and vital changes in the administration of military law. Chief among the radical changes proposed were those of making enlisted men members of general courts martial; of establishing a civilian court of military appeals; and of injecting into the principal courts martial a new functionary with powers so extensive and of such a kind as to constitute him the administrator of discipline. At the time the Senate was considering this bill a board of officers was convened by the War Department to recommend any changes it believed to be necessary in the Articles of War and in the methods of procedure which then obtained in the administration of military justice. After considering numerous recommendations from the army at large the board submitted a detailed report accompanied by a redraft of the Articles of War.

At the same time General Crowder, the Judge-Advocate-General, redrafted the Articles of War upon lines that he thought advisable in view of the experience gained during the war. The draft prepared by him was accepted by Congress with little change and became a law June 4 1920, though most of its provisions did not go into effect until six months later. The radical views as expressed in the Senate bill were rejected and the administration of military discipline was left to the military authorities.

This new code contains 122 Articles. In 85 Articles there are no changes except the formal variations made necessary by the creation of grades before unknown, such as warrant officers and nurses, and other analogous alterations. This leaves 37 Articles, a little more than one-fourth, in which there have been substantial changes. Many of these, however, are only statutory enactments of rules already established by administrative interpretation, orders, or customs of the service. Only about 20 Articles contain really new matter and of these it will be necessary to consider here only the more important.

Probably the most important of the changes is that effected by Article 50½ which creates a Board of Review in the office of

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the Judge-Advocate-General. Until Jan. 1918 the reviewing authority acted upon a court-martial sentence and immediately ordered it executed if he did not disapprove. By an order of Jan. 1918, it was directed that no sentence of death or of dismissal or dishonourable discharge not suspended should be executed until the record of proceedings of trial had been reviewed in the office of the Judge-Advocate-General or branch thereof. The effect of the new article was to establish by statute much the same procedure. The Board of Review consists of three or more officers in the office of the Judge-Advocate-General, and functions in the following classes of cases:

(*a*) Where the President is reviewing or confirming authority or where he has ordered a rehearing.

(*b*) Where the sentence does not require approval or confirmation by the President, but involves death, dismissal or dishonourable discharge not suspended or confinement in a penitentiary, unless, in the two latter cases, the sentence is based upon a plea of guilty.

All other general court-martial records are examined in the office of the Judge-Advocate-General, but do not go to the Board of Review unless found insufficient to sustain the findings and sentence, in which case the record is submitted to the Board of Review. When the Board of Review has acted, its action is submitted to the Judge-Advocate-General. If there be an agreement between the Board of Review and the Judge-Advocate-General that the record is legally sufficient to sustain the finding and sentence, the reviewing authority is notified and the sentence is forthwith ordered executed. If the Board and Judge-Advocate-General agree that the record is not sufficient to sustain the findings and sentence, the findings and sentence are by virtue of the statute vacated and the record is returned to the reviewing authority for action. In case of disagreement between the Board and the Judge-Advocate-General the record is transmitted to the Secretary of War for the action of the President. Provision is made for more than one Board of Review if business requires such and for a branch of the Judge-Advocate-General's office like that in France during the World War.

Another change is that in connexion with a rehearing of a case. In civil cases the defendant asks for a new trial and by so doing is held to waive the guarantee against repeated jeopardy. In the military procedure, if on examining a record prejudicial error be found, the accused receives the benefit of it without any affirmative act on his part. In other words, the appellate review is automatic. This requires some modification of the rules governing new trials before civil courts. It is accordingly provided that no proceedings shall be deemed a trial until final action by the reviewing authority. When a hearing is ordered it is to take place before a different court and the accused cannot be tried for any offence of which he was found not guilty by the first court nor can a sentence be imposed more severe than that of the first court.

Still another change is that which forbids the reviewing authority to return a record to the court for increase of sentence or reconsideration of an acquittal. And the reviewing authority is not permitted to act upon a record until he has referred it to his staff judge-advocate, but this reference was always customary. The prohibition against cruel and unusual punishments is broadened but not more than the customs of the service have already broadened it, and the President is authorized to set limits of punishment in time of war as well as in time of peace. Under the new code voting upon challenges and upon the findings and sentence is by secret ballot, and the majority ballot has been extended, so that a death sentence must be by unanimous vote, sentence to imprisonment for life or over 10 years by three-quarters vote and all other sentences by two-thirds vote.

The new Articles provide for the appointment on each general court martial of a law member who rules upon all objections to the admissibility of evidence and, subject to reversal by the court, rules upon other interlocutory matters except challenges. The investigation of charges before reference to trial has been extended and possibly to an extent such that resulting delay prevents the swift application of justice. But a large part of this procedure is ruled by regulation and can be changed when found necessary.

Another innovation is that of peremptory challenges, each side being allowed one, except that the law member can be challenged only for cause; and the trial judge-advocate's right to challenge is made statutory. The punishing power of summary courts is reduced. The disciplinary powers of commanding officers to handle offences without trial has been somewhat extended, but yet not made so extensive as to lead to unreasonable punishment; and this power extends to junior officers in time of war, but no officer shall be subjected to a forfeiture of more than one-half of one month's pay.

Under the new code there are three classes of courts—the summary, special and the general courts. The summary court consists of one officer and the limits of punishment are one month's confinement and forfeiture of two-thirds of one month's pay. The limits of punishment of the special court are six months' confinement and forfeiture of two-thirds pay per month for six months. The limits of punishment of the general court are established by the President under his statutory power to fix such limits both in peace and war, except where a specific punishment is made mandatory by the particular Article of War, as is dismissal under the 95th Article.

In 1913 the Judge-Advocate-General succeeded in establishing a method of restoration to the colours of men who had been sentenced to severe punishment. This included the establishment of detention barracks, called disciplinary barracks, and a system of drills and vocational training, by means of which a prisoner could earn honourable restoration to his position lost by his offence and sentence therefor. This procedure received Congressional sanction in 1915 and the process of reclaiming those who have made mistakes is probably the most enlightened of all systems of modern penology.

In addition to the foregoing there are many laws, statutory in character as well as those of regulation and custom, that could be properly classed as military laws. But as these are mostly administrative in character they are not usually considered in a brief account of military laws. Among these are the Acts of Congress reorganizing the army, establishing the pay of grades, and making appropriations for the expenses of the army. These laws are administrative and only incidentally affect military justice, but the organization of the army in 1921 was to a great extent covered by the Act of June 4 1920, the Act which also contains the Articles of War already described. (H. A. W.*)

VIII. History

Conditions in 1908.—The year 1908 seemed one of the quietest in recent American history. The seven previous years of President Roosevelt's administration had been marked by lively contests between the executive and Congress, and also between the Government as a whole and the railways and other strong financial and industrial organizations; but the President possessed the fullest authority and influence. He had established a supremacy in many legislative matters, had carried out a vigorous foreign policy, and might have gone on to a third term had he wished. Instead, he chose to put forward William H. Taft, Secretary of War in his Cabinet, and previously head of the Government of the Philippine Is., as his choice for the Republican candidate in the impending presidential election. With that powerful backing Taft was nominated, and in the election of Nov. 1908 easily defeated William J. Bryan, for the third time the Democratic candidate. The Republican party cast 7,700,000 votes against the Democrats' 6,400,000 and secured 321 of the 483 electoral votes. The Republicans also had a clear majority in both Houses of Congress. The country was prosperous, contented, and aroused by the positive and constructive policies of President Roosevelt and of several state governors, who had furnished the country an example of the possibility of personal leadership by state and national executives, as against the leadership of self-constituted groups which had been usual in both state and national Legislatures.

The people of the United States were much more conscious of themselves in 1908 than in recent periods, because they had come to recognize the variety of their make-up. The total pop. in 1910

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in the continental United States was 92,000,000. Of these, only 50,000,000 were native whites of native parentage; while 13,000,000 were foreign-born and 19,000,000 others were of foreign-born or mixed parentage. The negroes and Indians were 10,000,000. This meant that out of the white pop., three-eighths were substantially foreign, and nearly one-half went back to a foreign ancestor not more than two generations behind them. Nearly one-half of this half came from S. or E. Europe. The urban pop. (in places having more than 2,500 inhabitants) was 43,000,000, or 46% of the whole. Here were elements of greatness and also of dissension and bitterness. Race riots, except where the negro was concerned, were very infrequent, because the non-English-speaking groups tended to establish "islands" of population in the great cities and manufacturing towns and live by themselves. Their children, however, went to public schools, learned English, and began to consider themselves Americans.

Americans were of various kinds. Everybody in the United States except the American Indian is an immigrant from some other country or a descendant of an immigrant. The main race groups were, first, the descendants of the colonists, who were mainly Anglo-Saxons with some Germans and Scotch-Irish and small elements of other races. The descendants of that ante-Revolutionary population naturally thought of themselves as the preëminently American-born Americans. Next in the account were descendants of the foreigners who began to come over in great numbers about 1820. Lastly came the large number of recent immigrants and their children. In 1910 there were in the United States, 2,266,535 unnaturalized aliens, many of whom expected to return to their native country; or if they remained, to cleave to their own kind, use their native language and keep up their own schools, language press, and home connexions.

The country was not yet aroused to the dangers arising from this mixture of unassimilated races. The theory was that in the 20th century, as in the 18th and 19th, all comers would find the United States the great "melting pot." The process was one in which the public schools were supposed to play, and did play, an important part. Few voices were raised against admitting not only western Europeans, whose languages and customs were much like those of the United States, but men and women from E. and S.E. Europe and from W. Asia—Russians, Poles, Jews, Bulgarians, Greeks, Turks, Serbians and many other races. The only bar to immigration based on race in 1908 was the prohibition of Chinese immigration and the practical exclusion of Japanese labourers by a "gentlemen's agreement" with the Japanese Government (1907), which undertook to refuse passports to Japanese labourers intending to come to the United States. There was as yet no organization, public or private, to aid the in-comer in acquiring the language and knowledge of the Government of his adopted country. There was no intelligence qualification, no provision that a man who sought naturalization should be able to read, write, or understand the language of the nation he wished to join. Some of the states permitted an alien to vote if he had filed a declaration of intention to become a citizen, without even troubling themselves to see that he carried out that intention. The undigested load was becoming heavy.

The immigrants were not the only burden on the State. Millions of American-born, many of them descended from the old colonial stock, were poor and ignorant and criminal. The southern mountaineers, the frontier farmers, the loggers and the miners, included a host of men and families who lived a rough life. Parts of the rich United States were infested by tramps and vagabonds. In the wealthiest cities there was grinding poverty and degradation in the slums. The situation was saved by general prosperity and the American spirit of cheerfulness, and of confident waiting for things to come right. Furthermore, out of the most unpromising conditions arose some of the strongest figures in American history. Presidents Jackson, Lincoln, Johnson and Grant were all children of the rude frontier. Two other race problems complicated the social and political life of the country. The American Indians were a small group of only about 250,000, most of them living in tribes on Government reservations. The problem was to make them individuals; but in 1908 they were still a race group. The negroes, about 10,000,000 in number, were unorganized as a race, and were scattered over a large area, mostly in the South. Descendants of forced immigrants, they had no culture and no traditions but those of the United States. The results of their former servitude still clung about them; they were shut out from their constitutional suffrage in some of the southern states. Legally equals of the whites, they were subject to humiliating discriminations, and both in N. and S. were held in an inferior social position from which there was no escape.

Defects in Government.—The units of American society were held together by a complicated, but strong, democratic Government, well fitted to rule a diverse population. The political forms were familiar to every schoolboy—a group of (in 1908) 46 states, each with its own government, rigidly cast by the traditional principle of "checks and balances" into three departments; legislative, executive, and judicial. A national Government, also balanced, had under the Federal Constitution large powers in national affairs. A widely distributed franchise was almost equivalent to universal suffrage for adult males. There was a belief that the courts were the highest authority, not only as to questions of personal rights and duties, but as to the validity of the laws and acts of the other two departments. In addition a third type of government in the city, town and county, set up by the states, was considered to be an essential part of the system. This combination of governments governed reasonably well. It was expensive, it was not highly skilled, but it performed its tasks to the general satisfaction of most of the people. It was supported by the conviction of a large part of the population that it was the "best Government on earth."

The boast of the United States was its equal opportunity; the pride of the United States was its popular government, in which the will of the people was the only ultimate force. As a nation, Americans believed that they had, more than any other country in the world, the blessings of personal liberty, of free public education, of sharing in their government, of impartial judges. Everybody was supposed to have a fair chance in life. Few Americans could bring themselves to realize that equal opportunity was denied to those who chanced to be outside the advantages of education and of contact with their fellows; that the personal liberty of workers in mills, mines, or cotton-fields was much restricted; that some 10,000,000 negroes were subject to legal and social discrimination; that the public schools failed to reach at least one-fourth of the children who needed enlightenment and instruction; that the actual government of the country was in many communities carried on by a self-selected group of men who dictated nominations, controlled legislation and decided policies; that in matters of property or even personal rights, court proceedings were long, expensive and uncertain.

In the organization and conditions of business could be traced another startling contradiction between the word and the fact. Nominally all kinds of business not prohibited by law were open to all comers in free and honourable competition. In reality, by 1908 a great number of both employers and employees were engaged in a combat outside the laws, constant and conscienceless. Although the country grew wealthy fast, and commercial transactions increased, the small dealer or manufacturer or miner found himself shut in by a thick growth of corporations which had the great advantage of limited liability and the privilege of operating through the country under the legal fiction that a corporation was a "citizen" in the constitutional sense of the word. It was hard for individuals and firms to compete with corporations, and hard for small corporations to compete with large ones in the same line of business. For many years the steady accumulation of capital tended to flow into these expanding units, a process veiled by the use of parallel and "holding" corporations. The railways were among the most conspicuous of the large corporations, because everybody used them and because they, too, tended to combine into larger and more powerful units. The whole system was under suspicion, because railways and some other large corporations made it their business to get control of majorities in city and state Legislatures, and of party

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management. For example, the governors of California were in effect designated by the heads of a railway company. The states could not deal adequately with these powerful bodies because most of the railways and many of the other corporations operated from state to state, and could not be controlled at either end by anything short of Federal power.

The appeal to Congress for action, first against railways and then against other corporations, had led to the Interstate Commerce Act of 1887 and the Sherman Anti-Trust Act of 1890. It was a centralizing process; the more Congress did, the more eager became the desire to push Congress to restrict, and then to make restrictions still closer. The U.S. Supreme Court fell in with this process more readily than could have been expected of a body so conservative and so withdrawn from the arena of dubious business methods. Yet, notwithstanding a few decisions against railways and "trusts," the powerful corporations prospered and increased. They were bound to live, because they were economically effective; they found means of carrying on immense lines of business in an orderly manner; they supplied the demand. Their profits were large, but they gave employment to multitudes of every degree of skill.

Political organizations were on nearly the same basis as business companies—they also grew bigger and more powerful and gathered into fewer groups. Nominally, parties are simply associations of voters for common ends. Actually, they are armies acting under commanding leaders who in many cases hold no offices. The evils of this "invisible government" were apparent. Many states and cities were badly governed by unscrupulous men who were tools of the leaders, or by too competent men who plundered their fellow citizens. The average voter was honest, but stood by his party. Committees of voters, non-partisan leagues and citizens' parties tried to organize the voters for reform, but no permanent improvement was made. The political philosophy of the Americans was based on the belief that mankind was steadily growing better. Hence a tendency to look to laws and political devices to correct the ills of popular government. Millions of voters believed that if they could only get laws enough, they could break the power of the "bosses" and chain the corporations. They overlooked the fact that the real evil was the party managed by men who made politics a business, who were responsible for "getting out the vote," and always got out the votes of their friends, who knew from long experience that the weary and listless voter at last would cease to protest. On the other hand, the pressure of the trusts on small corporations and individuals was felt by masses of voters who protested against the corporations that felt strong enough to break the law and defy the voters. There was a glacier-like force of public opinion that could break down all opposition. What was most needed was the leadership of bold and far-seeing men. Roosevelt, a man of the type needed, retired to private life when President Taft was inaugurated, March 4 1909.

Political Reform.—When Roosevelt left the presidency the position of President was at the highest point of authority that it had ever known. Most Presidents are obliged to strive with Congress in behalf of their policies, inasmuch as their only means of officially proposing legislation is through public messages, and their heads of departments work directly only through Congressional committee hearings; American tradition is against the framing of bills by the executive, and the President's initiative is limited. Most Presidents have found their principal legislative influence in the veto, by which they have the weight of one-sixth of both Houses. President Roosevelt followed the McKinley method of emphasizing his wishes by personal discussion with members of Congress. He did more; he revived the Jacksonian method of announcing a legislative plan, and if Congressmen hung back, of appealing over their heads to the country at large.

This policy was adopted by President Taft, who was not afraid of a fight and who saw the advantage of assuming that the President was the natural party leader. William H. Taft had many of the qualities of leadership. He was large, happy, genial, fond of his many friends; a cheerful, balanced man. He was also experienced in the public service. Born in 1857, he graduated at Yale, and became a lawyer and a state judge in Ohio. In 1890 he was made solicitor-general of the United States and thus introduced into the Federal service. He was then selected as a Federal circuit judge and his decisions were valued. In 1891 he was appointed chairman of the Philippine Commission and was the first civil governor of the Islands. From 1904 to 1909 he was Secretary of War in Roosevelt's Cabinet, and proved himself an excellent executive. He made few enemies and had a most powerful friend in the President, who selected him as his successor. Throughout his career, including the presidency, he was an easy and popular speaker, a head of the Government who worked well with his associates and subordinates. Nevertheless, from the beginning of his term he found obstacles in his way. As an avowed successor to Roosevelt's policies he drew upon himself the opposition of Roosevelt's enemies. At the same time it soon became apparent that he was not relying on Roosevelt's friends.

President Taft's Cabinet was as follows: Secretary of State, Philander C. Knox of Pennsylvania, a man by experience and temperament, allied with the "stand pat" element of the Republican party; Secretary of the Treasury, Franklin MacVeagh, of Illinois, a business man of large experience; Secretary of War, Jacob M. Dickinson of Tennessee, succeeded in 1911 by Henry L. Stimson of New York; Attorney-General, George W. Wickersham of New York; Postmaster-General, Frank H. Hitchcock of Massachusetts; Secretary of the Navy, George von Lengerke Meyer of Massachusetts; Secretary of the Interior, Richard A. Ballinger of the state of Washington; Secretary of Agriculture, James Wilson of Iowa, remaining from the time of McKinley; Secretary of Commerce and Labor, Charles Nagel of Missouri. In the building of the Panama Canal Colonel Goethals continued as chief engineer. Maj.-Gen. Leonard Wood, as chief of the general staff, urged reform in the organization of the army, and the training of additional officers. Ballinger very soon involved himself in a bitter controversy with Pinchot, a warm personal friend of Roosevelt, over alleged irregularities in the disposal of public lands in Alaska. Ballinger was sustained by the President and a committee of Congress; but public pressure was such that he was obliged to resign, March 6 1911, and was succeeded by Walter L. Fisher of Illinois.

Taft's appointments were in the main good, including the elevation of Justice White to the chief justiceship of the Supreme Court, and the appointment as a justice of Charles E. Hughes, previously governor of New York. Nevertheless, a few months after the President's inauguration, his influence on Congress declined and he lost his hold on two powerful elements in his own party. The important business men—capitalists, bankers, managers of corporations, commonly called the "interests"—thought him disposed to interfere with them; while he found himself out of accord with the rising spirit of reform which aimed to give better expression to the will of the voters as a whole as against party leaders and political organizations.

Here was a critical point in popular government; for in practice it was almost impossible to elect a candidate unless he was on some party ticket. A small group of men, politely called the "organization," or more harshly the "bosses," in many states and cities had control of the machinery of the nominating conventions. Where they could not dictate a candidate, they could usually defeat the selection of any man whom they disliked or distrusted. Their power extended to national nominating conventions, particularly in the Republican party, because the Republican delegates from southern states, which almost always voted Democratic, were elected to national conventions by a handful of Federal office-holders and other professional politicians. Complaints were abundant everywhere of "hand-picked conventions," of delegates who sat silently in their seats until informed by their "organization" for what men they must vote. The solidifying principle was that the bosses' candidate could usually count upon the steady, regular members of the party.

A method of selecting candidates long practised in some parts of the country now spread rapidly through the Union; this was the primary, under which candidates were selected for each party by the ballots of the members of the party. The primary under-

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mined the convention system, which in some states was even prohibited. From nominations for local officers it spread by 1911 to state officers in two-thirds of the states; and after 1910 began to be applied to the choice of delegates to the national conventions. For a time the system seemed a great success; it opened opportunities to enter public life, and killed off unpopular leaders. An unforeseen effect was that the official ballots were made upon the basis of party nominations, with an opportunity for independent voting. The primary was therefore a public and effective election, which practically brought the party system into the domain of public law, as a part of the Government.

The distrust of conventions and controlled elections extended to the numerous and powerful bosses in city and state Legislatures. Three new devices were set at work to curb them and to interest the electors in public measures. The first of these, the referendum, was by 1909 spreading rapidly through the western states. It was a means of checking legislative action contrary to public sentiment. The system, both in local and state government, can be traced from colonial times; and most 19th century state constitutions were submitted to a popular vote, and also many statutes, if the Legislatures so directed. The referendum system furnished a mechanism, usually imbedded in state constitutions, by which a statute on the demand of a sufficient number of voters could be held back from effect until submitted to a vote of the electors. The state of Oregon was one of the earliest and most thorough-going in this reform.

What was to be done if the Legislature refused to enact a statute demanded by the people? How could this negative force be overcome? By the initiative, through which a designated number of voters could unite on a measure, which must then be submitted to the electors for their suffrages. Both the initiative and referendum were attacked on the ground that they were contrary to republican government, inasmuch as they substituted direct action for representation. The referendum had been so long and widely used that it was hard to make out a case against it. The initiative was based on the general principle that the ultimate source of authority is not the Legislature or any public officer, but the people at large. In a test case (Feb. 1912) the Federal Supreme Court declined to rule that the initiative and referendum were contrary to a "republican form of government"; and no further attempts were made to upset them on constitutional grounds.

A third branch of this system of appeal to the people was the recall, under which a public officer chosen by popular vote, and in a few cases those who were appointed in some other way, could be subjected to an election; and, if the majority decided against them, they would be thereby removed from office. The system began in the far western states and never spread so widely as the other two methods mentioned. In 1911–2 the recall came before Congress in connexion with the proposed constitution of the new state of Arizona, which included a provision for the recall of judges. President Taft vetoed the Act of admission because of this provision. The state therefore withdrew the clause, was duly admitted in 1912, and thereupon proceeded to reinsert the recall. In practice, recalls proved to be few, and recalls of judges very few. A still wider application of the principle of responsibility of functionaries to the voters was the recall of judicial decisions, which was advocated by Roosevelt in 1912 and was applied in one state, Colorado.

Popular elections were applied to the choice of Federal senators, first by an indirect method of pledging members of the Legislature, invented in the state of Oregon. The Senate contained some members who could never have passed the ordeal of popular election, yet were frequently re-elected by the Legislature. The result was the 17th Amendment, submitted by Congress June 12 1912, and added to the Constitution May 31 1913, under which all elections to the Senate from that time were to be made by direct popular vote. Another evidence of a rising feeling of responsibility in Congress was a statute (Aug. 7 1911) requiring candidates for the House and Senate to submit statements of the money raised and expended in their behalf and limiting the amount that they might themselves spend. One purpose of both these measures was to make it difficult for men to purchase their way into the Senate. On July 13 1912 Senator Lorimer of Illinois was practically expelled from the U.S. Senate for buying legislative votes.

Experience has shown that the load of responsibility placed upon the voters by these new measures was sometimes more than they were willing to bear. The scanty primary votes, and the inattention to some of the referendum and initiative questions put on the ballots, were seized upon as showing that the voter was interested only in men. On the other hand, the ballots of most cities, towns and states were loaded down with long lists of officers to be chosen at each election, so that the "vote for men" was in many cases a vote in the dark. The result was an agitation for the reform commonly known as the "short ballot," by reducing the number of elective officers and increasing the officers to be appointed by the few elective officials. Working difficulties were found in many of these reforms, and it was hard to keep the public keyed up to the necessary pitch of thought and attention at every election. It was evident, however, that the American people intended to free themselves from the shackles of what Elihu Root styled "invisible government."

Social Questions.—The spirit of discontent extended to many questions outside of politics. Throughout Taft's administration there was an increasing pressure for "equal suffrage"—that is, woman suffrage—which was introduced in the territory of Wyoming in 1869, gradually spread among the far western states, and then worked its way eastward. Inasmuch as the voters for the more numerous branch of the state Legislature are also voters for members of Congress and for presidential electors, women began to take part in national affairs, and one of them was a delegate in the Republican National Convention of 1908. As the number of suffrage states increased, it was natural to look forward to a constitutional amendment which would abolish sex distinction for voting and indirectly for office-holding.

Both state and national Governments were compelled to deal with the question of alcoholic beverages. From the earliest times there had been some restriction on liquor selling and liquor sellers as well as punishment for undue use of intoxicants. By 1909 in almost all states there was some form of general legal restriction; prohibition or local option or high licence or a state dispensary system. These laws were enforced more or less strictly within the state or communities to which they applied. The question became national, however, because the liquor trade transported its wares from one state to another; and that brought it within the Interstate Commerce clause of the Constitution and the Interstate Commerce Act. There was a long, running fight between the opponents of the liquor trade, Congress, the state Legislatures, and the Federal courts, which finally passed upon the validity of various Acts passed by the Federal Government regulating transportation. Eventually Congress adopted the policy, by the Original Package Act of 1890, of prohibiting shipments of liquor into prohibition states; and this law sustained the test of the U.S. Supreme Court. Pure food laws in force before 1909 were supplemented by the Drug Label Act (Aug. 23 1912), which greatly aided in preventing the adulteration of drugs.

Many questions arose out of immigration. The laws forbade the entry of labourers under a contract to work in the United States, of convicts, insane persons, and (after 1907) diseased persons; but the execution of such laws was slack. The first statute looking toward decided control of immigration was that of Feb. 1907, which increased the grounds of exclusion, and at the same time provided a plan to help the immigrants to find work. It also created an Immigration Commission, which in 1910 made a report in 41 volumes, strongly recommending the sifting of immigrants by testing their ability to read and write some language; but bills to that effect were twice vetoed by President Taft. Meanwhile, the number of immigrants rose in the decade 1901–10 to an average of a million a year. New machinery for registering departures brought out the fact that from 300,000 to 500,000 annually returned to their old homes, so that the rate of increase of population by immigration was no larger than it

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had been for 50 years. The alarming fact was that the immigration from W. Europe fell off, while great numbers of ignorant and unskilled people crowded in from Russia, Austria-Hungary, and other parts of E. Europe. Still, the newcomers found work and their employers found a profit in employing them.

Finances and the Tariff, 1908–13.—Every growing unit in the country—from a small school district to New York State—was harassed by questions of taxation and expenditure. The U.S. Government also searched for new resources, and found them in the income-tax, a method familiar in European countries and open to the individual American states. An income-tax had been levied by Congress during the Civil War, and again in 1884, when it was set aside by the odd decision of the U.S. Supreme Court that it was a direct tax which could be levied among the states only in proportion to their representation in Congress. Successful agitation brought about, July 13 1909, the submission of a 16th Amendment, to remove the restriction, and it was declared adopted by the necessary three-fourths majority of states, Feb. 25 1913.

June 25 1910 a postal deposit Act was passed which created a vast savings bank, of which many post-offices were the local branches. The new form of savings attracted foreigners who were accustomed to a similar system in their own countries; and in 1920 the deposits had risen to $157,276,322. Another new resource of the Federal Government was a tax upon corporations levied on net income (Aug. 5 1909). The immediate proceeds were small—only about $30,000,000 a year; but corporations were obliged to file accounts which showed their net income, and thus to give access to facts about their profits and methods. The more important question of reorganizing the national banking system so as to furnish a strong national institution was debated from 1908 to 1912, and was the subject of an elaborate report by a National Monetary Commission; but no action was taken at that time. The net Federal debt was $1,000,000,000, which was only about $11 per head of the population.

A financial resource as to which Congress had sole authority was the tariff. Under strong pressure from members of the party to carry out the promises of the Republican Convention of 1908, President Taft, a few days after his inauguration, summoned Congress to meet in special session, for a "revision." As usual there was a long controversy which resulted, Aug. 5 1909, in the Payne-Aldrich Tariff Act. The administrative features were good. The act created a permanent court of customs appeals, with power to determine finally all questions as to the value of imports; and also a Tariff Board, expected to make investigations and recommend specific measures which Congress would adopt. As to rates, the Act was not very different from its predecessor, except for a decided increase of duties on cotton and silk manufactures. There was a loud outcry that the "revision" called for by the party platform was plainly a revision downward and not upward. President Taft argued against the textile schedules, but signed the bill and in a speech at Winona, Minn., Sept. 17 1909, surprised the country by declaring that it was the "best tariff bill that the Republican party has ever passed." When in the next Congress the Democrats had a majority of the House, they passed a series of bills, covering a farmers' free list, woollens and cottons, which were carried also in the Senate by the aid of low-tariff Republicans; all these were vetoed by President Taft. In the campaign of 1912 the tariff played very little part. It was accepted that a considerable revenue must be raised by import duties; and the large import trade showed that the existing tariff was not prohibitive.

Trusts and Transportation.—During the 20 years ending with 1910 it had become clear that the most difficult question before the U.S. Government was the regulation of the vast aggregates of capital, commonly called trusts, which were combined into corporations and aimed at the control of particular lines of business, and also of the railways, which, as general transportation agencies, were of great importance in connexion with every kind of industry and trade. For many years Congress had been struggling with this question, and the result was two lines of restrictive statutes, headed by the Interstate Commerce Act of 1887 and the Sherman Anti-Trust Act of 1890. Upon these and the amendments to the Interstate Commerce Act was built a structure of decisions of the U.S. Supreme Court, sometimes annulling provisions of the statutes, more often altering decisions by the Interstate Commerce Commission. Partly to carry out and partly to avoid these decisions, the Mann-Elkins Act of June 18 1910 widely extended the Interstate Commerce Acts by including telephones, telegraphs, express and sleeping-car companies, and setting up a Commerce Court which was to hasten decisions on transportation questions. Armed with these new powers the Commission reduced some freight rates and raised others. December 2 1910, the Supreme Court dissolved the combination of the Union Pacific and Southern Pacific railways as contrary to the laws against mergers. The Commerce Court proved a failure; its decisions were received by the public as an unreasonable attempt to control the Commission; and in 1914 Congress refused appropriations, and the President was obliged to abandon it.

Federal control of railways on the whole worked well. It secured uniform appliances and a system of rates based on successive decisions of the Interstate Commerce Commission. This Commission was a striking example of disregard of the great principle of separation of powers inasmuch as it was a rule-making body, an executive body, and a court which interpreted its own rules, subject as to some questions to appeal to the Federal Courts. The great problem of the trusts was much farther from a solution than that of the railways, because the large corporations were linked together through the holding and manipulation of stocks by capitalists and banks, and through the so-called "interlocking of interests." Furthermore, except for Treasury processes for collecting taxes, there was no public agency other than the Department of Justice to call into action the anti-trust laws in specific cases and exact penalties for their violation.

The process of forming new and powerful corporations, frequently by the union of previous companies or firms, grew more active from year to year. Capital was abundant, vast riches lay in the development of mines and oil-wells and in manufactures and trade. The constant tendency was to combine and systematize so that such large lines of business as the production and manufacture of oil, the mining of iron ore and the manufacture of steel, the weaving of cotton, woollen and other textiles, the manufacture of tobacco, packing of meat, making of cordage, were rolling up into larger and larger corporate units. Above all, the railways which stretched throughout the country and were indispensable to business of every kind had consolidated into great systems which destroyed competition.

The only effective way of dealing with large corporations whose activities extended from state to state was to bring suit against them for monopolizing or conspiring to monopolize in their lines of trade. These were difficult matters to prove against corporations of great resources. Hence it was considered a triumph when, May 9 1911, the U.S. Supreme Court rendered decisions against two of the most powerful trusts, the Standard Oil Co. and the American Tobacco Co., the latter on an issue which had been pending since 1906. The minds of a majority of the Court worked in a roundabout way. It held that the anti-trust legislation must be interpreted by the "standard of reason" namely, that a combination was not unlawful or against the public interest unless it actually caused a restraint of trade and commerce among the Federal states or with foreign nations. Having thus set up a "rule of reason" which Congress had refused to enact, and created an example of judicial legislation, the Court proceeded in both the pending cases to hold that the companies were guilty of attempts to monopolize their lines of trade, and had tried to cloak their monopoly by setting up a variety of intertwined companies, thus concealing their transactions. The Court, therefore, upheld the justice and constitutionality of the Sherman Act, but as to penalties, the Court contented itself with ordering the offenders to disintegrate. The companies reluctantly and slowly went through the process of reorganization, but their stocks immediately rose on the market—a sufficient proof that the court decisions were more favourable than had been expected. Thenceforth the "rule of reason" required

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that positive proof must be adduced that a great combination was doing harm before it could be touched; the general danger of vast aggregations of capital was left out of account.

Another form of unlawful behaviour by trusts was their misuse of the patent laws. The question arose whether the maker of a patented device could insist that the purchaser must use also the seller's unpatented appliances in connexion with the materials employed. On this point the Supreme Court went through various stages of opinion. In the Dick case (March 1912) it held that such restrictions on the purchaser were legal. About two months later it held, in the "Bathtub Trust" case, that there could not be a monopoly of the product of patented machinery.

Labour Questions.—A long time was needed to make the discovery that closely connected with the railway question and the trust question was the legal and economic status of those who labour. Beginning in the 18th century with the English legal principle that a combination of labourers to raise their wages was unlawful, the United States changed its position and early accepted and for many years acted on the counter principle that strikes were lawful. No legal obstacle was put in the way of the organization, first, of local trade unions, then of nation-wide unions for single trades, and finally of national unions combining many trades. To this was slowly added by the unions the principle of the "right to labour," which means both that it is the duty of the community to see that the worker has a job, and also that at least the skilled workers have a kind of title in their employment, so that it is contrary to good morals for a "scab" to take the place of a striker. When the railways came under Federal supervision and control, the railway employees, especially the skilled workers, began to feel that they, as well as the shipping and travelling public, were entitled to protection by the Government. When, during Roosevelt's administration, the President designated an informal commission to negotiate a settlement of a wage dispute in the anthracite coal-mines in Pennsylvania, he made almost the first acknowledgment that such industries as fuel production and steel-making were national in their character and required national regulation.

The legal position of labour unions in these controversies was brought to a head by suits of national importance against unions.

The first test case was that of the Buck Stove and Range Co. against the American Federation of Labor, which was really a suit between a national labour union and a national organization of manufacturers. The charge was that the Federation, by posting the Company in its publications as "unfair" to labour, was boycotting and thus infringing legal rights. In its evolution the case turned into long-drawn-out proceedings against Samuel Gompers, president of the Federation, for contempt of court, on the ground that he had refused to obey a court order to abandon the boycott. After seven years of shifting of the case from one court to another, Gompers escaped the 12 months' imprisonment to which he had been sentenced. In 1910 a suit was decided against a union of the Danbury (Conn.) hatters, who had attempted to boycott the products of a local hat manufacturer. The jury found a verdict of $74,000 damages, part of which was eventually collected from members of the local union who had property, and refunded by the general trades union.

These court trials accented the labour controversy and led to violent strikes. In the midst of them sprang up a new labour organization, the Industrial Workers of the World (I.W.W.), which was an attempt on a large scale to organize the unskilled labourers, and also to reach the goal of one big union for all trades. The movement was unwelcome to the unions of skilled labour, because the unskilled were so much more numerous that they could always outvote the skilled, and were sure to insist on an equalization of wages, which would reduce the rates of the highly paid. For several years, strikes were frequent and often accompanied by acts of violence. In several instances labour unions supported their leaders in arson and murder. One such case was the blowing up of the Los Angeles *Times* building in Oct. 1910, for which two brothers named McNamara, one of them secretary of the International Association of Bridge and Constructional Iron Workers, were convicted and sentenced.

Another phase of the labour situation was the spread of employers' liability laws through various states, and an Act of Congress of April 22 1908 for the protection of employees of interstate railways. Minimum Wage Acts also were passed in a few states with the purpose of protecting the employees in industries that required chiefly unskilled or slightly skilled women. In June 1912 Congress added to its previous enactment of an eight-hour maximum regular day for public employees, by providing that all contract work for the Federal Government must also be on the eight-hour basis. The effect of these movements was that labour came to be recognized as one of the elements of production that must be considered; as most of the labourers were voters they brought to bear powerful influences on state Legislatures and Congress in favour of labour. On the other hand, the courts, particularly those of the states, were slow to recognize the changes in industrial conditions which made protection of wage earners necessary, and many statutes intended for the betterment of labour conditions were held invalid.

In addition, the courts began to use a system of labour injunctions; workmen, labour unions and members were forbidden to perform acts, which if performed would presumably be a violation of a statute and would therefore lead to prosecution, in which the question of guilt or innocence would be settled by a jury. If the offense were transformed by the injunction into a defiance of the Court, then the Court itself would decide on the responsibility and affix a penalty not specifically laid down in any statute. Labour was opposed to unlimited immigration, and nearly all the measures for restricting immigration were originally proposed by labour unions, particularly the convict and contract labour Acts. For many years there was a Labor or Socialist Labor national party, which regularly nominated a candidate for the presidency and cast a small popular vote. It did not succeed because there was a standing Socialist party which cast from half a million to a million votes and absorbed the Socialist vote; while the labour leaders saw that if they withdrew from the main political parties they would set the farmers and traders and professional men against them. Hence, in all the shifts of politics very few avowed Labour candidates were elected to the state Legislatures or Congress. Labour agents and agitators failed therefore, to influence the public at large—their speeches and literature were little regarded outside their own constituencies. Furthermore, the members of the labour unions, about 5,000,000 all told, were not more than one-eighth of those men and women in the United States who worked with their hands.

Foreign Relations, 1907–13.—In the pressure for action on social and political matters, foreign affairs received even less than the usual meagre attention given them by the American people. The tradition of isolation was a strong force in the public mind, notwithstanding the rapidly growing foreign trade and the influence of the great number of immigrants. The thing that brought the United States closest to European complications was the possession of the Philippine Is., which made the United States an Asiatic power, and compelled it to be interested in the fiscal and territorial conditions of China on the basis of the "open door" system proposed by Secretary Hay in 1901. In the western hemisphere the Americans upheld the Monroe Doctrine as applied by Roosevelt to prevent the use of force by European countries to collect debts and claims from delinquent American powers. Three steps had already been taken in pursuit of the Caribbean policy: the protectorate of Cuba, the Panama Canal undertaking, and the lodgment in San Domingo.

In the Hague conference of 1907 the U.S. delegates urged arbitration; and in accordance with the general principles put forth at that conference, Secretary Root in 1908 secured 25 arbitration treaties with as many countries. The United States and Great Britain arranged (Jan. 27 1909) to refer to the Hague tribunal their long-standing dispute on the Newfoundland fisheries, the first really important case brought before the tribunal. The result was a decision (Sept. 7 1910), which brought to a satisfactory termination the difficulty. President Taft, through Secretary Knox, secured in 1911 arbitration treaties with Great Britain and France. The Senate insisted on inserting in these

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documents a reservation of all questions involving what Roosevelt called the "vital interest, the independence or honour of the nation," and in 1912 it refused to approve them. A long-standing difficulty with Russia caused by the refusal of the Russian Government to recognize passports issued to Jews and some other people, was suddenly accentuated when, on Dec. 18 1911, the commercial treaty with Russia was abrogated. Trade relations went on for the time, however, without a treaty.

In 1911 the Republican majority under President Taft's leadership proceeded to a policy of commercial reciprocity with Canada, thus reviving the principle of the treaty of 1854 which went out of effect in 1865. An agreement was made with the Canadian Government by which each side should reduce or abolish duties on certain raw products and manufactures. For the first time in American history such an international arrangement was to be brought about by legislation on both sides, instead of by a formal treaty. With great difficulty the necessary bill was pushed through Congress (July 1911); but two months later the Canadian electors refused to support the Liberal Government which had negotiated the reciprocity agreement, and the plan broke down with the refusal of Canada.

Conditions in the Latin-American states did not remain harmonious. The United States ever since the Spanish war had been gaining territory and power to the southward. The arrangements of 1902 made Cuba practically a dependency; and from 1906 to 1909 it was found necessary to resort to those treaty rights and set up a provisional Government, supported by American troops. The Panama Canal was now approaching completion and the little republic of Panama, which it bisected, nominally an independent state, was in fact under complete American control. President Taft continued the occupation of San Domingo, the consent of the Senate to a treaty to that effect having been obtained in 1907. In 1911 he secured a convention by which Nicaragua ceded certain small islands on its Atlantic and Pacific coasts and gave exclusive canal privileges to the United States. Although the Senate did not ratify the treaty, President Taft practically took possession of Nicaragua and this occupation continued throughout his term. Another foreign question arose out of the possession of the Panama Canal. As the Canal approached completion, an Act of Congress was passed Aug. 27 1912 for laying tolls on shipping, from which American ships engaged in coastwise trade were to be relieved. The British Government lodged a protest (Dec. 9) on the ground that by its treaty with the United States the Canal was to be opened on equal terms to the ships of "all nations"; President Taft, however, stood by the Act, and the question was passed on to the next Administration (*see* PANAMA CANAL).

Still more serious were the relations with Mexico, where, in 1910, a revolution headed by Madero, assailed the presumedly solid Government of Dictator Diaz and drove the latter after a few months out of the country. Mexico was thrown into confusion, and President Taft found it necessary to place troops on the border; in 1912 he proclaimed an embargo on the export of arms or military supplies to Mexico. Meanwhile the concessions and property of Americans in Mexico were threatened or destroyed, and there were many cases of robbery, forced loans and murder. The Americans who had interests in Mexico began a steady pressure for intervention by the United States. The nationals of other countries were suffering from the same disorder and violence; but the temper of the United States was strongly against any show of force by other Governments, because it might be a direct or indirect violation of the Monroe Doctrine.

Across the Pacific, clouds rose on the diplomatic horizon. Chinese immigration had long been prohibited, but the commercial treaties with Japan allowed a reciprocal freedom of residence and trade to the nationals of the two countries. The immigration of Japanese was very distasteful to the people of California, who undertook to restrict Japanese children to separate schools. Behind this difficulty was the rising power of the Japanese and their national spirit, greatly enhanced by their victory over the Russians in 1905. In 1908 Roosevelt sent around the world a powerful naval fleet which visited Japan and was received with elaborate courtesy by a welcoming Japanese squadron exactly equal in number, ship for ship. In the Root-Takahira reciprocal note of Dec. 1 1908 (which was never submitted to the Senate), the United States practically admitted Japan's special interest in Asiatic affairs. In Dec. 1909, Secretary Knox suggested the nationalization of the Manchurian railways by China, which proved to be unacceptable both to Japan and Russia. The Japanese were evidently acquiring a sense of their special and almost exclusive rights to influence on the Asiatic mainland. The question of immigration was settled for the time being by renewal of the commercial treaty, July 24 1911; the previous "gentlemen's agreement" was continued, according to which, while not yielding its claim to a right of immigration into the United States, the Japanese Government pledged itself not to issue passports to labourers. There still seemed to be a feeling in the United States that the Japanese had in mind an imperial policy, and when in 1912 it was rumoured that they were trying to get possession of Magdalena Bay in Mexico, the Senate adopted the Lodge resolution against foreign occupation of territory near by which might be a point of vantage against the United States.

Politics, 1909–12.—In the action of Congress on many important issues as above described no party lines were drawn; though such measures as the tariff and the new taxes were distinctly Republican. As often happens when a party is firmly seated in power, the Republicans began to divide. On the tariff, some members from middle western states, particularly Minnesota, voted against the Payne-Aldrich measure because their constituents could see in it no advantage to themselves. Another influence which tended to divide the Republican party was resentment against the Speaker of the House, Cannon of Illinois, who exercised the powers that had been accumulating in the hands of Speakers for a hundred years. By his control of the proceedings of the House, by his appointments of committees, and by his power to refuse recognition of members who desired to take part in debate or submit proposals, he was practically the legislative premier. Through the combining of these powers the Speaker virtually had a veto on any measure or proceeding which he did not like. This concentration of authority in the Speaker, and a few chairmen of committees whom he designated, in many ways tended to unity and responsibility in legislation; but Cannon kept too tight a hand; hence, March 19 1910, a group of Republican "insurgents" joined hands with the Democrats of the House to reduce his power. By these and later changes in the rules, the power to appoint committees and to direct legislation was taken from the Speaker and never restored. The Speaker became simply a partisan moderator.

A new issue upon which both parties were divided was covered by the general term "conservation." The United States, though most of the arable land had passed out of its possession, was still, as owner of a vast area of public lands, the possessor of great tracts of forest, of mineral lands, and of water power. President Roosevelt became interested in stopping the waste of timber and minerals, in preserving part of the gifts of nature for future generations, and in retaining public ownership of the utilities of the country, particularly the forests and streams. The policy of conservation had hardly gone further than the reservation of large areas of forest land until 1910, when statutes provided for a new classification of land and for the reservation of coal by the Government. Congress in 1902 had provided for a system of irrigation, the cost to be advanced by the Government and repaid in instalments by the users of the water. This statute underwent various amendments so as to give greater encouragement to settlers. In 1910 large areas, previously held as forest lands, were thrown open to settlement. Under a statute of March 1911, considerable areas of mountain land were purchased in the Appalachians on the theory that their control would protect the watersheds of navigable rivers. Congress also reserved forever several scenic areas, particularly Rocky Mountain National Park in Colorado, Glacier Park in Montana, and later the Grand Canyon of the Colorado.

The Progressive Movement.—In the confusion of statutes, executive orders, proceedings of the Interstate Commerce Commis-

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sion and Supreme Court decisions, it was difficult to see how far the country was really advancing in its attempt to control capital and satisfy labour. The only clear result was that the Republican party was weakening, and that President Taft's popularity and influence were lessening. The diminution of power vested in the Speaker was an evidence both of discontent and of willingness to disregard party lines; and the State and Congressional elections of 1910 were unfavourable to the Republicans. The insurgents, who soon came to be called Progressives, gained most of the Republican districts in the west; and the Democrats gained about 50 seats in Congress, which transferred to them the control of the House; while in the Senate they had 41 of the 92 members.

The dissatisfied Republicans began to look forward to the presidential election of 1912, and a group of them gathered about Senator La Follette of Wisconsin as a leader and presumptive candidate. Meanwhile the state Legislatures were passing primary laws some of which included the choice of delegates to national nominating conventions. La Follette had broken into the Republican party organization in his own state, secured the governorship, and entered the U.S. Senate, where he violated the traditions of that conservative body by making speeches without waiting the usual length of time. Taft's friends and supporters naturally expected that the President would be renominated.

All these calculations were upset by the greatest personality in the country, Theodore Roosevelt. A few weeks after leaving the White House (1909) he undertook an expedition to Central Africa, and before returning made a series of visits to the countries of W. Europe. He was received as the ex-President of the most important of republics and as a commanding personage; immense crowds greeted him as a world celebrity. He returned to the United States June 18 1910 to find political conditions little to his liking. Most of his friends had disappeared from the Administration; his policies, particularly as to conservation and the more rigorous control of the trusts, seemed to him to have been slighted. Without any open breach of personal friendship Taft did not satisfy the ex-President, and the two drifted apart. On the other hand, the insurgent Republicans included some of Roosevelt's warm friends. It was impossible for him to remain silent, for he was called upon to speak in all parts of the country. Aug. 31 1910 at Osawatomie, Kan., he set forth a programme which he called "the new Nationalism," favouring publicity of the accounts and proceedings of trusts, a tariff commission, a graduated income-tax, a proper army and navy, conservation, protection of labour, and the direct primary with the recall of elective officers. This was a programme which could not be accepted by the conservative or "stand-pat" Republicans, with whom, by this time, President Taft, was included.

Nevertheless, throughout 1911 Roosevelt made no direct movement towards standing for the presidency. He publicly attacked Taft's position on the trusts in the columns of *The Outlook* of which he had become an editor, and openly classed himself as a Progressive. Meanwhile several of the western states, particularly California under the guidance of Gov. Hiram Johnson, had accepted a radical programme of political and social reform. A formal breach with Taft and the open candidacy of Roosevelt seemed inevitable. The crisis came when, Feb. 2 1912, La Follette suffered a physical and mental collapse which put him out of consideration; and on Feb. 12 President Taft in a speech alluded to the Progressives (evidently having Roosevelt in mind) as "Extremists—not Progressives; they are political emotionaries, or neurotics." This was taken as a challenge and a few days later Roosevelt openly declared himself a candidate, adding, "My hat is in the ring." Primaries or conventions had already been held in several states which would have instructed their delegations to support Roosevelt if they had known his purposes; in another large group of states, and those for the most part states that formed the backbone of the party, there was still time to organize and select delegates favouring Roosevelt.

Election of 1912.—As the convention held at Chicago approached, the lines of battle were developed. Behind Taft were Barnes of New York, Penrose of Pennsylvania, Crane of Massachusetts, and other "stand-pat" leaders. Among those in favour of Roosevelt were Garfield of Ohio, Pinchot of Pennsylvania and a strong body of Republican governors. Roosevelt himself had come to Chicago, established headquarters there, and thrown his immense energy and enthusiasm into the campaign. The convention was a scene of unusual excitement. Out of the 1,076 delegates something near 400 were pledged to Roosevelt, and there seemed a good chance of gaining for him some of the southern delegates, of whom a large number were negroes who recognized Roosevelt as favourable to their race. The decision was not made in open convention, but in the preliminary meetings of the national committee (chosen in 1908), which was strongly "stand-pat"; for that committee had to decide upon the right of claimants to be inscribed in the preliminary roll of delegates. The Roosevelt managers entered contests for many seats and had an especially strong case as to Missouri, Washington and two seats for California. In the end, every contest except that of Missouri was settled in favour of the Taft claimants. Even then the combination was almost broken. Notwithstanding the fact that the temporary organization was in the hands of Roosevelt's enemies, among them Elihu Root, his former Secretary of State, a test vote for temporary chairman showed 558 votes for Root against 502 for the anti-Taft forces. The shifting of 30 delegates from one side to the other in all probability would have brought about a "stampede" to Roosevelt; and those delegates Roosevelt would have had if he had thrown his "hat into the ring" two months earlier.

The conservative Republicans being thus in control, there was nothing for the Roosevelt men to do but to protest to the last. Roosevelt advised his delegates to take no further part in the proceedings. At the final roll-call, June 22, there were 561 votes for Taft, 58 scattering, and 107 for Roosevelt, besides 344 Roosevelt men not voting. In the last issue, therefore, Taft had a majority of 50 votes out of 1,070. Fairbanks of Indiana was nominated for Vice-President. In the minds of the conservative Republicans Roosevelt was extinct. He had entered the convention, been defeated, and he must bow to the will of the majority. In the minds of Roosevelt and most of his followers the nomination was a violation of the principles of popular government. At a great meeting held the same night Roosevelt openly advised a bolt. This was duly accomplished by a formal Progressive Convention which met in Chicago in Aug. and nominated Roosevelt for president and Hiram Johnson, of California, for vice-president.

Meanwhile the Democratic Convention at Baltimore met under the guidance of William J. Bryan, who had no hope of being the candidate himself but proved to be in a position to dictate the choice. He declared open war upon the capitalistic delegates, one of whom was sitting on the platform. The apparently sure candidate was Speaker Champ Clark of Missouri, who received a majority of the votes, but under the rules of the Democratic Convention requiring a two-thirds majority, he was finally defeated by Woodrow Wilson, governor of New Jersey, owing to the vigorous support of Bryan. Gov. Marshall of Indiana was nominated for vice-president. The platforms of the two old parties were of an usual type. The Republicans as usual declared for protective duties. The Democrats stood by their platform of a tariff for revenue only, additional regulation of the railways and presidential preference primaries. The Progressive platform was a general programme of political reform and "an enlarged measure of social and industrial justice."

It was not the platform, however, but men that appealed to the voters. The issue was really Roosevelt, Taft, or Wilson. Not for 50 years had there been so stirring a campaign. All three candidates took the field; and for the first time in presidential campaigns "soap-box" speakers appeared in large numbers on the streets of the cities. From the first it was clear that the real fight was between Roosevelt and Wilson, since Taft had to bear the unpopularity of the Republican party and also the Progressive charge that the Chicago Convention had given him a stolen nomination. The Progressives were well organized and their convention and campaign included many women. The final question was whether Roosevelt could draw to himself a

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sufficient number of Democrats to reduce the Democratic vote below the winning point. He was hopeful as to some of the southern states in which he had many warm friends and supporters.

The result in Nov. showed that the voters in the main stood by their regular candidates. The total popular Democratic vote, more than six and a quarter million, was only about 120,000 less than in 1908. The total Taft and Roosevelt vote combined was almost exactly the same as that of the Republicans in 1900. Roosevelt polled about four million popular votes to two and one half millions for Taft; but he carried only six states with 88 electoral votes against 40 states and 435 votes for Wilson. The only Taft states were Utah and Vermont with a total of eight electoral votes. Notwithstanding the ignominious defeat of their candidate, the Republican party was still intact with its "stand-pat" leaders, its "organization," and its control of state and local politics. On the other hand, Roosevelt had built up what seemed to be a new national party controlling four million votes, and he hoped for a continuation of that party as a power in the individual states and in national politics.

Woodrow Wilson.—The centre and soul of the Progressive movement was Theodore Roosevelt because of his ardent habit of mind; he felt intensely; he spoke with tremendous energy and deep conviction; he was accused by his critics of "inventing the Ten Commandments"; he was not only the head of a party, he was the head of a political cult (*see* ROOSEVELT, THEODORE). In that respect he was closely paralleled by Woodrow Wilson, who, on March 4 1913, was inaugurated as President. Wilson's life had been much less adventurous and varied than that of Roosevelt. Born in Staunton, Va., in 1856, of Scotch Presbyterian ancestry, son of a minister, he graduated from Princeton in 1879, essayed the practice of law in which he made no success, then studied political science and was a professor in several colleges, finally returning to Princeton. From 1902 to 1910, he was president of that university. In 1885 he published his first and most remarkable book, *Congressional Government*, which was a searching criticism of the weaknesses of the American legislative committee system and the separation of executive officials from legislation. He was an easy and attractive speaker, and had a remarkable literary style shown in several books on government and in an elaborate history of the United States. He moved much about the world, and mixed freely with people in and out of his profession, in which he was a leading figure. As administrator of a great university he chafed against the conservatism of his colleagues, and found he could not bring himself to share the responsibilities of direction with others (*see* WILSON, WOODROW). In 1910, a favourable year for the Democratic party, of which he had always been a member, he was put forward for the governorship of New Jersey by friends who looked farther than that office, particularly the journalist, George Harvey. New Jersey went Democratic, and during 1911 and 1912 Gov. Wilson had opportunity to show his skill as a party leader and his interest in reform. He made himself responsible for the "seven sisters," a group of measures dealing with direct primaries, corrupt practices, workmen's protection and control of trusts, and especially public service corporations, somewhat on the plan of the Federal Interstate Commerce Commission.

In 1912 when the Democratic party was looking for a candidate, Woodrow Wilson was put forward against Champ Clark, the experienced political chieftain. He was taken up by Bryan who saw in him first of all, an exponent of the political principles for which Bryan had stood for many years. He was wise enough to see that the party needed a leader and a President who could meet the Progressives on their own ground. He persuaded the Democratic Convention to nominate Wilson, who had a special advantage in his southern birth but was little known among the ranks of the party. Bryan also aided him by drafting a platform hardly less progressive than that of the Progressive party. The split in the Republican party rendered Wilson's election inevitable. On the eve of his inauguration he published a collection of his speeches, chiefly delivered in the preceding campaign, under the title of *The New Freedom*. It was in effect a confession of political faith, a forecast of what the President intended, a summing up of the fundamentals of American government. He protests against the political conditions and methods of the time, finds economic conditions even worse, and points out the baleful influence of corporations and trusts on parties and Governments. The book advocates publicity and action by popular vote as the remedy for the ills which the writer so clearly sees.

On entering office the first duty of the President was to select his Cabinet. It was only reasonable that Bryan, the most prominent man in the party, who had been three times its candidate for presidency, should enter it; but not that he should be made Secretary of State, an office for which he had little training and as little adaptation. A new Cabinet office had just been created by Congress, the secretaryship of the Department of Labor, to which was appointed W.B. Wilson, a former member of Congress and a strict labour organization man. Lindley M. Garrison, Secretary of War, and Franklin K. Lane, Secretary of the Interior, were strong men. Albert S. Burleson, Postmaster-General, and Josephus Daniels, Secretary of the Navy, had no adequate training for their duties. David F. Houston of Missouri was made Secretary of Agriculture, William G. McAdoo, Secretary of the Treasury, and James C. McReynolds, Attorney-General. Most of the members of the Cabinet were men who could be trusted to follow the President's lead. One remarkable figure, not included in this list, was Col. E. M. House of Texas, who for six years was the President's most trusted counsellor and political friend without holding any political office. The President's judicial appointments were good, including one man, Louis D. Brandeis, as justice of the Supreme Court, against whom a propaganda was raised because he was supposed to be unduly radical and favourable to labour. In the minor civil service Wilson carried out his principles by enlarging the classified list of posts which could be entered only by competitive examinations.

Although a genial man, who could be a delightful companion, full of experience and of Scotch Presbyterian humour, President Wilson from his first day in the White House cut himself off from most of his countrymen. There were none of those receptions open to all, which had delighted President Roosevelt; none of those sessions with newspaper correspondents that Taft had thought not beneath his dignity. The President's theory was that he must husband his time so as to consider his views upon public questions; nor did he expect the members of his Cabinet to act as antennæ for him, to test the currents of public sentiment. He gauged the public mind for himself. He had a powerful mind, an amazing skill of expression, and an intense belief in the power of ideals to arouse and inspire a people. Furthermore, he stood by the political programme indicated in his book *The New Freedom*. He thought he had no need of conferences, of feeling the public pulse, of mixing with members of Congress and party leaders, of personally greeting the average voter who so much appreciates a word from the President.

Finance and Tariff.—The election of 1912 carried with it a safe Democratic majority in the Senate and a two-to-one majority in the House, so that the responsibility for legislation was clear. Champ Clark again had the empty honour of the Speakership. April 8 1913, the President created a surprise by appearing in person to address the two Houses of Congress jointly at the opening of a special session, instead of sending the written message which had been invariable since 1800. This practice he followed throughout his administration, with great effect. It was part of his conception of the presidency. He was not only chief magistrate of the nation, but head of the Democratic party, and practically the premier of the Government from whom ought to proceed plans for important legislation. May 26 1913 he publicly denounced the lobbyists in Congress who he declared, were endeavouring to control tariff legislation; and Congress accepted the rebuke. He disdained the arts of Jefferson or McKinley in soothing individual congressmen; he revived and enlarged Roosevelt's practice of telling the country what Congress ought to do. Furthermore, he had in his mind a sheaf of statutes which he believed the country needed.

The special session was called particularly to frame a tariff Act; the outline of which was contained in his first address. Repre-

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sentative Underwood, chairman of the Committee of Ways and Means, gave to the new measure his name and large experience. The purpose of the statute was to enlarge the free list of raw materials, foodstuffs, and some manufactures, to make a moderate reduction of the protective duties, and to correct some of the things which made the Payne-Aldrich Act unpopular. It was with but one exception the first measure for tariff reduction enacted since the Civil War. Included in the statute was an income-tax, at last made possible by the adoption of the 16th Amendment (Feb. 25 1913), which was expected to supply any revenue which might be lost by the reduction of duties (*see* INCOME TAX, *United States*). The tax was low: 1% on incomes from $3,000 to $20,000 a year, and a sliding scale on larger incomes, with 6% as a maximum. A Tariff Commission was created to make researches into the workings of the Act and try to find out what was the actual difference between the cost of labour in the United States and in foreign countries. The Republicans naturally fought the bill throughout, but it became a law, Oct. 3 1913.

The powerful influence of the President was again exerted to secure a systematic banking system, with the result that (Dec. 23 1913) the Owen-Glass Federal Reserve Bank Act was added to the statutes (*see* FEDERAL RESERVE BANKING SYSTEM). The principle was no longer to rely on separate national banks, each chartered as a separate entity and having no official connexion with other banks, but to create a national institution, which was to be divided into 12 regional banks, in each of which was a body of directors, besides the central organization in Washington. In these 12 subdivisions clustered such banks, whether national or state-chartered, as chose to accept; but pressure was put upon national banks to go into the new system. The Federal Reserve banks were authorized and expected to rediscount commercial paper discounted by the local banks. The new institution was also to issue a new form of paper money. Federal Reserve banks were authorized to act as depositories and fiscal agents for the Government. It was about a year before the system could be put into operation, but it was from the start recognized as a great improvement and a large national asset. At the same time a Rural Credits Act was passed (July 17 1916), which created a special group of banks to lend money to farmers on the security of their farms. Both banking systems worked smoothly. The Federal Reserve banks greatly increased the elasticity of the currency; the effect of their operations up to 1920 was virtually to add an immense sum to the circulating medium of the country.

Transportation, 1914–6.—Experience showed that it was much easier to secure regulation of the railways than of other corporations. In 1914 the Interstate Commerce Commission began for the first time to sanction small increases in rates. Under a statute of March 1 1913 the Commission was authorized to enter on an elaborate valuation of the railway property throughout the country as the basis of a judgment as to what was a reasonable profit (*see* RAILWAYS: *United States*). The Supreme Court supported recent legislation by compelling the pipe-lines to accept the status of common carriers, and by breaking up some of the railway combinations, particularly that of the New York, New Haven and Hartford, which had tried to monopolize the steam, trolley, and steamship lines in southern New England. Down to the middle of 1916 the railways were doing well on the prevailing low rates for passengers and freight.

A new transportation problem developed as the Panama Canal approached completion; for this was the first great agency of transportation which was owned and managed by the U.S. Government. President Wilson undid the work of the previous Congress so far as it gave special privileges in the canal to American vessels. He used to the utmost his personal influence in supporting a bill repealing the discrimination in favour of American-owned vessels, of which the British Government had complained; it became an Act, June 15 1914. On Aug. 15 the first steamer passed through the Canal from sea to sea and in a few months the Canal was paying its own way. Temporary slides closed it for a few months; but in 1916 traffic was resumed and by the close of the fiscal year 7,046,407 tons of shipping had made use of the new international waterway since its completion. The success of the Panama Canal called attention to the possibilities of water transportation. A canal across Cape Cod, constructed by private capital, was opened July 29 1914. The state of New York spent a hundred million dollars in enlarging the Erie Canal which was then allowed to remain almost unused. Various plans were urged for an artificial waterway from the Great Lakes to the Gulf, ignoring the fact that the Ohio and Mississippi rivers had almost ceased to be used for traffic. Internal canals were all subject to the difficulty that they could not compete with the railways which received freight at any place in the United States for delivery at any other place; while in the northern part of the country ice prevented winter traffic on canals.

A new question of transportation was arising through the rapid development of motor vehicles. At first a plaything, then a luxury, by 1908 they were spreading throughout the country, for pleasure, for convenience, for professional work; then, as the motor-truck developed, for general transportation. These machines could not well be operated on the ordinary country roads or on some of the city streets; and the attention of the whole country was called to the absolute necessity of good roads. The old system of privately owned toll roads and bridges had almost disappeared, and the only way to accommodate this new traffic was to build roads at the public expense. Some of the states had for years been aiding the rural localities in this process. As soon as good roads were built, however, the public discovered to its consternation that they would soon wear out unless kept in order at great expense. In 1916 Congress passed an Act appropriating approximately $85,000,000 to be paid in about five years to such states as would contribute equal sums for good roads.

The Trusts, 1914.—Just before President Wilson took office, an investigation was begun of the so-called shipping trust, composed of some American and various foreign companies, which was charged with a monopoly of a large part of the business of marine transportation by steamers. A few hours before the end of President Taft's term a congressional committee reported against the "great and rapidly growing concentration of the money control and credit in the hands of a few men." The Supreme Court in its decisions followed this spirit of opposition to the growth of combinations. President Wilson urged successfully a radical amendment of the Sherman Act and the result was the Clayton Anti-Trust Act (Oct. 15 1914) against discriminating freight agreements, interlocking directorates and holding corporations. The field of governmental action was thereby very much enlarged. In June 1914 in a suit involving the International Harvester Company, one of the largest of the manufacturing corporations, the U.S. Supreme Court upheld state anti-trust laws. The ring of law and justice seemed to be drawing closer round the great offenders; yet these offenders still flourished, and huge corporations, such as the U.S. Steel Corp., paid dividends on thousands of millions in stock and bonds.

Another branch of the same attack on the money power was the Federal Trade Commission, created Sept. 26 1914, which was an attempt to find means of dealing with corporations engaged in interstate commerce other than banks and common carriers. It received large powers of investigation, and the very important authority to institute hearings as a preliminary to suits. In the same direction were the "blue sky laws" passed in this period by many states, to break up the practice of floating the stock of companies which had no property more substantial than the atmosphere. By these statutes and active prosecutions the Democratic party was put on record as the enemy of the enemies of the people. Unfortunately, the more the laws, the more the need for laws; while there was still what Roosevelt called the "twilight zone" of business action, an area in which neither state nor national laws were operative.

Labour 1913–7.—The example of capital, in rolling itself into masses too great to be controlled by ordinary means, was followed by labour, which during this period took the field most successfully. The American Federation of Labor was a loosely woven council of representatives from the great trade organizations; it did not undertake to call strikes, though it was likely to support

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them. Its agitation and its publications were lively; and it had great effect in bringing about combined and simultaneous demands for the various items in the labour programme. The leaders fixed upon an eight-hour day (commonly interpreted as 48 hours a week) as the basic working time; by which they meant that any work beyond the eight hours was overtime, to be paid for at extra rates. The eventual demand was for a "time and a half" rate (each hour to be counted as an hour and a half) for ordinary overtime, and "double time" for Sundays and holidays. The next item was the minimum wage, which made its way slowly and was not altogether acceptable to labour, since it tended to end the employment of feeble and old persons who could not earn even the minimum wage. Another demand was that American citizens should have the preference over aliens in employment. The Supreme Court set aside an Arizona statute in that direction, and affirmed a somewhat similar New York statute. Labour in general was unfriendly to child labour and was, therefore, interested in a Federal statute of Sept. 1 1916. Since Congress had no right to regulate child labour directly, it stretched the Interstate Commerce clause of the Constitution to cover the prohibition of the transport of products made by child labour under specified conditions. This Act was afterwards set aside by the Supreme Court. Some of the states set up public employment bureaus. Many labour acts were contested and nullified by the state courts; but there was an unmistakable gain in public sentiment favouring protection of labour.

As the labour unions gained in numbers and strength they used their energies in favour of the "closed shop," that is, a system by which union men refused to work in any establishment where men not members of the union were also employed. Their object was to bring everybody in that particular trade into the union so as to form a firm front. From this idea rapidly developed the system of sympathetic strikes, in which members of one union back up another union by refusing to handle or use or transport products of non-union labour. Thus a factory employing a thousand hands might be compelled to stop work because it directed two or three non-union men to clean a truck, or because it bought machinery built by non-union labour—hence boycotts and perhaps ruin for employers who had no difficulty or quarrel with their own workmen.

Never in the history of the United States had there been so many and so violent strikes as from 1913 to 1917. In New York 150,000 garment workers were unionized and they struck. In May 1916 nearly a million men in various states were out of work because they or some other union had struck. The I.W.W. organized long and tumultuous strikes among the silk weavers of Paterson, N.J., and the textile workers of Lawrence, Mass. More than half of these strikes were attempts to get higher wages; many of them aimed at new working conditions, and very often sought working rules which would add to the wages without increasing the service. In the trying years of 1916–7 there were violent strikes directed not only against non-striking workmen, but against the public peace—for instance, among the Michigan ironworkers and the Spokane lumbermen. In 1913 there were armed conflicts in Colorado. In July 1917 at Bisbee, Ariz., the tables were turned. A kind of vigilance committee seized and carried out of town, with orders not to return, about 1,200 striking miners and their friends. When after many months a trial was obtained in the state courts for those responsible for this illegal action, it was found that no jury would convict.

The most serious of all these labour struggles was the threatened strike in 1916 of the large and very powerful unions of railway employees. A day was set for a general strike all over the country. The companies refused to make further concessions, believing that a few days of strike would bring the public to their side. President Wilson intervened and all but compelled Congress to pass (Sept. 3 1916) the Adamson Act by which a basic eight-hour day was secured with *pro-rata* for overtime. This turned out to be in effect a large increase of wages. The Supreme Court upheld this statute, which went to the furthest verge of the Federal Government's authority over labour matters, and formed a basis for the increases of following years.

Social Movements, 1913–7.—These struggles between the railways and the courts, between the trusts and Congress, between labour and state Governments, between strikers and the President of the United States, are part of American history, because they were vital to the welfare of the country. Combinations, both of capital and labour, were too large to be dealt with by any kind of private organization, or by the local and state Governments. Neither the capitalist nor the labourer respected the restraint of state legislation. It was apparent that in the long run the country would go back to the "might makes right" of the middle ages, unless some peaceful settlement could be made by a force that must be respected. Yet the ordinary plain citizen was not much disturbed by these contests, unless he held stock in a trust or his son was a member of a trade union. The first concern of most people is their bread-getting, and the greater part of the population was earning its bread daily. The farmers everywhere were aroused, for they looked on railways as hostile to their interests, by overcharging for carrying their products, and they resented the trusts which they believed raised prices. The storm centre was in Washington, where President Wilson stood intent on finding the remedy for these difficulties.

The anti-liquor forces steadily developed strength. They urged out-and-out prohibition and secured it in more than half the states. At the end of 1917 war prohibition was enacted by the Federal Government and also prohibition in the district of Columbia. December 19 1917 a two-thirds majority was secured in Congress for a prohibition constitutional amendment—the 18th amendment—which was at once submitted to the states. Woman suffrage also advanced steadily. When it appeared in 1915 that a third of the male voters in the conversative eastern states of Pennsylvania, New Jersey, New York and Massachusetts favoured woman suffrage, the result was beyond doubt. Congress submitted an amendment in 1919. Thus changes that had been 50 years on the way finally were brought about by the force of public opinion.

A change was also visible in the attitude of the country toward immigration which Congress was determined to reduce by an intelligence qualification. Wilson followed the example of Taft by vetoing the new bill not once but twice; yet on Feb. 5 1917 it was passed over his veto. Besides a literacy test it raised the head-tax to $8 and excluded oriental labourers coming from certain geographical areas which did not include Japan but did apply to Hindus and Malays. Causes connected with the World War at the same time brought about a reduction in the number of immigrants.

Educational Progress, 1909–21.—The decade following 1909 was marked by a new sense of the possibility of general education, and the responsibility of the various governments within the United States for a more direct, searching and practical type of education. The country was accustomed to a system of graded public schools, offering the "common school education," and leading up to the few surviving endowed academies, and the thousands of public high schools, which were expected to "prepare" the small proportion of young men who went on to institutions of higher education. This system had been enriched in various ways.

By 1910 girls were given about an equal chance in the public elementary and secondary schools, and in a large number of co-educational colleges and universities, besides a small group of high-class colleges open to women only. Secondary education was subdivided into literary, commercial and industrial schools. The institutions of higher learning set up new professional departments including the intensive study of education and separate schools of science, engineering, agriculture and other specialties. Private enterprise created a great number of so-called business colleges, and a few very efficient trade schools. The prestige of the classics and of the so-called culture courses was declining; and the most conservative universities moderated their requirements for entrance and offered degrees to men and women on a variety of specialized and technical courses. The number of students in the higher institutions increased to 355,131 in 1918.

Nevertheless there was general complaint that the schools did not relate themselves to the life of the community in which the children were to pass their later lives. It was a common experience that the numerous boys and girls who left school at from 12 to 16 years of

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age, and even the graduates of the secondary schools, did not take hold readily of trades or business, and were hard to "break" to new tasks. For many years a remedy had been sought in manual-training schools, mostly secondary, which undertook to help the boy and girl to meet the manufacturer and employer by specific training in shop practice. The new steel town of Gary, Ind., introduced a general system of industrial schools, in which the pupils in the lower grades took various kinds of shop work. A National Society for the Promotion of Industrial Education became the focus of a movement to organize what now became generally known as vocational education throughout the country.

A national commission was appointed by President Wilson, in 1914, to consider the whole subject. The Federal Government was making annual grants to the state agricultural and mechanical colleges, founded by the Morrill Land Grant of 1862. This idea of grants-in-aid was incorporated into the report of the commission, and into the resulting Smith-Hughes Act, Feb. 22 1917, which provided the machinery and laid out the outlines of plans for action throughout the Union. It created a Federal Board for Vocational Education which framed an elaborate plan for instruction in the four vocational fields of agriculture, commerce, industry and home-making. The Act promised to appropriate Federal funds rising to about $7,000,000 in 1925 and thereafter, to be paid to such states as would match these funds dollar for dollar.

The underlying idea was that training for life-tasks was to be carried on in regular public schools alongside the usual culture studies; that it ought to begin in the lower grades and run all the way through; that it ought to apply to girls, particularly in the fields of home life and women's industries; and that it ought to offer facilities for those already employed, through continuation and part-time schools.

Private enterprise went alongside this movement by building up advanced engineering and trade schools of a high type, such as the Carnegie Institute at Pittsburgh; by improving the private commercial schools, and establishing advanced schools of business training in colleges. Some of the great manufacturers, especially in the automobile trade, set up schools within their own works.

When the United States plunged into the World War in 1917, and it was discovered that a vast number of young men were physically and intellectually unfitted for military service, a new influence was brought to bear in favour of a type of public education which would help to make citizens. The Government established a variety of vocational schools to train men for the numerous specialties of military service. It made great use of the shops and other vocational facilities of the existing schools and colleges. When the war was over, those institutions were used by the Government for "rehabilitation," preparing partially disabled soldiers for self-support. At the same time the schools and colleges of the traditional cultural type advanced in resources and efficiency, many of them taking on vocational subjects as suitable for higher education. Great sums were raised by special "drives" among the alumni and friends of the endowed institutions, and the state universities were allotted hitherto unheard-of grants. The strictly vocational schools were admitted into fellowship with the other institutions. The students fraternized, joined in athletic contests and alumni associations and university clubs. There seemed room for both the old and the new types of national education. (*See* EDUCATION: section *United States.*)

Foreign Policy, 1913–7.—Woodrow Wilson was naturally a man of peace, and so was Secretary Bryan. At the outset of the administration they set themselves to aid the cause of general peace by enlarging the plan of arbitration treaties which had been urged by Root and Taft. Secretary Bryan prepared a definite project for treaties by which the parties should pledge themselves in case of difficulties to submit their grievances and claims to a special arbitration commission; and to abstain from war or preparations for war until the commission should have had time to report. This method avoided the difficulty which had either wrecked or weakened previous arbitration treaties, namely the exclusion of certain matters from arbitration. On the other hand, under such treaties no country would be bound to accept the finding of a commission. The presumption was that a sensible nation would submit to the judgment of an impartial tribunal. There was little difficulty in concluding more than 30 treaties upon this basis in the course of a year. They were never effective, and they disregarded the fact that since the first suggestion of general arbitration on a large scale by the Hague Conference of 1899, there had been five important wars, in not one of which had any contestant expressed a desire for arbitration by an impartial tribunal. The truth was that the American people as a whole had been little accustomed to international questions and had no definite foreign policy.

The Government of the Philippine Is. was altered by setting up the first Filipino Assembly in 1908. Under President Wilson, Gov.-Gen. Cameron Forbes was withdrawn and Burton Harrison was appointed his successor, to carry out a policy of liberalization and preparation for independence. The Filipinos were allowed to hold a majority of the seats in the Commission, which was a kind of administrative upper House. Natives were substituted for Americans in many of the civil offices. The Filipinos were thus given a definite opportunity to govern themselves. In response to the pleading of President Taft, Congress in 1909 grudgingly included them within the customs boundary of the United States and thus in practice abandoned duties on goods arriving in the United States from the islands. The Jones bill proposed even greater local powers. As enacted Aug. 29 1916, it greatly enlarged the power of the popular part of the Government, and the Commission ceased to exist. The bill promised that the Filipinos should be given their independence when their ability to govern themselves should be demonstrated. In April 1919 President Wilson publicly declared that he was ready to grant complete independence. There was no answering sentiment in the United States, perhaps because the World War had made it clear that so feeble and unarmed a state could not hope to live without the continued protection of the United States.

At the other end of the American empire, Cuba, while nominally independent, remained a protectorate of the United States. March 2 1917 the Porto Ricans were for the first time made American citizens and received a popular Government of two elected Houses, possibly a preparation for statehood. President Wilson continued the practical administration of San Domingo which dated back to Roosevelt. He also took military control of Haiti in 1914 and followed it by a treaty which was ratified by the Senate Feb. 28 1916. He carried even farther Taft's policy in Nicaragua by a treaty (ratified by the Senate Aug. 14 1914) which converted that State into a virtual protectorate. Another area came under control of the United States by a treaty for the annexation of the Danish West Indies (Aug. 4 1916); these islands were duly organized under the title Virgin Is. of the United States. Little opposition was made to this creation of a virtual empire, including dependent provinces. No reluctance was shown by the American people in extending their borders, their influence and their naval stations, so as to include portions of the West Indies. They were unconsciously preparing the way for a policy of Caribbean activity, under which the United States would take that predominance in the West Indies which Great Britain had held for over a hundred years.

Latin America and the Orient, 1913–7.—The peaceful policy of the United States towards its neighbours was severely tested by disturbances in Mexico. Soon after Wilson's inauguration in 1913 Madero, president of that turbulent republic, was murdered and Gen. Huerta, an insurgent officer, thereupon declared himself the head of the State. The almost invariable policy of the United States had been to recognize any *de facto* head of any Latin-American Government, without inquiring into the source of justice of his title. To President Wilson and to many others it seemed an iniquity to recognize murder as a proper means of changing a Government. He therefore adopted what he called a policy of "watchful waiting." He steadily refused to recognize Huerta, who was compelled to battle for his dictatorship against Carranza, the bandit Villa and other rival revolutionists. Not having recognized Huerta, Wilson was not in a position to protect American rights of life and property in Mexico. Some years later a record was published of 112 murders or violent deaths of Americans. All Wilson could do was to declare neutrality as between Huerta and his rivals. In April 1914 a trifling dispute arose as to a salute of the American flag and Wilson, apparently yielding to strong public sentiment, ordered the navy to attack and capture Vera Cruz, of which the United States remained in possession for some months. The real object appears to have been to discomfit Huerta, who was compelled to flee the country. Two years later, further and more serious trouble arose when the brigand Villa raided the town of Columbus, N.M., and killed several soldiers and civilians. The Government of Mexico had no control over Villa, and President Wilson ordered a military expedition under Gen. Pershing to advance into the interior of

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Mexico, which remained about eight months, without capturing Villa or accomplishing any other definite result. The three friendly nations of Argentina, Brazil and Chile—commonly known as the "A B C Powers"—offered a kind of mediation; and after many months of delay, at their suggestion Carranza was recognized as president by the United States. But disorder continued; neither life nor property was safe. Not till 1921, after 11 years of civil war and immense destruction of life and wealth, did Mexico emerge from the state of revolution which had been its chronic condition before the time of President Diaz.

The long controversy with Mexico was highly disturbing to the intention of the Administration to cultivate close relations with Latin-America in general. In spite of four pan-American congresses and several scientific congresses, in spite of the visits of Roosevelt and Secretary Root and Secretary Knox to S. America, and the opening of the short route to the W. coast through the Panama Canal—there could be no harmony if the United States were to continue annexing small and defenceless Latin-American nations and engaging in undeclared wars with Mexico. President Wilson sought to relieve apprehensions in this regard, and in a speech at Mobile Oct. 27 1913 declared that the United States had no designs on the territory or independence of its Latin-American neighbours. Colombia, too, had a grievance arising out of the loss of the isthmus when the Panama Canal Zone was annexed in 1904. Wilson gave his approval to a treaty to pay $25,000,000 to Colombia and to include an apology for the disagreeable events of 1904; but he could not push his measures through the Senate, though a similar treaty, minus the apology, was ratified by the succeeding Administration in 1921.

In regard to the Far East, Wilson had little opportunity to develop a policy. He began by disavowing the plans made under the advice of President Taft for a concert of American bankers with those of other countries to lend money to China. He continued, on the same lines as the Taft Administration, to argue with the people of California because they insisted on passing a statute restricting alien ownership of lands by Japanese residents. The World War soon made the United States and Japan temporary allies, and on Nov. 2 1917 the Lansing-Ishii note, on the same plan as the Root-Takahira note of 1908, set forth that the United States recognized Japan's "special interests in China." In the deeper currents of East Asiatic diplomacy the United States did not enter until after the war.

Outbreak of the World War, 1914.—Long before the domestic and foreign policies of the United States reached the results described in the preceding sections, the United States was brought face to face with new and vital problems arising out of the war. That the country was peaceful in 1914, and expected to remain indefinitely at peace, is shown by the lack of anything that could be considered national military preparation in the terms of modern warfare. When on Aug. 4 1914 President Wilson issued a proclamation of neutrality as between the two groups of European nations just engaging in a gigantic struggle, the authorized military establishment was about 107,000 men of whom some 87,000 were enrolled. The United States had not one military aeroplane of approved type; had only four modern heavy field guns and no transport for them; had not a trench bomb nor a mine-thrower; nor considerable supplies of any weapons or equipment except 800,000 excellent rifles; nor any officers experienced in the kind of warfare used in the recent South African, Manchurian, Balkan and Tripolitan campaigns; nor any instruction camps for officers or men. The navy included a fleet of battleships recently built, but was weak in small and swift vessels and particularly in submarines, though it had the great advantage of trained crews accustomed to the strategic units of sea warfare. For the protection of the Texas border, and as a second line in case of an invasion of Mexico, militia was available, but when called out later proved to be of little service. The tradition of a hundred years led the American people to expect no wars and in case of danger to rely on hasty volunteer enlistments. Bryan, in many respects a far-sighted man, publicly declared that the nation needed no preparation, for it could raise a million men between sunrise and sunset.

The foreign policy and the diplomatic organization of the United States were not fitted for such a crisis. Apparently not one of the American ambassadors realized the imminence of war in Europe or warned the Department of State of trouble; although Theodore Roosevelt as far back as 1909 had detected the hostile attitude of Germany toward the United States. The traditional diplomacy of America was based on the Monroe Doctrine as a principle that would keep European Powers out of the Americas, and therefore out of dangerous controversies with the United States. On the other hand, the principle of isolation forbade the United States to take any part in European crises or wars. Friendship with all nations had been the avowed policy of many successive presidents. If nations fought among themselves, the United States expected to remain neutral. As a neutral it stood by the principle of "freedom of the seas," by which was meant in particular the right to carry on commerce with all belligerents, in case of war, subject to the limitations of the then acknowledged international law as to contraband and blockade. Moreover, the United States during the Civil War had laid down principles of "continuous voyages," which it could not refuse to accept so far as its own commerce was concerned. Yet probably not one voter in ten had any clear notion of the external policy and principles of his Government, or understood that such a war as broke out in 1914 must deeply affect the United States, and might at last draw it into the struggle.

The diplomatic activities of the United States at the beginning of the war created no difficulties. Thousands of American tourists and residents were caught in the mobilization of the great European armies, and on Aug. 8 1914 $5,500,000 was sent over by the Government on a U.S. steamer to aid in bringing them home. A few weeks later relief was organized on a large scale for the Belgian people, most of whose country was overrun and held by the Germans. From year to year this system of relief was enlarged, so as to include French refugees as well as those who were still in the devastated portions of France, the unhappy peoples of Serbia and Asia Minor and other non-combatant sufferers, besides the sick and wounded of the contending armies. The agents of the American Red Cross and similar organizations were received in most parts of the war area, and privileged to work at the front and to carry on their operations within the warring countries. Supplies costing more than $1,500,000 were sent to Europe by the American Red Cross before the United States entered the war. This work of mercy put these unofficial representatives of the United States in the position of exponents of American neutrality.

Difficulties of Neutrality, 1914–7.—From another point of view the United States was compelled at once to take into account the relation between the war and American industries, commerce and finance. Very soon after hostilities began, loans were sought by most of the belligerent Governments. Large amounts were placed in the United States by Great Britain, France and Russia. The German Government floated several small loans, chiefly among their nationals and former nationals. President Wilson for a time advised Americans against aiding either side in that way and issued a proclamation (Aug. 18 1914) advising that the people remain neutral "not only in act but in word and in thought." Such neutrality was impossible, because the natural course of neutral trade put the United States at once in the position of a source of supplies of every kind for any belligerent that could transport them. Probably not a dollar of the loans placed in America ever crossed the Atlantic in cash; as fast as the money was borrowed it was spent in the United States for the purchase of food, clothing, animals and especially munitions. Though the privileges of this trade were in theory equal, in practice it was decidedly unfavourable to the Central Powers. In the first weeks of the war German commerce was driven from the seas and more than 80 German steamers took refuge in ports of the United States. The Allied command of the sea very nearly cut off trade of any kind between the United States and Germany and her allies; while commerce continued in ever-increasing volume with England and France. This disparity led to violent protests on the part of the German Government, supported by

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Germans and pro-Germans in the United States, and also to lawless acts perpetrated or directed by agents dispatched by the German Government for the purpose of buying up or paralysing the munition factories.

In addition to this controversy as to munitions and other supplies there was the question of the German methods of carrying on war, and particularly of the treatment of the occupied areas of Belgium and France. Neither the State Department nor any considerable number of American statesmen saw any obligation under the Hague neutrality treaties of 1907 to go to war for the defence of Belgian neutrality; nevertheless the German policy aroused deep and lasting resentment. Within a few weeks after the war broke out the United States realized for the first time that its population included hundreds of thousands of citizens of the belligerent countries, many of whom were liable to military service and attempted to return to their homes in order to serve. The road for recruits was blocked for the Germans and their allies, but open for the English, French and later for the Italians, Serbians, Greeks and Armenians. No neutrality proclamation could prevent these men from believing in their native countries, defending them by argument, and going over to fight for them if possible. For the first time in a hundred years the United States found within its own borders the sharpest division on questions of foreign policy.

On the other hand, the war trade brought immense profits. The favourable balance of trade rose from $691,000,000 in 1913 to $1,768,000,000 in 1915 and $3,000,000,000 in 1916. This prodigious debit was balanced by about $3,000,000,000 sent to the United States in securities and gold, besides $2,000,000,000 in foreign war bonds. Under these circumstances genuine neutrality was out of the question; and while direct commerce with Germany and Austria was almost cut off, enormous shipments continued to the western Allies. A decided preponderance of sympathy developed toward these countries which were profitable customers and also were in close and almost undisturbed intercourse with the United States, and, as time went on, seemed to be fighting against a ruthless, arrogant and dangerous autocracy.

International Controversies, 1914–7.—The internal tension of the United States was tightened by the incidents of the war and especially by the controversy over submarine warfare. The practical issue was the insistence of Germany on the right to use new weapons, tactics and procedures of war, without submitting to the limitations supposed to be provided by international law, without mercy to non-combatants, on the basis of a law of necessity, and supported by all the physical and political force of the German Empire engaged in war. No able-bodied German man or woman was really a non-combatant; all Germans insisted that they must regard all civilian enemies as combatants. In so far as contact in the field was concerned they carried out their theory unhesitatingly. They introduced the use of poison gas and bombing aeroplanes; they murdered civilians and practically enslaved Belgian men and women. There was no way to stop them except by conquest, and conquest was impossible without using these new methods of warfare. On the sea their principle was the same, but the execution was different because it brought them into controversy with neutrals and especially with the United States.

Great Britain, which in the London Maritime Conference of 1912 had shown some disposition to enlarge the privileges of neutral commerce, seized American ships and shipments, and arbitrarily extended the list of contraband, until (Dec. 26 1914) a dispatch signed by Secretary Bryan, but known to be the work of President Wilson, made a protest. Some of the incidents of the British practice as to neutral vessels were given up; but in the course of 1915 the British Government took up the American principle of "continuous voyages," and eventually extended it so as to cover shipments to neutral ports in cases where those shipments were likely ultimately to reach Germany, or would replace products of the neutral countries that could thus be spared to Germany eventually, or if the neutral countries declined to make a hard and fast agreement not to reship. In 1916 the British were practically blockading neutral ports and capturing vessels, American and other, wherever they liked. The Central Powers, which were in no position to interfere with neutral trade by ordinary cruising, as an offset to this very effective system set up a new war practice, on principles never before asserted, by using submarines as commerce destroyers. On Feb. 4 1915 this practice was asserted as a right. The American Government at once protested, and President Wilson at one time declared that any use of submarines against merchant ships was contrary to international law. He based his protest chiefly on the failure of the Germans to observe the usual rules as to safety of life for ships' crews and passengers, when submarines sank merchant vessels. The fact was, and it was perfectly clear to the large majority of thinking Americans, that whatever the state of international law on that subject, belligerent or neutral vessels carrying Americans and American property, and also American merchant ships, were sunk by the Germans whenever they felt so disposed.

The crisis came through the destruction of the British passenger liner "Lusitania." May 7 1915, with the loss of 113 American lives—all neutral in the war, all non-combatant. That sinking was a deliberate act of the Germans to test the temper of the United States. Apparently they were greatly surprised when the people of the United States rose in resentment. President Wilson, who had months before notified Germany that "strict accountability" would be demanded, insisted on a protest such as could not be ignored. Mr. Bryan thought milder measures sufficient, and on that issue resigned the Secretaryship of State, June 8 1915, and was succeeded by Robert M. Lansing. The correspondence went on for months until, after the sinking of the British steamer "Sussex," while plying across the English Channel, and the killing of more Americans, on May 4 1916 Germany informed the American Government that merchant ships would not be sunk without warning and the opportunity to save non-combatant lives. Meanwhile, throughout 1915 and 1916, a constant series of attacks was made on the United States or its citizens within the boundaries of the country through systematic violations of the neutrality laws of the United States by Germans and Austrians. These acts caused the dismissal of the Austrian ambassador to the United States and of the two most obnoxious members of the German ambassador's staff. The whole status of neutral trade was changed by the ruthlessness of the Germans, who drew upon themselves the belief that they would hesitate at nothing during the war.

"*Preparedness.*"—By the end of 1915 it became clear that the war would be long and destructive; and that, with or without their own desire, the people of the United States might find themselves involved. The whole world was taken by surprise by the new methods of warfare, and the United States was visibly in no position to attack across the sea or to defend itself against the kind of warfare which was by this time going on all over the world. President Wilson desired peace. As late as a day or two after the sinking of the "Lusitania" he spoke of there being such a thing as "a nation that was too proud to fight." The speech containing these words was, however, prepared before the sinking of the "Lusitania," and in his message of Dec. 1915 he urged national defence and the protection of American shipping by placing it all in the hands of the Government. The movement in favour of preparedness grew, and the President in Feb. 1916 favoured a bill for concentrating the national forces, and abandoning the idea of a Federalized army composed of state militia contingents. Because the President refused to use upon Congress the influence that had carried through so many measures, Garrison, Secretary of War, resigned and Newton D. Baker of Ohio succeeded him. The only result was the passage of a weak and inadequate bill.

Long before this time the war had brought about a violent change in the economic conditions of the country. The great demand for foodstuffs raised the price of grain and other farm products. "The high cost of living" became a political issue. The munition factories offered unheard-of wages and drew hundreds of thousands into improvised towns, thus inaugurating a movement for the increase of wages in other industries. One of

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the unexpected effects of the war was a great change in immigration. Hundreds of thousands of men left the United States for Europe to join the various armies; and the countries at war were not likely to allow anybody to evade military service by going to America. Net immigration fell from 1,218,480 in 1914 to 298,826 in 1916.

Election of 1916.—In the midst of the turmoil and confusion of business and public policy caused by the war came the preliminaries of the Presidential election of 1916. The sharp difference of opinion as to the responsibility for, and the conduct of, the war was reflected in Congress, which included many ardent friends of the western Allies, others without a doubt pro-Germans, and a much larger number who desired to keep the United States out of war, no matter what happened overseas. President Wilson, though of Scotch-Irish descent and much inspired by English law and history, carefully abstained from taking sides; but the aggressive submarine policy of Germany made necessary a much sharper tone toward, and much more direct and insistent demands on, the Germans than in the case of the English. He was not only President with complete control of all diplomatic negotiations, he was the acknowledged head of the Democratic party; he was also commander-in-chief of the army and navy of the United States. He felt the need of caution, particularly because a growing group of men inside and outside Congress, among them Roosevelt, were coming to the conclusion that eventually the United States would have to go into the war.

During the early part of 1916 the President was studiously neutral and careful. In April the little force under Pershing was withdrawn from Mexico. May 4 the President succeeded in securing from Germany the promise to refrain from submarine warfare on neutrals. In June the great national nominating conventions met, in which the attitudes of the President and his opponents upon the war were issues. As usual the Republican Convention came first, and was called in Chicago for June 7. A strong effort was made by those friends of Roosevelt who had returned to their relations with the Republican party to make him the Republican candidate. One result of the complaints regarding the Convention of 1912 was that the Republican National Committee recommended a change in the basis of representation in the Convention, which reduced the representation of those southern states in which the Republican vote was very small. Such a reduction, if made four years earlier, would have brought about Roosevelt's nomination. Nevertheless, in most of the states the "stand-pat" Republicans had control of the party machinery including the primaries, and Roosevelt showed little strength in the Convention. The Progressives, who in Nov. 1914 had cast 1,800,000 votes for Congressional and state candidates, met in convention in Chicago side by side with the Republicans. Their purpose was to make such a demonstration of strength as would compel the Republicans to nominate Roosevelt as the only means of healing the breach. That effort failed because it became evident that a large number of the Progressives throughout the country would vote for any candidate nominated by the Republican Convention who seemed likely to carry out the Progressive principles, and they gave up all hope of electing Roosevelt on a third-party ticket. The Republicans nominated Justice Hughes of the Supreme Court who had been a reform governor of New York State. No course was left to Roosevelt but to refuse the nomination offered by the Progressive Convention. The days of the Progressive party were numbered.

In the Democratic Convention, June 14, there was practically no opposition to Wilson and his running-mate Marshall. The platform in many respects was similar to that of the Republicans. Both favoured woman suffrage, conservation of national resources, and national enforcement of child-labour laws; both approved the Monroe Doctrine. But in opposition to the Republicans the Democrats upheld tariff for revenue only; they endorsed the promise of ultimate independence to the Filipinos; they commended the establishment of a Federal trade commission; and they approved a merchant marine owned and operated by the Federal Government. In the campaign Roosevelt publicly supported Hughes, though he felt no enthusiasm for him. He was more interested in questions of neutrality and in the moral support of the hard-pressed Allies than in the election. Hughes and Wilson, especially the former, canvassed the country, which was not interested in the questions of tariff and immigration but was eager to know what would be the effect of the victory of one party or another on foreign relations. The only "slogan" that caught the public ear was favourable to Wilson: "He kept us out of war." The result was the reëlection of Wilson, who received about 9,000,000 popular votes against 8,500,000 for Hughes. The electoral vote, however, was very close and was finally decided by majorities of a few hundred in New Hampshire, Minnesota and especially California.

Peace or War, 1917.—Although the election had been so close, President Wilson stood in a very strong position in the United States and in the world. He was reëlected. His policy, whatever it was, was approved. He felt that he had the nation politically united. The Administration soon began to take a firmer tone in protesting against the Allied system of neutral blockade. Meanwhile the Allies were hard pressed. During the summer of 1916 the Russians made their last aggressive campaign against Austria-Hungary. Rumania entered the contest Aug. 28 1916 but was defeated by the Germans by the close of the year. England, France and Italy were holding the western lines with difficulty. It seemed to President Wilson that only the one great neutral nation could bring about peace. Dec. 18 1916, six weeks after the election, he sent an appeal to the warring Powers to take some steps to come to an understanding of each other's demands. In a later document, Jan. 27 1917, he suggested a "peace without victory," which should give the right of self-determination to the different national units. The western Allies responded courteously. The practical German answer was a brief note communicated by Ambassador Bernstorff to Secretary Lansing Jan. 31 1917, announcing that the Germans would shortly resume submarine warfare without mercy. High military authority in Germany had decreed that this was the way to win. They were convinced that the Americans would never sacrifice the large profits of export trade and incur the huge expenses of war merely for the sake of a question of neutral maritime rights.

Nevertheless it was announced Feb. 4 that the United States was using its influence to persuade other neutrals to sever diplomatic relations with Germany, and immediate steps were taken to make the navy ready for war. Unfortunately, the United States at that moment was not in a position to assemble even so small a land force as 30,000 men and send it abroad. It had no organized transport service to carry numbers of troops or their supplies. For a time the President dallied with a plan of maintaining official neutrality while arming merchant ships and authorizing them to defend themselves. This measure, proposed to Congress Feb. 26, certainly would have brought about war in a few days, by an engagement between some American merchant ships and a submarine. Although Congress was ready to grant to the President almost any power, this armed ship bill was killed by a filibuster in the Senate, which the President characterized as the act of "a little group of wilful men representing no opinion but their own." The Administration then took steps to arm merchant ships without Congressional authority. One result of the controversy was the adoption by the Senate March 8 of a mild and cumbrous method of cutting short debate by closure.

During Feb. and March 1917 a few American vessels and one belligerent vessel having Americans on board were torpedoed by German submarines. It was apparent, therefore, that Germany would not desist from these atrocities, and that the United States must resort to war. The President called Congress in special session for April 2. Congress, elected the previous Nov., contained a small Democratic majority in both Houses and welcomed the first woman representative in the person of Miss Jeannette Rankin of Montana. On Feb. 8 the Government published an intercepted German despatch to the Mexican Government asking the Mexicans to join in the war, promising them the "former Mexican provinces," long incorporated in the

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United States. This so-called "Zimmerman Note" further suggested that Mexico induce Japan to desert the Allies and join her in war on America. The participation of the United States in the war was now inevitable. A formal declaration signed by the President April 6 after a House vote of 373 to 50 and a Senate vote of 82 to 6, stated that war had been already begun by Germany. Relations with Austria and Turkey were at once broken off, but the declaration of war with Austria was delayed until Dec. 17 and no declaration was ever made against Turkey.

Though the breach with Germany was initiated by a Democratic President and passed by a Congress in which the Democrats had a small majority, it was a spontaneous national action representing the practically universal belief that the United States could no longer live in peace with such a nation as Germany had become. In a succession of brilliant speeches President Wilson had developed the idea that it was the duty of the American people to make the world "safe for democracy." Moreover, there was widespread sympathy with the three western Powers closest to the United States in their political principles and system of government. Righteous wrath was aroused by the German treatment of the people of Belgium and other conquered countries. In some minds existed a genuine and well-grounded fear of a future attack upon the United States by Germany if the resistance of the Allies should be destroyed. Amid all the motives for the war, the one thing clear was that the American people recognized Germany as an enemy, and the enemies of Germany as natural friends and partners in the great enterprise of subduing "the Hun." (*See* also WORLD WAR.)

War Measures.—Passionate national spirit, patriotism, and urgent reasons for war were all useless unless the United States could enroll, train, equip, convey, and continuously supply an immense army. By improved methods of coping with submarines the British were giving such protection to their merchantmen as to keep up their connexions with the centres of food, raw materials and munitions. The American navy, though the vessels were good and the crews skilled and well commanded, was in no position to give direct aid in the process of destroying the German army and still less the German navy. The main service to be rendered by the United States must clearly be to raise and convey to the fighting front a large force of American troops. Under the Act of 1916 nothing had been done toward organizing an efficient expeditionary force—a real army was still to be made.

One saving service the United States was able to do at once: it could help the western Allies in their pressing financial difficulties. Besides the immense industrial production of military and other supplies, the country was blessed with an abundant surplus of foodstuffs. The main crops of 1915 and 1916 were large and prices high. The U.S. Treasury and banks were holding about $3,000,000,000 in gold, which was one-third of the world's supply. Federal taxes were low and little felt. The new income-tax was just beginning to be significant. The total Government income for the fiscal year 1916–7 was $1,118,182,978.

Soon after the declaration of war by the United States, missions from the various Allied countries were sent to America to suggest from their experience plans for coöperation. The British Mission, headed by Arthur Balfour, British Foreign Secretary, and including military and naval officers as well as financiers, reached Halifax April 20 and proceeded to Washington. The French Mission, headed by René Viviani, the former Premier, and including Marshal Joffre, landed at Hampton Roads April 24. Other missions came from Italy, Belgium, Russia, Rumania and Japan. Conferences were held with officials of the U.S. army and navy departments with regard to the prosecution of the war. Afterwards the French Mission travelled through the eastern and middle western states, visiting Chicago, Kansas City, St. Louis, Springfield (Ill.), Philadelphia, New York, and Boston; it was everywhere welcomed with enthusiasm, Marshal Joffre being hailed as a hero. With the Japanese Mission an important agreement was signed (the so-called Lansing-Ishii Agreement), which recognized Japan's special interests in China, but provided for a continuance of the "open door" policy for commerce in that country. The commissioners from the European Allies asked for immediate financial assistance. Under Acts of Congress beginning Oct. 17 1917, the Allies received credits which amounted eventually to $9,500,000,000: this was supplied to take up the floating debts held in the United States and to purchase more supplies. This material support, backed by the moral support given by America, was a great encouragement to the Allies through the winter campaign of 1917–8.

These enormous payments were among the results of the so-called Liberty loans. April 24 1917 was passed the first loan Act, under which some 4,000,000 people joined in offering in June $3,000,000,000 to the Government. Three later issues of Liberty bonds followed, and in 1919 an issue of Victory notes. The result was an increase of the interest-bearing debt from $972,469,290 on Dec. 31 1916 to $25,234,496,000 in 1919. These loans were supplemented by the War Revenue Act of Oct. 17 1917, which laid a variety of new taxes, increased the income-tax heavily, and combined with it an excess-profits tax, the purpose of which was to bring into the Treasury unreasonable profits likely to be made in the war industries.

All limitations on raising an army were discarded. Volunteers were authorized as in previous wars. Ex-President Roosevelt asked permission to raise a division of which he might take command, and Congress gave its authority for such a special force, but the President refused him a commission. It was soon seen, however, that the only fair and helpful method was to call out all able-bodied men within certain ages. May 18 the Selective Service Act was passed, which provided for raising the regular army and National Guard to authorized strength, and also the enlistment of 1,000,000 men by "selective draft." There was abundant raw material, but it took time and energy to make it available. A system was provided for registering all men of military age. When they were compelled to appear for physical and mental examination the astounding facts were revealed that one-fourth were illiterate, one-fifth were physically unfit for military service, and another fifth defective but not enough so to prevent their serving. (See the table below.) When called up, the men had to be clothed, housed, fed and drilled. Thousands of officers were necessary, and training camps, both for men and officers, were established on a vast scale. Eventually about 4,000,000 men out of 11,000,000 registrants were inducted into the service.

Table Showing Rejections of Draftees for Physical Defects by Local and Camp Boards, Compiled by Maj. Albert G. Love, Office of the Surgeon-General.

	Local Boards	Camp Boards	Total
1. Infectious diseases (excluding tuberculous and venereal)	1,415	351	1,766
2. Tuberculous	69,935	15,446	85,381
3. Venereal	5,796	9,342	15,138
4. General	31,772	13,878	45,650
5. Nervous system	37,873	8,717	46,590
6. Mental alienation	40,167	12,930	53,097
7. Eyes and their annexa	91,755	25,531	117,286
8. Ear	30,794	8,699	39,493
9. Nasal fossae	1,892	1,257	3,149
10. Throat	1,216	3,416	4,632
11. Circulatory system	110,527	31,769	142,296
12. Respiratory system	8,365	4,448	12,813
13. Digestive system	42,900	42,928	85,828
14. Genito-urinary system (non-venereal)	7,186	1,843	9,029
15. Skin and cellular tissue	5,949	2,535	8,484
16. Bones and organs of locomotion	113,287	58,533	171,820
17. Congenital malformations and ill-defined	97,889	20,864	118,753
Total defects	698,718	262,487	961,205
Cases with two defects in one man (rejected men only)	149,619	55,865	205,484
Total men rejected for above causes	549,099	206,622	755,721
Total men examined, not defective in those respects	3,215,002	2,538,451	
Total men examined	3,764,101	2,745,073	
Total number of men in Class 1 available who were not inducted	469,929		
Total number of defective men included in the 2,745,073 who were not rejected, but accepted for military service	848,482		

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Nothing could conceal the hard fact that no considerable force could be made ready in less than about a year from the declaration of war. In May 1917 a few American destroyers reached England. June 8 Gen. Pershing, who had been selected as commander-in-chief, arrived in England. June 26 a small detachment of U.S. troops reached France. From that time contingents continued to arrive, thus giving to the Allies the assurance that succour on a vast scale was being organized. New branches of military service were established, among them the Chemical Warfare Service which provided materials for lethal gases and for gas-masks and other means of resisting the enemy attacks. Congress, July 24, appropriated $640,000,000 for aviation. The whole land was full of unwonted and startling preparations. By Aug. about 700,000 men were enrolled in the army and 230,000 in the navy. Nevertheless, on Dec. 31 1917 the total number of troops in France was only 176,665.

Control of Industry and Transportation.—The establishment of huge war industries for making guns, munitions, clothing, and the varied supplies for a vast army put a great strain on the industry and transportation of the United States. The country was called upon to feed its own people, the army that was preparing to go abroad and, in considerable part, the Allied armies. Aug. 10 1917 a Food Control Act gave the President powers never before conferred with regard to food and fuel (*see* FOOD SUPPLY). Herbert C. Hoover, of California, who had distinguished himself in the management of the Red Cross in Europe and especially in Belgium, was made Food Administrator with large powers. Before the war ended he had established "meatless days," "wheatless days," and "porkless days"; the price of grain was fixed; eventually the farmers were assured $2.20 a bushel for their wheat crops, which was more than twice what had been considered a good price before the war. The winter of 1917–8 was very severe and coal shipments were delayed both by storms and by pressure of war industries; so that even New York City was for a few days almost without fuel. The warming of buildings and houses was cut to the lowest point. Dr. Harry A. Garfield, president of Williams College, was made Fuel Administrator, and carried through drastic measures for stimulating production, regulating shipments and distributing the supply.

During 1918 these sweeping war powers were rigorously applied. In the food bill was a provision against the use of grain for the manufacture of liquor. Later, manufacture for sale was entirely prohibited by Congress as a war measure. On March 19 1918 Congress passed a Daylight Saving law, for putting the clocks one hour ahead of Standard time from March to October. On March 21 the Federal Control Act placed the management of all the railways in the country in the hands of the Government during the war, and for a period after its close (*see* RAILWAYS). Secretary of the Treasury McAdoo was made director-general of the railways; later Walker D. Hines, an experienced railwayman, succeeded him. President Wilson declared all telephone and telegraph wires to be under the control of the Government and appointed Postmaster-General Burleson to take charge.

One of the most serious needs of the time was a fleet adequate to carry across the Atlantic the army and its supplies and then keep up the shipments of reserves and munitions. The merchant marine of the United States registered for foreign trade was in 1914 only 1,066,288 gross tons. Most of the food and munition tonnage, which was immense, was carried up to 1917 in British or neutral ships, some in French and Italian. The Government then undertook the great task of improvising a merchant fleet (*see* SHIPPING). After a contest between those who insisted on steel ships and those who thought they could be supplemented by wooden vessels, construction was authorized in both materials. But the war was over before any considerable number of new ships were completed, and the wooden ones were a failure.

The Army and Navy at the Front.—The sea duty was strenuous but less dangerous than army service at the front. Beginning with patrol work on the American coast as soon as war was declared, the activities of the U.S. navy extended to coöperation with the British and French in the hunting down of submarines and the protection of convoys. No German fleet gained access to the high seas, but in 1918 one or two commerce destroyers succeeded in doing a little damage to Allied commerce. In the laying of the North Sea mine barrage, extending from the Orkneys to Norway and completed by July 29 1918, the U.S. minelayers placed 56,611 out of a total of 70,263 mines. The American navy had some part in blockading the Austrian coast of the Adriatic, and participated in maintaining that Allied command of the sea which in the end was fatal to Germany. One of the most remarkable feats accomplished by the United States during the war was the development of a convoy system whereby over 2,000,000 troops were carried safely 3,000 m. overseas to France. In this work the utmost secrecy was necessary and there was little to appeal to the public mind. On entering the war the United States was wholly unprepared to transport a large expeditionary force; but in June 1917 a few cruisers and transports were provided and the first troops sent across. This convoy was attacked by submarines, but no boat was damaged and no lives were lost. The convoy system was generally adopted. At intervals vessels assembled and sailed on definite routes under the protection of destroyers. Under Rear-Adml. Albert Gleaves the cruiser and transport service was rapidly increased, eventually comprising 24 cruisers and 42 transports, besides 4 French men-of-war and 13 foreign merchant vessels, manned by 3,000 officers and 41,000 men. By a system of zigzag courses, camouflage and protection by swift destroyers the German submarines were rendered almost powerless. Of the escort protecting the convoys up to the Armistice the United States furnished about 83% (Great Britain 14% and France 3%). Of American troops, according to the report of the Secretary of the Navy (1920), 911,047, or 43·75%, were carried on U.S. navy transports, and 41,534, or 2·5% on other U.S. ships. The rest were carried chiefly in British ships. The peak of movement for any one day was reached on July 9 1918 when 75 transports, carrying 171,639 men, were on the high seas. The record month also was that of July, during which 306,350 troops were embarked. So successful was the convoy system that not one east-bound American transport was torpedoed by the German submarines; only three were sunk on their return voyage—the "Antilles" (Oct. 17 1917, 70 lives lost), the "President Lincoln" (May 31 1918, 26 lives lost), and the "Covington" (July 1 1918, 6 lives lost). The "Mount Vernon," returning from France, was torpedoed Sept. 5 1918, but made port; 36 lives were lost. Only three fighting ships were destroyed by the enemy—the patrol-boat "Alcedo," a converted yacht (Nov. 5 1917, off the French coast, 20 lives lost), the torpedo-boat destroyer "Jacob Jones" (Dec. 6 1917, off the British coast, 62 lives lost), and the cruiser "San Diego" (July 19 1918, sunk by a mine off the New York coast, 6 lives lost). Interned German vessels were used as transports, the "Leviathan" alone (the former "Vaterland") making ten voyages to France and carrying almost 100,000 troops. Other large U.S. transports were the "President Grant," 9 voyages, carrying all told about 80,000 men; the "George Washington," 9 voyages, about 46,000 men; the "America," 9 voyages, about 37,000 men; the "Agamemnon," 10 voyages, about 35,000 men.

The first notable appearance of American troops was at Cantigny May 28 1918. On June 6 there was a fierce engagement between the Americans and the Germans at Belleau Wood. During July 15–18 American troops, posted at Château-Thierry, desperately and successfully held the German forward movement. By Aug. about 1,500,000 soldiers had reached France. During Sept. 11–13 the Americans were given the task of clearing the Germans out of the St. Mihiel salient, their first independent action. From Sept. 26 to Nov. 11 the American army was engaged in the sanguinary Meuse-Argonne campaign, finally capturing Sedan and breaking the German lines. In these brief and territorially limited operations the American army, of which not more than 600,000 actually came within reach of the enemy, lost through casualties about one-third of those engaged.

The work of frenzied preparation and the steady drives on land and sea would have been impossible but for a new kind of organization of the War Department and other parts of the Government machinery at Washington. Under the Overman

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Act of May 20 1918 the President was authorized to rearrange the departmental work and to transfer bureaux according to his discretion. Large numbers of civilian men and women were brought into the War, Navy and other departments, some on salaries, others as "dollar-a-year men"—that is, men who for one reason or another could not enter the army but desired to serve their country at their own cost. The pace was severe, the administration complicated. The main object was to start things moving, without due regard, at times, to immediate results or costs. Plans were made with a view to a prolonged war. The sudden cessation of hostilities found the Government in possession of vast stores of supplies, now unneeded and inviting waste. There was a large accumulation of raw materials but comparatively little of finished product. The most glaring contrast between expenditures and results was in the construction of aircraft. In April 1918 Gutzon Borglum, the distinguished sculptor, and other civilians charged that the aircraft production was extravagant and inefficient. Charles E. Hughes was appointed by the President to make an investigation; he later reported that waste and confusion and inefficiency existed but that there was no wilful plunder of the Government on the part of anyone. Notwithstanding such errors large armies were speedily raised, dispatched and reached the front in time to give decisive aid to the Allies.

During the campaign of 1918 efforts were made to extend the possible field of enlistment by the passage of the Man Power bill of Aug. 27. All men between 18 and 45 were required to register with a view to service if needed, and 11,000,000 were registered. On Aug. 17 it was reported that some 3,000,000 men were with the colours at home and abroad. By a statute of Oct. 6 1917 provision was made for a system of military and naval insurance available for all men in the service. General Pershing officially reported that at the date of the Armistice, Nov. 11 1918, there were in Europe 2,071,463 American officers and men (approximately 82,000 officers). Only about 15,000 soldiers had returned to the United States. On the same date, according to figures compiled by the War Department, the number of troops encamped in the United States was 1,634,499, including 104,155 officers. The casualties up to Nov. 18 1918 were: killed in action, 35,556; died of battle wounds, 15,130; died of other wounds, 5,669; died of disease, 24,786; total deaths, 81,141; wounded 179,-625; missing, 1,160; prisoners, 2,163; total casualties, 264,089.

War Activities at Home.—Immediately after the declaration of war the American people through official and unofficial channels made preparations to give support by civilian service and money contribution. One of the first war measures of President Wilson was to designate, April 14 1917, a Committee on Public Information, composed of the Secretaries of State, War and Navy, and one civilian, George Creel, journalist, as chairman. It was designed to be the official source of news relating to Allied war activities and issued a daily *Bulletin*, widely distributed for the special use of the press. Newspapers were requested to coöperate and to refrain from publishing unauthorized war news. The Committee kept up a lively system of publicity throughout the war, and at times was accused of providing favourable information even when things did not go altogether well. Its publicity work was aided by the National Board for Historical Service, created April 28 1918 at a conference of historians at Washington. Numerous pamphlets, maps and moving pictures were prepared and a nation-wide organization effected for furnishing a patriotic speaking service of "four-minute men," who by arrangement with the purveyors of public amusements made brief talks before their audiences. By an executive Act of Oct. 12 1917 a Censorship Board was established for censoring all communications—mail, cable, radio—passing between the United States and foreign countries. Its members consisted of representatives of the Secretary of War, Secretary of the Navy, Postmaster-General, War Trade Board, and the chairman of the Committee on Public Information. Control of all radio stations within the jurisdiction of the United States had been placed under the Secretary of the Navy April 6 1917; on April 28 the transmission of cable messages between the United States and foreign countries had been placed under the same supervision and international telephone and telegraph messages under the Secretary of War; censorship of the mails began Nov. 2, under the direction of the Post Office Department. This last provision was of great service in enforcing the Trading with the Enemy Act, in suppressing enemy propaganda, and in preventing the disclosure of military information to the enemy.

As early as Aug. 29 1916 a Council of National Defense, created by Act of Congress, had been approved and on March 3 1917 was fully organized. Its duty was the "coördination of industries and resources for the national security and welfare" and the "creation of relations which render possible in time of need the immediate concentration and utilization of the resources of the nation." Composed of the Secretaries of War, Navy, Interior, Agriculture, Commerce and Labor, it utilized the counsel of an Advisory Commission of seven persons, each one a specialist in one branch of industry. After America entered the war this Council devised the ways and means for efficient production and transportation of the essentials of war. Under it were later created several special organizations such as the War Industries Board (succeeding the earlier General Munitions Board), created July 28 1917, for assuring the prompt equipping and arming, with the least possible disadjustment of normal industrial conditions, of whatsoever forces might be called into the service of the country; the Purchasing Commission, formed Aug. 28 1917, for coördinating the purchases in America of supplies for the Allies; the Emergency Fleet Corp. of the Shipping Board, incorporated April 16 1917 for the purchase, construction, equipment, lease, charter, maintenance, and operation of merchant vessels in the commerce of the United States (*see* MUNITIONS). Early steps were taken also to conserve the supply of food and fuel. At the request of the Secretary of War (April 9 1917) the various states also organized State Councils of Defense, which supervised such matters as the conservation of food, sale of Liberty bonds and draft registration.

On April 21 1917 the Council of National Defense appointed a Woman's Committee, with Dr. Anna Howard Shaw as chairman, to coördinate the patriotic work of the women throughout the country. Divisions were organized in every state, and within a year four-fifths of all counties had subdivisions. Through these organizations the country's needs were promptly reported and all households mobilized for thrift. On April 2 1917 a General Medical Board was established under the Council. Through its aid medical officers were recruited, various committees were appointed and advice given in the interest of camp sanitation and health of the soldiers.

Hardly less important than production was transportation. The Advisory Commission of the Council of National Defense created a Committee on Transportation and Communication, with Daniel Willard, president of the Baltimore & Ohio railway, as chairman. Already in Feb. 1917 a Special Committee on National Defense had been appointed by the American Railway Association. Railways were requested to adopt measures for the most efficient handling of freight. At a meeting of the presidents of the important railways, held in Washington, April 11, plans were made for organizing an executive committee, composed of the presidents of five railways and of two *ex-officio* members one each from the Council of National Defense and the Interstate Commerce Commission, with Fairfax Harrison as chairman. This Committee, popularly known as the Railroad War Board, undertook to secure unity of operation among all railways, to subordinate private interests, and to eliminate competition. It continued to work until Dec. 28 1917, when the President placed all railways under Government control. William G. McAdoo, Secretary of the Treasury, was named as Director-General of Railroads, and under him was organized the U.S. Railroad Administration. By an Act approved March 21 1918 each railway, during the period of Federal control, was allowed compensation equivalent to its average income during the year ending June 30 1917; it was further provided that the roads should be kept in good repair and with equipment equal to that assumed by the Government. It was an emergency war measure

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and Federal control was not to last longer than 21 months after the end of the war. The country was divided into regions, each under a regional director, and methods were devised for rapid transportation of troops and supplies. The roads were returned to private ownership on March 1 1920. On April 11 1918 the important coastwise steamship lines also were placed under control of the Director-General of Railroads. At the latter's suggestion the four large express companies had combined in May 1918 under the name American Railway Express Co. which on Nov. 16 was placed wholly under control of the Railroad Administration. Authorized by a joint resolution of Congress, dated July 10 1918, the Government assumed control of telegraph, telephone and marine cable systems, under the U.S. Telegraph and Telephone Administration, directed by Postmaster-General Albert S. Burleson. Radio control was already under the Navy Department. The telegraphs and telephones were taken over Aug. 1 1918. Contracts as to compensation were made with various companies, including the American Telephone and Telegraph Co., and the Western Union Telegraph Company. The Postal Telegraph-Cable Co. refused to enter into a contract, but was given compensation. There was considerable opposition to the taking over of the wires, due to the fact that the Postmaster-General was an avowed advocate of Government ownership, and it was surmised that he would use his influence for permanent Federal control. The cables were not taken over until Nov. 16 1918, five days after the signing of the Armistice, an action which aroused much criticism. They were returned to their owners May 3 1919. The telegraphs and telephones were returned Aug. 1 1919.

On Oct. 6 1915 a Naval Consulting Board had been organized, with Thomas A. Edison as president, and after the outbreak of the war it was associated with the Council of National Defense. Through various committees it studied such questions as those connected with life-saving appliances, explosives, mines and torpedos. At the same time many scientists were engaged in research throughout the country under the National Research Council, organized by the National Academy of Sciences with the support of President Wilson.

In order that available capital might be turned into channels contributing to the successful prosecution of the war, two agencies were devised. In Jan. 1918 the Secretary of the Treasury asked the Federal Reserve Board to pass upon all proposed issues of securities that should be referred to it. The Board formed a Capital Issues Committee for this purpose, and all banking institutions were asked to refrain from assisting in the floating of new securities until passed upon by the Committee. In general, approval was given only to such issues as contributed to the winning of the war or to the promoting of national welfare. This committee, however, had no legal status. Accordingly by Act of Congress, April 5 1918, there was created a Capital Issues Committee of the same nature, with authority to investigate and pass upon all issues, with certain specified exceptions, of securities of $100,000 or more. However, it was not empowered to require the submission of such securities to its investigation or to impose acceptance of its decision. The production of non-essentials was discouraged and many doubtful enterprises were repressed. The committee became inactive after Dec. 31 1918. It had investigated issues totalling about $3,800,000,000, of which amount about $900,000,000 had been disapproved.. The same Act that created the Capital Issues Committee also created the War Finance Corp., the purpose of which was to encourage production of war essentials by providing funds for approved enterprises. With authorized capital of $500,000,000 furnished by the Government, it was placed under the direction of the Secretary of the Treasury and four associates. Up to Oct. 31 1918, requests for loans had been made amounting to $323,329,000 and loans amounting to $67,716,000 granted. At that time the net earnings of the Corporation had reached $2,169,000. A special War Credits Board was created Nov. 20 1917 for supplying loans to producers of munitions of war, its policy being to supply funds when not available elsewhere. Up to May 1919 loans of about $248,000,000 had been made, of which sum $163,000,000 had been repaid.

By the Espionage Act of June 15 1917 the President was empowered to control exports. A Bureau of Export Licenses was created through which were issued permits for shipments to foreign countries. The object was to prevent, so far as possible, American goods from reaching the enemy. Later this Bureau was placed under the Exports Administrative Board, created Aug. 21 1917. After the passage of the Trading with the Enemy Act of Oct. 6 1917 this Board in turn was merged with the War Trade Board, organized by executive order of Oct. 12 1917, and consisting of representatives of the Departments of State, Treasury, Agriculture, and Commerce; the Shipping Board, and the Food Administration, with Vance McCormick as chairman. The War Trade Board undertook the control of imports as well as exports, and aimed to strengthen the blockade and to injure Germany's trade. With the aid of a Bureau of Enemy Trade a list was prepared of firms throughout the world with whom Americans should not trade. This Enemy Trading List was distributed for guidance among Americans engaged in foreign trade. Trade agreements were made with neutral countries, allowing them to receive American goods under conditions intended to prevent their reëxport to the enemy.

The importance of securing the coöperation of labour was recognized from the first. One of the six members appointed on the Advisory Commission of the Council of National Defense was Samuel Gompers, president of the American Federation of Labor. On April 2 1917 Gompers called a conference at Washington, which was attended by representatives of labour, employers, and social workers. The result was the organization of a Committee on Labor of the Council of National Defense, designed to advise as to the relations between labour and employers during the war. Suggestions were issued through the Council of National Defense and requests made that no changes in existing standards be made without the Council's approval. Labour conditions were investigated, information published, and efforts made to settle disputes without interruption of work. During the summer of 1917 serious labour trouble arose in the west in connexion with the production of such important war materials as copper, lumber, and oil. A special commission, popularly known as the President's Mediation Commission, was appointed by the President, Sept. 19 1917, with William B. Wilson, Secretary of Labor, as chairman, and Prof. Felix Frankfurter, of the Harvard Law School, as secretary and counsel. A thorough study of labour conditions was made and many disputes settled. A report made Jan. 9 1918 formed the basis of all subsequent labour adjustments. In Jan. 1919 the Secretary of Labor called a conference, inviting employers and labour to send five representatives, each side to choose a chairman to preside on alternate days. Plans were formulated for governing relations between employers and employees, recommending, among other things, that the right of collective bargaining should be conceded on both sides; that no change should be made in existing conditions as to the "open" and "closed" shop; that women replacing men should be paid on an equal basis; and that the minimum wage should insure reasonable comfort for the worker's family.

Following a suggestion of the conference there was created, April 9 1918, a National War Labor Board, whose membership, chosen by the Secretary of Labor, was identical with that of the labour conference, and consisted of 12 members. It acted throughout the war as a "supreme court" in settling labour disputes. To supplement the work of this Board there was appointed, May 13 1918, a War Labor Policies Board, intended to be representative of all the Governmental producing agencies, for the purpose of standardizing wages, hours of labour, housing conditions, draft exemption, and employment of women.

A matter of great importance was the recruiting of labour and its directing into necessary industries. After America's entrance into the war several existing services under the Department of Labor were enlarged and new ones created. The U.S. Employment Service, under the Bureau of Immigration, with offices throughout the country, assumed Aug. 1 1917 the task of recruiting unskilled labour for all war industries, excepting farms and railways. Private employment bureaux were closed. Much

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skilled labour, also, was secured for shipyards and camp construction. From Jan. 1 1918 up to the signing of the Armistice, about 2,400,000 workers had been placed in essential industries. Later this Service undertook to find employment for ex-service men; and from Dec. 1 1918 to Sept. 27 1919 out of 758,474 registrants, 474,085 were duly placed (*see* DEMOBILIZATION AND RESETTLEMENT). The influx of labour in the industrial centres created a serious housing problem. In Feb. 1918 in the Department of Labor there was organized a Bureau of Industrial Housing and Transportation. On May 16 Congress appropriated $60,000,000 (later increased to $100,000,000) for providing adequate housing facilities for labourers and their families. By Act of June 4 1918 the President was authorized to form a corporation for carrying on this work. Accordingly, on July 10 1918 the U.S. Housing Corporation was incorporated under the laws of New York. The personnel was the same as that of the Bureau of Industrial Housing and Transportation. Elaborate preparations were made for erecting dwellings, dormitories, and cafeterias, but actual construction had not proceeded far before the Armistice.

In addition to these and other official organizations several private agencies were established which had the goodwill and aid of the authorities and raised large sums for the comfort and health of the soldiers in the service, the care of the sick and wounded and aid to refugees and non-combatants in the war zones. Chief among these was the American National Red Cross, which during a single drive raised $100,000,000 and was to be found wherever there was fighting, sickness, suffering, or starvation. At the date of the Armistice its total membership was 19,928,022; the number of women giving their services in Red Cross workrooms was 8,000,000; supplies had been furnished to the amount of almost $76,000,000. Special attention to the social welfare of soldiers in camps both in America and overseas was given by the Y.M.C.A., Y.W.C.A., Knights of Columbus, Salvation Army, Jewish Welfare Board, American Library Association, and War Camp Community Service. An attempt was made to coördinate the work of these various organizations through the War Department Commission on Training Camp Activities, which also acted in an advisory capacity in connexion with the prevention of the sale of intoxicating liquor and the discouragement of brothels near the camps.

The Government formally took charge of all foreign trade Feb. 15 1918, and seized not only all German ships interned in U.S. ports since the war broke out, but also ships under the Dutch and other neutral flags, and impressed them into war service. Under the Webb Act of April 10 1918 the Government went to the extent of permitting combinations for foreign trade, which would otherwise have been in violation of the anti-trust Acts.

Enemies in the United States.—While the people of the United States were practically a unit in favour of a vigorous prosecution of the war, there were a few, chiefly foreign-born or sons of foreign-born, who were opposed to the war or more often to the nations in concert with which and partly for whose salvation the United States was fighting. Ever since 1914 the country had been irritated and aroused by a series of illegal, violent and often murderous acts which were traced to German and Austrian agents. For example, determined efforts were made to blow up the international bridge at Vassalboro, Me., and the locks of the Welland Canal, by men acting within the boundaries of the United States. Bopp, German consul-general at San Francisco, was convicted and imprisoned for aiding German vessels in the Pacific in defiance of neutrality laws. Rintelen (after the war specially rewarded by the German Government) was sent to the Federal prison at Atlanta for aiding in placing bombs on outgoing vessels with intent to destroy them. In 1910 Eugene V. Debs, Presidential candidate four times of the Socialist party, was sentenced to ten years' imprisonment for advising men not to enlist in the army. Victor Berger, member of Congress from Wisconsin, was convicted and sentenced for disloyalty, then reelected to Congress, which refused to seat him.

The I.W.W. took advantage of the general confusion to engage in a campaign of disturbance and violence in the west; as many as 97 leaders of that order, including William Haywood, were convicted of disloyal conduct by one court at one time. These prosecutions were supported by the Trading with the Enemy Act of Oct. 6 1917, the Espionage Act of June 15 1917, and the Act of April 18 1918 as to alien enemies. Several thousand German and Austrian citizens who were believed to be dangerous were interned. On Dec. 19 1918 two pro-German editors were punished for disloyal utterances in a German-American paper. These prosecutions against American-born citizens, naturalized citizens and unnaturalized foreigners continued for two years after the end of hostilities. The authorities were particularly incensed by an open propaganda carried on by Russians and others in favour of Bolshevism as a principle of Government and a substitute for the institutions of the United States. In Dec. 1919 some 250 alien anarchists were placed on a Government transport and taken to Russia. On Dec. 25 1921 President Harding commuted the sentences of Debs and 23 others who had been convicted under the Espionage Act, but a number of persons remained in jail under sentences for disloyal action.

The Armistice and the 1918 Elections.—All at once this tremendous energy, these costly preparations, this enrolling of millions of men, this unceasing action of the great national relief societies, were interrupted by the end of the war in western Europe. The fierce campaign of 1918 was the final effort of the Germans. For the second time in the war they came almost within striking distance of Paris, but were repelled by the bravery of the French and British combined with the new armies from America. No one can say positively that the American army in the field was the chief element that insured victory; but there is not a doubt that the triumphant success in raising, drilling and transporting incessantly provisions and supplies, was to the German mind convincing and disheartening evidence that the Government and the people of the United States, with all their power and potentiality, would stand by the Allies indefinitely. November 11 1918, by the Armistice in which the American armies shared, the Germans admitted their defeat and at once began to evacuate the occupied regions and also portions of their own national territory.

This climax came a few days after the state and Congressional elections of the autumn of 1918. The war was a national war. Enlistments, whether volunteer or by draft, had no relation to politics. Nobody paid any attention to the party affiliations of officers or men or civilian administrators and aids. Nevertheless, Oct. 15, a few days before the elections, President Wilson took the strange course of issuing a circular letter urging the voters to return a Democratic majority to the Senate and the House, because, if the Republicans were successful, it would be considered an imputation upon the President. The warning was in vain; in fact, it probably helped the Republicans materially. The result of the election made the new House decidedly Republican and the Senate Republican by two votes. It was apparent, therefore, that the Administration in making the necessary adjustments after the war must take into account the preponderance of the opposition in both Houses of Congress. Several changes came about in the Cabinet at the end of 1918. McAdoo resigned and was followed in the Treasury by Carter Glass, a representative from Virginia, who gave way in turn to Houston, transferred from the Department of Agriculture, where he was succeeded by Meredith. February 13 1920 Secretary Lansing was practically removed by President Wilson for "insubordination," and was succeeded in the State Department by Bainbridge Colby.

Throughout the year 1918 the influence of Theodore Roosevelt was steadily growing. He was by his whole nature a supporter of the war. He and his four sons volunteered for service, though, as he put it with plaintive humour: "Wilson has kept *me* out of the war." He was recognized as a Republican and the most powerful Republican. Even his strongest political enemies admitted that the party must reckon with him. As the months passed it became clear that he would be nominated by the Republican Convention of 1920 and in all probability would be elected President. But he died suddenly, Jan. 6 1919, leaving behind him a long roll of achievements and a place among the greatest of American statesmen and world figures.

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Peace and the Treaty.—Two great tasks remained when active war ceased. The first was to secure a settlement and register it in a treaty or series of treaties, thus returning so far as possible to normal international relations. The second was to reconstitute the world and to protect it, if possible, against future wars. A third task for the United States was its internal reconstruction by putting an end to the special war laws and conditions and by readjusting business, transportation and labour.

The first two of these tasks are described in detail elsewhere (*see* PEACE CONFERENCE and LEAGUE OF NATIONS). In addition to the suggestions made in the winter of 1916–7 President Wilson put forward on Jan. 9 1918, during the height of the war, "fourteen points" (*see* WILSON, WOODROW) which he considered a necessary basis for the peace of the nations and a subsequent world agreement. These points he enlarged in later addresses to twenty-seven. The Germans afterwards asserted that the points were an essential part of the Armistice. One week after the signature of that document President Wilson decided that he would attend the necessary Peace Conference in person. As soon as Congress assembled he announced that purpose and designated as peace commissioners with himself four others—Secretary Lansing, Col. House of Texas, his most intimate friend and political adviser, Gen. Bliss of the army, and Mr. White, formerly minister to France. These commissioners were not passed upon by the Senate, only one of them was a Republican, and not one was a member of either the Senate or the House. To Republicans it seemed that the President meant it to be a Democratic peace as well as a Democratic war. In the Peace Conference President Wilson, as representative of the richest and most powerful nation in the world, became one of the four representatives of the four Great Powers—Great Britain, France, Italy and the United States—who engineered the Treaty.

President Wilson was deeply interested in the League of Nations; and, when he found that the French were not ready to adopt such a plan without some guarantee of protection, he signed a treaty of alliance between the United States, France and Great Britain pledging the United States to join in war in case of the invasion of France by Germany. No one familiar with the temper of Congress and of the American people should have supposed that such a treaty would be ratified. President Wilson returned home for a short stay (Feb. 24–March 4), defending the general terms of the Treaty and the Covenant of the League of Nations, of which he was the most significant draftsman. He returned to Paris and on June 28 1919, he and the four commissioners signed for the United States the formal Treaty of Versailles, including the Covenant of the League of Nations, which was interwoven into the text of the Treaty. Upon one of the subjects covered by the territorial adjustments of the Treaty in which the people of the United States felt a deep national interest—the continued occupation of Shantung by the Japanese—the President reluctantly gave way and consented to its retention by the Japanese, in spite of the general adverse opinion in the United States.

The Treaty had many powerful supporters in the United States among all parties, particularly ex-President Taft, the League of Free Nations and the League to Enforce Peace, in which A. Lawrence Lowell, president of Harvard University, was the leading spirit. The Senate, which had the constitutional right to pass upon the Treaty by a two-thirds majority, was divided into strongly opposed groups. Most of the Democrats, under the lead of Senator Hitchcock, followed the President in favouring the Treaty with the Covenant as it stood. A group of Republicans, headed by Senator Lodge of Massachusetts, favoured "amendments" to the Treaty and "reservations" as to the League which would have maimed but not killed the two projects. The contest ostensibly centred about Art. X. of the Treaty, under which the members of the League undertook "to respect and preserve as against external aggression the territorial integrity and existing political independence of all members of the League," and agreed that in case of need the Council should "advise upon the means by which this obligation shall be fulfilled." This group expressed fear lest the United States be drawn into foreign wars and insisted that "no American soldiers or sailors must be sent to fight in other lands at the bidding of the League of Nations." The President, on the other hand, regarded Art. X. as the heart of the whole Treaty. Another group wished reservations that would practically destroy the document. A small but implacable junto, headed by Borah of Idaho and Johnson of California, were against both the Treaty and the Covenant in any form or with any reservations.

The President declined at the critical moment to accept either amendments or reservations, except certain minor alterations approved by himself. Senator Knox of Pennsylvania proposed a resolution intended to put an end to the fictitious state of war with Germany. It was passed by both Houses, but was vetoed by the President (May 27 1920). After strenuous debate and by a test vote, Nov. 19 1919, the Senate refused to ratify the Peace Treaty with reservations—the vote being 55 to 39 in favour, but not the necessary two-thirds. Thus after five months' discussion the Treaty was rejected, and the United States was left in the absurd situation of remaining at war with Germany and Austria though all hostilities had ceased a year before.

President Wilson until the last moment believed that he could force ratification of the Treaty by his logic and influence. September 26, while on a speaking trip through the country in favour of the Treaty, he was struck down by paralysis; when he rallied sufficiently to think of public business he continued to hope that he would recover. His Cabinet and closest friends joined in an attempt to minimize the extent of the President's illness, though for months he was unable to see even members of his Cabinet. Had he possessed his usual mental force, the result would probably have been the same. The difficulty with the Treaty and the League was that both were signed by a body of so-called commissioners who represented no lawful authority except that of the President. The only one who held public office or responsibility was Lansing, who by his own account fundamentally differed from the President at Paris but always surrendered his convictions. Whether President Wilson, or the statesmen who opposed him in the Senate, had the clearer view of the state of the world and the duties of the United States, whether the opposition could have been avoided by taking counsel with a larger group of competent men, cannot now be decided. The fundamental fact is that the opposition to the Covenant was strong enough to prevent the ratification of the Treaty even with serious reservations: the representatives of the United States at Paris were out of accord with the constitutional treaty-making power of the nation. Since the President had the last word in framing treaties, nothing could be done.

Rehabilitation.—The task of *post bellum* economic adjustment was entirely within the control of the people of the United States, except so far as foreign trade was involved. The census of 1920 showed a pop. of 105,000,000 in the continental area and 12,000,000 more in the dependencies. At the end of the war the Federal Government by war statutes was controlling the food supply and its distribution, manufactures, the coal supply and shipments, railways, telegraphs and telephones, foreign commerce and shipping, the care of the property of aliens through an Alien Property Custodian, as well as the conditions of interstate labour and of labour in other fields, through a War Labor Administrator, and a National War Labor Board. For foreign commerce there was still a Shipping Board, an Emergency Fleet Board, a War Trade Board and a War Finance Board. Two million American soldiers were overseas and wanted to come home as soon as possible. The average cost of living was about 80% higher than in 1914. The United States had spent on the war about $35,500,000,000, including $9,500,000,000 loaned to the Allies. Congress was willing enough to impose high taxes, and the people were ready to pay them; but expenditures after peace came continued on a scale far beyond any previous experience of the country. This complicated condition was to be readjusted by a Government made up of a President physically unable to perform his duties, a Senate and a House opposed to him in politics, and a group of abnormal war agencies. No swift or judicious result could be expected.

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In the course of six months after the Armistice, about two-thirds of the troops were brought back, leaving behind them enormous stores, large parts of which were sold at heavy discounts to European Governments. General Pershing, the only military man of high rank whose achievements caught the public eye, received the reward of the permanent rank of general. By 1920 the only American troops left in Europe were an Army of Occupation of about 17,000. In Sept. 1919 the American Legion incorporated by Act of Congress was formed to look after the interests of the ex-soldiers.

Two constitutional amendments crystallized some of the results of the war. The various prohibition measures passed by Congress, on the ground that the use of liquor impeded the success of the war, were powerful aids to the general arguments against liquor. Many of the states had absolutely prohibited the sale of liquor and on Jan. 16 1919 the 18th Amendment, prohibiting the manufacture, sale, transportation or gift of intoxicants (submitted in 1917) was ratified by 36 states (eventually 45 states). It went into final effect Jan. 15 1920, enforced by the Volstead Act (passed Oct. 28 1919, over the President's veto), which declared all liquors containing more than one-half of 1% of alcohol to be intoxicating and therefore prohibited (*see* PROHIBITION).

The active war patriotism and service of women, together with the votes they already enjoyed, caused Congress June 1919 to submit the 19th Constitutional Amendment, annulling all sex restrictions of suffrage. It was warmly supported by the former Progressives and by President Wilson, received its 36th ratification Aug. 24 1920, and went into force August 26.

Railways and telephones were restored to their owners. Federal control over fuel stopped; but the abnormal number of executives and clerks in Washington and elsewhere remained under pay. Congress provided for the men disabled in the war by establishing hospitals and by giving to the weak and maimed an opportunity to acquire some trade or calling by which they could make a living. This system enlarged the functions of the Federal Vocation Board created by the Vocational Education Act of Feb. 23 1917. Trade and oversea transportation were discouraged by the financial conditions of the European nations that had been accustomed to trade with the United States. All the war countries in Europe except Great Britain were on a paper-money basis, and a dollar in gold in Oct. 1920 would buy 15 French francs, 26 Italian lire or 71 German marks; even the English sovereign was as compared with the dollar at a discount of 25%. These conditions demoralized international exchange. Transportation in the United States was much disturbed because of the great increase in the money cost of labour and supplies. Feb. 28 1920 Congress passed the Esch-Cummins Transportation Act for the return of the railways to their owners, with certain guarantees of compensation for a period of six months and a stipulation directing the Interstate Commerce Commission to make rates yielding a return of 5½% to 6% for a period of two years. Sea traffic was confused, and in 1921 became almost profitless because of the increased number of ships which were competing for a decreasing amount of business.

The most serious trouble was with labour. Railwaymen and many other skilled employees received wages amounting in some cases to more than double the figures of 1914, and naturally were unwilling to relinquish their advantages. Whenever there was an attempt to reduce wages there was a strike. New York and other ports were several times almost paralysed by strikes of longshoremen or officers and crews of ships. In Aug. 1919, under President Wilson's direction, the Government threatened to use military force to break a railway strike. The police force of Boston struck Sept. 9 1919 as a protest against an order not to join the American Federation of Labor. The strikers stood by and saw without protest scenes of riot and pillage. They were all dismissed and Governor Coolidge of Massachusetts, in replying to a telegram from Samuel Gompers, declared that "there is no right to strike against the public safety by anybody, anywhere, any time." In 1916 there was a strike of 600,000 bituminous coal-miners in the west. Notwithstanding conferences and boards and mutual understanding there was no national or state machinery that could effectively deal with these troubles.

Political Overturn of 1920.—As the months passed, dissatisfaction grew. The soldiers received in many states a money bonus varying in amount, and demanded a similar bonus from Congress. The general public complained bitterly against the "high cost of living," while many corporations continued to make war profits in time of peace. Salaried men, people living on investments, holders of life-insurance policies and depositors in savings banks, saw their incomes and expectations reduced by the fall in the purchasing power of the dollar. The Democratic party was paralysed by internal difficulties over the Peace Treaty and by lack of the trusted leadership of the President. The Republicans had broken the foreign policy of the Administration and were in possession of a majority of both Houses, but had no fixed policy of foreign relations or reconstruction.

In the winter and spring of 1920 Presidential candidates began to develop. General Leonard Wood, formerly chief-of-staff of the army, who had been refused a foreign command during the war, was put forward by a large group of Republicans. Governor Lowden of Illinois had a considerable following. A movement was made in favour of Hoover, well known for his services on the Commission for Relief in Belgium and other relief agencies and also as Federal Food Administrator. When the Convention assembled at Chicago June 9 1920, it proved to be impossible to nominate any of the three, and Senator Harding of Ohio received the nomination backed by a strong group of stand-patters to whom, however, he seems to have made no pledges as to policy or appointment. Governor Coolidge of Massachusetts was put on the ticket as vice-president.

The Democratic Convention held at San Francisco was confronted with a similar difficulty. Woodrow Wilson had already served two terms and was known to be physically unable to perform the duties of the office. The leading candidates were McAdoo of New York, formerly Secretary of the Treasury, and Attorney-General Palmer of Pennsylvania; but after many ballots the nomination went to Governor Cox of Ohio, a man little known in national affairs, with Franklin D. Roosevelt, a cousin of the former president, as vice-president. The Republicans had the lead in the campaign, in which for the first time women were eligible to vote in every state. The result was a complete triumph for the Republicans, who elected Harding by a popular majority of about seven million and an electoral majority of 404 against 127 for Cox, besides securing solid majorities in both Houses of Congress.

March 4 1921 Woodrow Wilson accompanied the President-Elect to the Capitol as the last act of his official life. He had been president for eight years, during six of which he was the undisputed leader of his party and of the nation. Except for a few not very important measures passed over his veto, up to the summer of 1919 he had his way with Congress and with the people. He was responsible for a group of important revenue, banking and labour laws. He had a great hold on the affections and opinions of millions of his fellow citizens, and maintained the country's dignity in war and peace. He had the people behind him in entering the war. He stood behind the measures for organizing and transporting millions of American soldiers. For a time in Paris he was the foremost man in the world, and he succeeded in inducing foreign statesmen, not much interested in, and at heart disliking, the project, to accept a League of Nations. At the height of his career he suddenly lost control as war president of the whole country, was no longer accepted as unquestioned head of his party, and ceased to be the one man who could appeal from Congress to the people. Before illness disabled him, he had already lost his hold upon the minds of the majority of his fellow countrymen.

His work was transferred to a new man less experienced in politics, for a short time a quiet member of the U.S. Senate, whose task it was to take over the discordant elements and build out of them a national policy. President Harding accepted this new responsibility and began his administration under favouring auspices. An excellent impression was created through-

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out the country by his choice of a Cabinet above the average, several members being chosen in the face of strong opposition from the professional politicians. The members were: Charles E. Hughes, State; Andrew W. Mellon, Treasury; John W. Weeks, War; Harry M. Daugherty, Attorney-General; Will H. Hays, Postmaster-General; Edwin Denby, Navy; Albert B. Fall, Interior; Henry C. Wallace, Agriculture; Herbert C. Hoover, Commerce; James J. Davis, Labor. The new President early showed tact and ability in leading his party in favour of constructive action. Within four months the epoch-making bill providing for a Federal budget system was passed by Congress and approved (June 9 1921). This was in line with the President's constant appeal for economy, which led him also to urge postponement of legislation for the grant of a Federal bonus to ex-service men in view of the existing burden of taxation. He displayed keen interest in all attempts to restore business to a sound basis and urged prompt action in the assistance of the railways. By nature conservative, he laboured to bring the country back to a state of "normalcy," to use a favourite word of his own. Treaties of peace negotiated with Germany, Austria and Hungary were ratified by the U.S. Senate Oct. 18 1921.

Of world-wide importance was his call for a conference of the different Powers bordering on and interested in the Pacific Ocean, to be held in Washington and to discuss both Pacific questions and the question of limitation of armament.

The conference assembled Nov. 11 1921, "Armistice Day," and closed Feb. 6 1922. The participants were the United States, Great Britain, France, Italy, Holland, Belgium, Portugal, China and Japan. Important agreements were signed:—to limit construction of capital warships; against improper use of submarines, and against gas warfare; for maintenance of Pacific insular possessions; and on other questions involving relations with Japan and China (*see* WASHINGTON CONFERENCE).

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UNITED STATES NAVAL ACADEMY (*see* 27.736).—The expansion of the Naval Academy in the period 1910–20 began before the entry of America into the World War. In 1912 the six-year course (including two years at sea as "midshipmen") was discontinued, and midshipmen were commissioned ensigns immediately upon graduation from the Academy. By Acts of Congress in 1916 and 1917, the number of annual appointments to the Academy allowed to each senator, representative, and delegate in Congress was increased from two to five; presidential appointments from 10 to 15, and appointments of qualified enlisted men from 15 to 100. Thus the total number of authorized appointments reached 3,126; and the number of midshipmen increased from 758 in 1910 to 1,230 in 1916, and in 1920 to about 2,200. Since 1920, physically qualified candidates have been allowed to enter either by examination or by certificate from a recognized school.

As a war measure, the class of 1917 was graduated in March of that year, and the class of 1918, after a period of intensive study, in the following June. The course was reduced to three years; but by cutting down examination periods, holidays, and reviews, and increasing the academic year to nine months, practically the same work was covered. In 1919 the four-year course was resumed. Between Sept. 1917 and Jan. 1919, five reserve officer classes, composed chiefly of former enlisted men who were graduates of technical schools, were quartered at the Academy for periods of about three months' training. In this way 1,622 officers were added to the service as temporary ensigns. The post-graduate school for officers, established in 1912 in the former marine barracks near the Academy, was suspended during the World War, but reopened in 1919 with about 50 student-officers. These spend a half-year or year at the post-graduate school before continuing their studies in civilian technical institutions. To provide for increased attendance, in 1918 two wings accommodating 1,100 additional midshipmen were added to Bancroft Hall, an extension to the Marine Engineering Building was completed in 1919, and a new Seamanship Building in 1920. In this period, the discipline and the course of studies were modified progressively to meet changed requirements. In 1919 the civilian corps of instructors was reorganized with increased pay and systematic promotion. The staff of the Academy increased from 146 officers and civilian instructors in 1910 to nearly 300 in 1921. (A. H. S.)

UNTERMYER, SAMUEL (1858–), American lawyer, was born at Lynchburg, Va., March 2 1858. He was educated at the College of the City of New York and at the Columbia Law School (LL.B. 1876). He was admitted to the bar in 1879 and practised thereafter in New York City. Between that time and the end of 1921 he was counsel in many celebrated cases covering almost every phase of corporate, civil, criminal and international law. As counsel for H. Clay Pierce he prevented the Standard Oil Co., after its dissolution in 1910, from dominating

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the Waters-Pierce Co. In the same year he effected the merger of the Utah Copper Co. with the Boston Consolidated and the Nevada Consolidated Co.'s involving more than $100,000,000. In 1912, as counsel to the Kaliwerke Aschersleben and the Disconto Gesellschaft in the controversy arising out of the control of the potash industry by the German Government, he assisted in bringing about a settlement. In 1903 he undertook the first judicial exposure of "high finance" in connexion with the failure of the U.S. Shipbuilding Co., organized only a year before as a consolidation of the larger shipbuilding companies in America including that subsequently known as the Bethlehem Steel Co. As a result of the sensational exposures connected with that company a reorganization was effected under the name of the Bethlehem Steel Co., in which Mr. Untermyer became a large shareholder. After this he conducted a number of similar exposures. In 1911 he delivered an address, entitled, "Is There a Money Trust?" which led the following year to an investigation in which he appeared as counsel, by the Committee on Banking and Currency of the Federal House of Representatives. This so-called Pujo Money Trust Investigation resulted in the passage of a mass of remedial legislation. Mr. Untermyer for years agitated before Congress and state Legislatures such measures as the compulsory regulation of stock exchanges. He for many years conducted agitations and wrote magazine articles dealing with reforms in the criminal laws, the regulation of trusts and combinations and other economic subjects. He was counsel for many reorganization committees, including those of the Seaboard Air Line, the Rock Island railway, the Central Fuel Oil Co., and the Southern Iron and Steel Co. In 1915 he acted as one of the counsel for the U.S. Government in the suit brought against the Secretary of the Treasury and the Comptroller of the Currency by the Riggs National Bank of Washington, D.C., which charged there was a conspiracy to wreck it; the defendants were cleared. He took an active part in preparing the Federal Reserve Bank law, the Clayton bill, the Federal Trade Commission bill, and other legislation curbing trusts. He was a delegate to the Democratic National Convention in 1904, 1908, 1912, and delegate-at-large for the state of New York in 1916. He was a strong supporter of President Wilson's administration. After America entered the World War he was adviser to the Treasury Department regarding the interpretation of the income tax and the excess profits tax laws. He was appointed by President Wilson to serve on the U.S. section of the International High Commission, which sat at Buenos Aires, in 1916, for the purpose of framing uniform laws for the Pan-American countries. In 1920–1 he was counsel for the Lockwood Committee, appointed by the state Legislature to investigate an alleged conspiracy among the building trades of New York City. It was charged that labour leaders were using their power by extorting bribes for the prevention of strikes, by preventing independent bids and by forcing building awards to favourites. Many illegal acts were disclosed and numerous convictions secured. Robert P. Brindell, who was at the head of the labour council of the building trades with a membership of 115,000 was prosecuted by Mr. Untermyer, who conducted the case in person as a special attorney-general, and convicted of extortion and sentenced to from five to ten years in state prison. At the end of 1921, when the prosecutions were being continued, more than 600 indictments had been found as a result of the investigation and many more were said to be impending. There were more than 200 convictions including pleas of guilty by employers, labour leaders and others and over $500,000 had been collected in fines. In connexion with the exposure of abuses and acts of illegality among the labour unions, all unions in the state were required, under the threat of criminal prosecution and of submitting to incorporation, to amend their constitutions and by-laws by eliminating these abuses; this they all agreed to do. It was shown that in many of the building trades both manufacturers and dealers, often with the collusive aid of labour leaders, had organized to fix prices and prevent competition. Subsequent prosecutions established the fact that these and other unfair practices were an important element in preventing building operations and increasing rental charges for dwelling property. Public opinion, especially in view of the housing shortage, reacted sharply to these revelations, and it was felt that Mr. Untermyer's work in this connexion had been performed with admirable public spirit, energy and courage. It was generally believed, moreover, that the evils brought to light by the committee were not confined to New York, and a demand for similar investigations arose in other parts of the country.

Mr. Untermyer was an ardent believer in the Zionist movement and was President of the Koren Hayesod, the agency through which the movement was conducted in America.

UNWIN, RAYMOND (1863–), English architect, was born at Rotherham, Yorks, in 1863, and educated at Magdalen College school, Oxford. He received his earlier training in an engineer's office and later as an architect. He was for many years associated in practice with Barry Parker in Buxton. Interesting himself more particularly in housing as a social question he acquired a reputation as an authority on the laying-out and designing of "Garden-Cities," being responsible for the first English example at Letchworth. The planning of many other garden suburbs, villages and estates was carried out from his designs. Amongst them are the layout and buildings at New Earswick, Yorks, for the Joseph Rowntree Village Trust, and the Hampstead Garden Suburb in the N.W. district of London. In 1914 he was appointed the first chief town-planning inspector to the Local Government Board, and, immediately on the outbreak of the World War, director of the housing branch under the Ministry of Munitions. Here he was responsible for the layout of many buildings for the new township of Gretna, and for Mancot Village, Queensferry, and much other work. He also during the war served on departmental committees dealing with small holding buildings, building by-laws, and building materials research. After the war he was appointed chief architect dealing with site planning, and, subsequently, deputy director of housing, under the Ministry of Health. He published *Town-planning in Practice* (translated into French and German), and (with Barry Parker) *The Art of Building a House*.

URUGUAY (*see* 27.805).—The pop. at the end of 1918, the latest figure available, was 1,429,585. This represented a growth of 34% since 1908. The average density increased from 12·9 per sq. m. in 1908 to 19·2 in 1918, the latter being greater than that of any other S. American country.

The administration of President Claudio Williman (1907–11) marked a definite period of progress and stabilization. Since no serious armed attempt was made to overthrow the Government, its efforts could be largely concentrated on educational progress and internal development. The first child-labour legislation was adopted, the death penalty abolished and a model penitentiary and a tuberculosis sanitarium were established. The Agronomical Institute of the university of Montevideo, which was opened on Sept. 15 1906, developed into a National Agricultural College modelled on the best European and U.S. institutions, and distracted the attention of the rising generation from revolution as a profession. The first chilled meat plant was opened in 1907, and a large and thoroughly modern packing and freezing plant at Montevideo in 1912. In 1920 Uruguay had two freezing plants, 13 salting plants, three canning and three tongue-preserving factories and a large factory for liquid extract of meat. Through rail communication between Montevideo and Rio de Janeiro was completed in 1911 by the connexion of various railways in southern Brazil, and so increased the points of contact between Brazil and Uruguay.

The social and educational progress of the country continued during the second administration of José Battle y Ordóñez (1911–15), who succeeded Williman. Hours of labour were further regulated, a National Insurance Bank was established and many experts were brought from the United States and Europe to advance various phases of education, particularly industrial and agricultural. The first S. American International Conference of Agricultural Defence was held at Montevideo on May 2 1913, and $200,000 annually was appropriated for free seeds for farmers. A law of July 12 1911 set aside $100,000

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Uruguayan gold for encouraging immigration. While only 262 immigrants arrived in 1908, the number reached 2,455 in 1910 and 5,358 in 1913, a tribute to the continued stability and prosperity of the country.

In May 1910 ratifications were exchanged of the boundary treaty concluded in Oct. 1909 between Uruguay and Brazil; this settled several minor but long-pending questions in a satisfactory manner. A subsequent treaty of May 7 1913, since carried out, provided for delimiting and marking the boundary. Brazil ceded to Uruguay "the waters and navigation" of Lake Mirim and the Yaguaron river, and the contracting parties agreed not to fortify their new frontiers.

Uruguay continued to prosper under her next president, Feliciano Vieira (1915–9), who surrounded himself with able advisers of the young and progressive group which continued to dominate Uruguayan affairs. Most of them had studied or travelled abroad. Baltasar Brum, Vieira's successor in the presidency, had been Minister of Foreign Affairs in the latter part of Vieira's administration, when the growing pro-Allied sympathies of Uruguay were crystallized by the entry of the United States into the World War.

The Uruguayan Government, which had been pro-Ally, did not hesitate to express its sympathy with the action of the United States in declaring war, acting on the principle that "any act perpetrated against one of the countries of America in violation of the precepts of international law as universally recognized shall constitute an offence against all of them and consequently cause a common reaction in all," a statement largely inspired by dislike of Germany's submarine policy. On June 19 1917 President Vieira issued a proclamation stating that Uruguay would not regard as subject to the restrictions applicable to a belligerent any American nation which, in defence of its own rights, finds itself at war with nations of other continents. A month later a U.S. squadron under Adml. Caperton visited Montevideo and was received with great popular enthusiasm and pro-Ally demonstrations; while the Luxburg disclosures and the Argentine Congress's vote in Sept. (*see* ARGENTINA) for a rupture of diplomatic relations with Germany further stirred Uruguay. Finally, on Oct. 6 1917 President Vieira formally broke diplomatic relations with Germany, having been authorized to do so by a Congressional vote of 74 to 23, and on Oct. 15 a presidential decree stated that the rules of neutrality would not be applied to the Entente Allies. July 4 and 14 were proclaimed national holidays, in recognition of the national holidays in the United States and in France, and although no military or naval aid was sent to the Allies, Uruguay's sympathies continued with them until the end of the war. On Nov. 9 1917 the eight German merchant vessels in Montevideo harbour were seized by the Uruguayan Government and were chartered by the U.S. Emergency Fleet Corp. A credit of 15,000,000 pesos (approximately £3,000,000 at normal exchange) was advanced to England by the Uruguayan Government at 5%, to be used for the purchase of supplies in Uruguay, and a visiting British warship was most cordially welcomed. No less than five new branches of foreign banks were opened at Montevideo between 1915 and 1921, one of them from the United States and one from Canada. Uruguayan trade with the United States greatly increased during this period.

For some time Battle y Ordóñez and his followers had been urging a new constitution to replace that promulgated on July 18 1830, and in 1916 a Constitutional Convention met to discuss one which had largely been composed and influenced by Battle himself. The convention concluded its task in Oct. 1917, and the new constitution came into effect March 1 1919. The most important change in it was the definite separation of Church and State, making all religions free. The Roman Catholic Church, though no longer recognized as the state religion, was given control of such places of worship as had been already wholly or partly constructed by funds from the national treasury. Members of the clergy may be chosen as representatives or senators. Decentralization of the formerly strongly centralized Federal Government was brought about by the installation of popularly elected assemblies and autonomous councils of administration to regulate the local affairs of the departments, with control over the municipalities. The chief-of-police in each department, however, is paid by the national treasury and is directly subordinate to the president of the republic, who appoints and removes him. For the first time in the history of American constitutions the executive power is divided. It is shared between the president (elected by direct vote for four years) and an administrative board composed of nine members elected by a popular vote for a six-year term, one-third of its members retiring every two years. The president coöperates with this board, which directs the affairs of the departments of Finance, Public Instruction and Public Works, the president controlling those of the Interior, Foreign Relations, War and Marine. Minority representation is protected by a system of plural voting, and for the first time in S. American constitutions the adoption of woman suffrage is sanctioned for national or local elections, but a two-thirds majority of all the members in each chamber of the Legislature is required for its adoption. The General Assembly, composed of two Houses, is charged with the interpretation of the constitution, and also elects the justices of the Supreme Court. Perhaps the fact that Uruguay spends more money on education than on her combined army and navy (in 1915 there was one school in Uruguay for every 900 inhabitants, 63% of the children of school age attending school), best illustrates her prospects of progress under this new and liberal constitution.

Uruguay's youngest president, Baltasar Brum, took office on March 1 1919, shortly after travelling, while Minister of Foreign Affairs, in the United States and throughout S. America. He had developed a strongly pro-Ally and pan-American policy while Minister of Foreign Affairs, and he surrounded himself with an able and progressive cabinet. The visit of Mr. Bainbridge Colby, U.S. Secretary of State, to Montevideo in Dec. 1920, to return President Brum's visit to the United States two years before, caused renewed expressions of pan-American solidarity, which were intensified by the continued numbers of young men and women sent to the United States to study and the reduction of the average passenger voyage from New York to Montevideo from 24 to 17 days. Uruguay ratified the Peace of Versailles in 1919, and also concluded obligatory arbitration treaties with Great Britain and Italy in that year.

Economics.—The public debt of Uruguay was $129,774,119 in 1900 and $154,733,367 in 1916, which shows a very small relative increase. Agricultural development favoured the increase of small holdings and of peasant proprietors. In 1908 there were 43,874 rural holdings and in 1916 57,974. In 1916 there were 11,472,852 sheep, 7,802,442 meat cattle, 567,154 horses, 303,958 swine, 16,663 mules and asses, and 12,218 goats. The accompanying table, given in U.S. dollars, contains the latest available statistics of foreign commerce:—

Imports into, and Exports from, Uruguay.

From or to	Imports		Exports	
	1907	1917	1907	1917
United States	$3,556,336	$11,009,259	$2,415,632	$26,218,746
Great Britain (United Kingdom)	11,965,605	6,054,393	3,089,343	19,358,161
Argentina .	2,650,335	8,421,124	8,419,392	12,376,146
Brazil . .	1,813,018	6,677,020	6,346,753	1,299,622
France .	4,057,487	1,429,274	7,961,725	16,180,680

The trade with Spain was not important. In 1907 Germany stood second among the countries supplying Uruguay's imports. In 1917 she only supplied Uruguay with $106,733 worth of merchandise.

(C. L. C.)

UTAH (*see* 27.813).—The pop. of Utah in 1920 was 449,396, an increase over 1910 of 76,045 or 20·4%, a rate of increase 5·5% greater than that of the United States as a whole. The density of pop. increased from 4·5 persons per sq. m. in 1910 to 5·5 in 1920. The urban pop. increased from 46·3% in 1910 to 48% in 1920.

Before 1891 the two political organizations in the state were known as People's party and Liberal party, closely corresponding to Mormon and anti-Mormon. These old names ceased to be used in the decade 1910–20; there was an evident desire to

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forget the old feuds between Mormons and non-Mormons who alike composed the Republican and Democratic parties, and political divisions were no longer on religious lines. Utah has been Republican since its admission as a state in 1896, excepting in 1896, when the electoral vote was cast for Bryan, and in 1916, when the presidential vote was for Wilson and a Democratic governor and other state officers were elected.

Recent governors have been William Spry (Republican), 1909–17; Simon Bamberger (Democrat), 1917–21; Charles R. Mabey (Republican), 1921– . Bamberger, the only governor of Utah not connected with the Mormon Church, was born in Germany of Jewish parents. Joseph Fielding Smith, president of the Church of Latter Day Saints from 1901, died in Nov. 1918. He was a nephew of Joseph Smith, founder of the Mormon Church. His successor was Heber J. Grant.

The state's most important irrigation enterprise, the Strawberry Project, begun in 1906, was practically completed in 1918. By means of a tunnel 4 m. long through the Wasatch Mts., water is brought from a drainage basin on the E. side of the mountains into the Utah valley, 45 m. away. The reservoir in Strawberry valley, covering 8,100 ac., 7,600 ft. above sea-level, has a capacity of 280,000 ac. ft., of which only 75,000 are to be used annually until the project is enlarged. Use was begun Sept. 1913, and in 1920 70,000 ac. were irrigated from it. The state's irrigated acreage in 1909 was 458,273; in 1919 722,772; and works existed capable of irrigating 944,727 acres. Two canyons, Brice's and Little Zion, are reserved as national parks.

In Aug. 1909 Earl Douglass, a geologist, while conducting an expedition sent out by the Carnegie Museum of Pittsburgh, discovered in Uinta county the first complete skeleton of a dinosaur. Excavations for its removal revealed a deposit, the most extensive yet found, of fossil remains of extinct animals. The spot, embracing 80 ac., was set aside in 1915 by the U.S. Government and named Dinosaur National Monument.

Amendments to Constitution.—Section 3 of Article 10 was amended Nov. 8 1910 to provide that funds from the state tax for high schools be apportioned among cities and school districts according to attendance at high schools, so long as the schools are maintained at a standard fixed by the state Board of Education. Section 4 of Article 13 was amended to provide that after Jan. 1 1919 metalliferous mines and mining claims be assessed at $5 per ac. and in addition thereto at a value based on some multiple or submultiple of net annual proceeds. All other mines or mining claims and other valuable mineral deposits, including coal or hydrocarbons, are assessed at full value, as are also machinery and surface improvements. Article 22, Miscellaneous, was amended by adding Section 3 prohibiting after Jan. 1 1919 the manufacture and sale of intoxicating liquor containing in excess of one-half of 1% of alcohol. Amendment to Section 7, Article 13, approved by referendum Nov. 1920, provided for a minimum appropriation for school purposes from state funds, of $25 for each child of school age. Amendment to Section 5, Article 16, gave the Legislature power to make recovery in fatal cases definite, thereby eliminating long suits, enabling dependents to obtain definite amounts without expense, and protecting them against settlements at less than the law provides.

Government.—By an Act of the Legislature, passed in 1911 to take effect in 1912, government by a board of five commissioners was made mandatory in all cities of the 1st class; and in cities of the 2nd class by a board of three commissioners; cities of the 3rd class remained under mayor and councilmen. An Act of 1919 authorized levying of taxes for libraries and gymnasiums in cities of the 3rd class and in unincorporated towns.

Education.—In 1919 Utah enacted much legislation extending the educational work of the state. Among things provided for were the establishment of standard high schools in voting precincts having 1,200 or more school population; vocational education; part-time schools for those excused for necessary employment; health education supervisors and school nurses; care for physical welfare of children of pre-school age; free dispensaries and clinics; Americanization by requiring persons not speaking English to attend evening schools; county public libraries; libraries and gymnasiums in cities of the 3rd class and unincorporated towns. By 1920 legal provisions had been made for public schooling, including kindergartens, for all children from 4 to 18 years old, and for supervision of the activities of all children of school age for 12 months in the year. Class-room instruction was not extended over the usual vacation periods, but each student was to enroll for "out-of-school" activities in which he and his parents might be directly interested. Credit for such work systematically done was to be given on the school records. Improvement of equipment and teaching staff resulted from consolidation of many rural schools. While in 1909 685 public schools were reported and in 1920 only 683, increase of enrolled pupils from 84,804 to 117,406 reflected the increased provision for public education. The average attendance in 1920 was 97,008. The total expenditures of 1919–20 were $8,353,133. The total number of teachers in 1909 was 2,255 (1,645 women) and in 1920 3,739 (2,824 women). The average salary of high-school principals in Salt Lake City in 1920 was $3,750; the lowest salary paid any teachers in the rural schools was $502. The Branch Normal School at Cedar City, formerly connected with the university of Utah, was transferred to the supervision of the Agricultural College. There were in 1920 46 tax-supported libraries, 22 of the buildings being Carnegie gifts.

Agriculture.—The number of farms in Utah in 1920 was 25,662, an increase of 18·4% over 1909. The farm acreage was 5,050,410, of which 1,715,380 ac. or 34% were improved. The value of lands and buildings in 1920 was $243,751,758; of implements and machinery $13,514,787; of live stock $54,008,183: showing respectively an increase over 1910 of 107·4%; 202·5% and 87·6%. The average value of land and buildings per farm was in 1920 $9,499 as compared with $5,423 in 1910. Of all farms operated by owners in 1920, 47·6% were mortgaged as compared with 28·9% in 1910. Of the 25,248 white farmers, 21,276 were native and 3,972 foreign-born. Of native white farmers 18,683 were owners, 268 managers, and 2,320 tenants. Of foreign-born white farmers, 3,652 were owners, 25 managers, and 295 tenants. The 414 coloured farmers comprised 239 owners, 3 managers, and 172 tenants. There were 627 women farmers, including 609 owners, 1 manager and 17 tenants.

Crops.—The total value of crops in 1919 was $58,067,067, an increase of 219% over 1910. In order of value the chief crops were hay and forage; cereals; sugar beets; potatoes and other vegetables; fruits and nuts; clover and alfalfa seed. As compared with that of 1909 the acreage of oats, 61,825, showed 23·5% decrease; wheat 268,457, increase of 50·5%; barley, 15,938, decrease of 40·4%. The average yield of oats per ac. in 1919 was 27·9 bus.; of wheat 15·3 bus.; barley 22·9 bus. The total acreage of hay and forage in 1919 was 549,967 with a total production of 1,031,609 tons. There were 12,047 ac. in potatoes, a decrease of 15.2% as compared with 1909; the average yield per ac. was 136·8 bus. as against 169·5 in 1909. The production of strawberries in 1919 was 484,792 qt.; raspberries 363,801 qt.; apples 759,696 bus.; peaches 883,950 bus.; cherries 123,477 bus. The acreage of sugar beets in 1919 was 93,359 as compared with 27,442 in 1909, an increase of 240 per cent. In beet production (1,338,000 tons) Utah ranked next to Colorado in 1920. In that year there were sugar factories in 18 towns, and their product totalled 153,200 tons. The value of the sugar production in 1920 was approximately $30,000,000.

Live Stock.—On Jan. 1 1920 the number of beef cattle was 397,563; dairy cattle 108,015; value of beef cattle $16,806,429; dairy cattle $5,821,441. The number of horses was 125,471 valued at $9,642,418; of sheep 1,691,795 valued at $18,881,529; of goats 29,512 valued at $253,100; of swine 99,361 valued at $1,551,880.

Industries.—Important industries in 1920 were meat-packing; creameries and condenseries; canneries; flour and cereals; candy; salt; metal and sheet iron; cement and lime. The following table, from the U.S. census of 1920, gives a comparative summary of manufactures for 1919 and 1909:—

	1919	1909
Number of establishments	1,160	749
Wage-earners	18,868	11,785
Capital	$140,785,034	$52,626,640
Cost of materials	$110,154,349	$41,265,661
Value of products	$156,933,071	$61,989,277

Mining.—The production of gold in Utah has been decreasing steadily since 1908. In 1920 the value was $1,949,000. More than half the gold of 1920 was from the Bingham district, about 30% from the Tintic district, and the rest from Park City and other camps. Most of the gold was produced from silicious, copper, and lead ores treated at smelting plants. The largest producers of gold were the Utah Copper Co., U.S. Mining Co., Deer Trail, Chief Consolidated, Utah Consolidated, and Grand Central mines. The value of silver output in 1908 was $4,479,209 and in 1920 $12,664,000, the latter a slight decrease from 1919. The Chief Consolidated Mine at Eureka continued to be the largest producer of silver in the state, and the Tintic Standard followed closely. Although production of copper in 1920 was somewhat less than in 1919, it was considerably greater than a decade before. In 1908 the copper output was valued at $12,851,377 and in 1920 $19,991,000. The Utah Copper Co. at Bingham produced nearly 9,000,000 lb. a month throughout the year. In 1908 lead mined in Utah was valued at $3,728,655; in 1919 $6,562,940; in 1920 $10,939,000. The largest producers of lead were the Utah Apex, U.S. Mining Co., Tintic Standard, Chief Consolidated, Utah Consolidated, Silver King Coalition, Daily Judge, Ophir Hill, and Eagle and Blue mines. The largest increases were those of Chief Comsolidated and Tintic Standard in the Tintic district. The zinc product increased from $68,646 in 1908 to $323,465 in 1919 and $487,000 in 1920. In 1908 the production of coal was 1,846,792 tons; in 1918 the output of Carbon county alone was 4,607,192 tons; and in 1920 the total state production was 6,125,000 tons. (G. E. F.)

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VACCINE THERAPY.—Since the discoveries of Pasteur it has become recognized that a very large number of the diseases from which human beings suffer are due to infection of the tissues by living micro-organisms, most of which belong to the simpler forms of plant life.

Immunity from such infections may be natural or may be acquired. By natural immunity we understand a natural resistance to infection by certain micro-organisms which are known to have pathogenic properties for other species of animals. It is known, for instance, that microbes which produce a rapidly fatal disease in one kind of animal are quite innocuous when introduced even in enormous numbers into another kind.

As an example of an acquired immunity may be taken the immunity conferred as a rule for a lifetime by an attack of measles or chicken-pox. The individual who has once overcome such an infection is usually immune from a further attack, even though exposed to infection.

It is this fact which led Jenner to try to confer immunity against smallpox by producing a modified mild "attack" by vaccination with calf lymph. It is now admitted that such vaccination does confer immunity, and that even should infection occur the disease runs a mild course.

Since the discovery of bacteria as causative agents of disease, much study has been devoted to the part played by the cells and fluids of the tissues in recovering from bacterial infections. Evidence has been sought for response on the part of the body to the bacterial invasion. It is to Metchnikoff that we owe the knowledge that the white blood corpuscles and other cells of the body react to the introduction of bacteria into the tissues. Enormous numbers of these cells congregate at the site of invasion and engulf the microbes (phagocytosis). As Sir John Burdon Sanderson aptly put it, the white blood corpuscles act as the policemen of the body.

It was soon learnt, however, that this is not the only way in which the body reacts to microbic infection. Buchner was able to show that the tissue fluids and the blood serum in particular acquire new properties as a result of bacterial infection, properties which render them highly injurious to the invading microbes. It was shown, for instance, that if actively mobile typhoid bacilli are brought into contact with the blood serum of a normal individual the bacilli are but little affected by the serum. On the contrary, if the bacilli are brought into contact with the serum of an individual convalescent from typhoid fever their mobility ceases, they are massed into clumps (agglutination) and finally killed (bactericidal action) and dissolved (bacteriolytic action). Sir Almroth Wright was able to demonstrate that a further property is acquired by the serum, namely an increased power to render the bacteria more readily ingestible by the phagocytic cells (opsonic action). Exactly how and where these new properties are acquired is not yet known, but one of the most striking facts emerging from the study of these reactions is that they are directed against the particular micro-organism which has invaded the tissues; the reactions are said to be specific. Thus the blood serum of a patient convalescent from typhoid fever, which is strongly bactericidal for the typhoid bacillus, behaves like a normal serum when brought into contact with any other kind of bacteria. Similarly, while an attack of typhoid fever confers immunity against a second infection by the typhoid bacillus, it confers no immunity from infection by other bacteria, even those so closely related as the para-typhoid bacilli.

It must be admitted that recent work goes to confirm the opinion that there is a concomitant non-specific response common to the reaction against all microbic infections, but this does not detract from the importance of recognizing the highly specific nature of these immunity reactions.

A very important step forward was taken when it was demonstrated that the body responds to the introduction into the tissues of dead bacteria in the same way as it does when living bacteria invade the tissues, for this made possible artificial immunization. To attempt to confer immunity against any microbic disease by the introduction of very small numbers of even attenuated living bacteria is fraught with manifest dangers, for the bacteria are capable of multiplication in the tissues and are no longer under control. To attempt to confer immunity against disease by the introduction of dead microbes into the tissues is a different matter, for the dosage can be regulated and the bacteria cannot multiply in the tissues.

Thus it was that Sir Almroth Wright proposed to confer immunity from typhoid infection by inoculation into the healthy tissues of a standardized suspension of dead typhoid bacilli in physiological salt solution (typhoid vaccine). The immense benefit derived from such inoculations was fully demonstrated during the World War 1914–8. Wright's studies in immunization had demonstrated that it was possible to confer immunity against microbic infections by the inoculation of bacterial vaccines into healthy individuals. It seemed at first that nothing but harm could result from the inoculation of such vaccines once the tissues had become infected. It appeared, indeed, as if to do so were merely to add more poison to a system already being poisoned. Such, however, is not the case. Pasteur was the first to show, in connexion with rabies, that beneficial results could be obtained by inoculating vaccine during the incubation period of the disease. But it was the discovery by Wright that the rapidity with which a specific response to the inoculation of a vaccine occurs depends on the dose of vaccine given, and that this response occurs very rapidly if the dose is an appropriate one, which opened up the whole field of vaccine therapy. Wright showed that the inoculation of too large a dose of vaccine can lead to a state of lessened resistance to infection and that no immunizing response follows. But this so-called negative phase can be modified as regards severity and duration by the adjustment of the dose, even to the point of its virtual disappearance, and nevertheless a good immunizing response follows. And such a satisfactory response occurs when vaccines are inoculated into an already infected individual. This means that, if the gravest generalized infections be excepted, there is not in microbic diseases a wholesale poisoning of the tissues of the body. There is infection of certain tissues and others remain healthy or, at all events, capable of an immunizing response. And it is to the power of these healthy tissues to respond that we turn in vaccine therapy. Just as the tissues of a healthy individual inoculated with an appropriate vaccine respond by elaborating protective substances against the microbe or microbes contained in that vaccine, and such response confers immunity on the individual, so do the healthy tissues of an infected individual respond to a vaccine containing the infecting microbe, and such a response raises the resisting power of the individual to the infection.

Now infections by microbes can broadly be divided into two classes: (*a*) generalized, and (*b*) localized. By a generalized infection we mean that the microbes and their products have ready access to the blood and lymph stream, and thus exert their baneful influence not only locally but at a distance on various tissues of the body. In a localized infection, on the other hand, the microbes affect a particular region of the body only and the remaining regions are not at all or only quite secondarily affected. From what has been said before, it is obvious that in the first class vaccine therapy has but a limited sphere of application; in the second class it has a very wide one. For it is on the satisfactory response of the tissues that the success of vaccine therapy depends and this will bear definite relationship to the healthiness of the tissues; further, the gravity of the infection must necessarily enter into account, just as a small war calls for but a small effort, whilst a great war, in which the life of a nation is at stake, calls for a maximal and sustained effort.

When it is borne in mind that the substances elaborated in response to the inoculation of a vaccine are largely carried to the

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site of infection by the blood stream, it will be realized that the success or failure of vaccine therapy depends largely on the blood supply of the affected area. So long as the newly elaborated anti-bacterial substances can come into contact with the bacteria, success may be anticipated, but when barriers to their arrival exist, success is limited or denied by the extent or completeness of the barriers. Thus in acute lobar pneumonia the affected area of the lung is occupied by an impenetrable clot of blood; little good can therefore be expected from vaccine therapy once this clot has formed and as long as it remains. But this does not preclude the exploitation of vaccine therapy in pneumonia in the earliest stages of the disease or after resorption of the clot has begun. Fortunately, in the majority of infections there is no such general disturbance of the blood supply to the infected area; in such case it surely follows that a supply of blood rich in protective substances must constitute an advantage, as against a supply of blood poorer in such substances. It will be realized from these remarks that the utmost care is needed in the accurate bacteriological diagnosis of each infection before vaccine therapy is employed, and the vaccine must be prepared with care as to sterility and specificity.

The administration of the vaccine needs the knowledge not only of general medicine but of bacteriology and the principles of active immunization against microbic infections.

The Vaccine.—For practical purposes bacterial vaccine may be defined as sterilized and enumerated suspensions of bacteria, the liquid medium being either physiological salt solution or dilute nutrient broth. The bacteria must be isolated in pure culture and strictly identified by the usual tests. The microbes thus identified are usually inoculated on to the surface of a solid medium (*e.g.* agar-agar) and, after growth has occurred, the bacterial colonies are floated off into sterile physiological salt solution. The suspension thus obtained is placed in a hermetically sealed tube and thoroughly shaken, if necessary by mechanical means, so as to break up the colonies and obtain an even suspension. A small sample of the suspension is then removed for enumeration, the tube once more hermetically sealed and the whole placed in a water bath at 60° C. for one hour. This temperature has been found to be sufficient to kill most of the pathogenic bacteria without profoundly altering their chemical composition. Sterility of the vaccine is not, however, presumed and each one is subjected to cultural control before being certified sterile.

The enumeration of the suspension may be carried out in various ways. The original method of Wright is as follows:

It has been the practice for some 25 years to enumerate the corpuscles of the blood in a counting chamber of known depth and ruled with squares of known size. Wright, therefore, mixes an equal quantity of blood and the bacterial suspension. Films of the mixture are made and appropriately stained for microscopic examination. An adequate number, about 500 usually suffices, of red blood corpuscles are counted in a series of fields of the microscope and at the same time the number of bacteria seen is noted. The number of red blood corpuscles per cub. mm. has previously been determined in a counting chamber, so that all that remains to be done is to work out the proportion of bacteria to red cells and so to arrive at the number of bacteria per cub. mm. or cm. of the suspension. There are technical difficulties in the way of enumerating certain bacteria, *e.g.* the tubercle bacilli; in these cases the bacterial growth is weighed, and the dosage, instead of being expressed in millions of microbes per cub. cm., is given in milligrammes or their fractions, *e.g.* a usual dose of a staphylococcus vaccine will be 250,000,000 cocci, whilst that of a tubercle vaccine would be 0·0001 milligrammes.

A vaccine made from cultures obtained directly from the patient to be treated is said to be an autogenous vaccine. A vaccine made not directly from cultures obtained from the patient but from cultures of the same species of microbe as that which is infecting him is termed a stock vaccine. In general it may be affirmed that autogenous vaccines are nearly invariably to be preferred to stock vaccines, whilst in the case of certain microbes they are indispensable. Stock vaccines, however, are usually effective, save time and expense and have very wide application. Latterly attempts have been made to reduce the toxic action of the bacterial suspensions and so-called sensitized and detoxicated vaccines have been recommended, but it is doubtful whether these procedures constitute a useful advance.

The accompanying table gives a summary of the microbes from which vaccines are commonly prepared, together with the minimal and maximal effective doses in which they are administered.

Vaccines are administered by hypodermic injection and the inoculations are painless.

Where the minimal effective dose is employed the inoculation is not followed by any local or constitutional disturbance. If there is any sensible constitutional change, that change is in the direction of increased well-being. When a medium dose is inoculated there may be a small amount of local tenderness and a transient aggravation of the patient's symptoms, or slight constitutional disturbance, malaise, headache and possibly a slight rise in temperature. But none of these negative phase effects are at all marked except where an excessive dose has been employed.

	Autogenous vaccine advisable	Stock vaccine adequate	Effective doses	
			Minimal	Maximal
			million	million
Acne bacillus	In some cases	Generally	5	50
Staphylococcus	..	Generally	50	1000
Streptococcus	In most cases	..	1	10
Pneumococcus	Generally	..	5	50
Influenza bac.	Generally	If polyvalent	10	500
B. of Friedlander	Generally	..	5	100
B. coli	Generally	..	1	100
M. catarrhalis	Generally	..	5	100
Bordet's bac.	..	Generally	50	500
Diphtheria bac.	Often	Often	10	50
Gonococcus	..	Generally	1	50
Actinomyces	..	Generally	1	25
Meningococcus	..	Polyvalent	50	1000
M. melitensis	..	Generally	30	100
B. typhosus	..	Yes	10	100
B. paratyphosus A	..	Yes	10	100
B. paratyphosus B	..	Yes	10	100
Tubercle bac.	(?)	Nearly always used	1/500,000 mg.	1/1000 mg.

It is outside the sphere of this article to enumerate the various diseases in which vaccine therapy finds application, but a few in which vaccines have proved of exceptional value may be mentioned.

Boils, carbuncles and other staphylococcal infections usually yield readily to treatment by staphylococcus vaccine. Erysipelas, puerperal septicæmia, acute surgical septicæmia and septic wounds are conditions benefited by treatment with a streptococcus vaccine. Certain forms of rheumatism, arthritis and fibrositis are relieved and the progress of the disease is arrested by treatment with an appropriate vaccine, and the same may be said in the case of certain cases of bronchial asthma, chronic bronchitis and recurrent colds.

The distressing symptoms of inflammation of the bladder due to infection by the bacillus coli are relieved and may entirely disappear under treatment with an autogenous vaccine.

Tuberculous disease of the glands, skin and joints is amenable to treatment with a tubercle vaccine, and in rigidly selected cases the same holds good for tuberculosis of the lung.

It may be confidently asserted that, with increasing knowledge, vaccine therapy will find wider application and will become recognized as a valuable weapon in the combating of microbic diseases.

(A. C. I.)

VACHELL, HORACE ANNESLEY (1861–), English novelist and playwright, was born at Sydenham, Kent, Oct. 30 1861. Educated at Harrow and the Royal Military College, Sandhurst, he received a commission in the Rifle Brigade in 1883. In 1894 he published his first novel, and in 1897 the first to make its mark, viz. *A Drama in Sunshine.* Subsequent novels included *John Charity* (1900); *Brothers* (1904) and *The Hill* (1905), both Harrow school stories; *The Waters of Jordan* (1908) and *The Fourth Dimension* (1920). He is the author of many plays, some, such as *Searchlights* (1915) and *The Case of Lady Camber* (1915) original; others, such as *Her Son* (1907) and *Quinney's* (1915), dramatizations of his own novels, or like *Fishpingle* (1916), afterwards issued as novels; whilst others again, *e.g. Who is He?* (1915) and *The House of Peril* (1919), were dramatized versions of novels by other authors.

VAIL, THEODORE NEWTON (1845–1920), American capitalist, was born on a farm in Carroll county, O., July 16 1845. When a child, he moved with his parents to New Jersey, studied at the Morristown Academy, and for two years studied medicine with an uncle. Meanwhile he had become interested in telegraphy. In 1866 he went with his parents to a farm in Iowa, but two years later became station agent and telegraph operator on the Union Pacific at Pine Bluffs, Wyo. Then he was appointed clerk in the railway mail service and his efficiency led to his being called to Washington, D.C., in 1873, where he was made assistant-superintendent of railway mail service, rising in 1875 to general superintendent. In 1878 he was made general manager of the American Bell Telephone Co., and for the next seven years was actively engaged in the development of the telephone business, for which he foresaw a great future. In 1885 he resigned from the Bell Co., and was elected president of the newly organized American

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Telephone and Telegraph Co., which in 1900 acquired the American Bell Telephone Co. In 1887 because of ill health Vail retired and spent the next nine years in travel and on his farm at Lyndonville, Vt. During a visit to S. America he became interested in traction problems and in 1896 installed an electric railway system in Buenos Ayres, and later introduced telephone systems in many S. American cities, enlisting British capital for these enterprises. In 1904 he retired to his farm but in 1907 was again induced to accept the presidency of the American Telephone and Telegraph Co. When this company in 1910 bought control of the Western Union Telegraph Co., Vail was made president of the latter also, and introduced many changes, including "night letters" at reduced rates. When in 1914, as the result of a threatened suit by the Government, the Western Union was again segregated, Vail remained president of his old company. After the taking over of the wires in Aug. 1918 by the Government as a war measure, he was appointed adviser by the Postmaster-General and urged unified control of all cables, telegraphs and telephones. When the wires were returned in 1919 to private ownership he was elected chairman of the board of directors of the American Telephone and Telegraph Co. In 1920 the gross earnings of the company were $103,946,988, net earnings $70,686,904, number of miles of wire owned 25,377,404. Vail died in Baltimore April 16 1920. The value of his estate was estimated at about $2,000,000. He left $100,000 each to Princeton and Dartmouth, and $200,000 to be divided equally among Phillips Exeter Academy, Middlebury College, Harvard, and the Massachusetts Institute of Technology. To the last named he left also his large collection of books on electricity.

See A. B. Paine, *In One Man's Life* (1921).

VAMBÉRY, ARMINIUS (1832–1913), Hungarian Orientalist and traveller (*see* 27.876*), died at Budapest Sept. 4 1913.

VANBRUGH, IRENE (1872–), and **VIOLET** (1867–), English actresses, youngest and eldest daughters respectively of the Rev. R. N. Barnes, Prebendary of Exeter cathedral.

VIOLET VANBRUGH was born at Exeter June 11 1867, and married Mr. Arthur Bourchier, the actor, in 1894, their marriage being dissolved in 1918. She first appeared in London at the Criterion theatre in 1886, and later toured with Toole. In 1889 she was with the Kendals both in London and in America, and in 1892 played Anne Boleyn at the Lyceum in Henry Irving's production of *Henry VIII*. After her marriage she played leading parts in many of her husband's productions, both in Shakespearean and modern drama. Amongst her rôles may be mentioned Queen Katherine, Portia, Lady Macbeth (which she also played in 1911 at His Majesty's theatre), Yanetta in *The Arm of the Law*, and the heroines of many modern comedies by Sutro, Henry Arthur Jones and others.

IRENE VANBRUGH was born at Exeter Dec. 2 1872 and married Mr. Dion Boucicault (b. 1859), the actor, in 1901. She first appeared in London at the Globe theatre in *Alice in Wonderland*. Like her sister she played with Toole, remaining with him for four years and touring with him in Australia. Subsequently she acted with George Alexander at the St. James's theatre, with Arthur Bourchier at the Royalty and with Charles Wyndham at the Criterion in Jones's play *The Liars*. Her first notable successes were as Sophy Fullgarney in Pinero's *The Gay Lord Quex* (1899), Letty Shell in his *Letty* (1904) and Nina Jesson in *His House in Order* (1906). She also appeared with distinction in various short plays by Barrie, especially *Rosalind* and *The Twelve Pound Look*, and in other modern dramas.

VANCOUVER (*see* 27.883), in British Columbia, the chief Pacific port of the Dominion of Canada, was estimated to have a population of nearly 200,000 (the suburbs of North Vancouver, South Vancouver and Point Grey included) at the end of 1920. Vancouver proper had a population of 100,400 in 1911. As the natural western outlet for the Prairie Provinces, Vancouver had expected to gain materially by the opening of the Panama Canal. Not until the spring of 1921 was the first cargo of wheat carried to England by sea direct from Vancouver, but the success of that experiment made probable a speedy development of a new trade for the British Columbian port.

With one of the finest natural harbours in the world Vancouver has grown in importance as a port during recent years. Already the terminal point for British, Australasian and Asiatic terminal lines, Vancouver was the prospective terminal in 1921 for a new Pacific line to be inaugurated by the Canadian National Railways. Government contracts had then been let for further improvements on Burrard Inlet (the chief of Vancouver's three harbours) for greater dockage and for a system of car ferries crossing the Inlet to carry freight from the city to North Vancouver without transfer. In 1920–1 the Canadian Pacific railway built a pier of concrete and steel, equipped with all modern freight-handling devices, at a cost of $1,500,000.

The Dominion Government in recent years has erected a grain elevator with a capacity of 1,250,000 bushels. Shipbuilding became a prominent industry during the years of the World War and as many as 5,000 men were at one time employed in the shipbuilding yards. In 1920 Vancouver had approximately 543 industries employing 28,800 people. They included lumber and shingle mills, pulp and paper mills, salmon, halibut and herring fisheries, foundries and structural steel works, sugar refineries, shipyards, etc. The output in 1917 was $57,172,309. Clearing-house returns for Vancouver in 1919 were $577,670,063. In that year 108,111,090 ft. of lumber were exported by sea. The customs revenue in 1920 amounted to $9,202,940. Exports in that year were $39,535,283, and imports $49,256,913. Shipping passing through the port in 1919 was approximately 23,000 vessels of 10,691,411 tons register. Building was quiescent for several years preceding 1919. In that year the building permits amounted to $2,271,411. Shaughnessy Heights is a wealthy suburb developed since 1911 by the Canadian Pacific railway.

The foundation of the university of British Columbia brought about a closing down of the British Columbia branch of McGill University and a transfer of the staff, equipment, etc., of the latter to the new college. The newly founded university made use at first of temporary buildings in the city, but just before the war secured extensive grounds for a campus and buildings at Port Grey. Construction was delayed by the war but was begun in 1921.

Granville I., a large block of reclaimed land near the retail business district, has of late years been providing excellent sites for industries, such sites being served with trackage, wharfage, electric power, etc.

VANDERLIP, FRANK ARTHUR (1864–), American banker, was born at Aurora, Ill., Nov. 17 1864. After leaving the public schools he studied for a time at the university of Illinois and at the old university of Chicago. In 1889 he became a reporter on the Chicago *Tribune* and in 1890 was made its financial editor, but resigned in 1894 to accept the associate editorship of the *Economist*, a paper published weekly in Chicago. His contributions to it attracted wide attention and he was frequently called upon to deliver addresses. On March 4 1897 he became private secretary to the U.S. Secretary of the Treasury, Lyman J. Gage, and four months later was appointed by President McKinley assistant Secretary of the Treasury. On resigning in 1901 he was elected vice-president of the National City Bank, of New York City, and in 1909 president, serving in the latter capacity for ten years. Before taking up his work in 1901 he spent a year in Europe studying financial and industrial conditions. When the War Savings Committee was appointed by Secretary of the Treasury McAdoo, to promote the sale of War Savings Certificates during the World War, he was made chairman, serving from Sept. 1917 to Sept. 1918. He was chairman of the board of directors of the American Industrial Corporation and director in many organizations, including the Haskell & Barker Car Co., the Midvale Steel & Ordnance Co., and the Union Pacific R.R. Co. He was a trustee of the Carnegie Foundation for the Advancement of Teaching. He was the author of *The American Commercial Invasion of Europe* (1902, the result of his studies in Europe); *Business and Education* (1907); *Modern Banking* (1911) and *What Happened to Europe* (1919).

VAN DYKE, HENRY (1852–), American writer, was born at Germantown, Pa., Nov. 10 1852. He studied at the Brooklyn Polytechnic Institute, and after graduating from Princeton in 1873 and from the Princeton Theological School in 1877, he spent two years at the university of Berlin. In 1879 he was ordained a Presbyterian minister, was for three years stationed at Newport, R.I., and from 1883 to 1900 was pastor of the Brick Presbyterian Church, New York City. In this capacity his preaching gave him a national reputation. From 1900 he was professor of English literature at Princeton. During 1902–3

** These figures indicate the volume and page number of the previous article.*

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he was moderator of the Presbyterian Church in the United States. In 1908 he was appointed American lecturer at the Sorbonne. He was a member of the American Academy of Arts and Letters, and in 1909 was elected president of the National Institute. In 1913 he was appointed by President Wilson minister to Holland and Luxemburg, but resigned in 1917. When after the fall of Liége in 1914 von Jagow handed to Mr. Gerard, the American ambassador in Berlin, the note to Belgium, offering full reparation for damages, in case free passage to France were granted German troops, Van Dyke flatly refused to act as intermediary. From the first he championed the cause of the Allies in the World War, and after America's entrance into the war he served as a naval chaplain. Dr. Van Dyke was an eloquent speaker. His books, both prose and in verse, give him a high place in modern American literature. Among his best works are his "outdoor essays," especially *Little Rivers* (1895) and *Fisherman's Luck* (1899). His publications include *The Reality of Religion* (1884); *The Poetry of Tennyson* (1889); *The Other Wise Man* (1896); *Ships and Havens* (1897); *The Toiling of Felix, and Other Poems* (1900); *The Poetry of the Psalms* (1900); *The Blue Flower* (1902); *Days Off* (1907); *The House of Rimmon* (1908); *Out-of-Doors in the Holy Land* (1908); *Collected Poems* (1911); *The Bad Shepherd* (1911); *The Unknown Quantity* (1912); *The Lost Boy* (1914); *Fighting for Peace* (1917); *The Valley of Vision* (1919); and *Golden Stars* (1919).

VAN HORNE, SIR WILLIAM CORNELIUS (1843–1915), Canadian financier (*see* 27.894), died at Montreal Sept. 11 1915.

VAN'T HOFF, JACOBUS HENDRICUS (1852–1911), Dutch chemist and physicist (*see* 27.896), died at Steglitz, near Berlin, March 1 1911.

VASSAR COLLEGE (*see* 27.946).—During the period 1910–20 the endowment of Vassar College grew from about $1,500,000 to $3,118,904.40 with 800 ac. in campus and farm. Student enrolment is limited to 1,000, the number that may be housed on the campus; but the pressure for admittance and the difficulty of estimating withdrawals make it impossible to maintain this limit with exactness, and the enrolment for 1921 was 1,106, the faculty numbering 142. The funds available for student aid in one form or another amounted in 1921 to $456,371.55. Students are admitted on passing the examinations set by the college entrance examination board, or by an examination covering three years of preparation in four selected subjects; this latter method takes the place of entrance by certificate from approved schools. The physical equipment of the college, exclusive of faculty residences, includes 27 buildings, seven of them dormitories, and a farm of 675 ac., with vegetable gardens and a model dairy.

Student self-government is in effective operation, the students themselves assuming responsibility for most of the regulations governing attendance and conduct, and for the management of the Students' Building and the Good Fellowship Club House, and for all extra curriculum activities, including the providing of various money-making occupations for self-supporting students. The facts that the price for rooms and board is the same for every student, the rooms being selected by lot, that there are no sororities or other clubs to which membership is not absolutely open, and that no admission fee may be charged to any campus meeting, all help to maintain a democratic spirit.

Among the notable war-time services of Vassar were the farm unit, the reconstruction units, and the training camp for nurses. In the summer of 1917 Vassar undertook the experiment of student labour on the college farm. Its success led to many similar enterprises throughout the country. Volunteers were accepted for the summer of 1918 to work in two shifts of six weeks each. They were housed in one of the campus buildings, paying their board out of their wages, working eight hours a day, and undertaking every form of farm work, as well as work in the model dairy, and drying, canning and preserving in the college kitchens. The Vassar units for service abroad, one under the American Red Cross, and a canteen unit under the Y.M.C.A., were financed by alumnae and undergraduates, with assistance from the Red Cross, and served in France. The Red Cross reconstruction unit included trained nurses, a dietitian, a doctor and social workers. Much of the rehabilitation work at Verdun was in their charge. The summer training camp for nurses was organized under the direction of the Red Cross and the National Council of Defense. Five hundred graduates of colleges for women entered upon a course of training for three months at Vassar and two years in a hospital, leading to the degree of registered nurse. One hundred and ten colleges were represented in this training camp, the probationary nurses coming from 46 different states of the Union and three British colonies. (B. J.*)

VAUGHAN WILLIAMS, RALPH (1872–), English musical composer, was born at Down Ampney, Oct. 12 1872. He was educated at Charterhouse and Trinity College, Cambridge, where he took the degree of Mus. Bac. in 1894. He studied further at the Royal College of Music, and also at Paris and Berlin. He took the degree of Mus. Doc. at Cambridge in 1901, and in 1919 received an hon. musical degree from the university of Oxford. His works include *Toward the Unknown Region* (1907); *Willow-wood* (1909); *Sea Symphony* (1910); *On Wenlock Edge* (1911); *London Symphony* (1914; Carnegie award 1917) and many fine songs, including arrangements of traditional melodies.

VAUGHAN WILLIAMS, SIR ROLAND LOMAX BOWDLER (1838–1916), English judge, was born in London Dec. 31 1838, the fifth son of the Rt. Hon. Sir Edward Vaughan Williams. He was educated at Westminster and Christ Church, Oxford, where he took his degree in 1860. He was called to the bar in 1861, and was made a Q.C. in 1889. In 1890 he was raised to the bench of the Queen's Bench division, in 1891 was transferred to the Bankruptcy division, and in 1897 became a lord justice of appeal. In 1906 Vaughan Williams was appointed chairman of the royal commission on the disestablishment of the Church in Wales. He retired from the bench in 1914, and died at Abinger, Dorking, Dec. 8 1916. His book *The Law and Practice of Bankruptcy* (1870; latest ed. 1915) is a leading authority.

VAZOV, IVAN (1850–1921), Bulgarian poet and writer, was born at Sopot in Bulgaria in 1850, and received his first education in the Sopot village school. Later on, he went to Russia to continue his studies. His first literary efforts took the form of essays and songs describing the sorrows of the Bulgars under Turkish rule, their hopes for a free united Bulgaria, their disappointment when the Treaty of Berlin divided the Bulgarian people once again. His most important work is the novel *Pod Igoto* (Under the Yoke), which has been translated into many European languages. *Pod Igoto* gives a simple and convincing picture of village life in Turkish times and of the heroes of the struggle for freedom. Among Vazov's other works are *The New Graves of Slivnitza* (Serbo-Bulgarian War of 1885–6); *The Kazalarska Czaritza; Borislav* and *Towards the Abyss*, two of his best plays. Vazov, who identified himself with the sufferings and joys of the people, is honoured throughout the country as the national poet and as a true patriot. His jubilee was officially celebrated in 1920 and he was awarded a pension from the State. He was the first Bulgarian writer whose works had been read outside Bulgaria. He died at Sofia Sept. 22 1921.

VENEREAL DISEASES (*see* 27.983).—There are three distinct diseases included under the term "venereal"—gonorrhoea, syphilis, and soft chancre, of which the first two are of primary importance in relation to public health. The advance in our knowledge of venereal disease, its prevention and curative treatment, during 1910–21, may be regarded as the outcome of experience upon a large scale based upon the following discoveries:—(1) the specific organism of syphilis by Schaudinn; (2) the inoculation of monkeys by Metchnikoff and protection therefrom by the application of a 33% calomel cream ointment; (3) the application by Wassermann of the Bordet haemolytic test to syphilis; and (4) the discovery by Ehrlich of "606" (salvarsan) as a rapid curative agent of syphilis. All four discoveries may be said to have laid the foundation of all modern methods of medically dealing with this disease.

The discussion of the whole subject at the International Medical Congress held in London in 1912, and the change in the attitude of a large section of the public and the press, eventually led up to the appointment of a British Royal Commission in 1913. The report of the Commission, published in 1916, was strongly supported by a National Council for Combating Venereal Disease, and ultimately an Act of Parliament was passed which made provision for the carrying out of its recommendations.

Scientific Advances.—During 1910–20 the so-called parasyphilitic diseases, general paralysis of the insane, and tabes dorsalis (locomotor ataxia), were proved to be the direct result of

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active proliferation of the spirochaeta pallida, in the brain and spinal cord respectively, of these two diseases. This knowledge was due to the discovery by Noguchi and Moore of spirochaetes in the brains of 12 out of 70 brains of persons dying of general paralysis. Confirmation of this was soon at hand in all civilized countries where these diseases occur. Mott was able to find the spirochaete pallida in the brains of 66 out of 100 successive fatal cases. Inasmuch as the cerebro-spinal fluid invariably gives a positive Wassermann reaction in general paralysis, it may be inferred that the spirochaete is always present. A large experience in the services during the World War has shown that in spite of modern energetic treatment a certain proportion of cases give a positive reaction of the cerebro-spinal fluid, and there is evidence to show that when generalization of the organism takes place in the secondary stage, its implantation in the substance of the central nervous system may occur; and it is these cases which subsequently develop this fatal and incurable disease, general paralysis; incurable because neither the mercury nor the arseno-benzol compounds are able to enter the substance of the nervous system and destroy the specific organism. This is a practical point of the greatest significance, for it shows that the only way to avoid this and other fatal incurable diseases is the adoption of curative treatment in the primary stage, as emphasized in the report of the Royal Commission. But even better is the adoption of prophylactic measures, by which the organism is killed while it is still on the surface of the body; for many persons may not know that they have been infected owing to the fact that the sore is not of a typical nature and in a number of cases is therefore regarded by the doctor or patient as a soft sore or chancroid; consequently only local treatment is adopted; or it may be that the sore causing little pain or discomfort leads to the patient neglecting treatment until it is too late.

A. Marie and Levaditi have recently put forward the view that there are two forms of specific organism—a neurotropic spirochaete, which seeks the nervous system, and a dermatotropic one which seeks the skin. Although there are no morphological differences discoverable in the organisms, yet certain clinical epidemiological and experimental facts support this argument.

Prevalence.—The returns of the Registrar General in England, as was shown in the report of the Royal Commission, are liable to many fallacies, which invalidate the accuracy of any deductions that could be made from them. The returns of deaths, which may unquestionably be assumed to be due to syphilis with the exception of general paralysis and aneurism, are very limited; yet we know that a large proportion of the deaths from organic brain and spinal cord diseases is due to this cause, likewise a large proportion of valvular and other diseases of the heart. Evidence was given at the Royal Commission showing that 5% of syphilitics subsequently developed general paralysis, also that 10 years is the average time for the brain symptoms to develop and several years then elapse before a fatal termination. It follows that the prevalence of syphilis in a community 12 to 13 years previously may be gauged by the percentage of deaths from general paralysis in any given year. Possibly this would be a more accurate method of estimating, to some extent, the prevalence of syphilis in a community than even the statistics afforded by the early treatment centres, for a large number of people suffering with the disease, even now, do not come under observation on account of avoiding the social stigma.

Death from general paralysis is about four times as great in men as in women; it may be assumed therefore that syphilitic infection is four times as frequent in men as in women. The incidence of general paralysis is about the same in all classes but it diminishes as we rise in the social scale in women. The inference is obvious as regards venereal disease and the social status of women. In the juvenile form due to congenital syphilis it occurs equally in the two sexes. Gonorrhoea, not being a direct cause of death, although of many chronic and even fatal diseases especially in women, rarely enters into the returns.

An attempt was made by the Royal Commission to estimate by the application of the blood test the prevalence of syphilis. Thus the present writer tested the specimens of blood withdrawn from a vein by Sir John Collie from 500 apparently healthy men applying for service in the L.C.C., and found that 9·2% gave a positive reaction. These, and many other statistics from various sources, notably hospitals, poor-law infirmaries, asylums for lunatics, idiots and imbeciles, and institutions for the blind and the deaf, published in the report, showed that a large percentage of the population had been infected with syphilis, and that a very large proportion of these people were suffering from a disease or disability directly or indirectly due to infection.

From the mass of evidence collected it was roughly calculated by the Royal Commission that probably 10% of the population had been infected with syphilis. This corresponds with the statistics of the United States:—

"The results of a survey by the Wassermann test of adults admitted to hospitals (apart from venereal clinics) in five large cities of the United States showed 9·5% positives out of a total of 15,264. Vedder obtained 13% positive reactions in 11,933 recruits for the U.S. army in 1916, 15% of 856 candidates for the police force, and 5% of 3,203 candidates for commissions in the army. It is worthy of note that in the same locality that gave 5·8% positive Wassermanns, Warthin found evidence of syphilis in 30% of post-mortem examinations. Hence Jeans concludes that the minimum of syphilitics in the United States is 10%, and the probable percentage twenty."[1]

It was assumed from the evidence before the Royal Commission that a much larger percentage of the people had suffered with gonorrhoea; inasmuch as one attack of this disease does not give immunity and relapses of an apparently cured infection frequently occur, it follows that reliable statistics of admissions for gonorrhoea are difficult to ascertain by the rate of admissions. Altogether it would not be an unfair estimate to assume that 20% to 30% of the population prior to the World War had suffered with venereal diseases.

The Annual Report of the Chief Medical Officer of the Ministry of Health for 1920 stated that the Ministry had based its policy upon the recommendations of the Royal Commission on Venereal Disease, 1916. The principal recommendations were thus summarized:—(*a*) Confidential registration of cause of death. (*b*) Extension of facilities for diagnosis. (*c*) Organization by the local authority of means of free treatment for all classes at convenient hours and under suitable conditions. (*d*) Improved professional and public education. (*e*) A grant-in-aid of 75% of total cost incurred in approved schemes. (*f*) Treatment in army and navy, poor-law institutions, prisons, etc. (*g*) Prohibition of all advertisements of remedies and unqualified practice. (*h*) Recognition by the Government of the National Council for Combating Venereal Diseases.

The Commission recommended that "no system of notification of venereal diseases should be put in force at the present time," and they condemned "unqualified practice" by chemists, herbalists and others as "disastrous" and "one of the principal hindrances to the eradication of those diseases," and they stated that "the most urgent requirement is to secure to every patient the freest and earliest possible access to medical assistance when there is suspicion of venereal disease. This implies, *inter alia*, that all temptation for the patient to have resort to an unqualified person shall be removed."

The National Council for Combating Venereal Diseases was established to promote and assist by propaganda and lectures the programme of the Royal Commission; it had the approval and support of the Local Government Board and of the Ministry of Health. Still, in spite of moral teaching, lectures, propaganda and early treatment centres, an alarming incidence of venereal disease occurred in the British armies and in those of the Dominions during the World War. Some idea of the prevalence of these diseases may be gained by reference to a statement by the late Sir William Osler (*Lancet*, May 26 1917):—

"The last quoted figures for the British army at home are (Hansard, April 23): 71,000 cases of gonorrhoea, 21,000 cases of syphilis, and 6,000 cases of soft chancre. In the Canadian army to March 31 1917, there have been 18,335 cases of venereal disease—figures which have stirred public opinion in the Dominions to boiling point."

[1] Medical Science Abstracts and Reviews. Published for the Medical Research Committee, vol. i., 1919–20, p. 397.

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There are many facts which show that there has been, in consequence of the war, and in spite of the application of the measures recommended by the Royal Commission, a very considerable increase in the prevalence of venereal diseases in the United Kingdom (see evidence by Dr. Sequeira, Miss Ettie Rout and others in the report of the Committee of the Birth-Rate Commission).

Table 1, taken from the Annual Report of the Chief Medical Officer of the Ministry of Health for 1920, indicates the extent to which the clinics were utilized in 1920. From this table it

TABLE 1.—*Experience of British Clinics, 1920.*

England and Wales	Number of persons dealt with for the first time.						Total Number of Attendances	Number of Clinics at end of year
	Syphilis	Soft Chancre	Gonorrhoea	Total V. D.	Other than V. D.	Total new cases		
1917	..	..	..	..	..	29,036	204,692	113
1918	26,912	806	17,635	45,353	6,622	51,975	488,137	134
1919	42,134	2,164	38,499	82,797	15,447	98,244	1,002,791	160
1920	42,805	2,442	40,284	85,531	19,654	105,185	1,488,514	190

appears:—(*a*) that in the fourth year of the scheme there were approximately 85,000 cases of venereal disease and 19,000 cases which proved not to be venereal disease, the total number of new cases being 105,000 and the attendances 1,488,000; (*b*) that there was a rapid increase of "new" cases of venereal disease in 1918 and 1919 and a stationary position in 1920. The term "new cases" can only be relative, and does not afford a basis for calculations of incidence; (*c*) that if the army estimate of the relative frequency of gonorrhoea and other venereal diseases (2½ to 1) be correct for the civil community, only a small proportion of the cases of gonorrhoea in the country came under treatment at the clinics; (*d*) that the total attendances (and the ratio of attendances to patients) had increased greatly, and that the number of persons who were apprehensive of their condition and who came to the clinics for diagnosis had increased—two facts which suggest that the clinics were better appreciated.

The total expenditure of British local authorities was £116,000 in 1917–8, £214,000 in 1918–9, £287,000 in 1919–20; towards which the Ministry of Health provided grants of £84,000, £145,232, and £224,716.

Owing probably to financial reasons and inefficiency of some of the clinics there were indications of a change of policy by the Ministry of Health, for in the above-mentioned report it was stated:—

"It cannot be too clearly understood that the best way of dealing with most cases of these diseases is through the skilful private practitioner. For a substantial portion of this problem the public clinic should be looked upon as a temporary organization pending the time when the practitioner is ready, available, competent, and properly equipped to undertake effective treatment. Certain patients require hospital treatment, but the authority should not needlessly establish institutions if and when the ordinary channels of medical practice are available and reliable, or can be made so." . . . .

"I am bound to advise that if the work of these clinics is not properly done—if it is casual, superficial or perfunctory—they should be disapproved by the Ministry. It is better to have only a few clinics well-organized and scientifically controlled than a large number which are not thus administered. These statements indicative of a change of policy in the future may find an explanation in a study of the statistics (see Table 2) relating to the number of patients discharged from venereal disease centres as having completed treatment. This table shows that 29% of syphilitics and 33% of persons suffering from gonorrhoea ceased to attend before completing a course of treatment. Nearly three times as many as those who were discharged after completion of treatment and observation and accordingly can be definitely tabulated as cured and non-infective. These facts seem to show the necessity of adopting some disciplinary measures to combat the evil, such as exist in the United States."

Prevention.—Sir Archdall Reid, in his work on the prevention of venereal disease, complains that no reference was made in the report of the Royal Commission of the value of Metchnikoff's discovery. The National Council strenuously opposed what they termed "the packet system" but the facts had to be faced.

TABLE 2.—*Patients at British Treatment-Centres.*

	Syphilis	Gonorrhoea	Total
(1) Number of persons dealt with during 1919 and 1920 . . .	105,619	87,792	193,411
(2) Number of persons who ceased to attend:—			
(*a*) before completing a course of treatment	30,459	28,869	59,328
(*b*) after completion of a course of treatment, but before final tests as to cure	9,350	6,481	15,831
(3) Number of persons discharged after completion of treatment and observation	8,240	13,300	21,540
(4) Number of persons who on the 1st of Jan. 1921 were under treatment or observation . . .	47,894	28,822	76,716

Early curative treatment and moral suasion by propaganda and lectures had not effected the purpose which most of the members of the Royal Commission believed and desired they would. Sir Bryan Donkin, in a letter to *The Times* in Jan. 1917, first called attention to the necessity of the adoption of immediate self-disinfection in accordance with the discovery of Metchnikoff. He cited the remarkable success attending the simple measures of immediate self-disinfection adopted at Portsmouth by Sir Archdall Reid. Reid states in his book that one in 1,000 solution of permanganate of potash, carried in a flat screw-stoppered bottle with a swab of cotton wool, proved a simple and cheap means by which he obtained successful results. The directions were that the soldier should immediately after exposure to infection thoroughly swab the exposed surfaces with the fluid; and he states on p. 130:—"Immediately venereal disease vanished from my units. For six months not a single case occurred. In two years and four months, during which quite 20,000 men must have passed through my hands, only seven men were infected. Of the seven cases, six of gonorrhoea and one of syphilis, all could be accounted for by drink or negligence."

A controversy as to the right or wrong of such treatment thus arose which eventuated in a number of eminent medical men leaving the National Council for Combating Venereal Diseases to form the Society for the Prevention of Venereal Disease by immediate self-disinfection. While not discouraging continuance of efforts by moral persuasion, athletics, education and early curative treatment, this Society realized that immediate self-disinfection either by calomel cream or permanganate solution, was essential supplement to the before-mentioned measures; recognising as the members of this Society do, that a large proportion of the adult population are not, and in our present social conditions, cannot or will not remain continent. It may be assumed that both the societies are animated with the same desire, and it was hoped that by the establishment of a special committee of the Birth-Rate Commission in June 1920, in order to take expert evidence on the value of the various measures for the prevention of venereal diseases, unanimity on the part of the two societies might arise. A report on "The prevention of venereal disease" by this Committee was issued in Feb. 1921. The report states (p. 21):—"The Committee is of opinion that any administrative or legal difficulties that may at present prevent individuals, who desire to do so, from purchasing such disinfectants from chemists, on their own initiative as a protection against venereal disease should be removed; and that the section of the Act dealing with this matter should be rendered more explicit and amended if necessary;" but up to June 1921 no result had been achieved as regards action by the Government or by way of settling the essential point of difference between the two societies.

The supporters of the S.P.V.D. maintain that if 183 curative treatment centres (which cost the State £300,000 in 1920) are necessary, a similar number of prophylactic centres are more necessary. Now the National Council advised the Government to establish what they call Early Ablution Centres where skilled but delayed disinfection would be carried out. There are so many obvious defects in this system when applied to the civil

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population, together with the enormous cost which would be thrown upon the present overburdened ratepayers, that even in June 1921 there was only one in operation (in Manchester), and only four other possible prospective centres. The London County Council and many boroughs had refused to adopt this method of dealing with these diseases, and most thinking people are of opinion that the onus of keeping clean and thus avoiding the spread of infection should be thrown on the individual who lays himself open to infection by promiscuous intercourse. In respect to prophylaxis therefore the policy of the National Council had entirely failed to deal with the problem, and it was the contention of the S.P.V.D. that the only practical preventive measure is, " immediate self-disinfection " and that all hindrance to facilities, such as the law forbidding chemists in England to sell prophylactics for the specific purpose of rendering an individual safe, when contemplating promiscuous sexual intercourse, should be abolished.

The National Council and its supporters could not deny the fact that immediate self-disinfection, if properly carried out, was an efficient method of prophylaxis; but on moral grounds they strongly objected to its employment, as condoning promiscuous sexual intercourse and thereby leading to increased risk of infection and a false security, because it could never be carried out efficiently by the civil population. Colonel Harrison, adviser to the Ministry of Health, who was responsible for its application in the army, supported the National Council in this contention. He stated that his experience showed that he was wrong in his estimation of the value of self-disinfection as a means of prevention of venereal disease in the army, and that it did not meet with the success that he anticipated. On the other hand there is the experience of Sir Archdall Reid, and the equally successful results obtained in the navy by Commander Boyden (see p. 227, Report of Birth-Rate Committee, and Archdall Reid's *Prevention of Venereal Diseases*, appendix pp. 437–442). Also Capt. Walker's results: " During Aug. and Sept. 1917 (64 days) a little over 5,000 officers and men came on leave to Paris, of whom 1,038 developed venereal disease or about 20 per cent. This closed the leave to Paris. Leave was reopened on Nov. 8 1917. . . . " " The actual results from Nov. 8 1917 to March 31 1918 was stated by Capt. Walker to be only 3% of infections among the men on leave to Paris." This great reduction was the result of prophylactic measures (*Public Health*, Sept. 1918). Although on a small scale compared with those of Col. Harrison, these results tended to prove that the personal equation plays an all-important part not only in respect to the faith, intelligence and desire of the man who employs self-disinfection as a means of prevention, but in the faith, intelligence and desire of the commanding officers and medical officers whose duty it is to see that the excellent army instructions, which were promulgated, were enforced and the necessary disinfectants provided. Indeed, had disciplinary measures been adopted and applied both to the individuals who became infected and to the medical officer in charge if carelessness or negligence in carrying out the instructions had been proved, far better results would no doubt have been obtained. Moreover, early detection of the practice of men seeking infection in order to escape service at the front, which became so prevalent as to necessitate classification as " self-inflicted wound," would have been easy and the practice prevented. Again, it is argued against chemists being allowed to sell specific prophylactics that it would lead to increase of venereal disease by the assumption of the purchaser that they might serve as a curative agent. Perhaps the strongest argument in favour of the efficacy of the adoption of immediate self-disinfection as the best means of prevention of venereal disease is the fact that at Portsmouth, where Sir Archdall Reid carried on his work, the Medical Officer of Health, Dr. Mearns Fraser, overcame the opposition of clergy and others to this mode of treatment, and advice and information on immediate self-disinfection was in 1921 given there by posters and on application to the Health Department at the town hall.

The policy of the Ministry of Health was thus stated by the Chief Medical Officer of the Ministry of Health:—

Facilities are now being provided for disinfection, as well as irrigation and other intermediate treatment, at the various kinds of treatment centres approved by the Ministry and elsewhere under medical supervision (Annual Report, 1920, p. 122).

The experience of the American army, with State control in the United States, supports the view that, to make any system efficient, disciplinary measures and notifications are desirable, but this can only be done when all obstacles to prevention are removed. Ignorance, prejudice and false sentiment must be banished and the public educated to regard venereal disease like any other infective disease:—

" Prophylactic treatment stations were established during the war in all the camps and in towns in the vicinity of camps in the United States and in France. These stations were under the supervision of American officers and in charge of carefully trained non-commissioned officers. Soldiers were not only instructed in the course of their training that prophylactic treatment does, in many cases, prevent the development of venereal disease but they were also under orders to apply for treatment after having exposed themselves. If a soldier developed venereal disease his record was examined to ascertain whether prophylactic treatment had been taken and if this duty had been omitted, the soldier was subjected to trial by court-martial to ascertain why preventive measures had not been undertaken and to undergo punishment in case neglect became evident. Inquiry into the effectiveness of this system establishes the fact that under favourable conditions, prophylactic treatment was effective in over 90 % of the cases received. It was found that apparent failures resulted from four causes:—(*a*) delay in seeking treatment; (*b*) incompetence on the part of the attendant giving the treatment; (*c*) previous history of venereal disease indicating a recurrent attack; (*d*) false statements on the part of the soldier." (" Combating Venereal Disease in Armies, "*International Journal of Public Health*, published by the League of Red Cross Societies, Jan.–Feb. 1921, vol. ii., No. 1.)

State Control.—The measures adopted in the United States to control venereal disease are described in the reports of the Public Health Service. These measures are as follows:—(1) Notification of cases of venereal disease to the health authorities, the records to be secret; (2) isolation and treatment in detention hospitals of infected persons who are unable or unwilling to take measures to prevent their becoming a menace against others; also measures for the suppression of prostitution; (3) educational measures, including information of the general public concerning the nature and manner of spreading of venereal diseases and the steps to combat them; (4) extension of facilities for early diagnosis and treatment; (5) prohibition of prescribing by druggists. These principles have been carried into effect in many of the states by rendering persons who are a danger to the public health on account of venereal disease subject to quarantine, and certain standards are laid down which have to be followed before discharging patients as non-infectious.

In Pennsylvania the following measures have been adopted. The work of the Department has been divided into three parts: medical, educational, and law enforcement. There are certain measures concerning the Medical Department, making for economy and efficiency, which are at variance with those adopted by the British Ministry of Health. These are as follows:—

There are 30 public clinics for the treatment of venereal disease, over which the Department of Health has entire supervision and for which it assumes all financial responsibility. In these clinics free treatment is given to those patients whose economic condition will not permit treatment either by private physicians or by clinics charging a fee. Upon entrance to clinics, patients are questioned as to their ability to pay for services. Those able to pay a private physician are referred to outside doctors who are registered with the clinics. If in position to pay only a small sum, they are referred to hospital clinics which charge a nominal fee. Indigent patients are treated free in the state clinics.

Continuance of treatment of a patient is insured by sending a notice to return for treatment. If this does not effect a return, the clinic makes use of the legal machinery at the disposal of the Department of Health.

Through an Act of the State Legislature passed in 1921, there has been placed at the disposal of the Department of Health a modern 400-bed hospital for the care and treatment of syphilitic patients who are menaces to the public health.

Immediate treatment (venereal prophylaxis) for those exposed to disease has been approved by the Pennsylvania State Department of Health. Prophylaxis as used in the army by means of stations is impractical in civilian life. Tubes containing material for self-disinfection are given the Department's approval, after

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being tested. The material usually employed is after the formula of Metchnikoff. The tubes are on sale in drug stores.

Self-disinfection in Women.—All authorities are agreed that self-disinfection in women under most circumstances is not likely to be attended by the same satisfactory results as in men, on account of the different anatomical construction of the genital organs. Dr. Morna Rawlins and Lady Barrett, in giving evidence before the Birth-Rate Commission in England, said that they would not recommend its use for several reasons. It would be employed for contraconception, and if the permanganate solution were used it might lead to the spread of the infection to the uterus. Sir Archdall Reid in his book discusses the subject, and refers to the opinion of Miss Ettie Rout, who was for years in France with the New Zealand and Australian forces. Although Miss Rout was not a doctor she had an extraordinary experience and knowledge of the subject. She points out that there is far more danger to women in outdoor relationships than in indoor relationships, and she supports this statement by the fact that the weekly average of soldiers infected was doubled and afterwards still further increased when the licensed houses in Havre were put out of bounds in April 1918, simply because immediate self-disinfection was not available to the women (or to the men) and they were not under medical supervision. Similarly in Amiens, Abbeville and other places, the amount of disease increased for the same reason. In her evidence before the Committee of the Birth-Rate Commission she stated that a weak permanganate solution was in use at the St. Louis Hospital, Paris.

Syphilis and Pregnancy.—Dr. Amand Routh, who has made a special study of this subject, estimates that at least 20% of the ante-natal and neo-natal deaths are due to congenital syphilis. Experience shows that treatment of the mother is very satisfactory, for she can be cured and the offspring prevented from becoming congenital syphilitics.

Modern Curative Treatment.—Sufficient time has now elapsed since Ehrlich's great discovery of the arseno-benzol compound known as salvarsan or "606" to appraise the value of this drug or its equivalents in the treatment of syphilis. It was at first believed that it would entirely replace the old mercurial treatment, but the greatest success has been attended by a combination of the two. Numerous other arseno-benzol compounds of a similar nature to the original "606" have since been introduced, and, although it is generally considered that they have not such a powerful influence on the disease, yet neo-salvarsan or its equivalent preparations are now almost universally employed, because the technique of administration is so much simpler. When salvarsan was introduced, a misapprehension of its curative effect arose in the mind of the public and many members of the profession; for it was believed that a few intravenous injections of the drug would suffice to effect a cure, and this might seem probable if, in conjunction with the patient showing no active symptoms, the blood previously positive in its reaction became negative. Under such circumstances the patient believed, and sometimes was led to believe, that no further treatment was necessary. Experience has shown that not infrequently serious consequences were the result. Therefore most authorities recommend what is termed "intensive treatment," namely a course of intravenous and intramuscular injection of an arseno-benzol compound combined with mercury in the form of intramuscular injections or inunctions. Periodic courses extending over two years are required. The Wassermann reaction of the blood is taken before treatment is commenced and the strength of complement fixation estimated before and after each course of treatment. The curative effects of the drug can thus in a measure be estimated. For ill-effects of salvarsan treatment and standards of cure, see pp. 114–5, *Annual Report of the Chief Medical Officer of Ministry of Health*, 1920. It will be observed that of 193,411 persons dealt with during 1919–20 there were 59,328 who ceased to attend before completing a course of treatment. Many of these were still infective.

Evidence given before the British Royal Commission showed that energetic "intensive treatment" employed in the primary stage before the Wassermann reaction was positive and therefore the spirochaete had become generalized in the body, had led to a complete cure in a number of cases. This was shown by the fact that although the spirochaete of syphilis had been found in the sore yet the Wassermann reaction was negative and remained so. A still more convincing proof of cure, in such cases, was the fact that re-infection has been known to occur. It is necessary to state that, owing to faulty technique and short cuts in performing the Wassermann reaction, cases have been reported as negative by one observer and positive by another. In some of these cases the patients were obviously suffering from disease, the result of a previous infection, in others there was no clinical sign. The Commission rightly laid stress upon the necessity of employing a standardized method to avoid error and thus avert very serious consequences, medical and medicolegal. Most authorities lay more stress upon the examination of the cerebrospinal fluid than the blood in diseases of the nervous system, presumably of syphilitic origin, as a means of diagnosis. Experience shows that many persons may be in good health or at any rate not suffering from any obvious clinical syphilitic disease, and yet give a positive Wassermann reaction of the blood, for the organism may be locked up in some functionally indifferent tissue, but a positive reaction of the fluid shows that the spirochaete is in the central nervous system and if it is not causing any clinically recognizable symptoms there is a positive danger that it may at any time do so. When once the cerebrospinal fluid is found to give a positive Wassermann reaction it is doubtful whether any treatment will make it negative. This fact shows how extremely difficult it is for the drug to attack the organism when once it has gained access to the substance of the central nervous system. It was for this reason that Swift and Ellis introduced the treatment of general paralysis and tabes by spinal intrathecal injections of salvarsanized serum; but it was found to have no advantages over the usual methods of treatment, and only a few authorities now employ it and claim successful results.

All those who have had experience in the prevention and treatment of venereal disease consider gonorrhoea and its complications the most difficult to deal with. It is not implied therefore that the effects of gonorrhoea are so serious as syphilis, but owing to the fact that the organism when it has invaded the deeper structures is not easily eradicated, a patient thinking himself cured, because he suffers no pain, may unwittingly infect his wife or other women. As there are immense numbers of these carriers it is easily seen how difficult is the problem of prevention of gonorrhoea; and this difficulty is greatly increased by the fact that this disease is not looked upon as serious; whereas all the evidence given before the Royal Commission showed that many serious diseases especially affecting women were due to gonorrhoeal infection. It is a frequent cause of disease of the reproductive organs, and sterility is a result. Its ill-effect upon the health and happiness of the nation is far greater than is generally imagined. If the complex medical and social problem involved in venereal infection is to be dealt with nationally on sound lines it is essential that the full confidence and support of the public must be obtained. This can only be done by getting the people, as the late Sir William Osler said: "to realize that it is a great communicable disease, many of whose victims are innocent."

The following works may be consulted for further information:—*System of Syphilis* (Oxford Press); The Report of the Royal Commission on Venereal Disease with appendices (1916); Report on the Prevention of Venereal Disease by the Special Committee of the Birth-Rate Commission; *Manual of Military Urology* (American Red Cross Association); *Medical Science*, abstracts and reviews, published by the Council of Medical Research (vols. i. and ii.); Sir William Osler, "The Campaign against Syphilis," *Lancet* May 26 1917; Sir Archdall Reid, *The Prevention of Venereal Disease;* Reports of the Public Health Service, U.S.A., 1920; Report of the Chief Medical Officer of the Ministry of Health, 1920. (F. W. Mo.)

VENEZUELA (*see* 27.988).—The permanent additions made to the population of Venezuela by immigration during 1910–20 were slight. The official year book for 1912 stated that the total number of persons arriving at Venezuelan ports in that year was 9,615, while the total departures were 7,981. It gave the approximate pop. of the republic as 2,632,754.

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Venezuela's constitution of 1909 declared that the republic be composed of 20 states, 2 territories, and a federal district. These states made provisions regarding their boundaries and territorial divisions by laws passed prior to March 16 1912. In Oct. 1912, the Federal district was made up of two departments, Libertador and Vargas, which were subdivided into 20 parishes or municipalities. The states had been divided into 147 districts and these subdivided into 597 municipalities. The territories had been organized into 10 municipalities. The Venezuelan constitution of 1914 allowed the main territorial divisions to remain as they were when established under the constitution of 1909. On June 14 1916, Congress enacted an organic law for the Government of the Federal territory of Delta Amacuro, which divided it into four municipalities and vested its government in the president of Venezuela according to certain prescriptions.

Communications.—Twelve railroads of some importance were operating in Venezuela in 1920 with a total mileage of about 600 m., and an invested capital of some 200,000,000 bolívares. Steamships plied up the Orinoco river to Ciudad Bolívar and thence to ports in the interior. Some ocean vessels entered Lake Maracaibo. La Guaira and Puerto Cabello were ports of call for important American and European steamship lines. During the rule of President Gómez, beginning in 1908, considerable attention was given to interior communications. Shortly after becoming president he conceived the idea that the construction, improvement, and repair of important Venezuelan roads was a most urgent public work. From Dec. 1908 to Dec. 1913, the construction or repair of several highways was undertaken by the national Government. Among these were the roads from La Guaira to Caracas, from Caracas to Guatire, and from Rubio to Uracá, which was macadamized. In some years the expenses for highway construction and maintenance constituted the major portion of the expenditures of the Department of Public Works. Plans were made for a comprehensive system of roads. On Aug. 11 1916, a presidential decree provided for the construction of the great western highway from Caracas to San Cristóbal through the states of Miranda, Aragua, Carabobo, Cojedes, Portugesa, Zámora, and Táchira. On Dec. 19 1915, another decree provided for the construction of the great eastern highway from Caracas through the states of Miranda, Anzoátegui, and Bolívar to the interior of Guiana.

Foreign Commerce.—According to official statistics in 1913 the total imports of Venezuela amounted to 93,420,225.90 bolívares. (Nominal value $.193 or 9.4d.) The imports from the leading countries were as follows: 35,979,980.03 bolívares from the United States; 22,260,593.57 from the British Empire; 13,404,073.91 from Germany; 8,218,689.19 from Holland; 5,666,611.43 from France; 3,744,276.53 from Spain; 2,878,928.50 from Italy; 1,184,266.30 from Belgium; and 66,575.84 from Colombia. In 1913 the total exports of Venezuela amounted to 152,765,749.04 bolívares. The countries taking the largest shares were: France, 51,751,523.27 bolívares; the United States, 43,914,670.33; Germany, 28,827,814.24; England, 11,394,058.90; Holland, 3,675,353.30; Colombia 2,151,434; Austria-Hungary, 2,051,273 and Italy, 1,308,325. According to statistics compiled by the Pan-American Union, the chief imports into Venezuela in 1918, exclusive of parcel post shipments, were as follows: cotton textiles, 16,709,753 bolívares; drugs and medicines, 4,242,157; machinery, 3,190,315; flour, 3,039,409; automobiles and accessories, 1,562,495; leather and leather goods, 1,135,198; paraffin, 1,625,949; wines, 1,303,388; stearin, 975,865; and soda, 921,384. The total imports in 1918, according to official statistics, amounted to 77,244,950.23 bolívares. Imports from the chief countries were as follows: United States, 46,564,983.71 bolívares; England, 22,396,-903.23; Colombia, 2,264,753.23; Spain, 2,240,538.71; France, 1,770,-621.41; Italy, 920,720.50 and Holland, 759,104.55. The chief articles exported in 1918, according to figures compiled by the Pan-American Union, were as follows: coffee, 38,568,176 bolívares; cacao, 19,798,054; rubber, 6,947,320; sugar, 5,481,139; corn, 3,987,698; cattle and hides, 3,249,060; tobacco, 3,179,902; gold, 2,348,914; frozen beef, 2,545,935; asphalt, 1,560,193; and petroleum, 1,041,742. According to official statistics, the total exports of Venezuela in 1918 came to 102,659,153.74 bolívares. The countries taking the largest quota were: United States, 46,382,272.70 bolívares; Holland, 17,640,887.74; England, 17,098,261.82; France, 10,068,966.33; Spain, 8,913,919.10; Italy, 1,142,422; Cuba, 719,151.-05; and Colombia, 612,203. During the World War the trade of Venezuela with the Central Empires altogether ceased, while her commerce with the Allies and with neutral Powers much increased, the United States securing a large part of the trade.

Government.—On May 18 1914, a Congress of Deputies from the Venezuelan states adopted a new constitution for their union. That constitution declared that the Venezuelan states reciprocally recognized their autonomy and equality, and that they retained all sovereignty which was not delegated to the central Government by the constitution. The states agreed to promulgate constitutions that would harmonize with the fundamental law and agreed to see that the national constitution, laws, and orders were obeyed. Early in June assemblies at the capitals of the respective states ratified the new form of Government, which was accordingly proclaimed in force June 13 1914. This constitution provided that the right of suffrage was to be exercised by male citizens 21 years of age or over. Foreigners who took part in political controversies (*contiendas*) could be arrested, confined, or expelled by order of the president. Executive power was vested in a president and a cabinet of ministers appointed by him. The president was to be elected for a seven-year term by the secret vote of Congress. During the temporary absence of the president from the capital his functions were to be exercised by a minister whom he designated. Among the extensive powers vested in the chief executive were the following: to administer the Federal district and the two Federal territories; to issue decrees and regulations for the better execution of the laws; to negotiate loans as provided by Congress; to grant certificates of naturalization; to appoint national officials whose appointment was not otherwise provided for; to convoke an extraordinary session of Congress; to declare war when authorized by Congress; to negotiate treaties with foreign nations; and to proclaim martial law throughout the republic. Article 137 of the constitution stipulated that the provisional president and vice-presidents of the republic should hold office until the new constitutional functionaries were inaugurated. Article 138 stipulated that the commander-in-chief of the national army should exercise his functions until the inauguration of the constitutional president of the republic. Legislative authority was granted to a Congress composed of a Senate and a Chamber of Deputies. The Senate was to be composed of two Senators from each state chosen by its Legislative Assembly for three years. The Chamber of Deputies was to be composed of members chosen from every state and from the Federal district by popular vote for three years at the ratio of one deputy to every 35,000 inhabitants. Congress was to meet annually on April 19 at the capital for a session of 70 days. Judicial authority was vested in a Supreme Court designated the *Corte Federal y de Casación* and in other tribunals established by law. The Federal Supreme Court was to be composed of seven judges who were to be elected by Congress for a term of seven years. Clauses defining powers of this court provided that it should take cognizance of accusations against the president and other high officials. It was given jurisdiction over cases involving claims against the nation, cases relating to foreign diplomatic agents in Venezuela, cases arising from contracts made by the president, and cases involving conflicts between laws or decrees. State or Federal.

Army and Navy.—In 1912 Venezuela purchased a vessel of about 1,000 tons from the United States, which was re-christened the "Mariscal Sucre" and made the flagship of the navy. About 1915 the Venezuelan navy was composed of two cruisers, three gunboats and two transports with a personnel of a few hundred men. The standing army was composed of some 9,000 infantry, artillery and cavalry. In addition there was a reserve which was estimated to consist of about 100,000 men. By a law published in June 1919, military service was made compulsory for all adult male citizens, with certain exceptions. Every man was obliged to serve in the army or navy for two years in peace-time and during war at the president's pleasure. Until they became 45 years of age those soldiers were to compose part of the reserve. A decree of April 17 1920 provided for a military aviation school at Maracay.

Education.—According to the official year book for 1912 there were in that year in the republic 1,408 elementary schools attended by 45,515 children. There were in attendance at 52 graded schools 4,853 pupils. On Dec. 19 1914 a fundamental law concerning education was enacted. This law provided that primary instruction should be compulsory and free for all children from 7 to 14 years of age. Secondary education, furnished in *lyceos* and *colegios*, should comprehend two successive courses: one of a general character, and another of a special type giving training in philosophy and letters, in physical and natural science, or in physical and mathematical science. A decree of March 1915 provided that the national Government should maintain a school of fine arts, furnishing instruction in music, declamation and the plastic arts; commercial schools at Caracas, Maracaibo, and Ciudad Bolívar; a school of arts and crafts for males and another for females; and a training school for nurses. In 1916 decrees were issued which founded at Caracas a number of institutions for higher education, such as a school of political

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science, a school of pharmacy, and a school of dentistry. Decrees were issued in the following year which established in that city a museum of natural history and an institute of fine arts. Besides the facilities furnished by various educational institutions in the capital city, there is the *Universidad de los Andes* at Mérida.

Finances.—The financial condition of Venezuela has improved in recent years. On Dec. 31 1913, the total indebtedness of the Venezuelan Government amounted to 176,460,251.14 bolívares. Of this 61,607,179.53 bolívares was domestic, while the balance was foreign debt. The domestic debt was thus classified:—

	Bolívares
National domestic debt, consolidated at 6%	54,699.59
Script at 1%	38,165.62
National domestic debt, consolidated at 3%	59,960,572.36
National domestic debt, consolidated without interest	1,204,639.83
Current indebtedness	349,102.13
Total	61,607,179.53

The foreign debt was as follows:

	Bolívares
National debt at 3% by diplomatic conventions	9,843,791.61
Provisional script (Spanish)	1,600.00
Diplomatic debt at 3%, issue of 1905	105,007,680.00
Total	114,853,071.61

In Aug. 1914 the Government of Venezuela issued a decree ordering a reduction in the number of offices and a decrease of 25% in official salaries. This was followed by other economies. Claims of French citizens against Venezuela amounting to 13,000,000 bolívares were adjusted by a protocol of Jan. 14 1915, at 3,000,000 bolívares. For the satisfaction of this obligation a non-interest bearing debt was provided, the arrangement being that it was to be cancelled by the payment by Venezuela of 57,692.31 bolívares monthly. The national revenue for the fiscal year 1917–8 amounted to 53,253,686.06 bolívares; while the expenditures came to 52,948,924.48 bolívares, leaving a surplus of 304,761.78. Revenues for that year were derived from the following sources:—

	Bolívares
Customs duties, consular fees, etc.	24,544,127.42
Cigarette tax	6,317,345.85
Liquor tax	7,437,183.09
Salt monopoly	6,725,814.75
Stamps	4,295,891.95
Stamped paper	177,520.90
Inheritance taxes	179,965.92
Other sources	3,575,836.18
Total	53,253,686.06

On July 13 1919, the national domestic debt of Venezuela was as follows:—

	Bolívares
National domestic debt, consolidated at 3%	46,623,077.29
Script	2,098,652.50
Treasury bonds	349,102.13
Total	49,070,831.92

Upon the same date the national foreign debt was as follows:—

	Bolívares
National debt at 3% by diplomatic conventions	9,208,291.61
Provisional script (Spanish)	1,600.00
Diplomatic debt at 3%, issue of 1905	84,511,750.00
Non-interest bearing diplomatic debt as arranged in 1915	230,769.12
Total	93,952,410.73

The total indebtedness of the Venezuelan Government on July 13 1919 thus amounted to 143,023,242.65 bolívares. The bolívar was relatively stable during the World War. The exchange value of the U.S. dollar measured in bolívares at different dates was as follows: July 1914, 5.30; April 1917, 5.14; April 1918, 4.32; Jan. 1919, 4.25; and Dec. 1919, 5.16. An official estimate in 1919 stated that there were in circulation some 25,000,000 bolívares of bank-notes; 49,000,000 in silver coin; while the gold in circulation and in reserve came to 62,000,000 bolívares. In July 1920 eight companies had banks in Caracas. Two indigenous institutions were the *Banco de Venezuela* with a capital of 24,000,000 bolívares and with more than a score of agencies, and the *Banco Caracas* with a capital of 6,000,000. The Royal Bank of Canada had a bank in Caracas and four branches in other cities. The National City Bank of New York had a bank in Caracas and four branches in other cities and towns. The *Hollandische Bank voor West-India* had a bank in the capital city. The Mercantile Bank of the Americas of New York City had established a central bank in Caracas with branches at La Guaira, Puerto Cabello, and Maracaibo. The Commercial Bank of Spanish America Limited—affiliated with the Anglo-South American Bank Limited—with a capital and reserves of 200,000,000 bolívares, had banks in Caracas and Puerto Cabello. The Deschanel International Corporation of Venezuela, affiliated with a corporation of that name in New York City, with a capital of some 1,260,000 bolívares, had established banks in Caracas and La Guaira. Another important institution of Venezuela was the *Banco de Maracaibo*, with a capital of 937,500 bolívares.

History.—When in Nov. 1908, President Castro left Venezuela to visit Europe, the first vice-president, Juan Vicente Gómez, a wealthy land-owner and an efficient military leader, was given the presidential power. In decrees of Nov. 23 1908, Gómez appointed a general secretary and confirmed the existing Cabinet appointments. On May 3 1909 he issued a decree announcing that he was exercising the powers of President of Venezuela, and after suppressing opposition to his rule in certain quarters, he was acclaimed President Dec. 19 1909. Under the constitution of 1909, on Aug. 27 1910, Congress elected Gómez constitutional President for four years. In June and July 1911, Venezuela celebrated with appropriate ceremonies the centenary of her declaration of independence. During the rule of Gómez diplomatic relations with foreign nations that had been ruptured were resumed, and Venezuela undertook to pay her obligations to foreign nations upon which payments had lapsed. Upon an attempt of ex-President Castro to regain his power, President Gómez issued a proclamation on Aug. 3 1913, announcing that as the peace of the republic had been disturbed by Castro, he (Gómez) was leaving the capital to undertake a campaign for the restoration of public order. Upon the following day he entrusted his authority to José Gil Fortoul, president of the council of government. On Jan. 1 1914, he reëntered Caracas at the head of his army and at once reassumed the powers of President.

According to the constitution the term of office of President Gómez ended on April 19 1914. Upon that day a Congress of Deputies from the Venezuelan states adopted a provisional constitutional statute for the Union. That statute declared that all laws not inconsistent therewith should remain in force. It further provided that this Congress should elect a commander-in-chief of the national army at the same time that it elected a provisional president of republic. Congress was also to frame a new pact of union for Venezuela, which should be submitted to the assemblies of the states for approval. The period of provisional rule should last until the new constitution had been ratified by the states and until the constitutional functionaries had taken their posts. On the same day Congress elected Victorino Márquez Bustillos, who had been Minister of War and the Navy, provisional president. By a decree of the same day Provisional President Márquez Bustillos appointed his ministers of state, making César Zumeta Minister of the Interior. Congress elected General Gómez commander-in-chief of the national army. On May 3 1915, the Congress chosen under the constitution of 1914 unanimously elected Gen. Gómez President of the republic for the term ending April 19 1922. However, the President-elect did not assume the presidency. The provisional president continued to exercise the president's authority while Gen. Gómez remained commander-in-chief of the army with the title President-elect of the republic. Among the members of the first Cabinet of Provisional President Márquez Bustillos were C. Zumeta, Minister of the Interior; M. Díaz Dodríguez, Minister of Foreign Affairs; Román Cardenas, Minister of Finance, and Felipe Guevara Rojas, Minister of Public Instruction.

Boundary Disputes.—Protocols signed in Caracas in 1905 between Brazil and Venezuela acknowledged those portions of the Brazilian-Venezuelan boundary which had been surveyed by their commissioners as the true boundary line. In Feb. 1912, these nations agreed to select commissioners to determine their boundary between Cucuy and the Salto de Hua. In 1914 those commissioners proceeded to mark that part of the boundary line exactly. By a treaty signed in 1881 Venezuela and Colombia agreed to submit their long-standing boundary dispute to the arbitration of the King of Spain, who was to fix the line which in 1810 separated the captaincy-general of Venezuela from the viceroyalty of New Granada (Colombia). The award of the Spanish monarch was given on March 16 1891. Subsequently, however, a heated correspondence took place between Colombia and Venezuela about this line, mixed commissions delimited a part of it, and Colombia proceeded to take possession of regions which clearly belonged to her. Venezuela objected to this action and at times war seemed imminent. By a treaty signed at Bogotá on Nov. 3 1916, the contending nations agreed to submit to an arbiter the question whether or not Colombia had the right to

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enter upon the possession of territory that belonged to her by the award or whether she should postpone such occupation until the boundary line had been fully drawn. The parties agreed that both states should remain, for the time being, in the possession of territories which they held at the date of the treaty. As arbiter they selected the President of Switzerland, who, after pronouncing his decision, was to appoint Swiss engineers to demarcate exactly the boundary where it had not been surveyed. In July 1917, when ratifications of that treaty were exchanged the parties changed the arbiter to the Swiss Federal Council. On June 24 1918, that council made known the regulations which should be followed in the arbitral procedure. Both parties presented their last arguments to the arbiter and a decision was pending at the close of 1920.

International Relations.—Although Venezuela did not publish a proclamation of neutrality upon the outbreak of the World War, yet on Aug. 12 1914, the Minister of the Interior sent instructions to officers of custom houses directing them to maintain neutrality in the conflict. Seven days later, at the instance of the Minister of Foreign Relations, the Minister of the Interior addressed to the chief executives of the states, the territories, and the Federal district, circulars informing them that the Venezuelan Government would maintain the strictest neutrality and directing them to prevent individuals from aiding any of the belligerent nations. Upon being informed by the U.S. minister of the rupture of diplomatic relations with Germany, on Feb. 23 1917, Ignacio Andrade, Venezuela's Minister of Foreign Relations, informed the envoy of the United States at Caracas that his country would fulfill all her duties as a neutral and would not relinquish any of her rights: "She wishes to preserve her relations of peace and friendship with all of the belligerent nations and to maintain the most perfect neutrality." Although the sympathies of many of her intellectual leaders were with the United States, yet Venezuela maintained her neutral policy throughout the struggle. In March 1920, Venezuela's minister at Paris filed his Government's adhesion to the League of Nations.

See *Alta Comisión Internacional, Sección Venezolana* (Caracas, 1919); *Annual Report of the Council of the Corporation of Foreign Bondholders* (London, 1910); *Anuario Estadístico de Venezuela* (Caracas, 1915); *Boletín Comercial e Industrial; Informaciones Consulares y Comerciales publicadas por la Dirección de Política Comercial del Ministerio de Relaciones Exteriores* (Caracas, 1920); *Constitución de los Estados Unidos de Venezuela sancionada por el Congreso de Diputados Plenipotenciarios de los Estados en 1914* (Caracas, 1914); L. V. Dalton, *Venezuela* (London, 1912); *División Político-territorial de la República* (Caracas, 1912); J. V. Gómez, *Mensaje que el General Juan Vicente Gómez, presidente provisional de la República, presenta al Congreso Nacional* (1910–1); F. Guevara Rojas, *El Nuevo Régimen de la Instrucción en Venezuela* (1915); *Itinerarios de Venezuela* (1914); *El Libro Amarillo de los Estados Unidos de Venezuela* (Caracas, 1910); *Memoria que presenta el Ministerio de Obras Públicas á las Cameras Legislativas* (Caracas, 1911); *Memoria que presenta el Ministro de Relaciones Interiores al Congreso Nacional* (Caracas, 1910); *Monthly Bulletin of the International Bureau of American Republics* (Washington, 1910); *Proceedings of the first Pan-American Financial Conference* (Washington, 1915); Pan-American Union, *Venezuela, General Descriptive Data* (1909); *Recopilación de Leyes y Decretos de Venezuela* (vols. xxxiii., 1913). (W. S. Ro.)

VENIZELOS, ELEUTHERIOS (1864–), Greek statesman, was born at Mourniés, in the island of Crete, on Aug. 23 1864, of a family that emigrated from Mistra (near Sparta) to Crete in 1770. His father, a merchant of Canea, took an active part in the Cretan patriotic movement and was therefore exiled by the Turks in 1866, but returned to the island in 1872. Young Eleutherios was educated in the schools of Syra and Athens, and then studied law at the university of Athens, taking his degree in 1887. Returning to Canea, he took up the practice of law, but, like most Cretan lawyers of that day, he soon was drawn into political life. In the insurrection of 1889 he was compelled to fly from the island and take refuge in Greece; after tranquillity was restored, he returned and was elected a member for Canea to the Cretan Assembly. It was not till 1897 that Venizelos came into prominence as one of the leaders of the Cretan uprising of that year, which culminated in the removal of Turkish rule from Crete (1898). Venizelos was in command of the insurgents' camp on Akrotiri, which was shelled by the united European squadrons on Feb. 21 1897. A few days later, he received at this camp the British, French and Italian admirals, who came under a flag of truce to negotiate a settlement between the insurgents and the Turks. These two incidents form the first occasion when Venizelos came into official contact with the Great Powers.

In 1898 Prince George of Greece landed in Crete as High Commissioner of the Great Powers, and a few months later, upon Sphakianakis' retirement, Venizelos became the head of the Cretan executive. He soon found himself at variance with the Prince, who inaugurated in Crete very much the same autocratic policy that his elder brother, King Constantine, subsequently adopted in Greece in 1915–7. Finally, a complete rupture took place in 1904 between the Prince and Venizelos; the Venizelist party were defeated at the polls by the personal canvassing of the Prince and the united efforts of the other Cretan party leaders, already jealous of Venizelos' rising star. Venizelos then organized a revolt at Therisso, which was partially successful but which died out after a few months, yet not until it had made the Prince's position in the island untenable. In 1905 the Prince departed, resigning his office as High Commissioner, in which he was succeeded by M. Alex. Zaimis. From 1905 to 1909 Venizelos' activities alternated between those of chief of the Cretan executive and those of leader of the Opposition. More than once during this period the Cretans came into sharp conflict with the four Great Powers; but Venizelos' wisdom and moderation prevented any rupture and maintained friendly relations with the Powers.

In 1909 the Military League at Athens, which headed a bloodless revolution against the existing political corruption and Court favouritism in Greece, found itself in need of a sound political adviser. As such, Venizelos went over to Athens at the invitation of the League three times within four months. He persuaded both the League and King George of the necessity of convening a National Assembly for the revision of the Constitution, as the only safe and satisfactory way out of the dangerous situation. The elections for this Assembly were held in the summer of 1910, and Venizelos himself (who had never ceased to retain his Greek citizenship, while in Cretan political life) headed the poll at Athens. His arrival at the Greek capital in Sept. was greeted with tremendous popular enthusiasm. Such was his unlimited mastery over Greek public opinion at that time, that at a nod from him the Royal family would have been expelled ignominiously. But Venizelos had come to Greece to establish reform and pacific progress; and little as he respected any member of the Royal family, he was fully conscious of the set-back that Greece's internal tranquillity and foreign relations would receive by a fresh change of dynasty or by the doubtful experiment of a republic. His first great work in Greece was the revision of the Greek Constitution, which was successfully accomplished in 1911. Simultaneously, he was busily reorganizing the public services, especially the army and navy, the former through a French, the latter through a British, mission. Within the short space of a year and a half he prepared the ground for the Balkan League, which had hitherto been universally looked upon as a Utopian project. By May 1912, the League was practically an accomplished fact, but a fact so successfully dissimulated that the outside world knew nothing of the League's existence. Only Russia, as the traditional protectress of the Southern Slavs, was in the secret. Other Greek statesmen, and notably Tricoupis, had worked for a Balkan League but failed, partly, no doubt, owing to adverse circumstances, but partly also because of Greek unpreparedness for war and of the inflexibility of the Greek claims. Venizelos was, it is true, favoured by circumstances—the Balkan races just then had been drawn together in self-defence against the newly fledged tyranny of the Young Turks in Macedonia and Thrace, while the military revolt of 1909 had swept the Greek political stage clear of nearly all the corrupt parties, that hitherto had blocked the wheels of the nation's progress. But even so, the Balkan League would never have sprung into being but for Venizelos' higher vision, and his supreme courage in consenting to an alliance with Bulgaria, without a preliminary agreement as to the division of the Turkish spoils in case of victory.

When the World War broke out, Venizelos hastened, in the dark days which preceded the first battle of the Marne, to offer Greece's aid and adhesion to the Entente. This courageous offer, made at a time when the situation in France was so menacing, was never forgotten by the Allies, though declined for the moment on purely military grounds. A few months later (Jan. 1915) the Allies themselves asked for the coöperation of Greece in their plans for the Dardanelles expedition, and promised Greece, in exchange, extensive territory in Asia Minor. But

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Venizelos' decision to accept this offer was incontinently vetoed by King Constantine; and Venizelos was forced to resign, though supported by a strong parliamentary majority and an all but unanimous public opinion. In the general election which followed (June 13 1915), despite the desperate efforts of the King and his party, the Venizelist party were returned with a large majority. But, contrary to all constitutional requirements, three full months were allowed to pass before Venizelos was summoned to resume office, the King's illness being made an excuse. When finally Venizelos formed his new Cabinet, the Dardanelles expedition had already failed, and another crisis was at hand. In the preceding spring Serbia had driven back the Austrian armies out of her territory; but now a fresh Austrian invasion was imminent, and Bulgaria was plainly bent on revenging herself for her disasters of 1913 by preparing to attack Serbia in the flank. According to the terms of the Greco-Serbian Treaty of 1913, Greece would, in that case, be bound to come to Serbia's aid. Bulgaria mobilized her army in Sept. 1915, and on the following day Venizelos obtained the King's signature to the decree mobilizing the Greek army. Two days later, Venizelos made an important statement in the Greek Chamber, declaring that, if Bulgaria attacked Serbia, she would have to face the Greek army as well. This declaration was received by the Chamber with loud cheers. King Constantine thereupon sent for Venizelos, and, after telling him that he would never consent to Greece drawing the sword against the allies of Germany, asked for his resignation. To the Premier's remonstrance that, after the recent verdict of the general election in favour of his policy, the Crown was not entitled to refuse its sanction, Constantine replied that in matters of foreign policy he did not consider himself bound to follow the national will, feeling himself "personally responsible to God alone." In the face of this attitude, Venizelos thought it best to resign once more (Oct. 1915); and after a Zaimis Cabinet had vainly endeavoured to obtain the support of the Venizelist majority in the Chamber, the latter was dissolved (for the second time within six months) and a new election ordered for Dec. 19 1915. This time Venizelos, as a protest against the King's unconstitutional proceedings, called upon his party to abstain from the polls; and as a result, only 230,000 votes were cast, as against 720,000 in the previous election. In consequence of this abstention of the Venizelist electors, no Venizelist was elected, and the new Chamber consisted almost exclusively of the old politicians, whom the military revolt of 1909 had swept out of politics.

Venizelos spent that winter and spring (1915–6) in endeavouring, through the press (he founded a newspaper called the *Keryx*), and by public mass meetings, to force the King to see the folly of his course. But after the surrender of Eastern Macedonia to the Bulgarians (Aug. 1916) he gave up all hope of converting Constantine to his views. On Sept. 25 1916 he took ship with his leading partizans for Crete, whence he sent out his proclamation to the Greek people, calling upon all true patriots to disavow Constantine and his fatal policy and to flock to the standard of the Entente. Proceeding on to Salonika, he established there a "Provisional Government of National Defence," which was in Dec. 1916 duly recognized by England, France and Russia, though not by Italy. His call for volunteers was responded to with enthusiasm by all parts of Greece not held by Constantine's troops, and 60,000 men were soon gathered at Salonika.

When at last England and France proceeded to dethrone King Constantine, Venizelos returned to Athens a few days after his removal (June 27 1917) and took over the government of the whole of Greece. His first measure was to convoke the Chamber elected in June 1915, whose dissolution by Constantine in Nov. of the same year was considered as a violation of the spirit, if not of the strict letter, of the Constitution. Venizelos then ordered a general mobilization of the Greek army and formally declared war against Germany and her allies. His path was beset by many serious difficulties. The German propaganda had done its work so thoroughly that a large section of the community were now entirely out of sympathy with Venizelos' war policy. Nearly one-half of the officers of the army and navy were against him and the Entente. These were given their choice between adhesion to the new regime and dismissal from the service. The large majority chose the latter; and thus 1,800 officers were retired on small pensions, and became a dangerous leaven for all subversive activities against the Government. Three distinct mutinies broke out while the newly mobilized reserves were being moved to the front. A large proportion of the public officials and judiciary were also disaffected; their removal from their posts was a matter of elementary prudence for a Government engaged in a war of such magnitude.

After the Armistice of Nov. 11 1918, and the assembling of the Peace Conference at Paris, Venizelos took up the diplomatic struggle for the rights of Greece. Between Nov. 1918 and Aug. 1920 he and his colleagues of the Greek delegation were almost continuously absent in Paris or London. He returned a few times for a brief sojourn to attend the meetings of the Greek Chamber; but there could be no rest for him until the Treaties of Neuilly and of Sèvres were finally signed. Never before had a Greek statesman achieved such magnificent results for his country. Never before had a representative of a small nation won such admiration or played such a brilliant part in a great international gathering. Yet no sooner was his triumph complete, than an attempt was made upon his life by a couple of young Greek naval officers (Tserépes and Kyriakos); and three months later, the Greek elections gave a crushing majority to his political opponents. Greek history is indeed full of such acts of popular ingratitude to public men, from Aristides the Just down to Charilaos Tricoupis.

Many explanations have been given of Venizelos' amazing overthrow in the hour of his greatest triumph. He himself attributed it to the war-weariness of the Greek people, that had been under arms with almost no intermission since 1912. His political enemies ascribed it to the determination of the Greek people to "regain their liberties" and to punish his "tyranny." It is, no doubt, the fact that a large section of the Greek people had been led to regard the situation in this light. The wildest stories were circulated in the press about the oppressive character of the Venizelist regime of 1917–20. Venizelos was accused of having cast 80,000 people into prison, shot several thousands of his political enemies, and dismissed 20,000 public servants. As a matter of fact, the aggregate number of persons imprisoned or interned or placed under police surveillance never exceeded 1,600. The only executions were those of military ringleaders of mutinies or military spies, after due public trial and conviction by courts-martial; the total number of these executions was 63. There were also some 9,000 dismissals of public servants for political reasons; but nearly all of these men were subsequently reinstated by the Venizelist Government itself, after they had sworn allegiance to the new order of things. When Venizelos' successors came into office in Nov. 1920 there were not more than 300 or 400 of these dismissed public officials still out of service by their own choice. There were, nevertheless, numerous acts of petty tyranny and injustice, that could be laid at the door of the Venizelist administration, during Venizelos' prolonged absence at the Peace Conference. Some of his lieutenants abused their power or failed to prevent such abuse by others. Many notorious bad characters had managed to creep into posts of influence and used their position to wreak personal vengeance or to enrich themselves at the expense of the public or the public treasury. But it may be doubted if, even so, the elections would have gone against Venizelos, had it not been for two other factors. One was the sudden death of the young King Alexander a bare fortnight before the election. This reopened the question of the succession to the throne; and although Venizelos, as a desperate makeshift, proposed Prince Paul, Constantine's youngest son, as King, the utter insignificance of this boy candidate only threw Constantine's own claim to restoration into stronger relief and gave a fresh impetus to the efforts of his party. Had Alexander lived until after the election, Constantine would hardly have succeeded in making his return good. The other factor in Venizelos' defeat was the blind over-confidence of his partizans; many Venizelists in Athens and the larger cities neglected to vote.

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The total vote polled by the Venizelist party throughout Greece was actually 436,781 as against 525,642 cast for all the other parties. Venizelos himself received a huge majority in Athens and Piraeus, but was defeated by the vote of the rural population of Attica. It is evident therefore that the large majority of anti-Venizelist deputies returned to the Chamber (256 out of 369) did not in any way correspond to a real anti-Venizelist majority in the electorate at large. After the election, and Constantine's return to Athens as King, a noticeable revulsion of feeling set in, especially in provinces where the anti-Venizelist vote had been strong. But up to Sept. 1921, when the great Greek statesman was occupied in cementing his domestic happiness by a second marriage in England, and the Greek army in Asia Minor was engaged in costly military operations against Turkey by way of making up for the loss of his powerful diplomacy, Venizelos himself had taken no further steps towards a restoration of his active influence in the national politics. He had been left a widower in 1895, with two sons, Kyriakos (b. 1893) and Sophocles (b. 1895); and his second wife, to whom he became engaged in Paris in the summer of 1921, the wedding being celebrated on Sept. 15 in London, was Miss Helena Schilizzi, heiress of a Greek Chiot family established in England.

See C. Kerofilas, *Eleutherios Venizelos* (1915); S. B. Chester, *Life of Venizelos* (1921).

VERDUN, BATTLES OF (1916-7).—On Dec. 6, 7 and 8 1915, the commanders-in-chief of the Allied armies on the western front, Sir Douglas Haig (Great Britain), Gen. Alexieff (Russia) and Gen. Cadorna (Italy), met together at Chantilly for a conference presided over by Gen. Joffre (France). The question to be considered was the best method of applying the suggestion of M. Briand, who had been president of the council of French ministers since Oct. 20 1915, for united action on an united front. It was decided to start a general offensive simultaneously on all fronts as soon as the British army had been able to obtain and train the expected reinforcements, and as soon as the Russian army, which had been severely tried by the 1915 campaign, had been reorganized as to men and war material, and the French army had its full complement of heavy artillery, trench mortars and ammunition reserves. Until the fulfilment of these necessary conditions it was impossible to fix a date for the offensive; it was, however, to take place as soon as possible. In the event of the enemy foreseeing the Allied attack and attacking one part of the front first the defender should be assisted by his Allies to their utmost powers.

On Feb. 18 Gen. Joffre chose the Somme as the theatre of the Franco-British offensive, and wrote to Sir Douglas Haig that the attack should take place about July 1. But the German High Command had decided upon a winter offensive. Maj.-Gen. Erich von Falkenhayn, who had relieved Gen. von Moltke as commander-in-chief of the armies in the field, was in reality generalissimo of the Central Powers; the Austrian High Command had suggested to him that nearly the whole of the Austrian forces should be directed against Italy, and that nine new German divisions should be sent as reinforcements to the Russian front. When once Italy was put out of action 400,000 Austrians would then be available to take part in the battle against France. Falkenhayn, however, rejected this proposal because he did not believe that a defeat upon a frontier of such extent would cause Italy to lay down her arms.

At the end of Dec., in a memorandum to the Kaiser, Falkenhayn reviewed the situation to the following effect. England, he said, was the soul of the Entente and the implacable enemy of Germany; she was exhibiting to-day the same tenacity that she showed in her historical struggles against the Low Countries, Spain, France and Napoleon. But in order to exhaust the resources of Germany she could hardly count on anything but a war of attrition; and Falkenhayn recognized that in reality time was on the side of the Entente. It was then necessary to strike a blow at England. But where? It was not possible to bring about a decision in the East; any success would be purely of a local nature, without influence on the course of the war. In France the marshy soil of Flanders was an obstacle up to the middle of the spring; and as regards the British positions farther south, the objectives were too distant and their conquest would necessitate the employment of 30 divisions at least, which in point of fact the German army did not possess, and experienced officers were lacking to form the nucleus for new formations. Since England was out of reach, it was necessary to deprive her of her weapons, which were the Allied armies, and to give up the idea of a direct attack against the British armies. "Obviously this is a pity from the point of view of what our feelings are towards our chief enemy in this war," said Falkenhayn, "but it is necessary to accept the situation. Above all the enemy must be struck at through submarine warfare carried out to its limit. There was no sort of imprudence in risking the hostility of America. Because of the strong current of political opinion which is favourable to Germany it is doubtful whether the United States could decide to take any active measures on the European continent. It is still more doubtful whether they would be able to intervene in time with sufficiently strong forces. In order to destroy the tools of England on the Continent, Austria-Hungary has demanded that Italy should be attacked. This scheme, however, must be discarded: its realization would have as its only result the securing of future advantages for Austria-Hungary, but it would not have any immediate influence on the war taken as a whole. Even if Italy abandoned the Entente (and this is difficult to admit) her defection would not have an appreciable effect on England. The military aid of Italy is so little, and Italy in any case is so much under the thumb of England that it would be strange to make any mistake in this appreciation of the situation. Interior troubles which may be expected in Italy at no long date will paralyze the power to fight in that country.

"The same thing," continued Falkenhayn, "applies to Russia. Her internal distress will soon oblige her to change her tune. An offensive on a grand scale is impossible for her in winter. In addition strategic objectives are not to be found: the capture of St. Petersburg would much complicate the question of supply; an advance against Moscow would lead us into the desert; the Ukraine is a granary, but we must wait for the settlement of the Rumanian question before pursuing the occupation of it. All the Allies then have been successively eliminated: only France remains. France," Falkenhayn repeats, "has almost arrived at the end of her military effort, with a devotion that has been after all admirable. If her people can be made to understand clearly that there is nothing more to be hoped for from a military point of view, the worst will be over and England will find herself without her best sword. A break-through carried out in mass, an operation which is doubtful and beyond the power of our forces, is not necessary in order to reach this end. Even by the employment of limited effectives our aim can probably be reached. Behind the French line on the western front there are objectives which are within accessible range, and for which the French Command would have to fight to the last man."

Falkenhayn saw then the solution in a terrible conflict of attrition fought out on a limited front against the French army by the German army; the latter holding the initiative in attack could manipulate it according to circumstances and limit itself in effort and in losses. Two objectives presented themselves, Belfort and Verdun. The capture of either would have an enormous moral effect in France. Between these two Falkenhayn chose Verdun, for the following military reasons. "The French lines here are still at a distance of about 20 km. from the German lines of communication. Verdun is always the most powerful *point d'appui* for every attempt of the enemy to make untenable the German position in France and Belgium by the employment of relatively weak effectives."

This noteworthy report by Falkenhayn is full of the most detailed comments on the general situation of the Central Powers and on the conduct of the war as seen at that time by the German High Command. It displays naively his hate for England and contempt for the United States. It should be compared with William II.'s speech on June 15 1918 to the Great General Staff, on the occasion of the anniversary of his coronation, when after three victorious offensives he was persuaded of certain victory

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and was already on the way to the Capital: "The German people did not clearly see, when war broke out, what meaning it would have. I see it very clearly. It was a question of a struggle between two conceptions of the world. Either the Prussian, German, or Teutonic conception of the world, where right, liberty, honour and morals should triumph, or the Anglo-Saxon conception, which implies abandonment to the idolatry of money. The peoples of the earth work as slaves for their masters the Anglo-Saxons, who hold them under the yoke. These two conceptions struggle one against the other. It is absolutely necessary that one of the two should be overthrown."

In addition it is worthy of note that, in conjunction with the detailed and fairly exact appreciation on the internal state of Russia and Italy, a total misapprehension existed concerning the material situation and especially concerning the *moral* of France; the whole plan of campaign was based on the fact that France was nearly at the limit of its effort towards the end of 1915, and that it would only be necessary to create a certain friction on the French front to bring about a rapid exhaustion of the army and of the nation. Subsequent events showed in a striking way the fallacy of this idea.

Besides the reasons given by Gen. von Falkenhayn there were others which pointed to Verdun as the objective of a German offensive. The German commercial element, whose influence in the councils of the Imperial Government and amongst the military High Command was considerable, had represented in a memorandum to the Emperor the necessity of annexing the Briey basin, the mineral wealth of which would be a happy adjunct to the Sarre coal: this peace aim could be kept quiet, for the war map was evidently to play the chief rôle in those future negotiations which the supposed exhaustion of the Entente seemed to foreshadow. Moreover, the Imperial Crown Prince commanded the Army Group which was detailed to attack Verdun, and the honours which were to come to him therefrom would assure the future of the dynasty.

As soon as it was decided to attack Verdun local actions followed one another along the whole western front in order to divert the attention of the Allies; in Champagne, at Tahure, from Jan. 8–12, an operation took place followed by important works which accompany the preparation of an offensive on a grand scale; on Jan. 24 in Flanders at Nieuport and Hetsas; on Jan. 23 in Artois at Thélus and at Givenchy on the 28th; in Picardy on the 29th at Frise; in Alsace at Seppois on Feb. 13.

The chief aim was not to reach the objective laid down for each attack; it was a question of studying under what conditions and to what degree the preparation, lasting several days, thought up till then to be necessary, could be cut down by increasing the number of batteries, and through the rapidity of the rate of fire, of the German artillery. In 1915 the attacks carried out in Artois and in Champagne by the armies of the Entente had necessitated a preparation lasting from six to eight days. They gave the enemy time to meet the attack. In 1916 the German army was trying to regain the advantage of surprise.

Local Situation.—During 1915 the French front at Verdun had played only a severely defensive rôle, rigidly set down by the High Command. The capture of Liége, Namur, Antwerp, Maubeuge and several other siege forts in France, had forced the admission that permanent fortifications had had their day. Whilst generalizing too hastily about certain experiences, the details of which were still not well known, it was admitted that every limited objective on which modern artillery was able to concentrate its fire should be smashed up in a few hours. Isolated defence of strong points and entrenched camps was no longer considerable; every detached fort became a nest for shells and could be defended only by evacuating it and by fighting outside. From this crept in the idea of submerging permanent works in a defensive zone, a "fortified region" making them a part of the whole scheme of defence.

Further, in a decree of Aug. 3 1915 siege forts had been suppressed with their autonomous organization within an enclosed perimeter, which implied the consequence of an isolated defence. This gave back to the armies powerful artillery immobilized in the interior of the country (2,300 heavy guns with 1,600,000 rounds and 1,800 field guns with 1,450,000 rounds) and territorial troops which were needed for urgent work on the front. Under the conditions under which the war was being fought it was inevitable, and this decree seemingly marked the definite end of the permanent fortifications which were to render such great services during the battle of Verdun.

Prolonged and well-directed bombardments by the most powerful artillery left the armour-plated turrets intact; the deep concreted shelters remained constantly in use, and the troops found these instant and safe shelter—hot food, provisions in food and munitions which prevented them from reaching the last extremity of exhaustion. The forts of old design needed deepening considerably, but they served their purpose usefully. One thing is certain, and that is that the officers commanding sectors which were attacked did not pay sufficient attention to the defence of the forts and fortified works.

The transformation of the entrenched camp of Verdun into a "fortified region" modified considerably the conditions of defence. The closed ring became an open chain; in addition, the salient on the right bank of the Meuse was very exposed, and quite rightly it appeared necessary to organize a second position on the left bank of the Meuse which would enable the continuity of the front to be reëstablished, should it be necessary to abandon the whole of the right bank to the enemy. But the manual labour and the engineering stores were lacking for the rapid construction of these important works; in 1915 the preparation for the offensive in Artois and Champagne had absorbed the greater part of available material, and on the entire front the requirements remained great, for every sector commander cried out for manual labour and material for work which was always urgent. The requirements of Gen. Herr, who commanded the fortified region of Verdun, were met only very sparingly. Towards the end of 1915 he gave warning of the preparations for attack opposite his front, but Gen. Gouraud made identical remarks about the front opposite the IV. Army, which he was commanding in Champagne, where the enemy was feigning the preparation of an offensive. The French High Command believed, moreover, that in the event of Verdun becoming the objective of the German offensive, that offensive would be made on both flanks of the old entrenched camp: on one side between the Argonne and the Meuse, on the other opposite St. Mihiel; the salient formed by the French positions on the right bank might then become untenable. It was hardly likely that the German High Command would limit itself to a frontal attack directed against a sector which was crowded with powerful and permanent fortifications. It was in this sense that Hindenburg himself addressed a reproach to his predecessor, and Gen. Herr inclined to the same view. It was necessary then to concentrate his efforts on the whole of the fortified region; this meant dispersal of effort, as the means at his disposal were very limited. This scarcity had not only been pointed out to the Army Command, but to the French Government and to Parliament. Colonel Driant, deputy of Nancy, had spoken to the Army Commission, of which he was a member, about the dangerous situation in which the whole defence of the French front in Lorraine was left, without labour or material. Making these complaints their own, the Army Commission had them transmitted to the Minister for War, Gen. Gallieni, who asked Gen. Joffre for explanations on Dec. 16. The next day Gen. Joffre explained the arrangements that he had taken on all the French front, and stated—a little quickly perhaps—that they were realized at Verdun; and he complained that the Government might compromise discipline in the army if they welcomed grievances and requests of his subordinates. General Gallieni replied, in the name of the council of ministers, that the Government retained all its confidence in the commander-in-chief, and that there was no question of a conflict of authority.

Meanwhile the construction of narrow-gauge railways, and the establishment of ammunition parks and new batteries, were being disclosed in Champagne at the same time as in Lorraine, and these indications became further noticeable in front of

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Verdun, and particularly on the northern front. On Jan. 20 Gen. Joffre sent Gen. de Castelnau there on a mission. The latter had been made chief of the staff of the group of French armies with the consent of the Government. After having stated that the resources placed at the disposal of Gen. Herr had been utilized judiciously and to the greatest degree possible, Gen. de Castelnau insisted that these resources should be increased; and this was sanctioned. From Feb. 1 onwards work was pushed forward actively, thanks to two reinforcing territorial divisions—but it was very late. The general effect of the measures undertaken by the enemy made it clear that the attack would materialize on the northern face of the salient on the right bank, between the village of Ornes and the Meuse. An army was concentrated to the rear of the threatened region: four army corps and considerable heavy artillery. The threat, however, on the Champagne front was not yet dispelled, and it seemed imprudent to determine the position of these reserves prematurely by bringing them into the line. As it was foreseen that the only standard-gauge line of supply—the line Verdun–St. Menéhould—would be cut in case of attack, the Verdun–Bar-le-Duc road was widened to six and then to eight metres in order to allow the continuous passage of two files of vehicles. Mensien, a small metre-gauge line, was improved so that the tonnage it could deal with was increased from 400 to 1,800 tons a day. These communications indeed appeared to be extraordinarily inadequate in comparison with the German network of lines, comprising 14 ordinary-gauge and 3 metre-gauge railways. They were, however, sufficient for the supply of the French troops.

General Herr had only a total of nine active divisions and six regiments of heavy artillery at his disposal on both banks of the Meuse as against nineteen German divisions, supported by a concentration of artillery hitherto unequalled.

The German line had been quiet for many months; to the rear great preparations had been observed, but in the front lines none of those approach works, considered as essential to the execution of an attack, had been made. At this period of the war, and for a long time after, it had been thought indispensable to place the attacking troops at an assault distance of between 200 and 250 metres, sheltered in parallel take-off trenches, in order to shorten as far as possible the distance to cover over open ground, at the same time avoiding "prematures" of their own artillery during the destruction of the enemy trenches and defences; the attacker had taken care not to reveal his intentions by digging these parallel trenches, which the French expected in order to be certain of a coming attack; he remained in his lines, at places 800 metres from the French trenches, because no defender would be in a fit state to fire after such an unheard-of bombardment as was being prepared; the French batteries destroyed or disorganized were no longer to be feared.

The German Attack and its Progress.—On Feb. 21, at 07.15 hours (7:15 A.M.), on a cold dry day, the German bombardment began with great violence on both banks of the Meuse; it stretched over a front of 22 km. and was particularly intense on the northern front of the right bank.

Simultaneously, the destruction of the first and second positions was carried out by the medium calibre guns (150 mm.—210 mm.) and the fortified works by the large calibre guns (280 mm., 305 mm., 380 mm. and 420 mm.). Six observation balloons and numerous aeroplanes directed the fire on this narrow zone. From 08.00 hours all telephonic communications were cut everywhere; many shelters fell in; the barbed wire disappeared; trenches and communication trenches were practically levelled out by the afternoon. The craters made by the huge shells gave to all the countryside an appearance like the surface of the moon.

At 16.00 hours the intensity of the bombardment reached its zenith. At 16.45 the German infantry left their trenches between the Hautmont wood and Herbebois, on a 4-km. front. Detachments of wire-cutters and pioneers, about 50 strong, preceded the successive waves which followed one another at a distance of 80 to 100 metres. The German officers had assured their men that they would penetrate the French positions with arms slung and without encountering resistance, as the artillery bombardment would have destroyed everything, both men and material obstacles. This assurance, however, had still to be realized. The French heavy artillery, although it had recently been reinforced, remained very inferior to that of the enemy and caused him little damage. The field artillery on the other hand opened fire at 13.00 hours, instead of commencing the bombardment in the morning as was laid down in the orders of the Army Group; it was increased at 16.00 hours and caused some losses when the attack was launched.

Some elements of the trenches were still in being with their defenders; groups came up out of the few shelters that were untouched, and they fought bravely, although scarcely under cover; here and there a machine-gun came into action and inflicted considerable losses on the massed enemy; on such a restricted front, these local resistances were sufficient to delay the German attack considerably, very feebly on the left, but a little more strongly on the right. On the evening of the 21st the first line trench was captured on the attack front, and the Germans gained a footing at certain points in the support trenches.

The following day, the 22nd, the German attack, led by the VII. Reserve Corps, the XVIII. and III. Active Corps, slowly followed up their success against the XXX. Corps under Chrétien, when the 72nd Div. under Bafst lost the village of Hautmont and the Caures wood, where, after a heroic resistance, they lost Col. Driant and Maj. Renouard.

Of the 14 battalions which he had in reserve Gen. Chrétien had used 8, and he received a brigade, which nearly made up his losses. His 51st Div. under Boullangé lost a little ground, but its counter-attacks stopped the enemy.

However, on the 23rd the 72nd divisional commander, influenced by the loss of Hautmont which thereby threatened his rear, evacuated the village of Brabant, which remained isolated on the Meuse; he received the order to retake it but could not succeed; the 51st Div. lost the important position of Wavrille. The whole of the French first position was captured, and the line now ran through Samogneux, the Fosse wood and Ornes. It was really the second position, which was linked up with the first at Ornes.

The 24th witnessed the crumbling in of this line. Samogneux was taken before dawn, the Fosse wood during the day; Beaumont, taken and retaken several times during the day of the 24th, fell during the night; and it became necessary to evacuate Ornes, outflanked on all sides. Then the enemy reached the heights of Talon and approached Douaumont. The situation appeared so serious that Gen. Herr asked permission to evacuate the Woevre plain and to draw back his front eastward to the Meuse heights; Gen. de Langle de Cary, commanding the Army Group, insisted on obtaining the sanction of Gen. Joffre for this withdrawal; he hoped to hold on on the front—Talon heights–Louvemont–Douaumont–Vaux—long enough to enable him to evacuate the right bank, which he thought to be inevitable. He even stopped on the left bank the elements of the XX. Corps which were reinforcing the XXX. Corps under Chrétien.

It was now a question of deciding on the abandonment of Verdun. Should it be held at all costs and risk a disaster, if the bridges over the Meuse should come under enemy fire before the troops and artillery would have the time to cross them? Three times during the course of this sanguinary battle the same question arose, and three times Gen. Joffre settled the matter with the same calm and imperturbable tenacity. He replied to Gen. de Langle de Cary: "I approve in advance of the decisions that you will take as regards the withdrawal to the heights of the Meuse of the troops dispersed in the Woevre, if you judge it to be indispensable; you are the sole judge of the necessities of the battle. But you must hold facing N. on the front between the Meuse and Woevre with all the means at your disposal. Use the whole of the XX. Corps without hesitation. To engage it is necessary in order to enable the reinforcing divisions to arrive; you must hasten their march to the Meuse."

General de Castelnau, his chief-of-staff of the army groups, left during the night, and after his arrival at the headquarters

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of the Army Group he telephoned to Gen. Herr confirming the orders of the commander-in-chief. On the 25th Gen. Joffre telegraphed simultaneously to Gens. de Castelnau, Pétain and Herr: "Yesterday, Feb. 24, gave the order to resist on the right bank of the Meuse to the N. of Verdun. Every commander, who, under these circumstances, gives an order to retreat, will be arraigned before a council of war."

It is true that great is the glory of those who carried out this order, and who by their military prowess, their knowledge of their men and their personal action, won this great battle. The chief actor, who from the first act to the last scene of the drama never ceased in removing from others the heavy burden of responsibility —that chief actor was Gen. Joffre. History must not forget this.

General de Langle de Cary accordingly issued his orders: he laid down that on the right bank they should hold fast facing N.; the movement of the XX. Corps, provisionally suspended, was to be continued; he evacuated the Woevre, however, withdrawing to the fort of the Meuse heights.

General de Castelnau arrived at 7 A.M. at Gen. Herr's headquarters, and his presence alone brought calm and relief. The 37th and 153rd Divs. had been engaged as brigades and even as regiments; these reinforcements had been sufficient to limit the progress of an attack which had been carried out on too narrow a front.

During the 25th the XX. Corps under Balfourier relieved the XXX. Corps under Chrétien, whose two divisions had lost 61% of their effectives (16,000 out of 26,000). The 37th Div. under Bonneval, believing its right to be on the point of being outflanked, evacuated the height of Talon and that of Poivre and withdrew to the Belleville height, a withdrawal of seven kilometres. A fortunate initiative stopped the enemy by an artillery barrage, and enabled the 39th Div. to regain the great part of the ground which had been given up. But if the enemy had been able to fight desperately on that day he would have engaged untried reserves at a propitious moment; he would at least have reached the foot of the Belleville height, and this advance would have made the occupation of the right-hand exceedingly difficult. On the left bank the whole French line would have been taken in rear and forced to retreat. As the German attacks were limited between the Meuse and in the Woevre, the arrival of an adequate number of reinforcements was sufficient to close the breach.

In the centre fighting had been continued the whole day round Fort Douaumont; Number 155 turret had fired almost unceasingly for four days; the fort had no garrison except the crew of 23 gunners, who manned this work, and who, at the end of their tether, slept after the fall of night. A patrol of the 24th Brandenburgers, finding the drawbridge lowered, entered the fort and settled themselves there without firing a shot. Such was the result of a badly understood order, which converted entrenched camps into fortified regions; it was due, perhaps, to insufficient liaison between two units in the first line, who should have got into touch in Fort Douaumont instead of maintaining themselves, one to the E. and the other to the W. of the fort, which at the beginning of the battle found itself 8 km. within the French lines without a garrison of its own. It was for the local commander to occupy it; but the prejudice against permanent fortification was such that no one on the spot thought about it. On the evening of the 24th Gen. Chrétien had, moreover, ordered his sector commanders to occupy all works. The important work of Hardaumont, which completed the defence of the Douaumont and Vaux forts, had no garrison, and was likewise abandoned to the enemy without the slightest resistance.

The day was a bad one. The capture of Douaumont was announced to the whole world in a triumphal *communiqué*: "To the E. of the Meuse, in the presence of His Majesty the Emperor and King we have gained important successes. In a vigorous advance the Brandenburg regiments reached the fort and village of Douaumont, which they captured by assault."

This glaring travesty of the truth made this name symbolic of a great victory; but when, taking up the challenge, the French were to retake Douaumont, the value which the Germans gave to its possession was to be the measure of their defeat.

General Joffre sent for Gen. Pétain to come to Chantilly; the latter had been supervising in the rear the training of divisions sent back in succession to rest. After Joffre had given him his instructions he sent him to take over the command of the army in process of formation on the left bank of the Meuse, which was to intervene when the right moment arrived. General de Castelnau thought that the moment had already arrived when Gen. Pétain appeared on the scene, as events were getting beyond the powers of the cadre of the fortified region, whose general staff was not adequate to direct operations of such importance.

General Pétain took over command on Feb. 26. He brought the I. Corps under Guillaumat into line on the left of Balfourier's XX. Corps. The front was immediately put into a state of defence foot by foot, and vigorous counter-attacks were carried out. The front was divided into sectors; the heavy artillery which had arrived was assigned to each; the Bar-le-Duc–Verdun road (the sacred way) which was cracking up under the ever-increasing weight of the motor lorries, was constantly repaired by gangs of territorial troops and doubled by lateral tracks.

The situation remained confused; it was the German *communiqué* which informed Gen. Pétain of the capture of Douaumont, and then he was nervous about the forts of Vaux and Souville, nearer to Verdun and not yet threatened.

The struggle was very lively on the Douaumont summit. The French line went beyond the fort to the E. and to the W. and hemmed it in; it was round this point, now of first importance, that the battle raged. It was only on March 4 that the line became stabilized for some weeks at a distance of 200 metres from the fort. There is no doubt that the counter-attacks carried out rarely gained any appreciable ground, but they broke up the German offensive, which was disconcerted by this new feature of the defence. General Joffre reiterated the necessity of these counter-attacks; he wrote to Gen. Pétain on Feb. 27: "At the present juncture of the battle, you feel as I do that the best method of checking the effort, which the enemy will make, is to attack in our turn." On March 1 he wrote: "You have now at your disposal forces outnumbering those opposed to you . . . above all it is necessary for you to take the initiative in offensive actions with definite objectives in view."

The German attack now progressed on the right bank exceedingly slowly. All along the Meuse it was harassed by the fire of the defence, which caught it obliquely and even in rear.

At last the Crown Prince decided to broaden his attack fronts on the left bank of the Meuse, attempting too late to rectify the original error of his offensive.

On March 4 he asked his army groups to make a supreme effort to take Verdun, "the heart of France." After a bombardment lasting two days he attacked on March 6 with two divisions. The French, however, had been expecting it for 15 days; after a fair resistance they gave up the crossing of the Forges stream, and that part of their line which was under the fire of enemy guns from the right bank and which could no longer be held except by very strong outposts. The following day the Germans continued their advance, paying for their progress more and more dearly, and they were stopped in front of Mort Homme.

From the 8th–11th the battle was extended simultaneously on both banks. Unimportant progress was made on the left bank, but Mort Homme held steadfastly, as did the Poivre height on the right bank. The Germans advanced to the outskirts of Fort Vaux, whose capture they announced in a new resounding *communiqué*: "Fort Vaux as well as the numerous adjoining fortifications has been captured in a brilliant night attack by the Posen reserve regiments. . . ." One can only imagine that the German prisoners led into the fort must have been taken for victorious attack troops. The next day the *communiqué* had to be contradicted; the turretted fort had become "a heap of ruins" and had been evacuated.

The first *communiqué* could very well have been the result of a mistake, but the second was a lie. Evidence from both sides, and notably from soldiers' letters, testifies to the desperate character of the struggle during these days, and to the bravery displayed by friend and foe alike. The French troops particularly

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VERDUN, BATTLES OF (1916–17)

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noticed the Bavarian troops among their enemies, whose blood was shed unsparingly by the Prussian command.

General Joffre thought that he had won the first trick in this terrible game. In historic words he thanked the soldiers of Verdun. "Germany hoped," he told them, "that the capture of Verdun would strengthen the courage of her allies and would convince neutral countries of her superiority. She had not reckoned with you . . . the struggle is not over, because the Germans must have a victory. You will take it out of their hands. Of you it will be said: they barred to the Germans the way to Verdun."

The generalissimo dared then to tell his soldiers that the battle would continue; he took up the challenge of the enemy, who attached a moral importance to the capture of Verdun, for want of a strategical importance which it had not. The Germans had not obtained the rapid "break-through" which they had hoped for, and their objective was limited to the capture of forts on the right bank of the Meuse, purely a local rectification of front. They were reduced to give this objective an importance purely fictitious—"Verdun, the chief stronghold of our chief enemy, the head and heart of France," etc., etc.

General Joffre's victory was enhanced by these same declarations of the enemy. He frequently visited the front, for two or three days at a time. He kept Gen. Pétain's second army under his own immediate command, thus relieving of responsibility the intermediary "group of armies," a formation often useless, sometimes harmful, always heavy and slow, unless under the command of a striking personality; as long as Verdun was to be the sole theatre of operations Gen. Joffre was to exert there his direct personal action. He was thus able to calculate exactly what forces he could employ there, because he had to keep in reserve effectives necessary for the French offensive which was being prepared on the Somme, according to the plan of operations decided upon in Dec. 1915, and the execution of which he was following through imperturbably. Sir Douglas Haig had been quite willing to extend his front so as to free the X. French Army, which force could then be employed as reinforcements for Verdun; the British general offered to contribute directly to the battle that was being fought; but Gen. Joffre declined his offer as he wished the whole of the British forces to be available for the forthcoming offensive.

On March 12 and 13 the German bombardment was renewed on both banks of the Meuse with great violence; on the 14th a small advance brought the attack line nearer to the Mort Homme, but it was stopped by some successful counter-attacks. On the 16th the village and fort of Vaux successfully resisted violent assaults repeated five times. On the 20th, however, after a furious artillery bombardment, the Germans seized the Avocourt wood, poorly defended by troops, who apparently allowed themselves to be unduly influenced by jets of burning liquid used in great quantities. However, on the following days, the attackers attempted to debouch from the wood in vain; well-directed artillery fire stopped any advance.

Prepared at leisure, a French counter-attack retook this wood on the 29th; it created a salient in the lines and might serve as a base for an advance which would embarrass the whole position. A violent struggle lasted four days for the possession of this ground, which finally remained in the hands of the French.

But against this the whole Malancourt salient fell into German hands; the French were obliged to evacuate Bethincourt and to fall back on the S. bank of the Forges stream; they even lost the summit of Mort Homme.

On the right bank the end of March witnessed the gradual advance of the Germans, slightly going beyond the village of Vaux. On April 2, descending the slopes of Douaumont, they seized the Caillette wood and crossed the Baril ravine; no defensive line, nor any reserve troops, separated them any longer from Fort Souville. They had even gone beyond the barrage fire of the French artillery.

At this moment the 5th Div. under Gen. Mangin came into line, and forestalling the hour for relief hurled in its first regiment to counter-attack. Uncertainty concerning the ground given up deprived the artillery of all accuracy in its fire, which was not able to support the counter-attacking line, but this uncertainty was the same for both sides. It was above all necessary to stop the enemy where he was, and then to drive him back. All arrangements were made during the night, and the fight was resumed on the 3rd with a first success of good omen.

On the following days the artillery was able to regulate its fire, the Caillette wood was recaptured completely, all the approaches to Souville and to the N. of Vaux were largely freed, in spite of German reinforcements. It was noticeable that this division had lost fewer men in recapturing the ground than the former division in losing it. The idea gained ground of continuing with the same troops so as to retake Douaumont.

The 5th Div. was sent back to rest, and the plan of attack, which anticipated an advance on the part of the division on its left, was drawn up. That division, however, lost ground instead of gaining it, and the objective now to be reached was altogether *en flèche;* as the adjoining divisions were not considered to be in a state to take part in the operation, the base of the attack became too narrow. Nevertheless it was launched on the 22nd about midday. After a fairly satisfactory artillery preparation, with magnificent dash it reached the fort in 11 minutes and occupied the superstructure with the exception of the northwestern angle.

To right and left the objectives laid down were reached almost entirely. The enemy, however, held on to the interior of the fort, and the outside was soon swept by his artillery fire; the machine-guns, in turrets which had not been knocked out, were soon augmented by others brought gradually into action.

The German reinforcements came up after the 23rd, because they were ready for this attack; the French reinforcements were too far back, and the officer in control of the attack did not have them under his orders. The struggle lasted two days, but the fort was lost again on the 28th.

Then the struggle broke out anew round Fort Vaux. The bombardment increased in intensity each day at the end of May; Damloup was taken on June 2 and the fort surrounded on three sides. The Germans finally occupied the superstructure, but Maj. Raynal continued the defence with steadfast heroism.

The fort fell on June 7. Its fall uncovered Fort Souville, already threatened by the German advance down the slopes from Douaumont; Thiaumont farm fell, the Caillette wood was retaken; and it seemed as if the heroism of the French soldiers was to be powerless in face of this advance, which appeared to be in some way mechanical.

General Pétain had taken over command of the group of French armies in the centre, and Gen. Nivelle of the Verdun army. General Pétain had already drawn the attention of Gen. Joffre to the gravity of the situation in May. He referred to it again on June 11, and insisted that the offensive to be undertaken on the Somme should take place as soon as possible. General Joffre replied the following day that he had made all his dispositions with this end in view, but that it was necessary to continue the struggle at all costs on the right bank, and even to risk the loss of batteries which could hardly be withdrawn.

The German advance, however, continued on the right bank, in spite of the energy of Gen. Nivelle, who repeatedly ordered counter-attacks, both immediate and instinctive.

The whole effort of the attacker was concentrated on this ground, an effort which amounted to a major operation having as its first objectives the work of Froide Terre, the village of Fleury and Fort Souville. Once that line was reached the old forts on the height St. Michel-Belleville would be easily seized, and the French would be hemmed in against the Meuse with its bridges under German artillery fire. Nineteen regiments belonging to seven different divisions were to be engaged; the reinforcements and reserves were brought up close to the front line in order to take advantage of the first successes, and to insure the strength and continuity of the effort. It was the most important and heaviest attack that Verdun had ever had to bear.

The artillery had been strongly reinforced, and began its preparation from June 20 with an intensity hitherto unheard of. On the morning of the 23rd the first-line trenches were literally

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ploughed up, and the German infantry hardly found a single defender at the beginning of the attack, which reached the Baril ravine, Fleury, the Thiaumont work, and even penetrated the moats or ditches of the Froide Terre work, where the advanced elements had been taken prisoner. The French counter-attacks, however, stopped the German attack. General Mangin, who commanded this section of defence, launched unceasing counter-attacks. They hurled themselves against the German attacks but their advance at first was very slow; however, that of the enemy was stopped and his will was soon to be conquered. The stubbornness of the two adversaries was equal, and the course of the battle reached a dead-lock, but it was felt that the battle had already assumed another aspect.

However, on the evening of the 23rd the situation was serious, as the German wave was very near to beating against the Belleville height, the last stronghold to keep it from Verdun.

It reached the head of the ravines coming down from Froide Terre towards the Meuse, and the Poivre height was in danger of being submerged and its defenders taken in rear. General Nivelle, commanding the army, conferred with Gen. Mangin. Both were in agreement in thinking that it was necessary to counter-attack to the utmost; the threatened front was in a position of unstable equilibrium, and its only salvation was to be found in a movement forwards; Gen. Nivelle approved the orders issued in consequence. On his return to his headquarters he found Gen. Pétain, who satisfied himself that all measures were ready for the evacuation of the right bank, prepared down to the last detail. The positions for withdrawal by echelons were fixed in advance, in such a way that this masterly retreat would not leave a single trophy of war to the enemy. There was to be found in Gen. Pétain an admirable steadfastness of soul. With the exception of Gen. Nivelle not one of his subordinates suspected his fears. When he asked that opinion should be prepared for the retreat to the left bank he was thinking of those at home; to his soldiers and their officers he continued to show an impassive countenance, and he kept on saying, "We shall have them!"

For the third time Gen. Pétain pointed out the gravity of the situation to the commander-in-chief. A third of the French artillery was on the right bank and would be lost in case of a reverse if it was not withdrawn before the German artillery could fire on the bridges over the Meuse, and three days were needed to carry out this withdrawal; it would be wise to begin it.

General Joffre, however, was imperturbable. He replied on the 26th that the preparation for the Franco-British offensive had commenced, and repeated that Verdun should be defended on the right bank; should there be a loss of material as a result of this decision the commander-in-chief would assume the entire responsibility for it. When the telegram that he had ordered to be written to the above effect was handed to him by his chief-of-staff, the latter drew his attention to this decision and to the responsibility which he was assuming thereby. "I have taken many others," said placidly the general as he signed. He explained the general situation to the Minister for War, who had invited him to hurry on the Franco-British attack; the launching of the offensive had been subordinated to the reinforcement of the British and Russian armies in men and material; the hour had struck, and the guns on the Somme made their thunder heard. The offensive, previously fixed for June 29, was postponed till July 1 on account of bad weather, which hampered the artillery preparation. But it was on that date that it had been fixed by Gen. Joffre on Feb. 18, three days before the attack on Verdun, which had not succeeded in advancing or delaying it a single day.

The French Counter-offensive.—The end of June had witnessed the arrest of the German advance by French counter-attacks. The ground, which had been won at one blow on the 23rd, was regained step by step; on the edges of the Thiaumont work the conflict always remained fierce enough; vibrations on the front decreased in magnitude, but its general tendency was towards the N. and to the detriment of the assailant. The work—or rather the small protuberance which marked the site of the work—was taken and retaken to such a degree that it changed hands 16 times during the summer; the slight advances which had carried the German line beyond the craters were gradually reduced, and from this side the initiative in attack belonged to the French.

On the other hand the German offensive continued to progress slightly in the direction of Fleury-Souville. The French had been almost completely thrown out of the village, which they had partly retaken on June 27.

The Crown Prince carried out anew a strong attack against Fort Souville. On July 11, after a violent artillery preparation and a storm of asphyxiating shells which enveloped the attack zone, he hurled 13 regiments belonging to 5 different divisions in between the slopes E. of Thiaumont up to the Vaux-Chapitre wood. The attack made a little progress on the 11th, very little on the 12th; a small detachment, however, was taken prisoner on the superstructure of Fort Souville. Certain counter-attacks organized unexpectedly had limited the gain of this strong offensive, very costly as it was in men, to a depth of 400 metres to the S. of Fleury on a front of 800 metres. By sheer tenacity a well-organized counter-attack led to the recapture of all the ground lost, resulting in the capture of many prisoners. After July 20 it was the French who attacked, in front of Souville as well as round Thiaumont. After the 11th Mangin's command was increased on this sector, and this unity made possible the powerful concentrations of artillery fire. Local attacks could be preceded by preparation on a large front, and thus leave the enemy uncertain as to the precise point where the action would unfold itself. Often several attacks would be carried out at the same time several kilometres distant from one another.

These minor operations were organized in detail, and numerous prisoners were taken along the whole front. This had its influence on the strength of the German troops, on their moral and physical condition, and on the march of reliefs and bringing up of supplies, which presented targets to the harassing fire carried out at night. The trenches to be attacked were covered by the fire of the 75's, which put up a barrage behind and prevented the escape of the defenders; at the same time the heavy artillery pounded them, either killing or burying the defenders; before the attack it often happened that whole detachments came out and surrendered themselves, declaring the position to be untenable. The advance of the attack was preceded by artillery fire from field guns which moved on at the same pace as the attacking infantry; this was the "creeping barrage," which made its appearance after the end of June. The French thus obtained the maximum results with the minimum losses. During the months of July and Aug. they took 3,500 prisoners, and their advance was continued.

The village of Fleury, retaken and lost again at the beginning of Aug., remained in the hands of the French from Aug. 17 onwards. The whole of the Fleury-Thiaumont crater was French, and the outskirts of Souville were well cleared on the north-east. But the enemy now attacked Souville on the E., issuing from Fort Vaux. He gained about 1,200 metres, and the pressure was disturbing. The unity of command then made itself felt between the Meuse and the Woevre, and produced its full results; at the beginning of Sept. the enemy was thrown back from the positions which he had just taken, and confined to the outskirts of Fort Vaux, from the other side of a crater whose inner slopes provided a good position for the defence of Souville.

The French losses had been heavier than the German during the first period, but the proportion was now reversed.

Hindenburg, who had just assumed command, proposed to the Kaiser that the attacks should be discontinued, and explained this decision as follows: "The battles which were fought in this region exhausted our strength as does a wound that will not heal. It was evident that this adventure did not leave us the least hope from whatever point of view, and its continuation cost us much more men than it did our enemy. Our advanced positions were exposed everywhere to the enemy's flanking fire; liaison with the front line was exceedingly difficult. The battle-field was a veritable hell, and the troops considered it rightly as such. To-day, after a retrospective study, I do not hesitate to say that from the purely military point of view, it would have been more to our advantage to improve our position in front of

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Verdun by voluntarily giving up the greater part of the ground taken. However, in the autumn of 1916, I thought it necessary to postpone that decision: we have sacrificed in this affair a great part of our best troops, and up to that time we allowed our people to hope that the struggle would terminate gloriously for us. Further, if we had withdrawn at that moment, it might have made the too facile impression that all our sacrifices had been in vain. I wished to avoid that strain on the *moral* of our population, which was already highly tried. In suspending our attacks on Verdun we counted on our adversaries themselves adopting, in this region, a purely defensive attitude; our hope was not realized. At the end of Oct. the French launched a counter-attack on a large scale on the right bank of the Meuse; it was boldly carried out and overwhelmed us. We lost Douaumont and we had not the troops to retake this monument of German heroism."

The conditions under which that action unfolded itself were as follows: In front of Souville and of the line of forts a stout barrier had been formed, which included several well-organized positions; the battle had died down on the right bank, and the French renewed the offensive from the Meuse to the Woevre, and regained their superiority over the enemy. On Sept. 13 the President of the French Republic came to bring to the martyr town the cross of the Legion of Honour and the decorations which the sovereigns of Allied countries had conferred upon it. From the casemates of the citadel, during a ceremony of moving simplicity, he pronounced an eloquent speech which consecrated the victory. But he had to keep all his fascination for the word which was at last to be spoken. Events had proved that every well-organized attack always commenced with success, and that it was exceedingly difficult to limit a victorious advance.

Now above all was it necessary to throw back the enemy from that barrier which had at last been remade. The hour had passed for those little attacks which aimed at the recapture of a few hundred metres; they had enabled them to get rid of successively the small or large pockets which the German line had dug into the French, but it was only by carrying the whole line forward at one bound that ground could be gained to advantage. An operation on a grand scale was called for.

General Nivelle entrusted Gen. Mangin with the study of this task. The latter considered the recapture of Douaumont as a possible consequence of success; this scheme was adopted after discussion, and the fort did not come into it except as one of the objectives of the attack. The same applied to Fort Vaux. The main object thus became the reconstitution in its integrity of the barrier of forts round Verdun.

General Mangin had all the necessary means at his disposal to bring this operation to a successful issue. He had a very powerful mass of artillery—289 field and mountain guns (calibre 65 to 96 mm.) and 314 heavy guns (100 to 400 mm.); 5 divisions in the front line, with 2 Senegalese battalions and 1 Somali battalion; 3 divisions under his immediate orders in the second line; while the adjoining divisions on the front of attack each placed a regiment in the line. The enemy opposed him with 7 divisions but they were very dispersed in depth: 16 battalions were in the first line; 6 in immediate support and in the zone to be taken; 11 in near support, which were all to be engaged on the evening of the attack; 25 in reserve, who would later come up to fill in the gaps. The French had located 209 German batteries (about 800 guns) capable of coming into action when the offensive began. After three days of destructive bombardment they feigned a general attack. The ruse was completely successful, and 158 batteries were disclosed; these were under counter-battery fire the next day, the day of the attack, to such effect that only 90 batteries opened fire that day, and then only under unfavourable conditions. The initial artillery superiority of the Germans had then disappeared. This was foreseen in the scheme of attack; the French commander knew that the means at his disposal would be inferior at the beginning to those of the defence, but would become superior during the action.

The infantry strengths were almost equal on both sides. The disposal of the German divisions on very narrow fronts, and somewhat hemmed in, lent itself less to manœuvre than did that of the French divisions, whose front was quite double, but above everything else the experience of former actions had shown the efficacy of the methods employed in this zone; a barrage of field guns falling behind the trenches nailed the defenders to them whilst the heavy artillery and the trench mortars made them indisposed for the fight. At the same time the fire of other heavy guns filled up the openings of the deep shelters, which in times of quiet served as strongholds for the defence; when the assault waves started, preceded by the creeping barrage from 70 to 80 metres in advance, they would not find more than rare local resistance, and would advance up to the deep shelters whose occupants would be taken prisoner. General Mangin was able to inform Gen. Joffre and Gen. Nivelle that two hours before the attack 22 German battalions had been almost completely wiped out. As far as the forts were concerned they were laid open; it was impossible to determine their capture with the same degree of certainty as that of the conquest of ground, but the occupation of the superstructure was certain and the capture of the whole appeared to be a matter of two to three days at the most.

If a success of this nature could be foreseen with such certainty, it was not due to an accumulation of material of war, since, at the beginning of the struggle the German artillery was undeniably much superior in numbers, in range, in rapidity of fire, and even in calibre (with the exception of a few French guns of 400 and 370 mm., whose fire was solely directed against the forts); nor was it due to the employment of masses of infantry which would overwhelm the enemy by sheer weight of numbers, since the density of the attack was thin so as not to expose more men to loss than those actually required to obtain the desired result. It was due to the use of logical methods, of well thought-out artillery bombardments, which gave them a superiority over the enemy and which compensated in large measure for inferiority in numbers and material; it was due, too, to the dash of the French troops and their confidence in their leaders. It was, however, further due to a perfect understanding in the command. The army commander provided his subordinate, who was in charge of the attack, with all the means at his disposal, and if they were not available he could ask for them from headquarters. Another factor was a thorough knowledge of the particular zone, and the experiences gained in this zone by the same leaders and the same staffs, who had been on the spot during a bitter struggle that had lasted several months. The result was assisted by the mistakes of the enemy, who had practically everywhere only one line of defence, in front of which he had been able to set up only elementary obstacles. These conditions were to be found again on the same field of battle two months later; but they were exceptional and weighed very heavily in favour of the French.

The artillery preparation, which commenced on the 20th and continued to the 24th with increasing intensity, produced its usual effects. The Germans gave themselves up singly or in little groups; a strayed carrier-pigeon brought in a message of distress from a battalion commander, who said that his troops were not in a state to fight. Finally, at 11.40, the artillery lengthened its fire and the French infantry left their assault trenches. A dense fog hid their advance from the enemy, who did not open fire till 12 minutes after zero time, when the two front waves had crossed his first trenches. The objective was reached in an hour, and it was consolidated very rapidly. In the first instructions the pause was to have been for half-an-hour; the commander of the groups of armies, considering it advisable to consolidate the position, the conquest of which was practically certain, had insisted that it should be much longer, and after discussion had finally fixed the pause for two hours. The bombardment, however, had been most thorough; a 420-mm. shell had brought about an explosion which was followed by a fire; one would have thought that it would have been a great advantage to hurry on and to profit by the confusion. Gen. Mangin, too, had fixed the time for consolidation as one hour.

The 38th Div. under Guyot de Salins formed the left wing. His colonial Moroccan regiment penetrated into Douaumont fort, which the Germans had evacuated the day before owing to

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the threat of explosion but were occupying again. They were putting their machine-guns into position, but the rising tide of the assailants overwhelmed them.

In the centre the dash of the 133rd Div., known as "La Gauloise," under Passaga, had overcome all obstacles; and it had established itself in the angle N.E. of Douaumont and by the pool at Vaux. On the right, in front of the 74th Div. under Lardemelle, the artillery preparation had been insufficient against some centres of resistance, and the advance had been more difficult. More powerful artillery, which had become available, smashed the framework of the fort; long-range guns enfiladed the casemates (the surface which faced Verdun was covered with only ordinary masonry instead of being concreted); and finally the advance in the direction of Douaumont enabled field guns to be brought into action on the only position from which they could fire on the very steep slopes to the E. of the fort, whose communications were thus cut. The pressure of the infantry continued after the 9th Div. under Audlauer had relieved Lardemelle's division; the enemy evacuated the fort and Gen. Audlauer installed himself there on the 3rd. He occupied the villages of Vaux and Damloup.

The recapture of the Douaumont and Vaux forts was an important event, which consecrated the victory of Verdun in the eyes of the whole world; 6,000 prisoners emphasized it. This great success, however, called for its complement.

On Oct. 21 Gen. Mangin had pointed out to Gen. Nivelle the necessity which obtruded itself, after the capture of the objectives assigned for the operation on the 24th, of seizing the crater Douaumont-Hardaumont and the Poivre height, both of which had direct observation into the positions which were to be conquered, and of clearing the way round Fort Douaumont. General Nivelle then considered a combined operation, but he was very limited by the means at his disposal. The front of attack must not be beyond that of one for three divisions, but it might be possible to have a break of continuity in the centre. The ammunition would be only that which could be economized out of the daily allowances. General Mangin, however, insisted on the advantages of an attack from the Meuse to the Woevre, even should it be necessary to wait for the necessary troops and munitions. It was this scheme which the command finally agreed to. Before Mangin's group the German front was held by five divisions in the front line and by four in the second; the latter could intervene in one night, 247 batteries having been identified (960 guns approximately).

The French attack had 4 divisions available in the first line, 4 in the second, and 740 guns. It was, accordingly, inferior to the defence, but it could count on the results obtained on Oct. 24. The artillery in actual fact rapidly established a superiority over the German artillery, thanks to deeper penetration; 13 German artillery officers were captured, whose evidence confirmed in detail this undoubted superiority. As far as the infantry is concerned the smashing in of the front trenches led to the complete destruction of the 13 battalions defending them, and to the partial destruction of the 13 battalions in support in the zone to be conquered, so that the attack could then meet the slight initial numerical inequality.

The enemy, forewarned by the experience of Oct. 24, had organized three lines of resistance defended by a network of barbed wire; further the distance of the final objective introduced a greater element of chance; it was, accordingly, necessary to have more elasticity in the mechanism of the creeping barrage and to vary its application. It was laid down in the attack orders of Mangin's group that: "Each objective must be seized at the first onset and with one bound—the pace to be 100 metres in four minutes. The infantry to be preceded at a distance of 70 to 80 metres by percussion shell and at 150 metres by shrapnel, time and percussion. Further, when circumstances demand it and when it is possible, owing to long-range observation, artillery fire will be carried out in conjunction with the advance of the infantry; general officers commanding divisions will organize, with this end in view, the closest possible liaison between infantry and artillery."

The great obstacle to the organization of the attack was the state of the ground, which was frightfully cut up by 10 months of repeated fighting; in the slushy clay, where the water oozes out at any altitude, the shellholes, nearly touching one another, were at this time covered with ice. Without a complete fitting up of the ground every attack would come to grief in the mud. It was necessary to construct 25 km. of roads, several of which were planked with wood, 10 km. of Dreauville line, and a very great number of telephone systems. Everywhere supply and ammunition dumps had to be made and camouflaged battery emplacements; water tanks and pipes had to be fitted up, etc., etc. The inclemency of the weather, very severe on the Meuse heights, made these works particularly arduous. All the soldiers, however, realized their necessity, and they were completed in five weeks with wholehearted self-denial and with great spirit by the divisions who succeeded one another in this zone, right up to the time when the attack divisions went into line.

On Dec. 15, about 10.00 hours, the French regiments, after as complete an artillery preparation as was possible, issued from their trenches and attacked from the Meuse to the Woevre. On the left, the 126th Div. under Muteau seized Vacherauville and the Poivre height, where it established itself; the 38th, under Guyot de Salins, once again on the ground of its former exploits, seized Louvemont; the 37th under Garnier-Duplessis advanced as far as the Caurières wood, fighting step by step; the 133rd ("La Gauloise") under Passaga captured the Hardaumont work and the village of Bezouvaux. The advance, which had slowed down at certain points, carried the attack on the 18th to the second objective. At the same time, after the 15th, offensive reconnaissances had gone right beyond their objectives, and, protected by their creeping barrage, destroyed guns and captured prisoners to the number of 11,387, including 284 officers. By adding the number of killed and seriously wounded the total losses of the enemy could not be estimated at less than 25,000, on a front of 10 kilometres. One hundred and fifteen guns were taken and destroyed, and the defence of Verdun was now established on the narrowest part of the Meuse heights and in an excellent position.

The moral effect of this victory was great on both sides. Ludendorff speaks of it in the following terms: "The blow which we then received was a particularly hard one. We suffered great losses and also lost important positions. The effort exerted during the year had been too great. The elasticity of our troops had been weakened by the immobility of the defence, by the powerful artillery of the enemy, and in consequence of our own losses. On the western front we were completely exhausted."

The Germans drew many useful conclusions from these events, and recognized noticeably the impossibility of reducing the defence to lines of regular trenches, too visible targets for the opposing artillery. The French learnt from them the brilliant confirmation of the methods employed on Oct. 24. Without in any way decrying this success, it should be remarked that the most distant objectives (3 km.), which according to the fixed time-table should have been reached in a few hours, had been conquered only on the fourth day. Indeed, this was not the condemnation of the methods used, nor of the time-table fixed in advance in particular; but it went to show the necessity of foreseeing that this time-table could not be followed, and that it was necessary to manœuvre, because the advance does not always develop with mechanical precision. On Dec. 12 Germany, for the first time, made overtures for peace, overtures which appeared to slacken the energies of the Government, of the armies and of the peoples of the Entente.

In thanking his victorious troops Gen. Mangin enumerated the results obtained, and the hopes that they could picture in the future. He added these words: "Admitting themselves incapable of conquering us on the field of battle, our savage aggressors dare to hold out to us a clumsy snare in the shape of a premature peace. While still picking up new arms they cry 'Kamerad.' You know that gesture. Our fathers of the Revolution refused to treat with the enemy as long as he was soiling the sacred

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ground of our country, as long as he was within our natural frontiers, as long as the triumph of right and of liberty over the tyrants was not assured. And we will never treat with that perjured Government to whom treaties are but a scrap of paper, with assassins and butchers of women and children. After the final victory, which will render them incapable of doing hurt, we will dictate to them our will. To their hypocritical overtures France has replied through the muzzle of your guns and by the points of your bayonets. You have been good ambassadors for the Republic; she thanks you."

Capture of Mort Homme, Height 304 and Chaume Wood.—The Verdun front remained comparatively quiet until the middle of the summer of 1917, when it was livened up in Aug. with a brilliant stroke by the II. French Army under Guillaumat. The French command had provisionally given up the offensive on a large scale having as its object the break-through, whether immediate or as a consequence to the slow using-up of the enemy. It contented itself with attacks with limited objectives, having as their aim the improvement of part of the front whilst inflicting on the enemy losses more considerable than their own. The French command was able to carry through these local actions with extremely powerful forces, and thus assured their success. The operations on Aug. 20 had as its object the improvement of the French positions between Avocourt and Bezouvaux.

From the 13th onward artillery preparation was begun; 2,400 guns, 1,100 of which were large-calibre guns, were employed. On a front of approximately 20 km. on the Meuse four army corps were deployed, two on each bank, each having two divisions in the first line and two in the second. The army kept two divisions in reserve. To meet this attack, so long and carefully prepared, the Germans had six divisions in the front line, three on each bank. The front held by a division was 3 km. on the left bank and 2,800 metres on the right. Behind them were five so-called "divisions of intervention," two on the right and three on the left bank, with one division in army reserve in the vicinity of Montmédy. The defence had 380 batteries (about 1,500 guns).

The French artillery, which thundered for eight days, accelerated its fire on the 20th at 04.00 hours. At 04.40 it lengthened and the infantry assaulted, preceded by their creeping barrage. The enemy did not start his counter-barrage until 12 minutes afterwards. On the left bank the XIII. Corps seized all its objectives in the Avocourt wood and to the E. of Height 304, which fell after open fighting. The XVI. Corps captured Mort Homme and made numerous prisoners in its deep tunnels; the Moroccan division under Degoutte took Cumieres, the Corbeaux wood and the Oie height. On the right bank the XV. Corps captured the Talon height after daybreak and the important position of Height 344, then advanced in the bend of the Meuse as far as Champ and Champneuville. The XXXII. Corps under Passaga captured the German positions to the S. of Beaumont Fosse wood and the outskirts of the Chaume wood.

The rapidity of the advance had disconcerted the enemy; the counter-attacks prepared in advance could not materialize, and the "intervention" divisions contented themselves by remaining where they were. During the night, however, the Germans attempted to react, without success.

On the 21st the French XV. Corps took Samogneux and the XVI. Corps the Oie height and Régneville.

On the 24th the famous position Height 304 fell. All the French objectives were reached. Seven new German divisions were hastily called up to hold the front, which became definitely stabilized on the left bank on the 24th. On the right bank the XXXII. Corps improved its positions in the direction of Beaumont and the Chaume wood on Aug. 26 and Sept. 8. On Sept. 9 a violent attack against Height 344 was repulsed. The captures amounted to 9,100 prisoners, 30 guns and 22 mine-throwers. Verdun was to a great extent cleared by this very successful operation. (C. M. E. M.)

VERDY DU VERNOIS, JULIUS VON (1832–1910), German general and military writer (*see* 27.1019), died Sept. 30 1910.

VERGA, GIOVANNI (1840–1922), Italian novelist (*see* 27.1021), died at Rome, Jan. 27 1922.

VERHAEREN, ÉMILE (1855–1916), Belgian poet (*see* 27.1023), produced in 1912 a tragedy, *Hélène de Sparte*, which was performed in German and Russian, besides French. His later poems include *Les Rythmes souverains* (1910); *Les Villes à pignons* (1910); *Les Fleurs du Soir* (1911); *Les Plaines* (1912) and *Les Blés Mouvants* (1912). On the outbreak of the World War Verhaeren came to England, where he received hon. degrees from various universities. During his exile he published *Les Ailes rouges de la Guerre*. He was killed at Rouen while attempting to enter a moving train, Nov. 27 1916.

VERMONT (*see* 27.1025).—The pop. of the state was 352,428 in 1920 as compared with 355,956 in 1910, a loss of 3,528 or 1%. This was the first time that the pop. had been less than in the preceding decade, though several times the gain had been very slight. The movement within the state was distinctly toward the urban districts. Of the total pop. of 1900 22% lived in cities and villages of 2,500 and over, in 1920 27·8%, and in 1920 31·2%. Of the 14 counties only six show an increase in population. The number of towns showing a decrease was 186 in a total of 248. There is no radical change in the character of the population, the proportions of native and foreign remaining about the same, with a tendency toward increase of Canadian immigrants. The following are the cities having a pop. of 5,000 or over and the percentage of increase for the decade:—

	1920	1910	Percentage increase
Burlington	22,779	20,468	11·3
Rutland	14,954	13,546	10·4
Barre	10,008	10,734	−6·8
St. Albans	7,588	6,381	18·9
Montpelier	7,125	7,856	−9·3

Agriculture.—The number of farms in Vermont in 1920 was 29,075 as against 32,709 in 1910, a decrease of 3,634 or 11·1%, but the acreage of improved land increased from 1,633,965 in 1910 to 1,691,595, a gain of 3·5%. The value of all farm property was $222,736,620, an increase over the 1910 figures ($145,399,728) of 53·2%. Of this value $82,938,253 was in land and $76,178,906 in buildings. The average value per farm was $7,661, with $2,853 in land and $2,620 in buildings, respective increases of 72·4%, 59·8% and 58·1% over the 1910 figures, which were $4,445 for all property, $1,785 for land and $1,657 for buildings.

In 1919 the leading crops with their yields and values were as follows:—

Crops	Acreage	Quantity	Value
Cereals, total	133,621	3,916,959 bus.	$5,171,758
Corn	21,186	937,375 "	1,687,275
Oats	83,097	2,396,349 "	2,396,349
Hay and forage	991,757	1,748,358 tons	29,581,464
Vegetables	..	..	7,387,254
Miscellaneous crops	..	..	3,622,443
Fruits	..	..	1,957,515

The total number of cattle in 1920 was 435,480, including 14,200 beef cattle and 421,280 dairy cattle. Dairy cows numbered 290,122. The value was $28,502,803 for all cattle, and $23,027,209 for dairy cows. The production of milk for 1919 was 122,095,734 gallons. The total value of all dairy products, excluding home use of milk and cream, was $27,207,813. For 1917 the reports show a value of dairy products handled in factories of $13,372,838. Vigorous efforts were being made to develop coöperative marketing, especially of dairy products. A decision of the Interstate Commerce Commission in 1916 abolished the leased-car system of shipping milk, and made possible the open-car system. This made it practicable to ship in smaller quantities. A state law was passed providing that any corporation using the word "coöperative" in its business name must provide (1) that voting shall be based on the number of shareholders and not of shares held; (2) that interest or dividends on paid-up capital shall be limited to 6%; (3) that a reserve fund shall be set aside, not less than 10% of the net profits annually, until the fund amounts to not less than 30% of the paid-up capital stock; (4) that the remainder of the earnings shall be distributed by uniform dividend on the basis of purchase and sale through the corporation by shareholders or the amount of raw material furnished; and (5) that not more than 10% of the capital stock shall be owned by any one member. Under this law there were, in 1920, 29 coöperative dairy plants incorporated, of which 27 had already begun business. The Commissioner of Agriculture estimated in that year that one-third of the entire dairy products of the state was being marketed through these plants. In addition to this movement there was being organized, in 1920, the Vermont Coöperative Creameries, Inc., a federation of coöperative enterprises for the purpose of securing col-

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lectively certain services beyond the reach of the separate plants, such as the buying of supplies, the selling of products, and standardized accounting.

Manufacture.—The reports for the five-year period 1914–9 show a substantial increase in the manufacturing activities of the state, due in large measure to demands of the World War. The number of establishments increased from 1,772 to 1,790, or 1%; persons engaged from 37,217 to 38,845, or 4·4%; salaried employees from 2,726 to 3,550, or 30·2%; wage earners from 32,704 to 33,491, or 2·4%; capital increased from $79,847,000 to $134,314,391, or 68·2%; value of products from $76,990,974 to $168,108,072, or 118·3%; value added by manufacture from $34,285,254 to $72,935,491, or 112·7%. In 1919 Vermont had 15 manufacturing industries the value of whose products were over $1,000,000 each, namely: marble and stone; woollen and worsted goods; paper and wood pulp; lumber and timber products; machine tools; butter; condensed milk; flour-mill and grist-mill products; other food preparations; knit goods; foundry and machine cars; general ship construction and repairs by steam railway; furniture planing-mill products; bakery products.

History.—In 1915 a workmen's compensation law was enacted, denying common-law defences to those employers who did not elect to operate under the provisions of the law. The statute covers all public and industrial employment except domestic service and cases where 10 or less are employed. Beginning in 1912 a series of Acts was passed leading to the organization of a state Board of Charities and Probation and more systematic provisions for the care of dependent, neglected and delinquent children. This movement has been extended to include widows' pensions in certain cases. In 1917 an important step was taken in the direction of coördinating the work of some of the many state departments, commissions, and boards. A state Board of Control was established by law, composed of the governor of the state, the state treasurer, the auditor of accounts, the director of state institutions, and a fifth person to be appointed biennially by the governor and Senate. This Board of Control meets regularly once a month. All state boards, institutions, commissions, officers and departments, other than judicial officers, must make monthly reports to the Board of Control. The Board has general supervisory powers over the various state activities, and may investigate any phase of their work. The Board makes its report biennially to the state Legislature.

Following an extensive educational survey, the public-school system of the state was radically reorganized in 1915, making the seventh form of administration that has been tried since 1845. Under the system adopted the office of state superintendent was abolished. In its place was established a State Board of Education consisting of five members appointed by the governor, one each year for a five-year term. This Board has general powers of supervision and management of the public educational system, and employs as state commissioner of education a trained and experienced educator, whose term of office is indefinite, being removable by a majority vote of the Board. The Board also appoints a number of superintendents with powers of supervision, and the state commissioner has power to appoint a suitable number of state supervisors when approved by the Board. The supervisors coöperate with the superintendents and supplement their work.

In 1919 the Legislature authorized the state Board of Health to divide the state into 10 sanitary districts, and to appoint for each a district health officer in place of the town health officers. This Act entirely reorganized the public health work of the state. The district officers are full-time officers and serve under the pay of the state. The public health work is much more effectively carried on than before, being after 1919 under five separate divisions, each under the direction of an expert supervisor.

Up to the signing of the Armistice Vermont had supplied for the World War over 15,000 men. Some of this number had gone across the line and enlisted with the Canadian forces before the spring of 1917. Of those in service more than one-half were sent over-seas. The deaths were: killed in action, 119; died of wounds, 47; total deaths, 612. The total wounded were 778. Total casualties recorded were 1,390.

The state has remained consistently Republican in politics since 1856, not excepting 1912, the year of the Progressive party campaign. The recent governors of the state, all Republican, have been: John A. Mead, 1910–2; Allen M. Fletcher, 1912–5; Charles W. Gates, 1915–7; Horace F. Graham, 1917–9; Percival W. Clement, 1919–21; James A. Hartness, 1921– .

(G. G. G.)

VERRALL, ARTHUR WOOLLGAR (1851–1912), English classical scholar, was born at Brighton Feb. 5 1851. He was the son of a solicitor, and was educated at Wellington and at Trinity College, Cambridge, where he graduated as second classic in 1873, becoming fellow and tutor of his college. He published editions of many classical plays, especially the *Medea*, *Agamemnon* and *Choephoroe*. In 1895 appeared *Euripides the Rationalist*, followed in 1905 and 1910 by editions of most of Euripides' plays. He was an original critic, with views of his own, often expounded in the *Classical Review* and other journals. In February 1911 he was appointed to fill the new King Edward VII. professorship of Literature at Cambridge, which had been endowed by Sir Harold Harmsworth, later Viscount Rothermere. He died at Cambridge June 18 1912.

VICTOR EMMANUEL III. (1869–), King of Italy (*see* 28.28). When in 1915 Italy declared war on Austria, the King at once went to the war zone, remaining there until the Armistice, appointing his uncle Ferdinand, duke of Genoa, Royal *Luogotenente* of the kingdom to act in his stead. At the front he lived in a most unassuming manner at the "Villa Italia" near Udine, and after Caporetto near Padua, constantly visiting the trenches and the most exposed positions, as well as the military hospitals. He took the deepest interest in everything concerning the army and the welfare of the troops; but, although nominally commander-in-chief, he never interfered with the conduct of the operations nor in the matter of appointments, and he allowed himself only the same amount of leave as any other soldier. After the conclusion of the Armistice he returned to Rome on Nov. 14 1918 and had a triumphant reception. He visited Paris and the French front with the Crown Prince (Dec. 19–21), and subsequently London.

After the birth of his son and heir Umberto, Prince of Piedmont (Sept. 15 1904), the King's family was increased by two more daughters, Giovanna, born Nov. 13 1907, and Maria, born Dec. 26 1914. He was devoted to his wife and children, and to study; and he took a special interest in numismatics, having in 1910 and 1913 already published two volumes of his monumental work on the coins of Italy, the *Corpus nummorum italicorum*. After the war he made over to the nation a large number of royal residences in various parts of Italy, a heritage of the days when Italy was divided into a number of separate states, each with one or more royal or ducal palaces and villas. Among the most famous of these are the Pitti Palace in Florence, the villas of Castello, La Petraia and Poggio a Cajano in the neighbourhood of that town, the royal palaces of Milan, Venice, Genoa, Naples, the villa Capodimonte near Naples and the "Neapolitan Versailles" at Caserta. Some of these buildings were turned into hospitals and homes for war victims, and others into museums.

VIENNA (*see* 28.50), the capital of the Austrian Republic, is situated in Lower Austria, but under the Constitution has in all matters which concern itself the status of an independent Territory. Under these special conditions, the *Gemeinderat* (or city council) exercises the rights of a *Diet* (or states assembly). In 1910, Vienna had a pop. of 2,031,498, but in 1920 only 1,842,005. In 1910 86·9% of the inhabitants were Roman Catholics; 3·7% Evangelicals; 8·6% Jews and 0·7% of other faiths. The proportion of males to females was in 1910 1,000 to 1,086; in 1920, 1,000 to 1,163. The non-German minority shown by the census of 1910 (98,430 Czechs and 8,954 others) greatly decreased after 1918.

VILLA, FRANCISCO (1872–), Mexican bandit and revolutionary, was born Dec. 4 1872 at Las Nieves, Zacatecas. He was outlawed for murder, and a price was put on his head by President Díaz. He joined Madero in 1910 for the sake of immunity, served under Huerta, and in 1914 joined Carranza, but quarrelled with him over military jealousies and presidential aspirations. He opposed Carranza in the Convention at Aguascalientes, led a campaign against him and occupied Mexico City in April and again in Nov. 1915, but was defeated by Obregon and driven to the border, where surrender under guarantee was denied him. On Jan. 12 1916 he led the Santa Ysabel massacre, in which a special train carrying a party of American mining

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men was held up and 19 of the number shot, and also the raid on Columbus, Tex., in March 1916, when the city was fired and 17 of the inhabitants killed. A punitive expedition under Gen. Pershing crossed the border March 16, and operated in the border states for 11 months, but did not succeed in capturing Villa. After Obregon's seizure of the presidential power in 1920 Villa was eliminated from political and military activity, and settled in the *hacienda* La Canutilla, Durango. (H. I. P.)

VILLARI, PASQUALE (1827–1917), Italian historian and statesman (*see* 28.76), was invested in 1910 with the order of the Annunziata. He died at Florence Dec. 5 1917.

VINCENT, GEORGE EDGAR (1864–), American educationist, was born at Rockford, Ill., March 21 1864. He was a son of John Heyl Vincent (d. 1920), a bishop of the Methodist Episcopal Church and one of the founders of the Chautauqua Assembly in 1874 (*see* 6.19). After graduating from Yale in 1885 he began editorial work and in 1886 was made literary editor of the Chautauqua Press. Henceforth he was active in the work at Chautauqua, was president of the Chautauqua Institution from 1907 to 1915 and thereafter honorary president. In 1892 he was appointed fellow at the university of Chicago, receiving his Ph.D. in 1896. He taught at Chicago as instructor, assistant professor, associate professor, and from 1904 to 1911 as professor of sociology. He was dean of the junior colleges from 1900 to 1907 and then for four years was dean of the faculties of arts, literature and sciences. From 1911 to 1917 he was president of the university of Minnesota. In 1917 he was chosen president of the Rockefeller Foundation in New York City; he had been a member of the General Education Board since 1914. He was author of *An Introduction to the Study of Society* (1895, with Albion W. Small) and *The Social Mind and Education* (1897).

VINOGRADOFF, SIR PAUL (1854–), Anglo-Russian jurist (*see* 28.100), was knighted in 1917. His more recent works include *Common Sense in Law* (Home University Library, 1914), *Self-Government in Russia* (1915), and editions of various works for the British Academy and Selden Society. During the World War he gave valuable assistance to the British Foreign Office in connexion with Russian affairs.

VINTON, FREDERIC PORTER (1846–1911), American portrait painter (*see* 28.101), died in Boston, Mass., May 19 1911.

VIRGINIA (*see* 28.117).—The pop. in 1920 was 2,309,187; an increase since 1910 of 247,575, or 12%, as against an increase for the decade 1900–10 of 207,428, or 11·2%. Negroes numbered 690,017, as compared with 671,096 in 1910. The urban pop. (in places having more than 2,500 inhabitants) was in 1920 29·2% and in 1910 23·1% of the whole.

The pop. of the principal cities and its increase were:—

	1920	1910	Percentage Increase
Richmond	171,667	127,628	34·5
Norfolk	115,777	67,452	71·6
Portsmouth	54,387	33,190	63·9
Roanoke	50,842	34,874	45·8
Newport News	35,596	20,205	76·2
Petersburg	31,012	24,127	28·5
Lynchburg	30,070	29,494	2·0
Danville	21,539	19,020	13·2
Alexandria	18,060	15,329	17·8

The great increase in Newport News, Norfolk and Portsmouth was largely due to industries related to the World War.

Agriculture.—In 1920 Virginia ranked as twenty-third state in value of agricultural products, $187,038,000 as compared with $100,531,000 in 1908. The production of the staple crops was:—

	1920	1909
Corn (bus.)	50,100,000	38,295,141
Wheat "	11,425,000	8,076,989
Oats "	4,818,000	2,284,495
Rye "	864,000	438,345
Barley "	405,000	253,649
Buckwheat (bus.)	540,000	332,222
Tobacco (lb.)	177,390,000	132,979,390
Hay (tons)	1,235,000	823,383
Peanuts (bus.)	4,416,000	4,284,340
Potatoes "	13,608,000	8,770,778
Cotton (bales)	19,000	10,480

An important element was the increased activity of the State Department of Agriculture. In addition to seed testing and the inspection of fertilizers a division of markets was established and plants were opened to supply lime to farmers at cost. Fruit crops in 1920 were large, the production of apples being 15,210,000 bus., peaches 1,470,000 and pears 296,000.

Minerals.—The mining and quarrying industry in 1919 showed a considerable increase since 1909 in the number of enterprises, a slight increase in the capital invested, and a large increase in the value of products. But there was a decrease in the number of individual mines and quarries and a slight decrease in the number of persons engaged in the industry. The statistics were:—

	1919	1909	Per cent Increase
Enterprises	202	150	34·7
Mines and quarries	216	244	−11·5
Persons engaged	15,537	15,960	−2·7
Wage earners	14,547	15,257	−4·7
Capital	$57,035,775	$55,992,693	1·9
Value of products	29,363,449	8,795,646	233·8

Virginia in 1920 was the leading state in the production of iron pyrites and soapstone, third in the production of lime and manganese, and sixth in mineral waters. The figures for mining and mineral water industries in 1919 were as follows:—

	Estabs.	Capital	Product
Coal	109	$48,978,261	9,111,454 tons
Iron	14	895,555	308,000 "
Manganese	47	2,489,400	13,665 "
Mineral waters	18	848,283	1,745,105 gal.
Pyrites	5	2,550,854	143,427 tons (1918)
Soapstone	4	617,887	$527,524
Millstones, and sand and gravel	6	522,152	$733,074
Slate		3,654,000	$264,275
Miscellaneous ores		1,587,491	1,313,439 tons
Lime			26,700 "

Manufactures.—Manufacturing industries made less progress than agriculture between 1910 and 1920. The following statistics for 1919 are the preliminary figures of the 14th Census; those for 1909 from the 13th Census:—

	1919	1909
Establishments	5,603	5,685
Capital invested	$464,517,000	$216,392,000
Materials	372,041,000	155,320,000
Value of products	641,810,000	219,794,000
Value added by manufacture	269,769,000	108,719,000
Wage earners (average)	119,368	105,676

Government.—Between 1910 and 1920 10 amendments to the state constitution were adopted. Local government was the subject of four amendments. In 1910 the state constitution was amended to permit the re-election of county treasurers and commissioners of revenue, and in 1912 another amendment permitted the re-election of city treasurers and commissioners of revenue. In 1912 the Legislature was empowered to classify cities according to population and to provide forms of city and town government, but cities with over 50,000 pop. were permitted to have special forms of government. Under this amendment the Legislature provided for general charters under the commission, or manager, form, but in 1920 another amendment was ratified which permitted Legislature to provide special forms of government for any city on condition that the sections of the constitution regarding franchises, changes in city boundaries, public debts and the assessment of property were not violated. In 1920 another amendment removed the requirement of residence within the municipality as qualification for appointment to office in a city government when technical training was requisite. In 1920, also, the construction of roads was made a proper subject for state debt, and other amendments bearing on education were adopted.

Finance.—The valuation of property assessed for taxation in 1910 was $756,194,480; in 1920 it was $1,459,762,653. In 1910 the public debt was $24,956,959; in 1919 it was $23,561,823. In 1910 the state's income and disbursements combined were $11,333,490; in 1920 they were $18,442,324. The long-standing controversy between Virginia and West Virginia concerning the division of the state debt as it existed in 1860 was finally settled in 1915 by the Supreme Court of the United States. The amount to be assumed by the state of West Virginia was fixed at $12,393,929 (*see* WEST VIRGINIA). Between 1910 and 1920 notable reforms were made in taxation and financial administration. A special tax commission was appointed in 1910 to recommend measures for the segregation of property for taxation. In 1912 the commission recommended the establishment of a permanent tax commission with power to investigate and to submit plans. A second special commission was then appointed; in 1915 a majority report recommended a revision of assessments

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under a permanent tax commission, and a minority report favoured immediate measures for segregation. The minority report was adopted, and the tax laws were revised as follows: the state levy on on real estate and tangible property was restricted to educational purposes, and state and local levies on intangible property were apportioned at 65c and 30c per $100 respectively; a permanent tax board was created consisting of the governor, the auditor, and the chairman of the State Corporation Commission, with power to employ assistants, whose duties are to collect information relating to taxation, to make recommendations to the Legislature, and to supervise the work of local tax boards. In 1918 local governments were denied the right to levy income taxes, and in the same year a special tax of eight cents per $100 was levied, four-eighths of which was to be applied to state elementary schools, three-eighths to the construction of roads, and one-eighth to the eradication of tuberculosis. In 1919 an additional tax of seven cents was levied for roads. In 1916 a commission on efficiency was constituted to recommend more efficient methods of state and local financial administration, and in response to its recommendations a state budget law was enacted in 1918 which gave the governor large powers over appropriations from the state treasury.

Education.—The school revenue, which in 1910 was $4,407,853, amounted in 1920 to $13,791,864, the expenditure *per capita* of attendance increasing from $14.77 to $39.48 and the length of the school term from 140 to 147 days. In this period the number of state high schools of all grades increased from 360 to 394. In 1912 an additional state normal school for the training of teachers was established at Radford. In 1918 a general property tax was added to the existing sources of school revenue which yielded approximately $660,000. In 1918 school attendance of all children between the ages of 8 and 12 for 16 weeks was required. Teachers' pensions have been provided for, and the pensions disbursed in 1920 amounted to $10,000. In 1918 the Legislature provided for an Educational Commission to make a survey of the educational laws and conditions and to make recommendations for reform and improvements. Its report was made in 1920, and in accord with its recommendations the Legislature in that year submitted for ratification the following amendments to the constitution: legalizing the membership of women on school boards, removing the limitation on county and district school tax rates and all limitation on the Legislature in enacting compulsory attendance laws, and giving the Legislature the power to fix the duties of the State Board of Education. Among statutes enacted in 1920 looking to the improvement of the school system were laws encouraging a nine months' term in rural communities, making the school age 7 to 20 years, provision for a school census, encouragement of rural high schools, conferring on the state superintendent the right to nominate candidates for positions as teachers, provision for physical education and medical inspection, and placing the state institutions of higher education on an all-year basis of operation.

History.—In 1912 the work of children under 12 years of age in coal mines was prohibited and the 10-hour day for children in factories was extended to workshops and mercantile establishments, with the exception of packing and fruit industries between July 1 and Nov. 1, mercantile establishments in towns of less than 2,000 pop., and Saturday work in mercantile establishments. In 1918 the mimimum age for employment was raised to 16 years. In 1914 the commitment of insane criminals to asylums by judicial investigation and order before trial for the crime committed was provided for, and in 1916 the State Board of Charities and Correction was required to register all the feeble-minded in the state, to take measures for their commitment to asylums, and to instruct parents in the care of feeble-minded children; it was also authorized to supervise private institutions for the feeble-minded. Two institutions for the feeble-minded are supported by the state, one for white patients near Lynchburg and one for negroes near Petersburg. In 1916 the office of public defender for cities of 50,000 or more pop., with the duty of defending the poor in lawsuits, and state compensation was authorized for attorneys appointed by courts to that duty. In 1918 a Mothers' Pension law was enacted which allowed city and county governments to make payments to widows with children under 16 years of age. In the same year the principle of the uniform Family Desertion Acts was adopted, and an Industrial Commission was provided to administer a workmen's compensation system.

Three sanatoria for the treatment of tuberculosis have been established, the Catawba Sanatorium in Roanoke county (1909), Blue Ridge Sanatorium near Charlottesville (1920), and Piedmont Sanatorium for negro patients near Burkville (1918). In 1918 a state orthopædic hospital was established at Richmond. In 1914 the Virginia Home and Industrial School for Girls, a private institution, became the property of the state, and since then three other reformatories have been taken over. In 1919 the State Prison Board was reorganized and reforms in prison management were adopted, notably better medical care of prisoners, investigation of their mental condition, provision for recreation, and elementary and industrial education. In 1914 a State Forestry Commission was established. In 1916 the State Board of Health was given control over all water supplies which might endanger public health. A state art commission was constituted in the same year.

In the World War Virginia supplied 81,140 men to the army, navy and marine corps and subscribed $263,948,400 to the Liberty and Victory loans.

In every state and national election between 1910 and 1920 the Democratic party had a majority. In 1909 William Hodges Mann (Dem.) was elected governor, his term being from 1910–4; he was succeeded by Henry Carter Stuart (Dem. 1914–8, and in 1917 Westmoreland Davis (Dem.) was elected, his term of service beginning in 1918. (W. K. B.)

VIRGIN ISLANDS (*see* 28.126).—The group of the Virgin Is. formerly known as the Danish West Indies was purchased by the United States from Denmark in 1917 for $25,000,000, the formal transfer taking place March 31 of that year. This group consists of the islands St. Croix, St. Thomas and St. John, together with about 50 smaller ones, most of them unnamed and uninhabited. These and the islands Vieques and Culebra ceded to the United States by Spain in 1898 now compose the Virgin Is. of the United States. The language of the people is English, although the islands had been under the Danish flag for 245 years. The total area of the three principal islands is about 132 sq. m.; St. Croix, the largest, had, according to the U.S. census of 1917, a pop. of 14,901; St. Thomas had 10,191; and St. John, 959, a total of 26,051, of which 7·4% were white, about 80% negroes and the remainder of mixed races. Illiterates constituted 24·9% of the pop. 10 years of age and over. The largest city in the islands, Charlotte Amalie, on the island St. Thomas, had in 1917 a pop. of 7,747. The other towns, Christiansted and Fredericksted on the island of St. Croix, had pop. of 4,574 and 3,144 respectively; these three towns embrace approximately 60% of the total population.

The principal industry, the production of sugar, rum and molasses, is confined to St. Croix. The importance of St. Thomas is due to its magnificent harbour, where the repairing and provisioning of vessels constitute practically the sole industry. In 1920 the U.S. Shipping Board completed an oil-fuelling station here with a capacity of 110,000 bar. St. John and St. Thomas produce the finest bay oil and bay rum in the world. In 1918 exports of bay rum amounted to 26,531 gal. valued at $29,101, and in 1919 these returns were more than doubled. There were, in 1917, 430 farms containing an area of 69,892 ac., which was 82·4% of the total land area. There were 6,084 persons, or 41·6% of the working population engaged in agriculture and animal husbandry, and 380 persons in fishing.

The total trade of the islands in 1919 was valued at $4,196,037, compared with $3,141,775 in 1918. Exports advanced from $1,249,346 in 1918 to $1,919,525 in 1919, while imports increased from $1,892,429 to $2,276,512. The major portion of this commerce was with the United States, being in 1918 more than seven times as great as with all foreign countries, and in 1919 about four times as great. The total exports of the islands to the United States in 1918 were valued at $1,137,501, 82% being sugar, compared with $1,593,130 in 1919, of which sugar constituted 88%. Of the other exports to the United States the chief were rum, hides and skins, and cabinet woods. Of exports to foreign countries in 1919, spirituous liquors to Denmark constituted about 44% and bay rum about 18%. The principal imports from the United States are breadstuffs, meat and dairy products, iron and steel products, cotton manufactures and coal. Since 1918 fuel oil from Mexico has constituted a large proportion of the imports. Many of the provisions imported are resold as ships' stores, while nearly all of the coal and fuel oil imported are used for bunkering ships at St. Thomas.

Since the transfer of the islands from Denmark, their administration has been under the U.S. Navy Department. The first governor was Rear-Adml. James H. Oliver, who was relieved April 8 1919 by Rear-Adml. Joseph W. Oman, U.S. navy. The latter was succeeded in April 1921 by Capt. Sumner E. W. Kittelle. When the United States took over the islands educational facilities were limited, but steps have been taken to improve conditions. Improvements have been made also in the municipal hospitals and along sanitary lines generally, especial attention having been paid to infant welfare work. (W. R. MA.)

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VISCONTI-VENOSTA, EMILIO, Marquis (1829–1914), Italian statesman and diplomat (*see* 28.129). After representing Italy at the Algeciras Conference the Marquis Visconti-Venosta retired into private life, but on account of his great experience, profound legal and political culture and sound judgment, he was often consulted by his Government, especially on questions of foreign affairs. He explicitly approved of Italy's declaration of neutrality on the outbreak of the World War. He died in Rome Nov. 28 1914.

VISTULA-SAN, BATTLES OF THE.—In the Austro-German autumn campaign of 1914 against Russia (*see* Eastern European Front Campaigns; also Map, Plate I., under same heading), the battles of the Vistula and the fighting on the San, with the battle of Chyrow, from Sept. 9 to Nov. 5, form a series of operations which are described below.

The retreat of the Austro-Hungarian armies in the middle of Sept. to the San and the area around and S. of Przemysl had hardly been completed when the Russian forces made ready to cross the San at its mouth with a view to enveloping Dankl's army, both at that point and on the left bank of the Vistula.

After the recent heavy fighting, in which Austria-Hungary had drawn upon herself alone the whole weight of the superior force of Russia, her army was exhausted and anything but fit to hold the San against the on-coming, steadily increasing mass of Russians. And yet if they were allowed to advance any further, not only would the Austro-Hungarian army be shattered but one of the main German industrial areas—Upper Silesia—would be in danger. For the protection of this area and the support of her ally, it was necessary for Germany to send immediate reinforcements. Negotiations to this end began between the two army commands by the middle of September.

Considerable portions of the German VIII. Army had been set free after the successful battles on the Masurian lakes. While the Austro-Hungarian armies were shaking off the enemy, a IX. German army under the command of Gen. von Hindenburg had been constituted in S. Poland and Upper Silesia out of the German XI., XVII. and XX. Corps, the Guard Res. Corps and a combined Corps, together with the 8th Cav. Division. This army was drawn up for deployment along the line Przynów–Lelów–Wolbrom–Cracow by the end of September.

On Sept. 16, protected by the Przemysl fortress, which was left to its fate, and the bridgeheads of Sieniawa and Jaroslaw, evacuated on Sept. 18 and 20 respectively, the Austro-Hungarian armies resumed the retreat which led them back to the line of the Dunajec, the Biala, and the farther side of the Carpathian ridge, by the end of the month. The Russians attempted no real pursuit, but sent only weak forces after them to beyond the Wisłok. They regarded the Austro-Hungarian army as worn-out, and turned their attention to preparing a powerful push through Poland into the heart of Germany.

The Austro-Hungarian armies, after re-establishment, were to join the German IX. Army in a new offensive which aimed at beating the Russians and relieving Przemysl.

The Austro-German Advance on the San–Vistula Line (Oct. 9 1914).—The idea underlying the new offensive was as follows: Hindenburg's army was to advance on the stretch of the Vistula between Zawichost and Ivangorod and envelope the Russians from the north. The Austro-Hungarian armies were to advance with a small group on the N. bank of the Vistula, but with their main forces to the S. of the river by way of Rzeszow and Krosno to the San and on Przemysl, while the II. Army moved forward correspondingly in the region S. of Przemysl.

The Russians were well aware of these measures, and as soon as the advance of the Allies began they abandoned the siege of Przemysl and withdrew their forces remaining in Galicia to the San and to the E. and S. of Przemysl, where they fortified their positions. Their main strength they concentrated in the first instance at Ivangorod, and later at Warsaw, in order to fall on Hindenburg's northern flank and thus compel the Allies to retire. As early as Sept. 22 the latter received the first news of the formation of a Russian IX. Army in the region round Ivangorod, and from this time reports kept pouring in of the shifting of strong Russian forces northward. It therefore became incumbent upon the Austro-Hungarian army to make a vigorous onslaught on the Russians, in order to contain as large a number of their forces as possible. The demand thus made upon it that army was in a position to meet only conditionally owing to the superiority of the Russians, who had meanwhile been reinforced by Siberian and Caucasian troops.

While on Oct. 4 the main forces of the Austro-Hungarian armies were advancing eastward S. of the Vistula, the German XI. Corps at Opatow and the Austro-Hungarian 3rd and 7th Cav. Divs. at Klimontow on the N. of that river came upon the enemy and drove him behind the stretch of the San between Sandomierz and Zawichost by Oct. 5. The Austro-Hungarian main forces in the area S. of the Vistula encountered at first only Russian cavalry. Until the San was reached only comparatively slight resistance was offered by the Russians. Only the IV. Army, of which the command had been taken over by the Archduke Joseph Ferdinand in the beginning of Oct., and the N. wing of the III. Army had to battle with and overcome strong Russian forces round Rzeszow, Lancut, and Barycz on Oct. 7 and 8. The I. Army, after some brief combats, was able to drive over the San the portions of the Russian V. Army which had remained in the angle of the San and Vistula. By Oct. 10 the Russians were over the San and behind Przemysl, with the exception of parts of the Russian III. Army, which held out until Oct. 12 at Jaroslaw on the W. bank of the San.

While the advance was still in progress news came of a northward diversion of the Russian V. Army. Large Russian forces were also debouching from Ivangorod and Warsaw. All the indications pointed to the fact that the Russians had transferred their centre of gravity to the Warsaw–Ivangorod stretch of the Vistula. The original plan of forcing the Vistula with Hindenburg's army between Zawichost and Ivangorod could not now be carried out. Instead, while the Austrian I. Army advanced gradually down the Vistula to the mouth of the Kamienna, Hindenburg was to cross the Vistula below Ivangorod, having first driven the Russian forces from Warsaw and Ivangorod back across the Vistula. The Austro-Hungarian main army was to make a vigorous effort to force the San and once more push on toward Lublin and Chelm.

Battles of Warsaw and Ivangorod (Oct. 10–Nov. 5).—The advancing corps of Hindenburg's army came into contact with large Russian forces to the S. of Ivangorod and Kalwarija and at Mszczonow-Grojec, and these they drove back on Oct. 10. South of Warsaw, where the resistance offered was only slight, the German corps gained ground, taking Blonie; but at Ivangorod and Alexandrya the attacks of the III. Caucasian Corps made things very uncomfortable for them.

The Russian offensive advance across the Vistula below Zawichost seemed to be getting well under way. The German IX. Army was reinforced without delay by two divisions on its right wing, and three more divisions of the I. Army were pushed forward into the Radom-Ilzanka area. To Hindenburg's left wing were sent two Landwehr Brigades and the Austro-Hungarian 7th Cav. Div., which, with the German 8th Cav. Div. was formed into a Cav. Corps under Gen. von Korda.

The fighting persisted stubbornly on both sides. In view of the constant Russian reinforcements, Hindenburg could achieve a decisive success neither at Warsaw nor at Kalwarija or Ivangorod. When, on Oct. 15, his left wing was forced back at Blonie-Grodisk, the Allied Army Commands were more and more inclined to think that the Russian main attack was about to be launched from Warsaw with two armies, the II. and V. Armies. The Allies decided to meet this attack by the German IX. Army on the line Lowicz–Skierniewice–Rawa–Nowemiasto–Radom. The Austro-Hungarian I. Army meanwhile was to concentrate seven divisions in the Radom–Ilzanka sector in readiness for an attack on Ivangorod. This concentration of the I. Army was completed by Oct. 21. The IX. Army held its ground against the numerical superiority of the Russians until Oct. 19, when, after Korda's Cav. Corps had dispersed a Russian Cav. Corps near Sochaczew, it retired to the above line.

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Simultaneous attempts to force the San were made by those portions of the Austro-Hungarian I. and IV. Armies posted on the lower San, but though partial successes were achieved, no tangible results were possible in view of the Russians' powerful counter-attacks, particularly as the Russians had succeeded in taking the W. bank of the San at Biellny, Zarzecze and Monasterz. For this brought the X. Corps of the Austro-Hungarian I. Army over to the W. bank of the Vistula, and the IV. Army had to take over the defence of the whole line of the San. To the W. of Warsaw the Russians were extending still further westward, and bringing up forces to the Lower Bzura, where the Russian I. Army was being formed.

On Oct. 21 Hindenburg and Dankl were grouped for attack in the order arranged, and on the 22nd Dankl advanced to the assault. In the battle of Ivangorod which followed (Oct. 22–7), some fine initial successes were obtained by the I. Army and the German Guard Res. Corps fighting on its left wing, but the 37th Honved Div., fighting on the right wing, was placed in a very critical position by the extremely violent attacks of the Russian XXV. and XIV. Corps. Embittered fighting persisted for the next few days on the I. Army's front. On Oct. 24, Hindenburg was attacked along the whole of the front by the Russian II. and V. Armies, but was able to repulse all their assaults. On Oct. 26 the Russians drove their right wing forward through Gadin, Osmolin and Lowicz. Here four Russian Corps forced back two German Landwehr Bdes., Korda's Cav. Corps and some German Landsturm. Hindenburg's main force, four Corps strong, was opposed by six Russian Corps, and the seven Austro-Hungarian Divs. posted in the direction of Ivangorod had to cope with double their own numbers.

As there was no prospect of a successful issue, and as an enforced retreat had in places already set in, the battle was broken off on Oct. 27. Leaving Dankl's army to put up an obstinate resistance along the line Kielce–Gura–Opuczna–Opatow–Sandomierz, Hindenburg led his army back to the line Sieradz–Jedrziejów. The Guard Res. Corps was to remain on the left wing of the I. Army, while Field-marshal Lt. Freiherr von Haner's Cav. Corps, newly formed out of the 2nd, 3rd and 9th Cav. Divs., was to constitute a liaison between the two armies.

Battle of the Opatowka (Oct. 31–Nov. 2).—The Russians pursued the Austro-Hungarian I. Army with their IX. and IV. Armies, the German IX. with their V. and II. Armies. Meanwhile the newly formed I. Army on the Russian right wing advanced on Kutno. By Oct. 30 the Austro-Hungarian I. Army had reached its position and strengthened it technically against all emergencies. On Oct. 31 the columns of the Russian IX. Army appeared at Opatow and proceeded to attack violently both there and on the Opatowka. At Kielce the fighting was of secondary importance, but E. of Opatow the Russians were aiming at a break-through. On Nov. 2 Dankl's right wing retired behind the Koprzywianka, exposing the flank of the Austro-Hungarian IV. Army fighting on the far side of the Vistula.

In view of the vigorous Russian pursuit and the impossibility of holding the Koprzywianka any longer with troops that were already greatly exhausted, the Austro-Hungarian higher command agreed to the retreat behind the Nida proposed by the I. Army command. On Nov. 3 the I. Army with the Guard Res. Corps, reached the area W. of the Czarna and Czarna Nida and on the 4th shook off the Russian IX. Army completely. On Nov. 5 the army crossed the Nida and on the 6th continued its march into the area round Cracow.

The German IX. Army, which remained practically unmolested during the whole retreat, commenced its further retirement to the Silesian frontier in the night of Nov. 3 and 4, arriving there on the 5th.

Battle of Chyrow (Oct. 13–Nov. 2).—The Austro-Hungarian II. Army had advanced to the S. of the III. Army, without encountering enemy opposition, but under the most unfavourable conditions imaginable. The leading division reached Kroscienko on Oct. 9, only to find the Chyrow defile, through which the advance to the area E. of Przemysl was to be made, blocked by the Russian XXIV. Corps. Gen. von Tersztyánszky's column (the IV. Corps), which had pushed on further to the E., reached Turka after taking the Uszok pass by hard fighting.

The II. Army came up against strong enemy forces, firmly established in well-prepared positions on the heights S. of Stary Sambor, and on those opposite the S. wing of Boroević's army. With its main force, the VII. and XII. Corps, the II. Army attacked the enemy's position S. of Czyszki, on both sides of the Blozewka hollow and at Starasol. Tersztyánszky's group, coming from the S. was to take the heights S. of Stary Sambor and push forward with one column (the 38th Honved Inf. Div. and 5th and 8th Cav. Divs.) through the Bystrycza valley to Sambor. Working in harmony with this attack, the S. wing of the III. Army, which was opposed by numerically superior Russian forces, was also to push forward. Gen. von Boroević reinforced this wing by bringing up the III. Corps and the 23rd Honved Inf. Div. from the area N. of Przemysl, where they had just driven the Russians across the San. The II. Army aimed at forcing a decision with Tersztyánszky's group. But while the preliminary battles were being successfully conducted there, a heavy Russian counter-attack set in in front of the left army wing. This led to very heavy fighting on the heights S. of Stary Sambor, at Slochynia, Blozew Gorna and Towarnia, and necessitated the putting in of all available reserves. The right army wing was able to achieve some successes in fighting down the Russian opposition, but an advance on the left wing by the XII. Corps was quite impossible, for there the Russians were doing their utmost to break through to Chyrow and Dobromil. The 20th Honved Inf. Div. and 34th Inf. Div. fighting on that wing had to be withdrawn to the area E. of Towarnia and toward Blozew Gorna, and from Grodowice to Slochynia, and even after the 17th Inf. Div. came on the field they could not stand against the overwhelming onslaught. Just when the situation looked most threatening, the 12th Inf. Bde. of the III. Corps arrived on the battlefield, and although not able to turn the scale it relieved the pressure on the Honved Inf. Div., which was the most exhausted.

On the morning of Oct. 16, the Russians were resuming their attacks, when the III. Corps made its counter-attack directed against the heights of Czyszki, Guty and Wegrzeliska. But though the coming into action of the III. Corps brought some relief to the fighting divisions, no success could be expected in view of the continuous vehement Russian attacks, and more especially, the devastating flank fire from the Czyszki and Magiera heights. To conquer these heights Boroević now brought up the XI. Corps also to the area S. of Przemysl. But in the night of Oct. 17–8, the Russians once more pushed forward with strong forces into the Blozewka hollow, and threw back the 22nd Inf. Div. onto the heights E. of Nowemiasto. The 34th Inf. Div. was likewise forced to give ground, and Blozew Gorna was given up to the enemy. On Oct. 19, the XI. Corps, advancing through Stroniowice and Tyszkowice on Mizyniec and Chodnowice, flung themselves into the battle, and drove the Russians back. Close by, a little further S., the 44th Inf. Div. stormed the Magiera height, and the advance of the III. Corps was made considerably easier. When the 23rd Honved Inf. Div. attacked from Byblo, it carried the whole front with it. The 22nd Inf. Div. recaptured Sanoczany, the 6th Inf. Div. seized Blozew Gorna, and the 28th Inf. Div. worked its way through to the edge of a wood opposite the Wegrzeliska height. The danger of a break-through now seemed to be finally averted.

Meanwhile Tersztyánszky's group on the right wing of the II. Army had also had some hard battles. In the Bystrycza valley the 38th Honved Inf. Div. column, which had gone on ahead, succeeded in beating back through Zalokiec, Podbuz and Uroz the Cossacks who had been pushed forward to protect the Russian left wing. But on Oct. 18 the Russians brought up new forces through Boryslaw with which to attack this column in flank, whereupon the column had to be taken back to the heights W. of Zalokiec and Podbuz. In the meantime Gen. Hofmann's Corps, destined for the defence of the Carpathians, which had advanced over the Beskid Pass on Oct. 8, had taken Stryj and despatched a group to Drohobycz. This group came up in front of Drohobycz on Oct. 21, but the Russians in the meantime had

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attacked Gen. Hofmann with greatly superior forces, so that the detachment sent to Drohobycz had to intervene at Stryj. It was therefore unable to procure any relief for the II. Army particularly as Gen. Hofmann had also been forced to retreat.

Simultaneously with this, the attack along the whole front of the II. and III. Armies was continued. In the case of the III. Army this culminated in the attempt to capture the Czyszki heights and in the defence of the Magiera height against the Russians who were longing to regain it, while the II. Army aimed at relieving the enemy pressure on the right wing. But by Oct. 23 the great numerical superiority of the Russians at this point had become evident, and the II. Army command found it necessary to bring back the IV. Corps—consisting of the 38th Honved Inf. Div., the 31st Inf. Div. and the 1st, 5th and 8th Cav. Divs.—without delay to the heights N.E. of Turka. The XII. Corps was to remain on the heights W. of Stary Sambor, and the IV. Corps was brought up from the III. Army to fill the gap between the two. The Russians kept touch with the retreating divisions but for the moment attempted no sort of pursuit.

The III. Army, stricken with cholera and short of munitions, had not been able to achieve any real success up to Oct. 26. On the afternoon of that day a general attack was delivered by the III. Army with the object of relieving the II. Army, but as this also failed almost completely the front was technically strengthened and the reserves were taken out of it and placed at the disposal of the II. Army.

Meanwhile the Russians had not molested the II. Army's right wing to any extent, but directed their energies toward the gap between the IV. and XII. Corps, where they hoped to break through. Their attack on Oct. 26 across the Holownia height had begun to look like a break-through, when Field-marshal St. Krautwald's group of the III. Army, together with two newly arrived Landsturm territorial brigades and a few march battalions, came to the rescue. The IV. Corps, as soon as it had recovered a little from the recent heavy fighting, went over to the attack, and took the Bzeniec, Podzemen and Zwihonka heights.

The attack by Krautwald's group and the IV. Corps had good results. By Oct. 31 the Russian VII. Corps had been driven from the stubbornly defended Holownia height. As this attack progressed, the XII. Corps and, shortly after, the III. Army joined in. On the morning of Nov. 2, the whole of the II. Army was engaged in the attack. Hofmann's Corps, which had retired on Skole after the abortive advance on Drohobycz, also joined in the renewed attack on Stryj. The XII. Corps came up close to Stary Sambor and up to the Kundieska height. The IV. Corps approached the strong Russian position Lisyj height—Zalarski height and the heights E. of Podbuz.

Just as the battle at Chyrów seemed at last to be taking a favourable turn, after the II. Army had received reinforcements, and the reconstruction of the railways leading to Chyrów and Przemysl promised a considerable improvement in the service of munitions and supplies, there came the order to retire, an order totally unexpected by the troops of the II. and III. Army engaged in the attack.

The army higher command had already informed the army commands on Oct. 27 of the unfavourable situation in the bend of the Vistula, and announced the possibility of the breaking off of the battle. The position of the armies fighting on the San, at Przemysl and at Chyrów, had been made untenable by the withdrawal of the German IX. Army and the Austro-Hungarian I. Army from the line Sieradz-Kielce, and from the Opatówka to behind the Nida—practically to the Silesian frontier. In spite of the successes just achieved on the S. wing, therefore, the Austro-Hungarian armies had again to be led back, in view of the general situation. In Upper Silesia, in the Cracow area and in Western Galicia, a new grouping of the Austro-Hungarian armies was to be undertaken, under the protection of the Carpathian ridge, in readiness for a new offensive in better circumstances in conjunction with the German IX. Army—which was also to be reorganized.

The retreat was begun in the night of Nov. 2–3, by the left wing of the Austro-Hungarian IV. Army, and by the right wing, now amalgamated with the III. Army. Both these and the II. Army broke contact with the enemy in the night of Nov. 4–5.

(E. J.)

VITAMINE, the term now employed to designate certain substances contained in foods. The exact nature of these substances is not known, but they have been shown to be necessary to the normal development of young animals (including children) as well as to the maintenance of health and well-being in adults. They are very labile substances which, existing abundantly in raw foods, especially in uncooked fruits and vegetables, become seriously attenuated or altogether destroyed by cooking, desiccation, decortication and other refining processes. There are probably a great many vitamines in natural foods—live or quick foods, as they are called—but up to the time of writing three only have been isolated. These are (1) the anti-scorbutic factor; (2) the water-soluble B.; (3) the fat-soluble A.

The Anti-Scorbutic Factor.—As long ago as 1734 J. E. Bachstrom observed that the disease known as scorbutus or scurvy appeared to be related to the ingestion of salted, preserved and dried foods. The disease in question was alarmingly prevalent among mariners on long distance sailing vessels, and the British navy was annually decimated by this scourge. The introduction of fresh vegetables and fruits into the dietary of the sailors was found to afford them complete protection against the disease, but the knowledge thus empirically gained was not followed by any scientific investigation, and though the door was thus widely opened to the discovery of vitamines, these important substances were destined to lie *perdu* for nearly 200 years. This anti-scorbutic factor is the most fragile of the three which have so far been isolated. It is present in large quantities in all uncooked fruits and vegetables, and it is interesting to note that the popular idea that foods which have been kissed by the sun have a greater value than those which have not, finds some justification in the fact that vegetables grown above ground are much richer in the anti-scorbutic factor than root vegetables. This factor is well represented in fresh milk, but boiling, pasteurization, or evaporation completely destroys it. The activity of the anti-scorbutic factor is much increased by germination; thus, beans, peas, or the grains of wheat or barley in the ordinary dry quiescent state contain no anti-scorbutic factor, but if they be placed in water and allowed to germinate, they immediately acquire this vitamine in large quantities. There is a practical application of this interesting fact which should not be lost sight of by travellers in inaccessible regions.

The Water-Soluble B.—Prof. Gowland Hopkins of Cambridge published in 1912 an article entitled "Feeding Experiments Illustrating the Importance of Accessory Factors in Normal Dietaries,"[1] in which he called attention to the serious effects upon the health of animals which resulted from the absence from their food of certain hitherto unrecognized principles. In the following year Casimir Funk[2] claimed to have isolated a "Factor X" which corresponded to the absent principles described by Hopkins to which he gave the name of Vitamine, in the mistaken belief that the factor in question contained an amino-acid. In spite of its faulty derivation the name caught on, and the word vitamine is now employed to include any of those essential substances which Hopkins unfortunately described under the term "accessory." The experiments of these two observers showed that the absence of the factor now known as the Water-Soluble B. was the cause of the disease known as beriberi, which a Dutch physician, Dr. C. Eykman, had in 1897 associated with the custom of eating polished or decorticated rice by the natives, to the exclusion of all other foods. Beriberi is a disease of the nerves, and it was found that other similar affections of the nerves, pellagra for example, could be experimentally produced by withholding this vitamine, and cured by reinstating it in the dietary; hence the term "anti neuritic" by which it is sometimes known. This factor is essential to the normal growth, development and well-being of young animals. It is present in great

[1] *Journal of Physiology* (1912), p. 425.

[2] *Ueber die physiologische Bedeutung gewisser bisher unbekannten Nahrungbestandteile der Vitamine. Ergebn. Phys.* (1913), 13, p. 125.

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abundance in all quick or natural foods, in grains and eggs. It is also present in the brain, liver, sweetbread and kidneys of animals, whereas from muscle or ordinary meat it is relatively absent. Yeast contains this vitamine in large quantities. In the vegetable kingdom, the leguminosæ afford it, uniformly distributed throughout their substance; whereas in cereals it is confined to the outside covering; hence the importance of unpolished rice and whole meal bread. It is soluble in water, especially in slightly acidulated water, and in alcohol, but not in fats. It resists a relatively high temperature; it is present for example after boiling for a short period, but is destroyed at 120° C.

This vitamine, as indeed the whole conception of vitamines in general, was first described in 1901 by Dr. Eugene Wildiers of Antwerp (1878–1908) under the name of Bios.[1] In a paper which appeared in *La Cellule* (Louvain) on April 2 1901 entitled "Nouvelle substance indispensable au développement de la levure," this young Belgian observer set forth a good deal of the knowledge which we now possess, but no notice was taken of his work, and his conclusions were arrived at independently by a different route about 12 years later.

The Fat-Soluble A.—In the year 1913 the third vitamine was described by McCollum and Davis.[2] Its absence was shown to provoke a disease of the eyes, characterized by œdema of the lids, ulceration of the cornea, blindness and ultimately death. These lesions, even when in an advanced state, were cured by the exhibition of the vitamine. The absence in some degree of this factor is held responsible by some for the disease known as rickets. Its presence is certainly necessary to the growth and normal development of young animals. It is found (*a*) in certain animal fats, *i.e.* milk, butter and glandular tissue; (*b*) in the green leaves of edible plants. It is thus interesting to note that though present in essential organs or so-called "noble" tissues, it is absent from connective tissue and reserve tissue, such as lard or the subcutaneous animal fats. Olive oil and other vegetable oils do not contain this vitamine, whereas cod-liver oil contains it in large quantities. Fat-Soluble A. is soluble in oil, but not in water. It resists high temperature better than the other two.

Such was the state of our precise knowledge in 1921 concerning these elusive substances. If only from the confused and cacophonic nomenclature, it is evident that this knowledge was still in a very embryonic state. That there is, in this matter, a very wide field of interesting and fruitful research awaiting us is obvious from the fact that the discovery of the vitamines has entirely altered our conceptions of the causes and origins of disease. Until lately disease was regarded as a sin of commission by some unseen and subtle agency; the vitamines are teaching us to regard it in some degree at any rate as a sin of omission on the part of civilized or hypercivilized man. By our habit of riveting our attention upon microbes and their toxins we had sadly neglected the side of the question which concerns itself with our own defences. We sterilized our children's milk against the bacillus, and in so doing we deprived it of its vitamines and thus lowered the resisting power of the victim, not to one microbe only, but to all. The importance of vitamines has taught us that the naturally nourished child is practically immune from the majority of the diseases which in spite of our bacteriological and hygienic knowledge have been raising the infant death-rate to a figure which was as surprising as it was appalling. But it is to be remembered that in order to attain to this immunity a child must be born healthy; it must have been suitably nourished during its intra-uterine life, and this can only be attained by feeding the prospective mother upon foods which contain the necessary vitamines in such an abundance as will satisfy the physiological needs of two. The gross diseases due to absence of vitamines, such as scurvy, beriberi, pellagra and xerophthalmia, called the "deficiency diseases" (*maladies de carence*) are characterized by symptoms which are acute and unmistakable, but it is certain that long before these acute symptoms appear there will have been a general ill-defined departure from normal health, called by the French *carence fruste* or *hypo-carence*, and the condition may never pass beyond this stage. It is thus not only futile but actually dangerous to seek to estimate, as has often been done, the minimum amount of vitamine which will insure protection from obvious disease. What is required is not the minimum but the optimum. Amongst these conditions of *hypo-carence* may be mentioned the majority of the maladies due to the deficient action of the internal secretory or endocrine glands, such as the thyroid, thymus, supra-renals, pituitary, gonads and others, which have already been shown to suffer severely from deprivation of vitaminous foods. In the same category of *hypo-carence* are also to be placed many of the so-called metabolic diseases such as gout, arthritis, diabetes and others. These may be occasioned directly by the vitamine deficiency, or indirectly by starving one or more of the endocrine glands of the all-essential principles. As might easily be supposed, this relative lack of vitamines is peculiarly liable to show itself in the gastro-intestinal tract. Digestive difficulties and intestinal inertia, appendicitis and colitis have been shown in a great number of cases to have been due to a lack of vitamines in the ordinary foods, a fact of which anyone may convince himself in the matter of the widely distributed disease known as intestinal stasis or chronic constipation. It has often been remarked that dental caries or defective teeth is an evil which has seemed to be very much on the increase during the last 20 years; the period, that is, during which all fresh and unsterilized foods have been withheld from the young in order that they may be fed on devitalized pap which, in addition to requiring no mastication, is, by boiling and other culinary processes, completely deprived of the vitamine content so necessary to the proper development and eruption of the teeth themselves. Vitamines have already revolutionized our ideas on dietetics. The erstwhile stereotyped proportions of the proximate principles, proteins, carbohydrates, fats and salts which were considered essential to bodily health have been so altered by the discovery of the vitamines that the whole question will have to be investigated and studied afresh, and the ineffable theory of calories which was based on the curious assumption that the behaviour of food in the human body was identical with its behaviour in a test-tube, will retire to the limbo of things well forgotten. The discovery of the vitamines presents would-be scientists with a much-needed lesson in humility. It reminds us that, in evolving man, Nature provided him with the foods necessary to his growth, development and well-being, and that in interfering with these natural foods by cooking, sterilizing and refining, he has sacrificed their efficacy, sometimes to his greed, but more often to his arrogant assumption of superior knowledge, with the result that he has not only promoted the prevalence of preventable disease, but has actually created others which but for his misdirected energy would have had no existence.

[1] "*Vitamines et Stomatologie*," par H. Allacys, "*Revue Belge de Stomatologie*," No. 9, Sept. 1920, p. 377.

[2] "The Necessity of Certain Lipins in the Diet during Growth," *Journ. Biol. Chem.* (1913), p. 167.

REFERENCES.—Report on Vitamines, Medical Research Committee (British Government, 1919); Weill and Mouriquand, *Alimentation et maladie par carence* (1919); Dr. G. Houbert, *La question des vitamines* (1920); Raoul Lecoq, *Les nouvelles théories alimentaires* (1920). (L. WI.)

VOGÜÉ, EUGÈNE MELCHIOR, COMTE DE (1848–1914), French author (*see* 28.172), died in Paris in 1914.

VOLUNTEERS (*see* 28.208).—The reorganization of the Volunteer Force in Great Britain, founded in 1859, as a Territorial Force fully constituted with staffs, troops and services, took place in 1908; and when this was completed, no units of the Volunteers continued in existence as such, except a few companies in the Isle of Man. The Volunteer Act, however, was not repealed.

At the outbreak of the World War, the existing organization of the British army, consisting of Regulars, Special Reserve, and Territorial Force, filled up its establishments generally, and the Territorial Force formed duplicate units, while the depots and surplus resources of the Regular army and Special Reserve formed the nucleus of the "New Armies." But over and above these, which were normal, or derived from normal organizations, there began in Aug. 1914 a widespread effort throughout Great Britain to prepare for the contingency of invasion by voluntary

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military training. Everywhere local units sprang up. These had no official status, all expenses being privately borne; and the organization and administration were vested in local committees.

In Nov. 1914, the British Government, realizing the necessity for making every provision for a possible invasion, granted recognition to these voluntary formations under the title of Volunteer Training Corps. They were affiliated to a body in London called the Central Association Volunteer Training Corps, which was made responsible by the War Office for their training and administration. A uniform enrolment form was prescribed, and the following conditions of service were imposed by the Army Council:—(1) that only those should be enrolled who, through age, were not eligible to serve in the Regular or Territorial armies, or were unable to do so for some genuine reason, and in the latter event agreed to enlist if called upon to do so later; (2) that it should be open to army recruiting officers to visit the corps at any time, and to recruit any eligible members whose presence in the corps could not be justified; (3) that no form of attestation involving an oath should be permitted. Clothing, equipment, arms and financial assistance were not provided by the Government; local appeals for funds were issued, and met with considerable success, many municipalities making generous grants. Whenever they were available, exempted men with military experience were appointed instructors. Buildings for drill purposes were hired where they were not lent by Territorial Force associations, and miniature rifle ranges were constructed. Some corps, owing to the patriotic generosity of individuals, were provided with uniforms of green-grey, as well as rifles. Every volunteer was supplied with a red brassard worn on the left arm when he was in plain clothes, inscribed with the letters "G.R.," showing his status as a combatant.

Many feared that this volunteer movement might provide a hiding place for shirkers from military service, but on the contrary, it proved a most powerful recruiting organization; over a million men passed through its ranks into the Regular army, the preliminary training they had received as Volunteers contributing materially to their efficiency. By the end of 1915, some of the corps had attained considerable proficiency in elementary drill, but the shortage of arms, and the inexperience of many of the instructors, militated against a high standard of efficiency.

The Volunteers were eager for the status of soldiers; and in March 1916, the King invited lords-lieutenant of counties to submit offers from corps willing to enroll under the Volunteer Act of 1863. The response was general. In May 1916, regulations for the reconstructed Volunteer Force were issued, which provided for the raising of Volunteer regiments on a county basis under county commandants. Owing to the wide distribution of the personnel of various battalions, a uniform strength could not be insisted on, but minimum and maximum establishments were laid down. The force was to be called out for actual military service only in the event of imminent invasion, as notified by royal proclamation, although at other times voluntary offers of temporary service either by corps or individuals could be accepted. Motor corps, field ambulance sections, and certain specialist units such as signal and electric light companies, were subsequently formed in order to complete the defence schemes for the commands.

The original organization proved unsatisfactory, as it called for no medical examination and imposed no drill obligation. In Jan. 1917, under powers conferred by a Volunteer Act passed in 1916, it was therefore decided to form special sections of the Volunteer Force, with qualifications as follows:—

Section A.—Men over military age, free from organic disease, who were able to stand service conditions in garrisons at home, to march at least 5 m., to see to shoot with the aid of glasses, and to hear well. In addition they had to be free to vacate their civilian employment on the occurrence of a national emergency.

Section B.—Exempted men of military age, with practically the same conditions as Section A.

Section C.—Lads under military age, but of not less than 17 years, of the same physical standard as for A. and B.

Section D.—Men who were not eligible for, or were unwilling to become, members of Sections A., B., or C.

Section P.—Special constables, who, in the opinion of the chief constable of the county could undertake this duty without interfering with the proper performance of their duties as special constables.

Section R.—Men employed in Government departments, on war work, and railway employees.

Officers and men of Sections A., B. and C. were required to sign an agreement to serve for the duration of the war, and to carry out a definite number of drills per month, becoming liable to penalites under the Army Act if they failed to fulfil their obligations. The sum of £2 was granted to the Territorial associations concerned for each Volunteer on his satisfying the prescribed authority that he had attained the requisite standard of efficiency. It was then the duty of the association to provide him, as a first charge on the grant of £2, with uniform, the balance, if any, being available for general administrative purposes.

The retention of Section D. men, who undertook no obligation, was a weakness to the force, and Sections P. and R. were also of little value, as they could not be depended upon to be available when required, and afforded to many a means of avoiding military obligations. Just before the Armistice, War Office instructions were issued ordering the discharge of all Volunteers over 55 years of age, and also of all who refused to agree to serve for the duration of the war. This would have had the effect of reorganizing the force on a really sound basis.

In Sept. 1916, the general administrative control of the reconstituted Volunteer Force was transferred to the director-general of the Territorial and Volunteer Forces at the War Office, the local administration in the counties being undertaken by Territorial Force associations, in consultation with county commandants. The Central Association Volunteer Training Corps then became mainly an advisory body. A senior staff officer for Volunteer services was appointed to each command and was made responsible to the general officer commanding-in-chief.

Voluntary efforts of service by corps or individuals were accepted by general officers commanding-in-chief of commands, and all kinds of pre-emergency duties were undertaken. When so employed, Volunteers were not entitled to army pay and allowances, but received free travelling warrants, and an allowance at the rate of 5d. per head for each complete period of six hours worked; this amount being paid to the corps for the provision of rations. The following were some of the duties thus undertaken. There was a complete scheme for guarding the various lines of communication by Volunteers, and many men carried out this guard duty on a " rota " system, which enabled them to carry on their normal work as well. A large amount of trench digging, principally in connexion with the London defence scheme was also undertaken. Much useful pre-emergency work was performed by the R.A.S.C., M.T. (V), in evacuating ambulance trains, distributing men arriving home on leave from the different theatres of war, conveying wounded to and from hospitals, and in the provision of transport necessary in the training of other branches of the force. The services of the R.G.A. (V) were in some cases utilized, on a " rota " system, in manning the guns of batteries on the coast at night, men attending at 7:30 P.M. and leaving at 5 A.M. the following morning. And Volunteers, especially in London, were employed on anti-aircraft duties.

Service in the Volunteer Force was not allowed to interfere in any way with the operation of the Military Service Acts, which subsequently withdrew a large number of the original Volunteers. These men were replaced by others, who, though fit and capable, were very busily employed on work of national importance, and were not only for the most part lacking in enthusiasm, but had little time for training. The Military Service Act of 1918 made service in the Volunteer Force compulsory for men exempted by military tribunals. This, of course, meant the administration of conscripts into a so-called " Volunteer " Force.

The formation of special service companies of the Volunteer Force for a limited period of whole-time service, replacing personnel of T.F. cyclists battalions on the E. coast, was undertaken in June 1918. In almost every county the Volunteers were most desirous of carrying out this duty. But the minimum period of service was fixed at two months, and strict medical limitations were laid down. Consequently there was difficulty in

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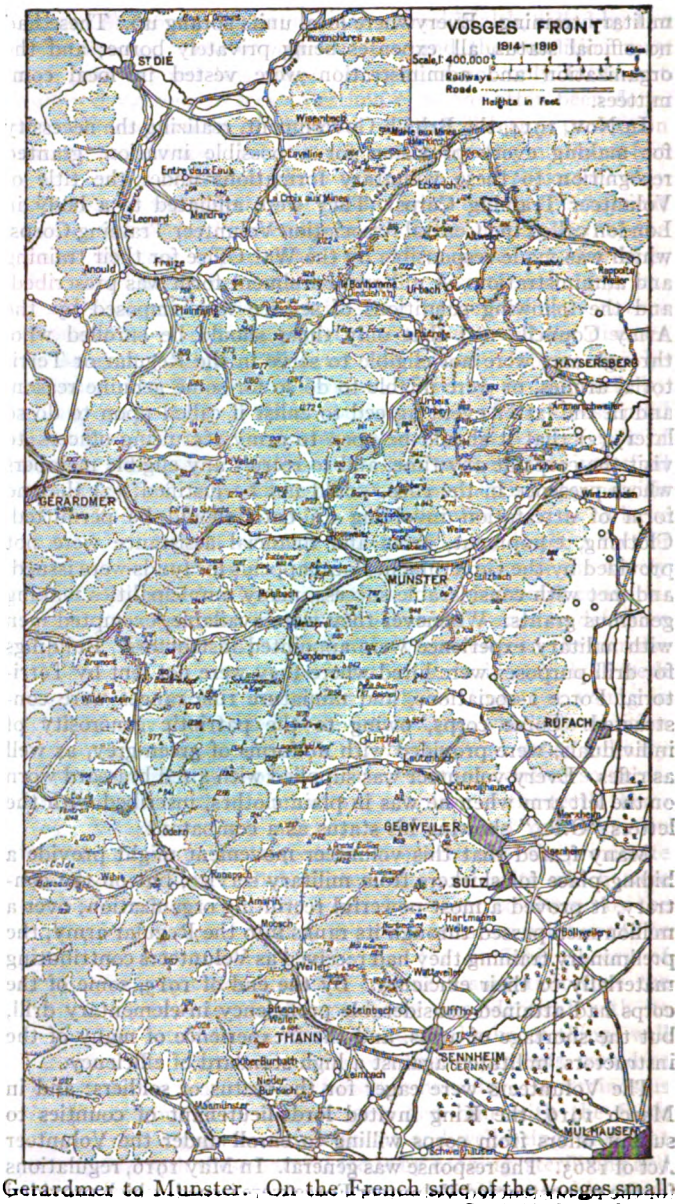
obtaining the necessary number. The total so employed was 484 officers and 7,777 other ranks, which was considerably short of requirements.

In Nov. 1918, the Volunteer Force consisted of:—11 companies of R.G.A.; 11 engineer corps; 1 signal and transport column; 63 motor volunteer corps (R.A.S.C., M.T.) (V); 282 infantry battalions; 1 pioneer company, and 22 medical corps; with a total strength of 254,826 all ranks. In Oct. 1920 the War Office issued instructions for the disbandment of the Volunteer Force. These instructions excepted the R.A.S.C., M.T. (V), of which the strength was:—468 heavy sections of transport, 79 light sections of transport, 92 sections of transport for field ambulance, 3 sections of transport for motor air-line sections, and 7 sections of transport for signal companies. These units were required for special transport duties, and were not disbanded till March 31 1921, when they received the special thanks of the Army Council. As a mark of appreciation of the services rendered by the Volunteer Force, the Army Council decided to allow officers to retain honorary rank on retirement, and granted them the right to wear uniform on special occasions. (R. E. G.)

VORARLBERG (*see* 28.211).—The pop. in 1910 was 145,408; in 1920 only 133,033 (132 per sq. mile). In 1900, 88% of the area was productive, and of this 51·3% was grazing land, 29·4% forest, 15·3% meadow, 0·5% gardens, and 3·45% arable. Vineyards occupied less than 0·1%. The most important towns are Bregenz, the capital (pop. in 1920 12,102, the town itself 7,488); Dornbirn (13,764); Feldkirch (4,593); Bludenz (5,488). Rieden, the suburb of Bregenz, is a manufacturing centre.

VOSGES, BATTLES IN THE, 1914-8.—The Vosges mountains (*see* 28.214) rise sharply to the N. of Belfort. From the groups of the Ballons, which reaches a height of more than 1,200 metres, the main ridge runs N. by the Drumont, the Grand Ventron (1,309), and the Hohneck (1,366). North of the Bonhomme pass (949) the ridge falls gradually to 558 metres at Saales, near the headwaters of the Bruche, one of the Alsatian tributaries of the Rhine. From the Saales gap the ridge rises to Mont Donon and Prancey, each over 1,000 metres high, and is prolonged through a series of vast forests as far as the Saverne valley. From the Ballon d'Alsace to the Donon, the Vosges form a mass of mountain with steep slopes, narrow deeply cut valleys and swiftly flowing torrents, a terrain always difficult and often impossible of passage away from the roads. The summit of the ridge generally takes the form of a swollen saddle, wooded in places but usually covered with the large grassy swards known as the Chaumes (Calvi Montes). These Chaumes are wind swept all the year round, very hot in summer and very cold in winter, and the snows which cover them completely from Oct. onward only disappear in early June. Both slopes of the ridge are clad with magnificent fir and pine forests, which end just below the crest in a thin ledge of bushes bending before the wind. The fall of these slopes is steeper on the Alsatian side than on the other; immediately below the crest a cliff of granite rocks or sandstone falls almost vertically, often in the southern part of the Vosges, for some 250 metres. From the foot of this wall begins a gentler slope extending all the way to the Rhine valley. On the Lorraine side, however, the mountains descend much less steeply in a series of ridges towards the Moselle and the Meurthe. The points of passage, formed by the roads crossing the ridge, acquire considerable importance owing to the absence of such crossings elsewhere. These points of passage, moreover, are not numerous. In the group of the Ballons the pass of Bursang, with the smaller passes of Oderen and Bramont, lead from the Moselle valley to the Thann valley. At the foot of the Hohneck the pass of the Schlucht leads from Gerardmer to Munster and Colmar; to the N. the Bonhomme and Louchpach join the valleys of the Vologne and the Weiss. The pass of Ste. Marie unites Ste. Marie-aux-Mines and Schletstadt; the gap of Saales leads from Prorenchers to Schismeck; and, lastly, a road which passes over the summit of the Donon leads from Celles to Molsheim and Strasbourg. The only railways across the Vosges were the two main lines from Strasbourg to Nancy, by Saverne, and from Mulhouse to Belfort by Dannemarie, together with the narrow gauge railway from



Gerardmer to Munster. On the French side of the Vosges small branch lines ran up into the mountains to St. Dié, Gerardmer, Cornimont and Bursang, and other branch lines on the Alsatian side ran from the Strasbourg-Mulhouse railway to the heads of all the Vosges valleys.

The frontier imposed on France in 1871 by the Treaty of Frankfort reached the crest of the Vosges, after cutting the gap of Belfort at the Ballon d'Alsace, and followed the watershed as far as the Donon; thence it changed direction from N. to N.W., and following a purely artificial line left all the upper Saar valley to Germany, cut the Seille at two points, and reached the Moselle 2,000 yd. below Pont-à-Mousson. From the military point of view this frontier left French Lorraine in a regular salient. General Sèré de Rivières, the far-sighted and skilful creator of the French defensive system, had therefore been compelled to go back to the Moselle to organize the barrier blocking the roads from the frontier. This barrier consisted of the two fortresses of Epinal and Belfort, connected by a line of forts along the upper Moselle. The importance of Belfort lay in the fact that it formed the right flank pivot of the whole defensive system, blocking as it did the gap between the Jura and the Vosges, and commanding the ground as far as the Swiss frontier. On their side the Germans had progressively strengthened the line of the Rhine by constructing the fortress Istein facing Mulhouse, improving the old strongholds on Huningen and Neubrisach, and turning Strasbourg into a great entrenched camp, extending its action by means of the forts of Mutzig and Molsheim as far as the Bruche valley.

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The Position in the middle of Sept. 1914.—The work carried on by either side for 40 years had made of the Vosges region a military area in which it was impossible to move without encountering some natural or artificial obstruction, defended on one side or the other by numerous garrisons. It was there, nevertheless, that hostilities between Germany and France actually started in the early days of Aug. 1914. After a few weeks fighting, however, the main offensives had been stopped in one place or another; and the position of the two adversaries towards the middle of Sept. was as follows:

On the western slope of the Vosges the Germans had been checked and obliged to retire on Sept. 7. In the Lunéville area they had maintained their hold on the Parois forest and Badonvillers. North of St. Dié, which they had evacuated on the 11th, they held the Ormont ridge and the vicinity of the Saales gap. On the Vosges crest their occupation of the Violu and the Bernhardtstein secured to them the pass of Ste. Marie-aux-Mines; a little further to the S. they held the Tête-de-Faux, commanding the Bonhomme pass. The pass itself was in the hands of the French, who, since the withdrawal of the army of Alsace, held all the crest from there to the south. The German counter-offensive had been stopped on this side facing the Schlucht on the summit of the Luige ridge, commanding the valleys of the Weiss and the Fecht; at Metzeval, blocking the upper Fecht valley, the Grand Ballon de Guebwiller was held by French outposts, and a French division occupied the Thur valley as far as Thann, the gate of the Sundgau. In the Sundgau itself the outpost line of the Belfort garrison had been pushed forward to Lauev, Mortzwiller, Dieffmatten, Traubach, Gommersdorf, Ballersdorf, Suarce, and Réchézy.

On the French side the forces in the Vosges consisted of three infantry divisions and ten Alpine groups, forming, under the command of Gen. Putz, a "Vosges group" attached to the army of Gen. Dubail. The troops in the gap belonged to the Belfort garrison and were under the governor-general Thévenet. On the German side the troops holding the gap of Saales belonged to von Falkenhausen's army detachment. Those in the Upper Vosges and the Sundgau belonged to the army detachment under von Gaede. Both consisted principally of Ersatz and Landwehr troops, von Gaede's strength being equivalent to five divisions.

From mid-Sept. onward the operations in the Vosges assumed the character of local and disconnected actions, always bloody and often prolonged. These actions may be dealt with here in succession, in each of the secondary theatres—the region of St. Dié, the eastern slope of the High Vosges, and the Sundgau.

The Region of St. Dié.—The Ormont ridge, on which the Germans halted after their retirement, was too close to St. Dié to be left by the French forces in their hands, and on Sept. 17 the 152nd were ordered to drive them from it. The task was no easy one, and for three days the gallant regiment of Gerardmer vainly attempted to maintain their footing on the slopes, which were stubbornly defended and swept by machine-gun fire. On the 20th it delivered a new surprise attack without preliminary bombardment from W. to S. The hostile resistance was as stubborn as ever, but after immense exertions two companies gained a footing on the summit, and despite fierce hand-to-hand fighting and heavy counter-attacks, the mountain remained in French hands at the price of 600 dead.

At the end of Oct. serious fighting took place around the Ste. Marie-aux-Mines pass for the possession of the Tête-de-Violu, commanding the pass to the west. After a series of actions, lasting from Oct. 31 to Nov. 12, the French Alpine troops held the hill, the pass itself remaining in the hands of von Gaede's Landwehr men.

On Dec. 2 Alpine troops stormed the Tête-de-Faux facing the Bonhomme pass on the Alsatian slope, thus securing the pass. On Christmas eve violent hostile attacks, intended to dislodge them, were repulsed by the bayonet and destroyed by the French artillery, and the enemy retired leaving over 500 dead.

The early months of 1915 were passed by both sides in entrenching themselves, but in April violent combats broke out for the possession of the promontory of the Ban-de-Sapt, N. of St. Dié, between Saales and Moyen Mautiers; the trenches were so close together and so strong that both sides had recourse to underground warfare. German and French mines and counter-mines were exploded one after the other, destroying the defences, and blowing great craters, the possession of which was hotly contested, with bomb and bayonet. After some months of this the French at the end of July had definitely secured possession of the Ban-de-Sapt by their occupation of hill 627, dominating the promontory and the hamlet of Launois in advance of it.

From now onward the positions on both sides were stabilized, and remained so for three years, during which trench mortars and machine-guns were daily in action, and frequent patrol encounters took place, without the fighting ever becoming as intense as during the first year of the war.

In Nov. 1917 the French were relieved by the Americans in the St. Dié sector, where the division under Menohery completed its training and underwent its baptism of fire.

The Eastern Slope of the High Vosges.—On the eastern slope of the High Vosges, between the Schlucht and Cernay, position warfare began in Sept. 1914. Trench systems were gradually dug and often hewn out of the rock. On the crests they were in places so near as to touch each other, and bristled with accessory defences. Elsewhere they were farther apart, separated by valleys and deep ravines. The German positions facing W. were close up against the mountains, but the Alsatian plain behind them facilitated the supply of materials, artillery and reinforcements, and by affording convenient billets rendered easier the task of the command. The French had the advantage of the ground, but there was no inter-communication between the valleys, the heads of which they occupied. The roads leading to the rear were poor, and the supply of ammunition and material of all kinds was proportionately difficult. Bivouacking on the crest was uncomfortable and even impossible in cold weather, while the exercise of command was much impeded by the poverty of communications.

The fighting in this region was necessarily of a local character, and exercised no influence on the general course of the operations; but owing to the stubbornness of the two adversaries its intensity was often such as to involve losses quite disproportionate with any possible results. On the French side the army detachment of the Vosges, under Gen. de Maud'Huy, thus became the VII. Army, which included practically all the available Chasseurs Italiens, while on the German side von Gaede's detachment also increased to the size of an army, in which some of the best troops of the German Empire often fought.

These local combats attained their greatest intensity during 1915, and the names of the sectors in which they took place, such as the Fecht and Linge valleys, and Hartmannswillerkopf, appeared in the communiqués for several months.

A severe winter, to which the troops were not yet inured, had for a time suspended operations, but at the end of Feb. 1915 the Germans became active in the Fecht valley, and after several vain attempts to push their line forward in front of Munster they occupied the Reichackerkopf on March 21. On April 17 the French retaliated by occupying the Schnepfenrieth, and a few days later the Sillackerkopf; once in possession of these two heights they drove the Germans from Steinbruck on the Fecht and advanced to the outskirts of Metzeral. During the whole of May fighting went on on both banks of the Fecht, and the French succeeded, after great efforts, in getting up sufficient artillery to render the valley untenable as far as Munster. They then between June 19 and 23 captured Metzeral and Sondernach, and picked up over 700 prisoners in the bottom of the valley. During the course of the following weeks the Germans made several attempts to recapture these villages, but without success, and eventually they turned their attention to the Linge ridge further to the north, activity in the Fecht being henceforward confined to artillery and patrols.

The Linge is a spur, some 3,000 ft. high, situated in front of the main ridge between the Weiss and Fecht valleys. The Germans had occupied it in Sept. 1914, and had constructed a maze of trenches with a thick belt of barbed wire and flanked by

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redoubts of machine-guns. Owing to the fact that the Linge hindered inter-communication between the upper Weiss and upper Fecht, the French decided in July 1915 to occupy it. The operation was an extremely difficult one, for it was necessary for them to come down from the heights, pass through a marshy valley, and scale steep rock-strewn slopes under hostile machine-gun fire; moreover the troops and supplies necessary for the operations had to be brought up from the rear by inferior mule tracks. After ten hours' intense bombardment, the assault was delivered on July 20 1915, and the struggle swayed to and fro uninterruptedly until the end of August. On this small peak there fell more than 50,000 shells; 7 German brigades came into action one after the other against 16 French Chasseurs battalions and 2 infantry regiments, and at the end of severe and costly fighting both sides remained face to face on the crest in trenches which were held unchanged until the end of the war.

The Hartmannswillerkopf, or, as the French soldiers soon began to call it, the "Vieil Armand," is a spur 95 metres high, thrown out to the N. of Cernay into the Alsatian plain by the Molkenrain (1,125 metres), itself an offshoot from the Ballon de Guebwiller (1,425 metres), the highest peak in the Vosges. This spur, with its steep slopes, commands the village from which it takes its name, at a distance of some 700 yards. Its sole advantage from the military point of view lies in the fact that it affords good observation over the Alsatian plain, from Isenheim to Mulhouse. The French therefore had advanced their outpost line up the Thann valley by Willer and Goldbach to the summit of the spur. Its possession by the French naturally annoyed the Germans, and on one wintry day in Jan. 1915 they surprised and captured the French post on the summit, and installed themselves there. In a short time they succeeded in transforming the position into a practically impregnable fortress. Trenches and belts of wire were constructed on all the crests, dug-outs were tunnelled out on the steep eastern slopes, a road was constructed to the summit, and aerial cable set up for the transport of supplies, and concrete shelters for troops and munitions erected, while subterranean passages gave access to all the advanced posts.

The loss of the Hartmannswillerkopf caused no apprehension to the French, who still remained in possession of the Grand Ballon and of the Molkenrain, nor could it even be said to cause them any real inconvenience, as they had no intention of taking the offensive in Alsace. Unfortunately pride spoke louder than reason, and a series of useless struggles, which the higher command did not intervene to stop, were undertaken to recover the lost position. The fighting went on for months under very difficult conditions for the French. On the slopes facing Goldbach the heroism and self-sacrifice of the French troops in their hastily dug trenches were unevenly matched against the facilities for defence and attack which had been accumulated by the patient labour of their enemies. Attack and counter-attack alternated during the whole of 1915, and French and Germans alike suffered fearful losses.

Of all these fruitless combats of 1915 the most characteristic were perhaps those which took place at the very end of the year. The 7th, 13th, 27th, and 53rd battalions of Chasseurs and the 152nd Infantry Regt. on the French side were engaged against the German 12th Landwehr Div., the 187th Ersatz brigade and parts of the 19th Reserve Division. On the cold winter morning of Dec. 21 the 152nd dashed forward under a crushing fire from trench mortars and machine-guns. Its waves advanced, broke, reformed, and advanced again, destroying with bombs every obstacle in their path; decimated but triumphant they reached the summit and even passed beyond it in their rush, chasing the routed enemy down the further slopes. At the end of the day the exhausted victors, who had made more than 1,500 prisoners, halted and passed the night where they were, without even being able to reform. The Germans meanwhile were concentrating a powerful artillery and massing their reserves to recover the lost ground. The German counter-attack took place on the morning of the 22nd. The French 152nd, extended in one long, thin line which was outflanked and broken through by the enemy, was exposed on the steep slopes to a hostile bombardment to which their own guns could not reply; it struggled desperately all the morning, although the men, exhausted by the previous day's fighting, had to make head against the onset of fresh hostile troops thrown in in whole battalions. After eight hours' fighting the heroic regiment was surrounded in the depths of the ravines, and amid the tangle of rocks was entirely overwhelmed. Forty-eight officers and 1,950 men were killed or taken; the rest cut their way out at the point of the bayonet, and rejoined the reinforcements which, though too late to succour their comrades, still held the summit of the "Vieil Armand." The Chasseurs hung on to the crest, and the fierce struggle continued for several more days until the Germans outflanked their position on the north and forced them to retire to their original lines.

A protest was made by the French Parliament against these useless sacrifices of Dec. 1915, and the Minister of War intervened to forbid all local actions not demanded by strategic considerations, and serving no purpose but to increase casualties. This put an end to the fighting which had made the name of the Hartmannswillerkopf famous throughout the world, and from now until the end of the war the two adversaries remained facing each other on the crest, and no further action took place save harmless exchanges of rifle fire. The actions of the Linge and the Hartmannswillerkopf had in this one year of 1915 cost thousands of human lives. Nowhere on the front had there been displayed more courage, more tenacity, more self-sacrifice, but the results had been absolutely *nil*.

From mid-Sept. 1914 onward neither of the two adversaries was in a position to manœuvre offensively in the High Vosges. The strategic defensive was here imposed on both alike by the course of the campaign, and by the local conditions. In the circumstances the task of the commanders was simply to observe the enemy, to strengthen their own positions, and to remain prudently alert without undertaking any local offensives which could only be foredoomed to failure.

The Germans, who disposed of ample resources and good communications in the Rhine valley, should have been content to hold the mouths of the Vosges valleys in strength, while keeping their reserves billeted in the Alsatian plain ready to manœuvre if necessary against any isolated columns which attempted to be debouched from the mountains. The French on their part had an excellent opportunity of applying to the existing situation on the Vosges crest the defensive principles adopted so successfully by Marshal Berwick in the Alps in 1709. A system of solid defences at the heads of the valleys, covered by small advanced posts and supported in rear by well sheltered reserves which could be rapidly moved to any threatened point, would have needed for its successful application a good road running N. and S. on the western slopes of the mountains and connecting up the roads to the various passes. Unfortunately no such lateral road existed, so that the Fecht and Thur valleys were absolutely isolated from each other. This fact explains, though it does not excuse, these attacks on the Linge and the Vieil Armand, which eventually assumed proportions far greater than had been originally intended.

In this respect however the situation began to improve after the spring of 1915. The Governor of Belfort then took in hand the construction of the good and well-concealed road between Massevaux and Willer, connecting the Doller and Thur Valleys. Later the commander of the VII. Army constructed another from the Thur valley road at Kruth along the heights, below the crest which passed behind the Schlucht and extended as far as the Luchpach pass. This new road, together with a few cross tracks, supplied the long-felt need of a lateral line of communication between Massevaux and the Bonhomme pass. It thus became possible to construct strong defensive systems on the heights, and to erect quarters for the reserves and supply parks served by aerial cables further back. A narrow-gauge railway was made from Bursang to Wesserling, so that by 1916 the VII. Army in the Upper Vosges was sufficiently well equipped to be able to fulfil its rôle with complete security. The Germans, on their side, refrained henceforward from partial attacks which could lead to no useful result. The sector thus became one of the

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quietest on the western front, and up to the end of the war no further fighting took place apart from artillery activity and patrol encounters. Morton's American division came into line here for the first time in 1918, prior to taking part in the decisive battles in that year on the Meuse.

Operations in the Sundgau in front of Belfort.—The headquarters of the 57th Div. had been transferred to Dannemarie on Sept. 18 1914. When this transfer had been completed, the offensive reconnaissances of the Belfort garrison were pursued with renewed vigour; they were even pushed as far as Altkirch and Waldighoffen, and their advance facilitated the occupation by outposts of the passages of the Largue between St. Ulrich and Seppois and the garrisoning of Pfetterhouse by custom-house officers from Chavannate. Toward the end of Sept. the organization of the Belfort garrison was unexpectedly changed by the departure of the active brigade which the Governor was ordered to despatch to the Meuse within 24 hours, and by the demands on its magazines made by the generalissimo in order to increase the reserves of the armies in the field. Batteries of 155 mm. short guns were formed from the artillery in the fortress; the stocks of 75 mm. ammunition were almost entirely depleted, and the loss of the active troops was not completely compensated for by the insufficiently trained territorial battalions which took their place, though the numbers in either case were about equal. As against this the Germans in the Sundgau were receiving important reinforcements; and the French reconnaissances, in the course of their daily encounters, met with an ever-increasing resistance. In view of these circumstances the Governor of Belfort made a careful calculation of his forces, and toward the end of Oct. proceeded to redistribute the troops which he considered could be allotted to the defence of the forward positions, leaving in the fortress only the minimum consistent with safety.

According to these arrangements the 57th Div. remained between Guvenhatten and Strueth as the centre, and, so to speak, the spinal cord of the new disposition. A northern group, equivalent in strength to a mixed brigade, held the interval between Guvenhatten and the Doller on its left, while a similar group was established on its right to occupy the front from Strueth to Pfetterhouse. The infantry of these two groups consisted only of territorial battalions, and the artillery of a few 75 mm. guns borrowed from the 57th Div., and some 90 mm. batteries formed from the reserve artillery of the fortress. All units were ordered to fortify their positions and to cover their fronts by means of heavy and medium calibre batteries borrowed from Belfort.

Two divisions of French reservists and territorials were thus in close contact with the enemy on a front of 20 m.—a line which would have been far too thin but for the fact that its flanks rested on the frontier and on the mountains, and its rear on Belfort. But the main strength of the dispositions lay in the fact that Belfort remained, for all the troops drawn from the garrison and operating in front of the forts, a centre of command which unified all their efforts, and a point of support which could sustain or receive them in case of need.

The new distribution of the French forces in the Sundgau marked the opening of a period of activity which was employed in consolidating the ground held, in rectifying the line, and carrying out small and methodical advances as far as the increasing hostile resistance permitted, until the limit of expansion permissible and the limited forces available was reached. The northern group first strengthened its position at Thann, establishing its heavy artillery on the heights of Roderen, and then established itself solidly on the left bank of the Soultzbach. It then swiftly assumed the offensive on Nov. 7; by the 10th it had pushed forward beyond Michelbach and thus rendered it impossible for the enemy to pursue his attacks against Thann, which was now in a pronounced re-entrant and could henceforward only be bombarded. On Dec. 2 Aspach-le-Haut fell to the combined efforts of the troops from Thann and those from Belfort, but the northern group was held up before Aspach-le-Bas and the Kalberg, which the Germans had converted into a regular fortress. It therefore turned its attention to the right bank of the Doller, occupied Pont d'Aspach station, penetrated on two separate occasions into Burnhaupt-le-Haut, but without being able to remain there, and finally established its right early in Jan. 1915 at the S.E. angle of Langelittenhag wood.

Meanwhile, in a series of successful operations, the 57th Div. had occupied Hecken, Falkwiller, Gildwiller, and penetrated into Buchwald and Keibacker woods. The advance of the northern group to Langelittenhag secured the division's left, and shortly after its front was firmly established on the eastern edge of the forest between the Soultzbach and the Spechbach. Beyond this forest lay the village of Ammertzwiller, which was strongly fortified and held; an attempt to storm it on Jan. 25 1915 failed owing to want of effective artillery support and lack of munitions, and was not repeated, and in front of Dannemarie, the villages of Balschwiller, Ueberkummen and Eglingen were taken and the 57th Div.'s front was pushed forward to the far bank of the Rhine–Rhone canal.

On the right of the 57th Div. the southern group, which was at first almost completely isolated, also set to work to gain ground by small partial offensives; the infantry advanced by slow degrees, consolidating the ground gained at each stage, and thus gradually succeeded in settling and straightening the general line of the front. On the extreme right it was pushed forward to the middle trench of the Largue, below Largin mill. At the same time the position of Pfetterhouse was put in a state of defence, and a 155 mm. battery was placed in position on the slopes S. of the village for counter-battery work against the hostile artillery near Mornach. In front of Seppois the occupation of the Largue valley was completed by the capture of the Entre-Largues salient, which encroached on the heights of Bisel, and further to the N. the southern group's outposts occupied a line in front of and more or less parallel to the Seppois-le-Bas–Largitzen road.

North of Largitzen the line of advanced posts was at first drawn in rear of a group of lakes in the middle of Hirtzbach wood. Later, when the southern group was reinforced, infiltration northward became possible, and the front was pushed forward to the eastern edges of the communal forests facing Carspach and Hirtzbach. Then on Jan. 25 1915, while the 57th Div. attacked Ammertzwiller, the southern group coöperated by advancing S. of the canal, the hostile positions were overrun and our troops crossed the Aspach road, but the check to the 57th Div. leaving them in a salient, they had to be withdrawn, having effected only a small permanent advance in Carspach wood. The action of Jan. 25 1915 was the last effort made to carry out an advance in the Sundgau. The outpost line of the Belfort garrison had then been advanced to a front from N. to S. along the edge of the Brickerwald in front of Michelbach, thence by Pont d'Aspach station, the S.E. corner of the Langelittenhag, the eastern edges of the Buchwald and of Gildwiller wood, Eglingen, the salients of Carspach wood and the communal forests, the crest of the slopes between Seppois and Bisel, the Entre-Largues and Largin mill. To the N. this outpost line joined with that in the Petit Doller, in front of Thann; to the S. it rested on a tongue of Swiss territory known as the Bec-du-Canard, between the Banholtz and Courtavon wood.

The Belfort garrison had employed the offensive-defensive method to the utmost possible limits in carrying on operations for five months, despite the constant depletion of its forces and munitions by the High Command, and in establishing itself firmly between the Petit Doller and the upper Largue; its resources in men, artillery and ammunition were too small to allow of more being done. The objects laid down by the governor in the dark hour at the end of 1914 had, moreover, been practically achieved. The fortress had been made strong enough to inspire a salutary fear in the Germans; the gap was barred and the barrier had been pushed far enough forward to secure Belfort against possible bombardment, save from the ineffective bombs of raiding hostile aircraft. Finally the Belfort troops had set foot as conquerors on the soil of Alsace—that soil whose inhabitants had twice been rendered desperate by the French retirements; they had re-established the prestige of their country at little cost in blood, and had had the honour of restoring to France a portion of her beloved lost provinces.

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From Jan. 1915 onwards, only patrol actions, exchanges of rifle fire and intermittent bombardments either of the trench lines or of the billets and communications in rear, disturbed the calm of the upper Alsatian front. Belfort was shelled from long range but remained inviolate. The front itself underwent no change, and in the hour of victory in Nov. 1918 it was still as the garrison of Belfort had made it at the end of 1914, close on four years before. For all that time the pivot on which rested the right flank of the Allied armies had remained firm, and these armies had been able to carry on their operations with no fear for their communications, while the centre of France, secured against attack, had been able to turn all its resources towards winning the war. (F. T.)

VOYSEY, CHARLES (1828–1912), English theistic preacher, was born in London March 18 1828. Educated at Stockwell grammar school and St. Edmund Hall, Oxford, he was ordained in the Church of England and held various curacies up to 1860, when he became curate of St. Mark's, Whitechapel. Thence he was ejected for heterodox doctrine, and went to St. Mark's, Victoria Docks, and later to Healaugh, near Tadcaster, where he was first curate and then vicar. But in 1869 he was summoned before the chancery court of the diocese of York for heterodox teaching, and deprived of his living. He appealed to the privy council, but the decision was upheld. He then established a theistic church in London, where he continued to preach and teach up to the time of his death. He died at Hampstead July 20 1912.

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WAGES.—In the following article, which should be read in connexion with those on COST OF LIVING and PRICES, the changes in wages during 1909–20 are considered.

United Kingdom.—In the movement of wages in recent years it is specially important to distinguish between rates of wages and earnings. Rates of wages are time-rates, sums payable for work in a definite time (hour, week consisting of a recognized number of hours and, rarely, a longer period) or piece-rates (sums payable for the performance of a definite task, or as additions to or in combination with time-rates, when the rate depends both on the quantity produced and the time taken in producing it). Earnings are the sums actually received by an employee, generally computed for a week or a year; the term is used specifically when the amount received on piece-rates is in question, and is also used to include payments for overtime in the case of time-workers. Time-rates are generally stated for the normal week or if the rate is an hourly one, as in the building trades, both for the hour and for the normal week; to get a comparable statement for piece-rates it is necessary to compute the average earnings of a number of men who worked normal hours. In modern times a statement of time-rates generally relates to rates agreed to by associations of employers and employees or umpired by the Government; these are frequently minimum rates and the relation between minimum rates and the average of those actually paid to a group of work-people can only be ascertained by special inquiries, such as those undertaken by the Board of Trade in 1886 and 1906. The assumption has to be made that between such inquiries average rates have kept the same proportion to minimum rates, which is only true over a short period and in the absence of disturbing causes. For piece payments the assumption that earnings move by the same percentage as the rates can never yield more than an approximation to the facts, and during the war such an assumption would be completely invalid even if reference was only made to earnings in a normal week, since there were very important changes in facilities for production, in the effort put into the work and in the nature of the work. In the absence of any general information about earnings, statistics in the war period must be confined to statements of time and piece-rates, which do not give a true picture of the economic position of the working class in that time; in 1920, however, industry was more nearly normal and overtime was relatively uncommon, so that a comparison of rates in 1920 and 1914 is not altogether misleading. In making such a comparison the general reduction of hours in 1918 and 1919 must be borne in mind; generally at the dates of reduction piece-rates and hourly rates were raised so as to give approximately the same earnings for the reduced as for the longer week, and weekly rates were the same before and after the reduction, but in some industries an increase for the week was arranged at the same time.

Table 1 shows the general movement from 1890 to 1914. The first column, computed from the XVII. *Abstract of Labour Statistics*, gives the average of a number of changes of time and of piece-rates. The second and third columns depend on additional data (see Bowley, *Elementary Manual of Statistics*, 1920, and Wood, *Statistical Journal*, 1909, p. 103, and 1912–3, p. 220), and give the computed averages based on the numbers in various occupations at the different dates, thus allowing for the relative increase of numbers in the better-paid industries. These figures should be taken in conjunction with the change in retail prices (*see* COST OF LIVING); the rise in wages from 1902 to 1913 was neutralized by the falling value of money.

Average annual earnings, allowing for unemployment and overtime, for all wage-earners in the United Kingdom (excluding shop assistants), men, women, boys and girls, are estimated at £51 in 1913 (*Change in Distribution of National Income*, Bowley, 1920, p. 13); average family earnings were probably between £95 and £100 annually. For full week's work the average earnings of a man were about 31s., for a woman 14s., for a boy 11s. 6d., and for a girl 8 shillings. There were very few changes between 1913 and the outbreak of the war.

Table 1.—Estimates of money earnings of all wages earners in the United Kingdom (expressed as percentages of their level in 1913).

	Not allowing for changes in relative numbers	Allowing for changes in relative numbers	
	Labour Abstract	Bowley	Wood
1890	86	83	83
1	87	84	83
2	86	84	83
3	86	84	83
4	85	84	83
5	84	84	83
6	85	84	83
7	86	85	85
8	89	88	85
9	91	90	88
1900	95	95	91
1	94	94	91
2	93	92	90
3	92	91	90
4	92	90	90
5	92	90	89
6	94	92	93
7	97	97	97
8	96	95	95
9	95	94	94
1910	95	95	95
1	95	96	..
2	98	99	..
3	100	100	..

The dates and amounts of increase of rates of wages in the period 1914–20 may be illustrated by the records in a number of selected industries. The summary in Table 2 is taken from Bowley's *Prices and Wages in the United Kingdom*, 1914–1920 (1921), pp. 105–6.

Table 2.—Estimate of movements of time-rates (for normal week) and of piece-rates in the United Kingdom, 1914–20.
(Average rates expressed as percentages of those in 1914).

	1914 July	1915 July	1916 July	1917 July	1918 July	1919 July	1920 July
Bricklayers	100	103	108	123	160	188	228
Bricklayers' labourers	100	103	113	133	180	225	284
Printers (compositors)	100	100	105	120	157	196	246
Railwaymen	100	110	120	155	195	225	280
Dock labourers	100	101	130	150	193	209	266
Cotton operatives	100	105	110	110	157	202	205
Woollen and worsted operatives	100	115	126	144	164	196	239
Engineering artisans	100	110	111	134	173	199	231
Engineering labourers	100	..	..	154	213	255	309
Shipbuilding: Platers' time-rates	100	..	..	130	169	193	223
Coal-mining	100	113	129	136	187 Aug.	224	260 May 254 Aug.
Agriculture: England and Wales	100	112	..	..	189	226	277
General rough average of percentages	100	105 to 110	115 to 120	135	175	210	255 to 260

The increases in the first two years of the war often took the form of a weekly war-bonus of the same amount for artisans and labourers (in some cases greater for the latter) to meet the rise of food prices (*see* COST OF LIVING and PRICES). In 1917 the usual method of changing miners' wages by percentage was replaced also by flat increases of 2s. or 3s. a shift to all underground workers, and no percentage increase was given till March 1920. In engineering and other trades in which munition work formed an important part an addition of 12½% to time-workers and 7½% to piece-workers reckoned on weekly earnings was awarded in

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1917–8, but all time-rates (artisans and labourers) in engineering had been raised 7s. weekly before this award, and after it subsequent increases were a flat weekly rate for time-workers and piece-workers alike. Before the war certain proportions had been established, by the working of economic forces modified by collective bargaining, between the earnings (whether time or piece) in various occupations and industries; the effect of these uniform increments was to modify these proportions very considerably. Some of the results are evident from Table 2 (p. 939) and can be studied also in the subsequent tables. In the six years building and engineering and dock labourers' wages had increased by a markedly greater percentage than those of building or engineering artisans or of compositors. In 1914 the bricklayer's labourer's wage was two-thirds of the bricklayer's, in 1920 it was nearly nine-tenths. To some extent the result was due to a definite effort to raise the standard of living of the lowest-paid workers; the minimum rates fixed by the Trade Boards were in 1920 generally three times those in 1914; agricultural wages in Dorset were raised from about 14s. to 46s. but in Yorks from about 21s. to only 49s. No such tendency, however, is observable in the cotton industry, where the old method of percentage changes has been maintained; in the woollen industries percentage changes are still the rule, but increments are not given on the amount by which any pre-war earnings exceeded 30 shillings. In the reductions made in the early part of 1921 there was an expressed desire on the part of the workers that decreases should be uniform for all grades; reductions on this basis tend to restore the pre-war proportions.

Most wage arrangements from 1917 to 1921 were dominated by the increase and subsequent decrease in the cost of living. The woollen industry was the first to arrange changes by a definite formula relating them to the official index number of that cost (Sept. 1919). The railway agreement of Jan. 1920 included a similar formula, and some other industries have followed the same plan. Generally the increase on wages is somewhat less by the formulæ than if the percentage changes of the index number were applied to the whole of standard wages, *e.g.* the railwayman gets only 1s. when the index number rises 5% of its 1914 level, which would only be sufficient if his standard wage was 25s. or under, if the official index truly measured the cost of living; a fall in prices is therefore to the advantage of persons whose wages are thus determined.

Besides the movement already described there has been a tendency to remove local and occupational differences in wages by levelling up lower rates to higher. As a result of the Transport Workers' Inquiry (1920) the rates in all ports were raised to 8s. for the four hours half-day, whatever the previous amounts, and some differential payments for special work were abolished. In successive awards of minimum wages in agriculture the county minima show less deviation. In 1917 the increases since 1914 in all engineering wages were levelled up to 7s. whatever the previous advances, but this award and subsequent national flat increases do not include all increases; nominally the rates in Jan. 1920 were pre-war time-rates + 7s. to make permanent time-rates, + 26s. 6d. war wage, + 12½% on earnings. Actually the average of 120 districts for ironfounders shows an increase of 8s. 8d. in permanent time-rates and that of 189 districts for turners an increase of 9s. 2d.; these increases in the averages arise from the fact that in the districts where wages were much below the average in 1914 the increases were 12s. or more, and throughout the list it is seen that the lower the wage the greater the increase. In the printing trade before the war wage changes were made by local bargaining, but in May 1919 the districts in England and Wales were arranged in six groups and the London district, and the standard rates were fixed at 77s. 6d. (minimum time-rate, compositors, jobbing) in London, 75s. in Liverpool and Manchester, and 3s. less in successive groups till in the lowest it was 60 shillings. Subsequent wage changes have been flat national increases, amounting by June 1920 to 17s. 6d. Prior to the grading there was considerable variation within each group. In other industries, also, there has been a tendency to standardize wages in groups of localities and to make changes nationally. The movement is partly connected with a desire to establish a national minimum and to raise the wage of the worst paid, and partly to avoid competition from low-paid districts and a consequent cutting of rates. It is doubtful how far the pre-war rates were differentiated by economic causes, the local demand for the products of the industry, the possibility of family earnings because of the presence of other trades, the relative cost of food and rent, and how far by accident and custom. It is certain that where real wages were specially high the most skilled workmen were to be found. The partial removal of these differences must have wide-reaching effects on local distribution of industry, whatever their cause. Also the change in the proportion of wages of different grades, discussed in the previous paragraphs, must tend to diminish the supply of skilled labour.

The rates expressed by the percentages in the preceding tables are all for the normal week. After the Armistice English workmen were at first more anxious to secure better conditions of work than higher wages, especially as it was not then anticipated that prices would rise further. In 1918 and 1919 an 8-hour day was generally adopted. More correctly this should be described as a 48-hour week in many industries; *e.g.* in textile factories 48 hours are distributed between Monday to Friday and Saturday morning, whereas in building and dock labour overtime is payable after eight hours on any day and there is a Saturday half-holiday; the normal week is 44 hours. In mines, hours per shift were reduced from eight to seven, and, if 11 shifts are worked in a fortnight, weekly hours from 44 to 38½. In many industries work is done in two spells instead of three in a day, work before breakfast being abolished; this tends to diminish lost time, but in other cases the time lost in starting and stopping is taken out of a shorter day and is relatively more important. There are no sufficient figures to show what has been the net effect on output, but if output per hour of nominal work has neither increased nor diminished, and there are no compensating factors, wage-cost per unit output rose in the six years 1914 to 1920 not in the rates 100 to 255 or 260 as in Table 2, but 100 to 280 or 290, since weekly hours have diminished more than 10%.

In the following paragraphs details of wage changes are shown for a number of industries, in illustration of the general movements now outlined.

Time-rates.—In Table 3 illustrative figures are given. London builders' summer hours were reduced from 50 to 44 weekly between July 1919 and July 1920. Leeds and Birmingham turners' hours were reduced from 53 to 47 and Manchester printers' from 50 to 48 between July 1918 and July 1920. London dockers' daily hours were reduced from 10 to 8 between July 1918 and July 1919. No other changes of hours took place in the period. Turners' rates are typical of artisans in the engineering trades.

Table 3.—Illustrative standard time-rates of wages.

	London		Leeds	Birmingham	Manchester	Port of London
	Bricklayer	Bricklayer's labourer	Turner		Printer (compositor)	Docker
July	Hourly rates		Weekly rates		Weekly rates	Daily rates
1909	10½d.	7d.	34s.	37s.	36s. 6d.	5s.
1914	11½d.	8d.	37s.	38s.	38s. 6d.	5s. 10d.
1915	11½d.	8d.	40s.	40s.	38s. 6d.	6s. 4d.
1916	12½d.	9d.	41s.	43s.	40s. 6d.	6s. 10d.
1917	13½d.	10d.	49s.	51s.	50s.	7s. 10d.
1918	15½d.[1]	11½d.[1]	57s.[1]	59s.[1]	70s.	10s. 6d.
1919	21d.	17d.	65s. 6d.[1]	67s. 6d.[1]	75s.	11s. 8d.
1920	28d.	25d.	76s. 6d.[1]	78s. 6d.[1]	92s. 6d.	16s.

[1] In these cases 12½% was added to the weekly earnings, whether they were as here stated for normal hours or increased by overtime. Thus the bricklayer's effective rate in July 1918 was 18·9d. per hour.

Building.—The general movement of builders' wages in the United Kingdom is shown in Table 4 (XVII. *Abstract of Labour Statistics*, Cd. 7733, p. 66; *Labour Gazette*, May 1919, p. 172, April 1920, p. 170, and Feb. 1921, p. 62). The increase from 1909 to the end of 1913 was 4·4%. The lesser percentage for weekly than for hourly rates, shown in Table 4, is due to the reduction

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Table 4.—Average of rates in a large number of towns.

	Bricklayers				Painters				Builders' Labourers			
	Hourly		Weekly		Hourly		Weekly		Hourly		Weekly	
	Amount	Percentage	Amount	Percentage	Amount	Percentage	Amount	Percentage	Amount	Percentage	Amount	Percentage
1914 Aug. 4	9·9d.	100	40s. 7d.	100	8·8d.	100	36s. 3d.	100	6·5d.	100	26s. 11d.	100
1919 April 30	18·6d.	188	..	..	17·9d.	203	..	..	14·9d.	229	..	..
1920 Feb. 29	22·0d.	223	83s. 7d.	206	21·5d.	244	81s. 5d.	224	18·5d.	284	70s. 3d.	261
1920 Dec. 31	27·5d.	278	100s. 10d.	248	27·1d.	308	99s. 3d.	274	23·8d.	365	87s. 3d.	324

of hours. It will be seen that nearly the same number of pence per hour was added in each occupation; and consequently the percentage increase is the greater the lower the initial wage.

Engineering.—Similar figures are given in Table 5 for engineers. The increase from 1909 to the end of 1913 was 3·6%. During 1915 increases of 3s. or 4s. were given to the majority of artisans and labourers in the engineering trades on time-rates, and 7½% or 10% on piece-rates and in 1916 a similar increase on time but not on piece. In April 1917 permanent time-rates 7s. (in some cases 8s.) and piece-rates only 10% above the pre-war level were arranged for both artisans and labourers, merging the former increments. War bonuses were subsequently granted as follows: April 1917 5s., Aug. 1917 3s., Jan. 1918 5s., Aug. 1918 3s. 6d., Dec. 1918 5s., Dec. 1919 5s., March 1920 and May 1920 each 3s. and 7½% on piece-rates.

Table 5.—Average of weekly time-rates (including bonuses) in a large number of towns.

	Turners		Moulders		Labourers	
	Amount	Percentage	Amount	Percentage	Amount	Percentage
1914 Aug. 4	38s. 11d.	100	41s. 8d.	100	22s. 10d.	100
1919 April 30	76s. 10d.	197	79s. 10d.	192	58s. 3d.	255
1920 Feb. 29	82s. 5d.	212	85s. 6d.	206	63s. 11d.	280
1920 Dec. 31	89s. 2d.	229	92s. 3d.	221	70s. 4d.	304

In addition to these increases, aggregating 39s. 6d. for time-workers and 25% for piece-workers, an addition of 12½% on weekly earnings was granted to skilled munition time-workers in Oct. 1917, and a similar 7½% to piece-workers in Jan. 1918. This new increase was extended during the early part of 1918 to unskilled munition workers, to all engineers, to builders first on munition work and then to all, to iron and steel manufacturers, and to a number of allied trades.

By June 1920 a turner's wage for a normal week of 34s. in 1914, had increased to at least 73s. 6d. + 12½% = 82s. 8½d. A labourer's wage had increased from 22s. to 69s. 2½d.

Hours in engineering were generally reduced in Jan. 1919 from 53 or 54 to a uniform 48 weekly.

The increases awarded to piece-workers were less than those to time-workers because the former were during the war able to work with greater facility and to make a great amount of overtime. The earnings of time-workers were also greater during the war; that is indicated by the above rates for normal hours.

Railways.—Earnings of all workmen employed by railways averaged 25s. 4½d. in a selected week in Dec. 1909, and 25s. 10d., 26s. 8½d., 27s. 4½d., 27s. 11d. in successive Decembers; the increase from 1909 to 1913 is 10% (XVII. *Abstract of Labour Statistics*, p. 66). The average for a normal week, however, when overtime earnings are omitted, and men employed in railway workshops are excluded, is estimated at only 26s. 6d. at the end of 1913.

A flat increase was given to all grades in Feb. 1915 of 3s. to men earning less than 30s., 2s. to those earning more. In Oct. 1915 this was raised to 5s. for all, in Sept. 1916 to 10s., in April 1917 to 15s., in Nov. 1917 to 21s., in April 1918 to 25s., and in Nov. 1918 to 33s.; at the last-named date the average wage for the normal week was about 59s. 6d.

In Aug. 1919 for drivers and firemen, and in Jan. 1920 for other grades, new standard rates were established at about 38s. above the pre-war level, and at the same time wages of the worse-paid grades and districts were levelled up. In Jan. 1920 a sliding scale of wages was introduced by which all wages were to rise or fall 1s. weekly for every five points that the cost-of-living index number rose or fell above its level in Dec. 1919 (125% above the pre-war level), but wages were not to fall below certain levels well above those of 1914. In addition to these changes a general increase was granted in June 1920 varying from 2s. to 7s. 6d. or 8s. 6d. and perhaps averaging 4s. 6d. Under the cost-of-living scale wages were raised 3s. in April, 2s. in July, 2s. in Oct. 1920 and 1s. in Jan. 1921 and reduced 4s. in April 1921.

In 1919 the week was reduced to 48 hours, beyond which overtime rates were payable (see *Labour Gazette*, Oct. 1919, p. 416, and June 1920, p. 290).

Agriculture.—In England and Wales the average cash weekly wages of ordinary agricultural labourers were estimated in 1907 at 14s. 9d., earnings (including piece payments, etc.) at 16s. 8d., and allowances in kind (including low rent) at 10d., making 17s. 6d. in all (Cd. 5460). Cash wages rose about 3½% by the end of 1913 according to one estimate (XVII. *Abstract of Labour Statistics*, p. 66) which gives 15s. 3d., but are computed at 15s. 10d. (with allowances at 1s.) in the estimates quoted in the *Report of the Committee to Inquire into the Cost of Living of Rural Workers* (Cmd. 76, p. 23, 57 *seq.*); in this report estimates are also given for 1918. By April 1915 average cash wages had risen to 17s. 10d. and by Aug. 1917 to 22s. 3d. (*Labour Gazette* June 1915, p. 200 and July 1917, p. 239). In Aug. 1917 a minimum rate of 25s. (to include the estimated value of allowance) was established by Parliament; in the summer of 1918 minimum rates were established for each county ranging from 30s. to 36s.; in May 1919 the range became 36s. 6d. to 42s.; in May 1920 a further increase was given, especially large in the lower-paid counties, making the range 42s. to 48s., and in Aug. 1920 they were further raised by 4s. (in two counties 4s. 6d.), making the range 46s. to 52s.: the lower rate applied to 35 out of 52 counties, and 52s. was paid in Cheshire alone, where the recognized hours were 54. In the fixing of minimum wages the hours of work corresponding to them are defined and overtime rates are payable for additional hours; in June 1919 the summer week was 54 and the winter 48 hours, and in Oct. 1919 summer hours were reduced to 48.

Piece-Rates—Cotton.—In the cotton trade no alteration was made in the method of arranging wage changes during the war. The wages of the great majority of operatives are paid by piece-rates, which are fixed in relation to standard lists, and changes are made by adding a general percentage to all rates depending on the standard. In recent years local differences have been merged and piece-rates in Lancs. and Cheshire move in accordance with percentage changes either in the preparing and spinning Bolton or Oldham lists or with the Blackburn and uniform weaving lists. Table 6 shows the changes from 1909 to 1921. Changes took place only at the dates shown till after April 1921. In July 1919 the weekly hours were reduced from 55½ to 48, and piece-rates were raised in the ratio 215:245 (= 48: 54·7) to compensate. If the hourly output had been exactly maintained, the increase above the standard would have been 172½% in May 1920.

Earnings, however, depend not only on piece-rates but also on the number of hours and efficiency of work, and are affected by modifications of machinery and in management. The *Labour Gazette* gives monthly statistics of earnings from which it can be judged that (after an acute depression at the beginning of the war) they rose more rapidly than piece-rates in 1916 and 1917. Subsequent movements are indicated by Table 7 (Bowley, p. 179).[1]

[1] These are the earnings of all persons employed by certain firms and are affected to some extent by changes during the war.

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Earnings increased as rapidly as rates in 1919 and the first half of 1920, after which there was a depression in trade.

Table 6.—Piece-rates of cotton operatives. (Percentages of recognized standards.)

	Preparing & Spinning.	Weaving.
1909	105	100
1912	..	105
1915 June	110	105
1916 Jan.	110	110
June	115	110
1917 Jan.	115	115
Feb.	125	115
July	125	125
Dec.	140	
1918 June	165	
Dec.	215	
1919 July	245	
1920 May	315	

Table 7.—Piece-rates.

	Piece-rates	Earnings
1914	100	100
1918 Jan.	133	142
June	157	143
Aug.	157	156
1919 Jan.	205	215
June	205	211
July	233	220
Aug.	233	228
1920 April	233	239
May	300	310
June	300	302

Wool and Worsted.—In these industries the organization of wages and their changes is less standardized than in the cotton industry, and a much larger proportion of operatives are paid by time. Between 1909 and 1914 we have to depend on employers' statements to the Board of Trade (*Labour Gazette*, monthly) of average earnings, and from these it appears that earnings increased in the ratio 93 to 100 in these five years, whether owing to changes of rates or to better trade.

During the war earnings advanced very rapidly owing to the great demand for woollen goods, and the following figures relate to time-rates for the normal week or to piece-rates.

The most complete statement for the first three years of the war relates to the Huddersfield district. Here weekly bonuses were given to all workers (whether on time- or piece-rates) in rough proportion to their pre-war earnings, as follows: April 1915 6d. to 2s., Jan. 1916 6d., April 1916 1s. to 2s., Oct. 1916 1s. to 2s.; in Jan. 1917 the bonuses were increased especially to those with the highest earnings and the aggregates since July 1914 were 3s. 6d. to all earning 10s. weekly or less before the war, 5s. to those earning between 10s. and 15s., 6s. 6d. to women earning over 15s. and to men earning 15s. to 20s., and 10s. to men earning over 20 shillings.

In June 1917 a common system was arranged for most of the districts and occupations in the Yorkshire woollen and worsted industries. Instead of the war bonuses 50% was added to the time-rates customary before the war and this was increased successively to 60% in Oct. 1917, 72½% in March 1918, 81¼% in Aug. 1918, 104¼% in Nov. 1918 and 107% in Feb. 1919; after March 1918 the percentage was only given on 30s. if the basic rates exceeded this sum. Male piece-workers were given $\frac{1}{2}\frac{1}{3}$ths and female piece-workers $\frac{1}{2}\frac{1}{3}$ths of these sums, the percentages being based not on piece-rates but on pre-war earnings. In the spring or summer of 1919 an additional 10% was added to the basic rates. From Sept. 1919 the increases were related to the cost-of-living index number, and the addition moved upwards 10% on the original basic rates for every complete 10 points added to the cost-of-living number, these increments were at first not applied to the 10% added in 1919, nor to the excess of basic wages over 30s., and consequently rates moved rather less rapidly than the cost of living as officially measured. In Dec. 1920 the "cost-of-living" wage was 175% of the basic rate, and owing to other changes the whole increment (to operatives where pre-war earnings were under 30s.) reached 216% for time-workers, 181% for male piece-workers and 190% for female piece-workers.

Hours were reduced in March 1919 from 55½ to 48 weekly, and in compensation piece-rates were increased 15% in addition to the increments already described, while weekly time-rates remained unchanged.

Coal-Mines.—The majority of men working in or at coal-mines in the United Kingdom are paid piece-rates, which used to be increased or lowered by agreed percentages in the various districts at frequent intervals, subject to a minimum day's payment for underground workers. The percentage levels reached in the principal districts from 1909 to 1917 are shown in Table 8.

Table 8.—Piece-rates in coal-mines (expressed as percentages of their amount) in July 1914.

	Northumberland	Durham	Federated Districts	South Wales	Scotland	General average
End of 1909	86	92	91	89	86	90
1910	87	91	91	91	86	90
1911	84	88	91	90	86	89
1912	92	93	94	95	97	94
July 1914	100	100	100	100	100	100
" 1915	109	107	115½	111	118	113
" 1916	141	120	127½	132	136	129
Feb. 1917	147	132	132½	146	136	136

In Sept. 1917 the adjustment by percentages in the different districts was given up, and, the mines being controlled by the Government, uniform movements over the whole country were arranged. In Sept. 1917 and also in June 1918 uniform increases of 1s. 6d. per day or shift were granted to all men, and a further increase of 2s. in Jan. 1919 resulted from the reports of the Coal Industry Commission. Evidence to this Commission showed that the average of all workers before the war was 6s. 6d. per shift and in Nov. 1918 as a result of the percentages increases and the bonuses of 3s. was 12s. 6d. In July 1919 the maximum time of a shift was reduced from eight to seven hours, piece-rates being increased to compensate for the shorter time. In March 1920 an increase of 20% on the wages paid before Sept. 1917 was added, bringing the average to nearly 17s. a shift; in Oct. 1920 after a strike further increases in proportion to any increase in output were arranged; in the early months of 1921 the demand for export coal fell off, and when control was removed on April 1 the miners refused to work at the lower rates offered.

Iron and Steel Manufacture.—Wages in these industries are generally related by a sliding scale to the selling price of the product. The movements in different districts have been so divergent that it is not possible to give a summary account of their results, but the following figures are illustrative.

In Cleveland (Yorks) ironstone mining, on Aug. 1917 piece-rates had risen 60% over those of July 1914; from that date to April 1920 the same additions were made as in coal-mining.

In Cleveland and Durham pig-iron manufacture, blast-furnace operators' wages were in successive Julys, 1915 to 1919, respectively 8, 31, 44, 57, and 92% above July 1914, and in Oct. 1919 108% above. In Nov. 1919 a new percentage basis was changed. In addition a bonus of 5d. per shift was added in Feb. 1915 and raised to 10d. in April 1917, and a war wage of 1s. 6d. per shift was added in Aug. 1918.

In Northumberland, Durham, and Cleveland iron manufacture, iron millmen's rates were in Julys, 1915 to 1920, respectively 7½, 50, 67½, 82½, 147½, and 187½% above those of July 1914; some bonuses were granted but merged in subsequent increases.

Minimum Wage under the Trade Boards Acts.—Under the Trade Boards Act of 1909 minimum wages were established in the following industries. Chainmaking (1910), lace finishing

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(1911), paper box making (1912), tailoring (1912), confectionery (1915), shirtmaking (1915), tin box manufacture (1915), hollow ware (1916). Under a subsequent Act of 1918 new powers were given to the Ministry of Labour, and a number of other industries in which the organization of the workers was imperfect and the wages low were included in the scope of the Acts. The Acts are not confined to women's wages only, but affect numbers of men in tailoring and other industries.

The hourly rates fixed in 1912–6 for women varied from 2½d. to 3½d., the lowest in 1914 being 2¾d. The rates rose gradually during the war, but in many cases, owing to the higher earnings possible to women in munitions and other work, more than the minimum rates were in fact paid. More considerable increases took place in 1919 and 1920, and by the end of 1920 8½d. or 9d. was the common rate. A normal week, usually 48 hours, has been fixed, after which higher overtime rates are payable. Piece-rates are fixed so as to give an average worker more than the minimum time-rate.

Wages in other Countries.—Apart from the United States, there are very few authentic computations of the general movement of wages or earnings during the war. Sporadic statements of wages in particular industries exist, but they are of little use when a general view is desired. So far as the information goes it indicates that wages in the neutral and Allied countries followed much the same course as in the United Kingdom. The nominal weekly rates increased later than prices in 1914–8 and gained rapidly (in spite of reduction of hours) in 1919–20, till at the beginning of the depression in the autumn of 1920 it was doubtful whether wages expressed in commodities were higher or lower than in 1914.

The following paragraphs summarize the available statistics. For their relation to prices *see* Cost of Living.

Norway.—Up to the summer of 1918 wages as a whole appear to have increased about 90% since 1914. For April 1919 we have detailed statements such as follow, which indicate a general increase of 160 to 180%. Wage rates are compared with those in 1914 taken as 100. Bricklayers, urban 254, rural 271; carpenters, urban 282, rural 279; bricklayers' labourers, urban 291; excavators, urban 301, rural 281; urban painters 281, bakers 288, shoemakers 309, tailors 244, carters 282, dressmakers 238, laundry workers 229; agricultural labourers (not provided with food and lodging) 279; State employees, railway guards, etc., 276, gangers and pointsmen 264, head engine drivers 231, assistants 261, postmen 258. By new collective agreements in April and May 1919 hourly earnings in factories were increased till in July 1919 they are stated at 341 (1914 = 100), but weekly hours were reduced from 55½ to 48. Unskilled labourers' rates are stated as 388 in Nov. 1919.

Finally an employers' association estimated that in May 1920 skilled adults' hourly wages were 382 in export industries, 398 in other industries, 349 in handicrafts, and for women generally 407, as compared with 100 in 1914.

Denmark.—Hourly wages generally: 1914, 100; 1918, second quarter 170, third quarter 200; 1919, first quarter 224, second 257, third 338, fourth 352; 1920, first quarter 358, second 376, third 398. During 1919 daily hours were reduced till they were generally 8 in 1920 as compared with 10 in 1914. In 1919 (third quarter) hourly wages on the same basis were for male workers, skilled 330, unskilled 366, and for women 353. In April 1920 collective agreements made future changes proportional to the cost of living.

Greece.—The Minister of National Economy (Greece) gives the figures shown in Table 9 for Athens as corresponding closely with those for other parts of Greece.

Table 9.—Wages in Greece.

	Drachmas	
	1914	1920
Daily wage-earners:		
Dockers	3·50 to 4	30 to 40
Bricklayers	4 to 4·75	18 to 20
Carpenters	4 to 7	18 to 25
Painters	5 to 6·50	20 to 25
Smiths	4 to 6	15 to 20
Printers	3	17 to 25
Turners	3·80 to 6·50	8 to 15
Boiler-makers	3·50 to 6·50	12 to 15
Fitters	2·50 to 6·50	6 to 16
Tailors	6 to 7	25
Miners	3 to 5	5 to 10
Monthly wage-earners:		
Corn mill workers	100 to 140	305 to 420
Textile operatives	180 to 200	720 to 820

Germany.—It is estimated that earnings including overtime had increased 34% in industries generally between March 1914 and Sept. 1916, while hourly rates had probably increased 25%. In Sept. 1918 the average daily wage of male adults is stated as 12·46 marks and of women 6·01 marks, compared with 5·17 and 2·28 marks in March 1914 (241 and 264 if the earlier wages are taken as 100). The Federal Statistical Office gives weekly earnings for male adults as 35 marks for the year ending July 1914; if this is taken as 100 subsequent figures are Aug. 1919 286, Feb. 1920 486, Nov. 1920 686. Factory inspectors at the end of 1919 reported a tendency to approximation between wages of unskilled and skilled workers.

Austria.—The Austrian Trade Union Commission reported that in Oct. 1920 men's wages (in currency) were from 22 to 27⅓ times the rates in July 1914 and women's 20 to 25 times.

New Zealand.—The *Official Year Book* for 1919 contains an elaborate analysis of the minimum wages payable from 1901 to 1919 in 26 occupations. Wages do not necessarily move exactly with their minima, but in unskilled trades they are in fact generally the rates paid. The results are shown in Table 10, the level in 1911 being taken as 1000 in each occupation.

Table 10.—New Zealand. Minimum hourly rates.

	Skilled occupations	Semi-skilled occupations	Unskilled occupations	General average (weighted in proportion to the numbers in occupations)
1901	929	915	940	932
1905	964	939	955	954
1910	992	991	1001	996
1912	1009	1006	1004	1006
1913	1024	1067	1025	1036
1914	1073	1078	1102	1087
1915	1073	1086	1113	1094
1916	1095	1147	1193	1152
1917	1124	1188	1250	1200
1918	1208	1247	1297	1258
1919	1352	1439	1451	1418

The occupations included are bakers, boiler-makers, bookbinders, paper-makers, bootmakers (male), bricklayers, builders' labourers, butchers, carpenters, coach-builders, coal-miners, drivers (horse), engineers, fell-mongers, flour millers, freezing works employees, furniture makers, grocers' assistants, iron and brass moulders, painters, plasterers, plumbers, seamen, slaughtermen, tailoresses, waterside workers, and woollen mill operatives (male). The *Year Book* for 1920 (p. 279) gives statistics for average wages in all but the smallest factories and workshops (Table 11).

Table 11.—New Zealand. Average annual wages.

	Males		Females	
	Amount	Percentage	Amount	Percentage
1900–1	£81·9	71	£31·3	62
1905–6	88·5	77	41·9	83
1910–1	115·1	100	50·6	100
1915–6	133·5	116	56·7	112
1918–9	159·4	139	68·8	136

Australia.—The *Official Year Book* for 1920 contains two statements relating to recent movements of wages from which Tables 12 and 13 are compiled. About 240,000 males and 80,000 females of all ages are included in the returns.

Table 12.—Australia. Average annual payment per employee.

	Males		Females	
	Amount	Percentage	Amount	Percentage
1913	£123·3	97	£47·7	97
1914	126·9	100	49·5	100
1915	128·0	101	50·2	101
1916	133·7	105	50·8	103
1917	143·5	113	54·5	110
1918	146·1	115	58·4	118

Table 13.—Australia. Average weekly wages in industries.

	Adult Males		Adult Females	
	Rate	Percentage	Rate	Percentage
	s. d.		s. d.	
1914 April	55 2	100	27 2	100
1914 Dec.	55 7	101	27 5	101
1915 "	56 6	102	27 4	101
1916 "	60 8	110	28 5	105
1917 "	64 2	116	30 5	112
1918 "	66 5	120	31 9	117
1919 "	74 11	136	37 1	137

(A. L. Bo.)

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United States.—That a large proportion of unskilled workers in the United States was paid wages, even in 1921, far too low for decent self-support is a fact confirmed by many wage investigations and well known even to those only slightly familiar with industrial conditions. Before the era of unprecedentedly high prices caused by the World War, it was the consensus of expert opinion that a weekly wage of $8, or more, was necessary under urban conditions for the maintenance of a self-supporting woman in simple decency and working efficiency, and that a man with a wife and three children needed $15 to $20 weekly. Yet a study made in 1914 of women's wages in the United States led to the conclusion that 75% of female wage-earners received less than $8 weekly, 50% less than $6 and 15% less than $4; and that the incomes from these wages were further reduced approximately 20% through lost time and unemployment. The pay of unskilled male workers was at a correspondingly low level. Frank H. Streightoff, in his discussion of American standards of living, estimated that at least 6,000,000 adult males, married as well as single, received less than $600 a year, or $12 a week. More intensive investigations bore out these figures. The U.S. Immigration Commission in 1907–10 studied many typical households of both native- and foreign-born, in 16 industries, and found that more than half the male heads of families earned less than $500 a year, and nearly two-thirds less than $600. The New York State Factory Investigating Commission examined the pay-rolls of over 2,000 stores and factories during the autumn, winter and spring of 1913–4, a year which may be regarded as normal, and found that of 57,000 women and girls, approximately 34,000, or 60%, earned less than $8 in a typical week. Of 14,000 married men, 7,000 earned less than $15. The causes of these low wages were: the lack of strong labour organizations and collective bargaining among this group of wage-earners; the belief of unskilled women wage-earners that their work was temporary; and the competition of married women who were only partially self-supporting; also a failure on the part of employers to recognize a relation between wages and productivity. In the United States, until the outbreak of the World War, the situation was further complicated by the stream of immigration, which furnished an abundant supply of cheap labour and provided still another barrier, in the shape of divergent language and customs, in the way of union organization.

During the war the wage level was appreciably raised, but owing to the great rise in prices that accompanied the change it is doubtful whether real wages were materially increased, except perhaps in a few war industries and in certain occupations covered by especially liberal Government wage awards. The average rate of wages failed to keep pace with the rising cost of living. Between Nov. 1918 and Jan. 1919 a study by the New York Industrial Commission of the earnings of 32,000 women in the same industries which had been covered by the Factory Investigating Commission in 1913–4 indicated that 60% of those in factories and 61% of those in stores received less than $14 a week, the equivalent of $8 in 1913. The average weekly wage of both sexes in many representative New York factories was $24.83 in Sept. 1919, while in eight large industries for which data were collected by the National Industrial Conference Board, the average weekly wage for male workers was $24.24 in Sept. 1918 and $23.37 in March 1919. In the skilled trades the effect of trade unionism was to increase wage rates: union minimum rates as provided in agreements with employers rose above the 1913 rate 99% for hourly rates and 89% for full-time weekly rates, exclusive of overtime, paid for at an increased rate.

The demand for increased wages has been the most frequent cause of strikes since 1915, as was to be expected in a time of steadily advancing living costs. Many of the strikes or threatened strikes were settled by Government agency. Considerations which influenced the arbiters were: the concept of a minimum living wage; increases in the cost of living; the desire for standardization, both within a given industry and in a given territory; increase in productive efficiency; and the effect of overtime work in increasing weekly wages. The National War Labor Board created a Cost of Living Section associated with the Bureau of Labor Statistics. The minimum requirement for an average American family of five members was found to be, for New York City, in June 1918, $1,350 to $1,400; in Dec. 1918, $1,500. Therefore, if the eight-hour day were observed, 55–60 cents an hour would be the lowest which might properly be received by the breadwinner. It was, however, expected that overtime would be worked, and lower rates were set, 40–45 cents an hour.

Before the war there were inequalities in wage rates in different parts of the country and between union and non-union workers; the tendency of war-time adjustments was to establish standards. But the rates of pay of the unskilled rose more rapidly than those of the skilled. Wages of unorganized common labourers increased 100 to 200%. These men had formerly been paid less than enough to maintain an "American standard of living." During the war there was such a demand for their services that wages rose as employers bid against each other. In certain cases the Government agencies fixed arbitrary standards to prevent a flow of labour back and forth between localities and between establishments. There were great differences in wage increases gained by skilled workers. The least increases were in the building trades, which before the war had been among the best-paid employments; but men engaged in shipbuilding received increases greater than the average for the trade. The U.S. Bureau of Labor Statistics estimated that the cost of the working-class standard of living doubled between 1913 and 1920. The cost of food increased 118%, as calculated from the prices of 22 food articles reported to the Bureau. The accompanying table shows the increase per cent for both cost of living and wages. This wage index is computed by the present writer on the studies of wages in 12 important industries, made by the U.S. Bureau of Labor Statistics. The index number computed is a simple, unweighted, arithmetical average of average full-time wages, with 1913 used as a basis. Increases in the trades studied were as follows: bakery trades, 1913 $18.14, 1920 $41.28; boot and shoe, 1913 $17.28, 1920 $29.32; building trades, 1913 $24.33, 1920 $44.18; cotton manufacturing, 1913 $10.17, 1920 $29.05; iron and steel, 1913 $28.47, 1920 $68.84; metal trades, 1913 $21.62, 1920 $42.37; mill work, 1913 $14.48, 1920 $41.19; printing, 1913 $19.56, 1920 $35.89; silk manufacturing, 1913 $12.39, 1919 $21.99; woollen, 1913 $10.14, 1920 $35.18; farm labour, without board, 1913 $7.58, 1920 $16.24; railroads, 1913 $21.94, Jan. 1920 $25.91.

	Cost of Living	Wages
1913	100	100
1914	103·0	100·2
1915	107·4	103·3
1916	113·3	117·5
1917	140·5	134·4
1918	165·8	157·5
1919	190·2	185·5
1920	208·2	206·4

The increase of the cost of living was in advance of the increase of wages for the whole period from 1913 through 1919, except possibly during 1916. The discrepancy was greatest in 1918. The purchasing power of wages, measured by the cost of food, fell more in 1917 than in any year since 1890. The drop was one of 17·7% in the purchasing power of 1913. From the middle of 1908 to the middle of 1921 the purchasing power of wages continued to be less than in the period 1890–1907. The purchasing power of wages ("real wages") was greatest in 1896 and in 1900. Total "real income," however, was not necessarily greatest in these two years, due to changes in the volume of employment. It appears that the prices of labour are influenced by the changes in business conditions, but to a less degree than the prices of commodities. In general, the average wage declined after 1893, recovered in 1896, and dropped again for the years 1897 and 1898. In 1899 the wage began to advance, halted in 1904, and dropped slightly after 1907; beginning with 1909 the upward course was resumed, with a slight drop in 1914. This upward movement continued to 1920, and was especially rapid after 1916. In the various industries there were differences in the degree of the movement of wages. The fluctuations in the

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iron and steel industry were numerous, as were also those in silk and cotton manufacturing. On the other hand, changes in the bakery and building trades were less noticeable. However, no industry escaped a reduction in wages after 1893, and none failed to register a large advance after 1916.

From 1914 to 1918 the purchasing power of hourly wages seems to have decreased considerably. But, due to steadiness of employment and to the overtime worked, actual weekly earnings may have increased. In 1919 and the early part of 1920 wages and wage rates rose more rapidly than the cost of living. The conservative and carefully compiled budget for 1918, drawn up by the Philadelphia Bureau of Municipal Research, specified $1,637 as necessary to support a family of five in the "minimum standard of health and comfort." This standard is lower than the "standard of health and decency" adopted by the Bureau of Labor Statistics. Cost of living is no higher, and may be lower, in Philadelphia than in other industrial centres. The Philadelphia budget in Nov. 1919 required $1,803 and in Aug. 1920 $1,988. If the increase was distributed evenly throughout the nine months, the average wage in manufacture was insufficient to support this standard. The deficiency in the case of textiles was between $450 and $570; in boots and shoes and paper manufacturing and in printing, more than $400; and in furniture manufacturing, more than $700. By 1920 the situation was better; although only in one industry studied, the manufacture of rubber goods, was the average full-time yearly income able to support the standard. If retail prices of food are taken as an index of living costs, *union hourly* real wage rates in 1918 were 20% lower than the average for 1890–9, and full-time real *union weekly earnings* probably 25% lower, due to the decrease in the number of hours worked. Allowance must be made for the fact that food prices rise more rapidly than cost of living as a whole, and for the fact that the figures here refer to *union scales of wages*, which often represent the minimum wage actually paid. The total income of most workers increased during the war period, due to steady employment; to the overtime work, usually at increased rate of pay; and to the fact that the war called into industry more members of the family than are ordinarily wage-earning. It is necessary to call attention to the fact that unemployment has never been taken into consideration in computing "real wages." Until a coefficient of unemployment has been found, no chart of "real wages" will be able to show the actual state of well-being of the wage-earning class. The average retail price of food in 1920 was 103% higher than in 1913. During 1920 it continued to rise; the highest point reached was 119% higher than in 1913, in June and July 1920. After that the prices fell and reached a point in April 1921 52% greater than in 1913. According to the philosophy of employers, as living costs fall, wage rates also should fall. However, by April 1921 earnings had already decreased owing to the decrease in available employment. It is not agreed that the 1913 standard of living was adequate: workers who have emerged from the "minimum of subsistence" level are loth to return to an acceptance of insufficient purchasing power.

The Bureau of Labor Statistics reported changes in rates of wages between July 1 1920 and March 31 1921. The total number of changes reported was 2,714, of which 1,689, nearly two-thirds, were increases. Two-thirds of the increases in the three months of 1921 were in the printing and publishing industry. The largest number of decreases were in the textile industry. The largest number of decreases reported were in Jan. 1921, the largest number of increases in July, Aug. and Sept. of 1920. The most frequent cut in wage rates was between 10 and 20%; 30% also was reported in a large number of cases. It must be remembered that *per capita* earnings decreased still further, due to the decrease in the volume of employment. Under the agreement between employers and union in the men's clothing industry in Chicago, wages were reduced in April 1921 5% for those who had received a 5% increase in 1919 and 10% for all others, except that no wages were to be reduced below $15 for the full-time week. In the same month the board of referees in the ladies' garment industry in Cleveland ordered the restoration of the July 1919 wage scale, with some exceptions. The reasons given were, first that the cost of living had not continued to rise as had been expected but had fallen, and, second, the serious business depression. To secure the workers continuity of income, the employer was ordered by the award to retain the satisfactory worker 20 weeks in each half-year or to pay an unemployment benefit of two-thirds the weekly wage, the employer's liability to be limited to 7½% of his direct labour cost for the guaranteed period. In July 1921 the U.S. Railway Labor Board, after hearings, ordered a 12% reduction in wages on 102 railways.

Babson's Statistical Organization reported the total earnings of employees in the manufacturing establishments in New York State in July 1921 as the smallest since May 1919. According to this study, wages reached a peak in Dec. 1918 at 120% greater than in June 1914, and again in Sept. 1919 at 129%, from which they rose to the highest peak in March and June 1920 with 177%. By April 1921 they had fallen to 95% greater than in June 1914.

REFERENCES. The most comprehensive studies of wages in the United States are those made by the U.S. Bureau of Labor Statistics, and published in special bulletins and in the *Monthly Labor Review*. Wages of farm labourers are reported to the Department of Agriculture. Wages of railway employees are published by the Interstate Commerce Commission. See generally Alexander M. Bing, *War Time Strikes and their Adjustment* (1921); David Friday, *Profits, Wages and Prices* (1920); Frank H. Streightoff, *Distribution of Incomes in the United States* (1912); National Industrial Conference Board Research *Reports*, 20, 31. Also the following articles:—I. M. Rubinow "The Recent Trend of Real Wages," *American Economic Review* (vol. iv., Dec. 1914); F. W. Jones, "Real Wages in Recent Years" (*ibid.*, vol. vii., June 1917); C. E. Persons, "Woman's Work and Wages in the United States," *The Quarterly Journal of Economics* (Feb. 1915). (J. R. Co.)

WAGE-SYSTEM IN INDUSTRY.—The normal systems of payment for the work of persons employed in industry under the capitalist system are wage-payment and salary-payment. It is not easy to draw an absolute line of distinction between these two forms of payment. Wages are usually paid weekly, and salaries over a longer period—monthly, or quarterly, for example. There are, however, cases of weekly salaries, and of wages paid monthly. Moreover, a good many of the supervisory grades in various industries are paid what is called an "upstanding wage," which in many of its conditions approximates rather to the salary basis of payment than to the wage as ordinarily understood. Usually the salary-earner possesses a higher status and a slightly greater measure of security than the wage-earner. Wages are, as a rule, paid only for hours actually worked, subject to the conditions mentioned below, and any period of illness or suspension of work for any cause, whether under the worker's control or not, involves a cessation of the payment of wages. Salary-earners, on the other hand, are in many cases paid during periods of sickness, and are usually paid for a full week, or month, even if some spells of enforced absence from work or failure of work due to some other cause are included. There are, however, very many intermediate varieties between the continuous salary paid throughout the whole year, and the wage paid only for hours actually worked. The salary-earner, it should be remarked, is usually entitled to a longer period of notice, from a month upward, than the wage-earner, who can usually be dismissed or suspended on a week's notice or less. The period adopted as a basis for the calculation of wages differs from trade to trade, and even from district to district or factory to factory within the same trade. In some cases the basis is hourly, in others a weekly rate of wages is laid down. In either case, there may be, but in the majority of cases is not, what is termed the "guaranteed week," that is, a guaranteed minimum weekly payment, irrespective of the number of hours of employment which the employed person is actually able to secure. In certain other cases, notably that of the dockers, there is the "guaranteed day," but not the "guaranteed week." The demand for greater measure of security than is afforded by hourly payment, without any guarantee of the week or the day, has increased, and a number of trades have secured concessions giving them guarantees of one sort or another.

Broadly speaking, the methods of remunerating the wage-earner under the wage-system can be divided into two main

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groups: (1) time-payments, and (2) "payment by results," although there are many intermediate varieties, and disputes often arise on the question whether a particular system is or is not to be regarded as "payment by results."

(1) Under the time-work (or "day-work") system, the worker's remuneration varies with the time which he actually spends on the employer's business. Thus, carpenters and joiners in certain districts in the building industry in Great Britain have a time-rate of 2s. an hour, and the majority of grades on the railways have time-rates varying from 65s. per week upward. These time-rates are practically always fixed in relation to a definite number of hours in the week, and if a larger number of hours has to be worked, the hours in excess of the standard week are termed overtime, and are usually remunerated on a slightly higher hourly rate—"time and a quarter," "time and a third," "time and a half" or "double time," for example. Extra payment is also frequently made for work done during the week-end or at night ("night-shift"). The time-work system operates throughout a large number of trades, including the greater part of the building industry and the railway and road transport services, and almost the whole range of non-manual employment. In many other industries it is found side by side with various systems of "payment by results." In almost every time-work industry there are some piece-workers; and in almost every piece-work industry some time-workers. A particularly obnoxious form of time-work is that known as "task-work," under which the worker is required to perform a definite amount of labour in return for a time wage, but receives no additional remuneration for higher output. This is strongly opposed by trade unions and does not prevail at all in organized industries in Great Britain.

(2) Under the term "payment by results" are comprehended many different methods of wage payment, the common factor among them being that, to a greater or less extent, the worker's earnings under them vary with the amount of output which he, either individually, or in conjunction with a group of his fellow-workers, is able to produce. The amount of work produced may not be the sole factor determining his remuneration under a system of "payment by results"; for such systems are very frequently, and in the organized trades usually, accompanied by guaranteed minimum or standard time-rates, which the worker is entitled to receive irrespective of the actual output which he produces. Strongly organized trade unions in many industries have consented to accept "payment by results" only on the condition that the standard time-rates of wages shall be guaranteed irrespective of output (*e.g.* engineering).

The simplest form of "payment by results" is that known as "piece-work." Under this system, a price is fixed for each unit of the commodity upon the production of which the worker is engaged, *e.g.* if the worker is turning out screws, a price will be fixed per hundred, or per gross of screws, this price being calculated, in theory at least, according to the time which is estimated to be necessary for the performance of the operation in question. Sometimes, as in the "time logs" in the tailoring trade, the piece-work price is expressed not in terms of money, but in terms of hours, and the worker is paid for so many hours at the standard rate, irrespective of the time actually occupied on the job. "Straight" piece-work systems vary very much in complexity. Where the operations are simple, and the character of the goods produced uniform, piece-work prices can be laid down with almost mathematical accuracy; but as soon as provision has to be made for a wide range of different products complications almost inevitably arise. These complications are of two kinds. The cotton industry in Great Britain is almost entirely a piece-work industry; but, despite the immense variety in the types of cotton goods produced and the variation in the times required for the spinning and weaving of different types of goods, piece-work rates can be devised to correspond with practically mathematical accuracy to the time required for the job because of the high degree of standardization at which the industry has arrived. The piece-work lists agreed to by the weaving trade unions and the cotton manufacturers are immensely complicated, and only skilled technicians are able to understand them. The universal acceptance of piece-work in the cotton industry is mainly accounted for by the fact that, under the system which has been adopted, a given amount of effort can be approximately relied upon under normal conditions to produce equivalent earnings.

This is much more difficult to secure in such an industry as engineering, where the products are far less uniform and where also the machinery which the worker is called upon to manipulate is far less standardized, so that it may take very different times to do the same job on two different machines. The fixing of piece-work prices in the engineering industry in Great Britain is therefore a constant source of friction, and it has been found impossible to express, in any tables corresponding to the cotton piece-work lists, the fair remuneration for most forms of work on engineering products. Piece-work prices in the engineering industry are a constant subject of workshop and trade-union bargaining, and there is a strong resistance in many sections of the industry to the introduction of piece-work, largely because there is not, as in the cotton industry, any simple method of arriving at a fair price, and the system thus produces constant allegations of "speeding up" and "price-cutting" on the one side, and of "speeding down" and "restriction of output" on the other. Where, owing to special circumstances, it is regarded as impossible to fix in advance a piece-work price for a particular job, the worker, especially in the engineering and shipbuilding industries, is sometimes paid what is called a "lieu rate," *e.g.* "time and a third" or "time and a half" for the hours actually occupied on the job in lieu of a fixed piece-work price.

The other main system of payment by results is the system of "bonus on output." Under this system the worker is normally paid a time-rate irrespective of output; but, if the output exceeds a given minimum, an additional bonus, calculated upon this excess output, is paid. There are literally hundreds of different methods of calculating this bonus. The system to which the greatest attention has been attracted in recent years, both in Great Britain and in America, is the "premium bonus system" in its various forms, of which the two best-known are the "Halsey" and the "Rowan" premium bonus systems. Under both these systems, a "basis time" is fixed for the accomplishment of the piece of work in question. If the work is done in less than the basis time, the workman is paid, over and above his time-rate of wages, which is guaranteed, a bonus, proportionate in one way or another to the time saved. The effect of this method of payment is that, under both the Halsey and the Rowan system, the labour cost of the job to the employer falls with every increase in output, while at the same time the earnings of the workman increase, but not in proportion to the increase in output. The simpler of the two best-known premium bonus systems is the "Halsey" system, so called after its inventor Mr. F. A. Halsey, an American efficiency engineer. Under this system, the workman is paid a fraction, usually either a third or a half, of his time-rate for time saved. Thus supposing the time allowed for an operation is 12 hours, and a worker, whose time-rate is a shilling an hour, does it in 9 hours, he will be paid at his time-rate for the 9 hours, and in addition will receive payment for a further hour or for an hour and a half, according to the particular variety of the system adopted.

The Rowan system is more complicated. The simplest way of explaining it is to say that for every 10% that is saved on the time allowed, the workman receives a 10% increase in earnings. The more complicated way is to quote the quite unnecessarily abstruse formula which is usually adopted by those who desire to explain the system. This formula is as follows:—

$$\text{Bonus} = \frac{\text{Time saved}}{\text{Time allowed}} \times \text{Time taken.}$$

There are all manner of modifications of these two systems, in the direction both of greater simplicity and in that of greater complexity. The advocates of "scientific management" have been especially active in devising fresh variations in the method of payment, intended to stimulate the workers' productive efficiency

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in the fullest degree. Efficiency engineers often contend that it is necessary to work out a different formula for each type of operation in order to apply in each case precisely the right stimulus to increased output. Most of these systems are based in one way or another on the premium bonus system in one or other of its two forms, or on the so-called "differential piece-rate" system advocated by Mr. F. W. Taylor, the founder of "scientific management." Under this system, two different piece-rates are fixed for the same job, and at the same time a standard output per hour is laid down. When the worker reaches or exceeds the standard output he is paid on the higher piece-rate; when he falls below the standard of output he is paid on the lower piece-rate. Day-work rates are not guaranteed. The object of this system is stated to be the elimination from the job of the less efficient worker by discouraging him with the offer of a lower piece-work price. It is impossible to attempt to chronicle the many different bonus and piece-work systems which have been put forward in Great Britain and America. The Ministry of Munitions in England, during the World War, accumulated a list of many hundreds of different systems which were actually in operation in the British engineering shops alone. It is particularly in the engineering and kindred industries that this wide diversity of forms of wage-payment exists.

It should be noted that both the piece-work system and the various bonus systems and adaptations of them can be operated either on an individual or on a collective basis. Under the individual system a single worker is remunerated in accordance with his individual output. Under the collective system a group of workers is treated as a unit, and the piece-work price or bonus is paid in respect of the output of the whole group. Collective systems are most often found where the work itself necessarily involves collaboration, and where it is therefore difficult or impossible to separate the individual contribution of the workers engaged upon it (*e.g.* "squad" or "gang" work). It has, however, been applied also in a large number of cases over a considerably wider area in the form of an output bonus paid on the work of a whole shop or factory. In these cases, bonus is sometimes paid only to workers directly engaged on production; but in other cases auxiliary workers, such as foremen, millwrights, maintenance workers, and even workers on the staff, may share in the pool. Many such systems were adopted in shell factories in various countries during the war.

A variety of collective "payment by results" is that which is known as the "fellowship" system. Under this system, the workers themselves form groups on a voluntary basis, and share out among themselves, either through the office of the firm, or by a subsequent re-division of the sums paid through the office, their collective earnings. This system usually operates among "fellowships" of skilled workers in a particular craft or in closely related crafts.

There are many different ways of sharing out the payment made under collective systems of "payment by results." The most usual method is that each worker included in the group shares in the payment in proportion to his time-rate and to the hours worked on the job. Sometimes, however, the pool, or any surplus over the time-rates of the workers concerned, is equally shared, and sometimes regard is paid only to one or other of the two factors mentioned above. In a few cases a specially large share in the pool is offered as an inducement to a leading worker, or to a few leading workers; but the system in this form approaches the system of "sub-contracting," which is universally objected to by the trade-union movement.

"Sub-contracting" is usually understood to mean a system under which one worker undertakes a piece of work which requires the coördinated labour of a group of workers. The sub-contractor receives the whole sum paid for the execution of the job, making, subject to any limitations that may be laid down in his contract, his own wage contract with the workers under him, and retaining any surplus for himself. Often a sub-contractor, himself paid "by results," remunerates the workers under him on a time-work basis. It is generally recognized that the sub-contracting system is open to grave abuse, and with the advance of trade-union organization it has been gradually eliminated from industry, surviving only in a comparatively small number of cases. The outstanding instances of it in the past have been the "butty" system in the mining industry, which still exists in one or two British coalfields, and the methods of payment which used to be adopted in many sections of the iron and steel industry.

Distinct from both the piece-work system and the various bonus systems is the system of "commission," which is applied in a certain number of occupations. Under this system the worker receives a commission on "takings" or on profits either as his sole mode of remuneration, or as an addition to a minimum wage or salary. This is the position of most workers in the insurance business, and of a number of managerial and semi-managerial workers in the distributive trades. It is also found occasionally in other occupations.

The attitude of employers and workers towards these various systems of wage-payment differs widely from case to case. Recently, attention has been mainly concentrated on the endeavours of employers to introduce systems of "payment by results" into industries in which time-work systems are at present largely in operation, *e.g.* building, engineering, shipbuilding. Usually these attempts have met with strong trade-union opposition. It must not, however, be concluded that employers are universally favourable or trade unions universally opposed to "payment by results." The position differs from industry to industry. In the textile industries, and in a number of the less-organized occupations, "payment by results" has been introduced and maintained not merely with the acquiescence, but often at the instance of the workers, who have seen in it an opportunity of securing higher earnings. At the other extreme, the worst forms of "sweating" in industry are very frequently found in conjunction with the time-work system of payment. In the past, trade unions have usually favoured, or at least not opposed, "payment by results" in those industries in which a standard of measurement can be found of such a character as to insure that, under normal conditions, a given amount of effort expended will result in a given amount of output, and therefore of earnings under the system. On the other hand, the unions have generally been opposed to the introduction of "payment by results" in those industries in which no such standard can be laid down, as well as in other cases where it has been contended that "speeding up," consequent upon the inducement offered for higher output, would have the effect of impairing the quality of the work done (*e.g.* building). Where "payment by results" has been accepted in industries of this latter type, a struggle has often followed over the question whether the right of the organized workers to bargain collectively over the fixing of piece-work prices or "basis times" shall or shall not be recognized. This struggle is still in progress over a wide range of industries; but the fixing of piece-work prices and "basis times" is still normally done by the employer or his representative, subject only to protest by the workers or their representatives.

It should be noted that the growth of "scientific management" has given a great impetus to the introduction of "payment by results," and has also considerably affected the methods adopted by employers in fixing piece-work prices or "basis times." In the great majority of factories, other than textile factories, in which systems of payment by results are in operation, piece-work prices are still fixed in a very haphazard fashion, and modified from time to time in accordance with actual experience of their working. But, where one feature or another of "scientific management" has been introduced, experiments have been made designed to introduce a greater scientific accuracy into the fixing of prices and times. The methods which have been introduced with this object are mainly those of "time study" and "motion study." "Time study" means an attempt, by actual observation of the doing of a particular job, either by a selected worker or in a number of selected cases, to fix the time which ought to be occupied in the doing of it by a normal worker. "Motion study" means the observation of the doing of a job with a view to eliminating all surplus motions, and to the laying

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down in detail of the method by which it can be done with the maximum of efficiency and in the least possible time. The former method has been adopted by a number of firms in Great Britain, the latter in comparatively few cases. Both are largely in operation in America. "Time study" and "motion study" are usually resented by the workers employed, and are regarded as devices adopted by the employer with a view to "speeding up." It is also contended that both, and especially "motion study," result in making work more monotonous and in taking such variety of initiative as remains to the worker under modern factory conditions out of his hands and in concentrating control in the hands of a small body of expert rate-fixers, or "time-study" and "motion-study" experts.

Where piece-work or bonus systems are in operation, friction is very likely to arise because there is a constant suspicion on the part of the workers that the employer is endeavouring to "cut" piece-work prices and to "speed up" the slower workers to the pace of the more rapid. Employers, on the other hand, allege that workers deliberately slow down with a view to forcing up piece-work prices. It is impossible to estimate the relative productivity of workers under time-work systems and under systems of "payment by results"; but it may be taken as certain that no system of "payment by results" which has yet been devised has succeeded in eliminating friction or the possibility of "price-cutting" on the one hand, and "restriction of output" with a view to securing higher prices on the other. Perhaps the nearest approach to the elimination of these two factors is in the cotton industry; but the comparatively smooth working of the piece-work system in this case is mainly due to the peculiar standardized character both of the product and of the machinery. The cotton "price-list" system cannot readily be adapted for use in the majority of industries.

REFERENCES.—There are only two books giving a general survey of the various wage systems. These are (1) *Methods of Industrial Remuneration* by D. F. Schoss (Williams and Norgate), which was written a good many years ago, and is now in many respects out of date, and (2) *The Payment of Wages* by G. D. H. Cole, which is the most recent study. See also, for conditions in England, *Industrial Democracy* by Sidney and Beatrice Webb, and *The Works Manager To-day* by Sidney Webb. There is an immense literature dealing with scientific management in relation to "payment by results." Reference may be made especially to *Scientific Management and Labour* by R. F. Hoxie; *Scientific Management* by C. B. Thomson; *Scientific Management* by F. W. Taylor; *Scientific Management* by H. B. Drury; *Efficiency* and other works by Harrington Emerson; *Work, Wages and Profit* by H. L. Gant; and *A Rational Wages System* by H. Atkinson. For premium bonus systems, see *The Premium System of Paying Wages*, published by *The Engineer*; *The Rowan Premium Bonus System* by W. Rowan Thompson; and *The Premium Bonus System, Report of an Enquiry*, published by the British Trades Union Congress. A great deal of information will also be found in the following reports issued by the Board of Trade: "Report on Collective Agreements" (1910) and "Report on Standard Piece-Rates." Unfortunately, however, no new or revised editions of these have been issued since some years before the war. See also the *Final Report of the Commission on Industrial Relations*, published by the U.S. Government in 1915. (G. D. H. C.)

WAGNER, ADOLF (1835–1917), German economist (*see* 28.235*), died in 1917.

WALLACE, ALFRED RUSSEL (1823–1913), British biologist, (*see* 28.275), died at Broadstone, Dorset, Nov. 7 1913. In 1910 he received the O.M. Among his latest publications were *The World and Life* (1910) and *Social Environment and Moral Progress* (1912).

WALLACE, SIR DONALD MACKENZIE (1841–1919), British author and journalist, was born Nov. 11 1841, the son of Robert Wallace of Boghead, Dumbartonshire. He was educated at the universities of Edinburgh, Berlin and Heidelberg and at the École de Droit, Paris. Even in his Edinburgh days he spent his vacations abroad and became proficient in modern languages, and when he completed his legal studies at Heidelberg he was already 28 years of age and was contemplating a career as a German professor in comparative law. He was, however, invited by a friend to visit Russia, and became so much interested that he remained there for six years. His *Russia* (1877), a volume dealing comprehensively with the country, had a great success, and was at once recognized as a classic; it was translated into many languages and was revised and reissued by its author both in 1905 and 1912. Shortly after its first appearance Mackenzie Wallace became correspondent of *The Times* in Petrograd; in 1878 he was moved in a similar capacity to Berlin, thence to Constantinople, and after the battle of Tel-el-Kebir (1882) to Egypt. From 1884–9 he was in India as private secretary to the Viceroy, Lord Dufferin, and to his successor, Lord Lansdowne. He accompanied the Tsarevich Nicholas during his Indian tour 1890–1 and the Duke of Cornwall (afterwards George V.) during his colonial tour in 1901. From 1891–9 he was director of the foreign department of *The Times*. In 1899 he undertook the editorship of the New Volumes (issued in 1902 as the 10th edition) of the *Encyclopædia Britannica*, which had been projected by *The Times* as a supplement to the 9th edition, with Dr. A. T. Hadley, then president of Yale University, as his American co-editor; but he felt somewhat overpowered by his task, and after April 1900, when Mr. Hugh Chisholm was brought in by *The Times* to assist his labours, Sir Donald left the editorial work in the sole charge of his younger colleague. He was made by Edward VII., with whom (as with Queen Victoria) he had long been on confidential terms, one of his official household, and was also included in that of George V. He had been created K.C.I.E. in 1887, and was made K.C.V.O. in 1901. In addition to his book on Russia he published *Egypt and the Egyptian Question* (1883) and *The Web of Empire* (1902). He died at Lymington Jan. 10 1919. A thorough diplomat of wide culture and personal charm, and one of the most remarkable linguists (speaking some twenty languages) and raconteurs of his time, he was also one of the most modest and unselfish of men. He was probably better informed than any other man of his day in the secret history of international politics, but he was also discretion personified in using his knowledge. One of his last important pieces of work for *The Times* was in 1905 at the Peace of Portsmouth (N.H., U.S.A.), which he attended as its correspondent, and he was able there to give valuable advice, in carrying the negotiations to a successful issue, to the Russian delegates, with whom he exercised considerable authority.

WALLACE, WILLIAM (1860–), British musical composer, was born at Greenock July 3 1860, the son of a doctor in good practice. He was educated at Fettes College and Glasgow University, where, with the view of entering the medical profession, he graduated M.B. in 1885 and M.D. in 1888. He afterwards specialized in ophthalmology, studying at the Moorfields eye hospital, and also at Paris and Vienna. His musical education was partly received at the Royal Academy of Music, but he remained there for less than a year, and was largely self-taught. His orchestral works include *The Passing of Beatrice* (1892); *The Creation, a Symphony* (1899); *Pelleas and Melisande* (1900); and the symphonic poems, *Wallace* (1905) and *Villon* (1909). He also published some fine songs and collections of songs (often to his own words), including *Freebooter Songs* (1899) and *Lords of the Sea* (1902) and *Three Songs of Blake*. He was for a period secretary of the Philharmonic Society. In addition to being a connoisseur of art in most forms, Wallace published several literary works of distinction. Of these *The Divine Surrender* was a mystery play; his books on musical history and theory, *The Threshold of Music* (1908) and *The Musical Faculty: its origin and processes* (1914), are both important in their way. Also he translated the operatic texts of Strauss's *Feuersnot*, Berlioz's *Faust*, *Le Chemineau*, *Muquette* and the poems of many songs by Sibelius and Weingartner. At one time he edited *The New Quarterly Musical Review*, and he was a frequent contributor to various magazines. During the World War he entered the R.A.M.C. as a captain, and acted as ophthalmologist to the Colchester military district, inspector of ophthalmic centres in the Eastern Command, and ophthalmological specialist for the London district, and he published various articles in scientific journals on the vision of the soldier and war injuries to the eye. In this way he made effective use of his earlier professional training. He married in 1905 Ottilie, daughter of Lord M'Laren, herself a sculptor who had been a pupil of Rodin; as deputy

** These figures indicate the volume and page number of the previous article.*

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assistant director of the W.R.W.S. she also did useful work in the war, and was given the O.B.E.

WALLENBERG, KNUT AGATON (1853–), Swedish statesman, was born in 1853, the eldest son of André Oscar Wallenberg (1816–1886), who in 1856 founded Stockholms Enskilda Bank. He went through the training of a naval officer, but in 1874 joined the directorate of the bank, was managing director during the years 1886–1911, and became chairman in 1917. This bank, under the control of K. A. Wallenberg and his brother Marcus, took a prominent place in the Swedish banking world and in the industrial life of the country. Through their good connexions abroad both brothers contributed much toward enabling Sweden to establish good economic relations with other countries. Both have played an important role in the developing of the iron-ore industry in northern Sweden. K. A. Wallenberg, in conjunction with the Crédit Lyonnais, introduced Swedish bonds into the French market in 1890, and during two decades he coöperated powerfully in taking up Swedish, Norwegian, Danish and Finnish state loans. In the Banque d'État de Maroc, which resulted from the Algeciras Conference, K. A. Wallenberg had a hand as a member of the governing board in Paris, a position in which he was succeeded in 1920 by his brother Marcus. K. A. Wallenberg was concerned in the founding of the Banque des Pays du Nord in Paris in 1911, and also in that of the British Bank of Northern Commerce in London in 1912, which in 1920 was amalgamated with C. J. Hambro & Son as Hambro's Bank of Northern Commerce, known as Hambro's Bank Ltd. since July 1 1921. He was a member of the town council of Stockholm from 1883–1914, a member of the First Chamber of the Riksdag from 1906–19, chairman of the Swedish Bankers' Association ("Svenska bankförening") from 1909–14, and a member of the Stockholm Chamber of Commerce from 1912–4 and again from 1918 onwards. He was one of the founders of the commercial high school ("Handelshögskolan") in Stockholm and its first donor. When Hammarskjöld formed his Government in 1914 (*see* SWEDEN), K. A. Wallenberg joined it as Foreign Minister, retaining this post until 1917. In 1918 he and his wife devoted 25 million kroner to the "Knut and Alice Wallenberg Foundation," the purpose of which was to further religious, social, scientific and educative movements and to support trade and industry.

His brother, MARCUS WALLENBERG (1864–), became an officer in the navy, and, after juridical studies and practice, joined the directorate of Stockholms Enskilda Bank and became managing director 1911–20, and later chairman. He founded or reorganized a large number of industrial enterprises, taking a chief part, for instance, in the financing of the mining-fields of northern Sweden, and founding in 1905 Norsk Hydro-elektrisk Kvaelstof Aktieselskab in Norway, of which he became chairman. He was one of the founders of the Norwegian Central Bank, of the Swedish Bankers' Association, and the Industrial Union of Sweden ("Sveriges industriförbund"), besides having taken the initiative in founding the Taxpayers' Association ("Skattebetalarnes förening") in 1920. He became a member of several committees on banking and stock exchange questions, and a member of the Economic Council. The Swedish Government sent him to London as Swedish negotiator in 1916–7 and 1917–8 for bringing about an agreement with the Allied Powers regarding trade and shipping and finance questions. He was a member of the Neutral Powers' financial section of the Supreme Economic Council from Feb. to June 1919 in Paris, took part in the meeting at Amsterdam in 1919 which arranged for the International Financial Conference in Brussels in 1920, at which he was Sweden's representative. He was a member of the Committee of the Economic and Financial section of the League of Nations.

WALLER, LEWIS (1860–1915), English actor (*see* 28.283), died at Nottingham whilst on tour Nov. 1 1915, shortly after making a striking success at Wyndham's theatre, London, in *Gamblers All*. His wife, whose stage name was Florence West, died Nov. 14 1912.

WALSH, WILLIAM JOHN (1841–1921), Roman Catholic Archbishop of Dublin, was born in Dublin Jan. 30 1841, and was educated at St. Laurence O'Toole's seminary, Dublin, afterwards entering the Catholic University and St. Patrick's College, Maynooth. In 1867 he became professor of dogmatic and moral theology at Maynooth, was appointed vice-president of the college in 1878, and in 1881 succeeded Dr. Russell as its president. Four years later he became Archbishop of Dublin on the death of Dr. McCabe. Archbishop Walsh, besides being an energetic worker and writer, was a keen politician, and was conspicuous for his extreme Nationalist opinions. He was one of the witnesses before the Parnell Commission of 1888–9, and served on many committees and boards, chiefly educational, becoming in 1891 a commissioner of education in Ireland. He would have nothing to do with the suggestion for settling the difficulty of Catholic higher education in Ireland by establishing a Roman Catholic faculty of theology in Trinity College, an institution which he attacked as a centre of Protestant influence, and insisted on the need for a university with a "Catholic atmosphere." In 1908 he became a member of the Dublin Statutory Commission appointed under the Irish University Act, which established the Catholic National University, of which he became chancellor.

In proportion as the Nationalist party seemed disposed to compromise with the Government, Dr. Walsh drew away from it; and after the concessions made to Ulster in 1914, and more especially after the rebellion of 1916, he threw his influence more and more on to the side of the extremists. In the election of Dec. 1918 he voted for a Sinn Fein republican candidate.

Dr. Walsh produced various volumes of addresses on religious and educational subjects, and also published *A Plain Exposition of the Irish Land Act of 1881* (1881); *The Queen's Colleges and the Royal University of Ireland* (1883–4); *The Irish University Question* (1897); and two attacks on Trinity College, Dublin, *Trinity College and the University of Dublin* (1902) and *Trinity College and its Medical School* (1906). He died in Dublin April 9 1921.

WALSINGHAM, THOMAS DE GREY, 6TH BARON (1843–1919), was born July 29 1843. He was educated at Eton and Trinity College, Cambridge, and succeeded his father in 1870. He was an enthusiastic entomologist and sportsman, and for some years travelled widely, making collections of specimens of all sorts, many of which he presented to the natural history section of the British Museum. In 1876 he was made a trustee of the British Museum; he was also a fellow of many learned societies and high steward of the university of Cambridge. He died Dec. 3 1919.

WARBURG, PAUL MORITZ (1868–), American banker, was born in Hamburg, Aug. 10 1868. After graduating from the Realgymnasium in 1886 he entered a banking house. From 1889 to 1892 he studied banking in England and France; then for the next ten years was engaged in the banking business in Hamburg. In 1902 he went to New York, where he became a member of the banking house of Kuhn, Loeb & Co. He was naturalized in 1911. He was an early advocate of a centralized banking system in the United States and in 1914 was appointed by President Wilson one of the original members of the Federal Reserve Board. In 1916 he was appointed vice-governor of this board, succeeding Frederick A. Delano, and in 1917 was reappointed. In 1918, at the end of the period of his appointment, he retired, wishing to relieve the Administration of any embarrassment that might follow his renomination. Considerable opposition to his holding the place had arisen after America's entrance into the World War, because of his German birth. On accepting the Government office he had resigned from Kuhn, Loeb & Co., as well as from numerous directorates, including the National Bank of Commerce, the U.S. Mortgage & Trust Co., Wells, Fargo & Co., the Westinghouse Electric & Manufacturing Co., the B. & O. R.R. Co., the National Railways of Mexico, and the Rockefeller Foundation. He was the author of *Essays on Banking Reform in the United States* (1914).

WARD, SIR ADOLPHUS WILLIAM (1837–), English man of letters (*see* 28.319), was knighted in 1913. His history *Germany 1815–1890* (1st vol. 1916, 2nd vol. 1917) was a notable addition to his published works, together with various chapters in the *Cambridge History of English Literature*.

WARD, GENEVIEVE (1837–), English actress, was born in New York March 27 1837, the daughter of Col. Samuel Ward,

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and at the age of 18 married Count Constantine de Guerbel. She studied singing in Italy and in Paris, and made her first appearance under the stage name of Ginevra Guerrabella at Bergamo in the opera *Stella di Napoli* (1855). She further appeared at Milan in *Lucrezia Borgia* (1856), in Paris in *Don Giovanni* (1859), in London in *Robin Hood* (1861) and in New York in *La Traviata* (1862). Loss of voice due to an illness obliged her to leave the operatic stage in 1862 and for some years she taught singing in New York, but in 1873 she came to England and began a long dramatic career, appearing first at the Theatre Royal, Manchester, as Lady Macbeth. In March 1874 she first appeared in London in *The Prayer in the Storm* and later played with Charles Wyndham in *The Hunchback* and at Drury Lane as Rebecca in *Ivanhoe* (1875). Her most popular success was as Stéphanie de Mohrivart in H. C. Merivale's and F. C. Grove's *Forget-Me-Not*, produced by herself at the Lyceum theatre, London, Aug. 21 1879, and subsequently played over 2,000 times all over the world. Increasing years found her talents as an actress in full vigour, specially in Shakespearean parts, and as late as 1920 and 1921 she repeated her old rôles of Volumnia in *Coriolanus* and Margaret of Anjou in *Richard III.* at the "Old Vic" theatre in London. On her 84th birthday, March 27 1921, she was created D.B.E. She published a volume of reminiscences (with Richard Whiteing), *Before and Behind the Curtain* (1918).

WARD, SIR JOSEPH GEORGE, BART. (1857–), New Zealand statesman, son of Thomas Ward, merchant, was born at Emerald Hill, Melbourne, April 26 1857, and was privately educated in Melbourne and at the state school, Bluff, N.Z. His first employment in New Zealand was as a boy of 13 in the department over which he was afterwards to preside as Postmaster-General with conspicuous success for more than 20 years. At the age of 21 he started business on his own account as a produce merchant, and began a connexion with municipal politics which lasted many years. He entered Parliament as Liberal member for Awarua in 1887, and retained the seat for more than 30 years. On the formation of the Ballance Ministry in 1891 he joined it as Postmaster-General, and filled the same office in successive Liberal administrations until 1912, and afterwards for four years in the National Government (1915–9). The value of his energy and enterprise in this capacity was acknowledged even by his opponents. In 1901 the success of his efforts to give New Zealand penny postage was rewarded by his being made a K.C.M.G., and at various postal conferences he distinguished himself by his pioneer advocacy of an All-Red Cable service and universal penny postage. In the Seddon Government he held other important portfolios, which included those of Colonial Treasurer and Minister of Railways, and his appointment as Minister of Public Health (Nov. 8 1900) is believed to have been the first such appointment in the world.

After Seddon's death, Sir Joseph Ward, who had on several occasions filled the position of Acting Premier during his late leader's absence from New Zealand, succeeded to the Premiership Aug. 6 1906 and held it till his resignation March 28 1912. (For his principal achievements in that capacity, the gift of a battle-cruiser to Great Britain and the institution of compulsory military training, *see* NEW ZEALAND.) After acting as leader of the opposition till Aug. 1915 Sir J. G. Ward joined with Mr. Massey, the Reform party's leader, then Prime Minister, in forming the National Government, in which the Reform and the Liberal parties were equally represented in order to avoid party strife for the period of the war. In the National Government thus established Sir J. G. Ward's principal office was that of Finance Minister. With Mr. Massey he went to London to represent New Zealand at the Imperial War Cabinet and War Conference meetings of 1917 and 1918; and he also attended the Peace Conference at Paris in 1919 as a member of the British Empire delegation. Shortly after his return with Mr. Massey from Paris Sir J. G. Ward dissolved the coalition by resigning his place in the National Government (Aug. 22 1919), and at the general election at the end of the year his party was defeated and he himself lost his seat. His own defeat was due in part to a sectarian agitation directed against him on the ground of his alleged bias as a Roman Catholic in favour of those of his own faith.

In addition to the occasions already mentioned Sir J. G. Ward represented the Dominion at the Imperial Conferences of 1907, 1909 (Defence) and 1911. At the 1909 Conference he strongly supported the ideal of an undivided Imperial navy. He was appointed to the Privy Council in 1906, and received a baronetcy in 1911. During his various Imperial missions he received the freedom of London, Edinburgh and other British cities, and the hon. degree of LL.D. from the universities of Cambridge and Edinburgh and Trinity College, Dublin. He married in 1883 Theresa Dorothea de Smith (C.B.E. 1919), and had a family of four sons and one daughter.

WARD, LESTER FRANK (1841–1913), American geologist and sociologist (*see* 28.320), died in Washington, D.C., April 18 1913. His numerous minor publications, together with biographical notes, were issued under the title *Glimpses of the Cosmos*, 6 vols. (1913–8), the last five volumes posthumously.

WARD, MARY AUGUSTA [MRS. HUMPHRY WARD] (1851–1920), English novelist (*see* 28.320), died in London March 24 1920. Since 1910 she had published *The Case of Richard Meynell* (1911), a study of Modernism and in a sense a sequel to *Robert Elsmere*; *The Mating of Lydia* (1913); *The Coryston Family* (1913); *Delia Blanchflower* (1914); *Eltham House* (1915); *A Great Success* (1915); *Lady Connie* (1916); *Missing* (1917); *The War and Elizabeth* (1918); and a posthumously published novel, *Harvest* (1920). She had also in 1918 published her memoirs, *A Writer's Recollections*, and during the World War she undertook, for propaganda purposes and with a view to enlightening the American public, a journey through the English munitions areas and two journeys in France, the results of which were published as *England's Effort* (1916); *Towards the Goal* (1917) and *Fields of Victory* (1919). From the great fatigue of the second French journey, undertaken in winter and in her 67th year, she never entirely recovered. Her work for children has been commemorated by the raising of a fund to further endow the Passmore Edwards Settlement, in Tavistock Place, London, re-named after her the Mary Ward Settlement.

WARD, WILFRID PHILIP (1856–1916), English man of letters, was born at Ware Jan. 2 1856, the second son of William George Ward (*see* 28.321). Educated at St. Edmund's College, Ware, Ushaw College, Durham, and the Gregorian University of Rome, he became lecturer in philosophy at Ushaw College in 1890, and examiner in mental and moral science to the Royal University of Ireland 1891–2. In 1906 he became editor of *The Dublin Review*. He was the author of numerous books: *The Wish to Believe* (1884); *The Clothes of Religion* (1886); *W. G. Ward and the Oxford Movement* (1889); *W. G. Ward and the Catholic Revival* (1893); *Lives* of *Cardinal Wiseman* (1897), *Aubrey de Vere* (1904), *Cardinal Newman* (1912), and several volumes of essays. He died in London April 8 1916. A biographical notice of him, written by his wife, JOSEPHINE MARY (b. 1864), daughter of J. R. Hope-Scott, was published as a preface to his *Last Lectures* (1916). Mrs. Ward was also the author of several distinguished novels, including *One Poor Scruple* (1899); *The Light Behind* (1903); *Great Possessions* (1910); *The Job Secretary* (1911) and *Not Known Here* (1921).

WAR GRAVES.—I. BRITISH FORCES.—One of the most interesting pieces of organization resulting from the World War is represented in the Imperial War Graves Commission, which was constituted on behalf of the Governments and peoples of all parts of the British Empire, and charged with the care in perpetuity of the graves of their sailors and soldiers.

History.—Early in Sept. 1914 a mobile unit, under the command of Maj.-Gen. Sir Fabian Ware, was formed in France, with the approval of Lord Kitchener, by the British Red Cross Society to search for "missing" on the line of the British retreat from Mons, along which the Germans were then being forced back. While similar work was being carried out from Paris, also under the auspices of the British Red Cross Society, this mobile unit operating between Lille and Amiens was found marking and registering graves in that area when the British army moved

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north from the Aisne. Sir Nevil Macready, then Adjutant-General to the British Expeditionary Force, perceiving that both the unprecedented number of casualties and the personal interest of the whole British public in the New Armies would demand attention to the graves of the fallen beyond that which was provided for in the existing organization of the Adjutant-General's Branch, transformed this unit, in Feb. 1915, into a department of his branch. The work increased so rapidly that it was soon found necessary to promote the department to the status of a Directorate of the British Army, and later to create a corresponding department of the War Office, with the title Directorate of Graves Registration and Enquiries.

By the autumn of 1915 the number of registered graves scattered over the countryside or situated in established communal or British military cemeteries had reached considerable proportions. Discussions therefore took place between the British officers responsible for the organization and the French Government, with a view to insuring the permanency of the British graves and cemeteries and their security from disturbance. The result was the passing of the French Law of Dec. 29 1915, one of the most generous and interesting enactments made by one nation on behalf of others. The law provides that all Allied graveyards on the soil of France shall be acquired by the Government of the Republic at its own expense and that the rights of ownership shall be enjoyed in perpetuity by the Allied nations concerned. This practical tribute to the valour of the British armies was profound in its effect on the relations between the two Allies during the war.

Under this law it was possible for an "association régulièrement constituée" by an Allied government to be entrusted with the care of its graves in France. The result was the establishment in Great Britain (Jan. 1916) of a National Committee for the Care of Soldiers' Graves, the presidency of which was accepted by the Prince of Wales. In its establishment there was to be found the germ from which developed the Imperial War Graves Commission, a body of wider powers and much deeper significance.

By May 1916 the extension of the fighting to more distant battlefields than France and Belgium had very greatly increased the work of the department. In the same month Graves Registration units were established in Egypt, Salonika, Mesopotamia and E. Africa. The large and rapidly growing number of casualties made it evident that the care of the graves after the war and the erection of permanent memorials would be a task too extensive for a body with the limitations of the National Committee to undertake. Among these limitations was the lack of direct representation of the Dominions and other parts of the Empire, whose soldiers were falling and being buried side by side with those of the United Kingdom. The first Imperial Conference since the beginning of the war was to be held in March 1917, and it was felt that this was an opportunity of suggesting to the Governments of the Empire the creation of an Imperial body responsible equally to the British and Dominion Parliaments, to whom the great work could be entrusted. In a memorandum addressed to the Prime Minister, dated March 15 1917, the Prince of Wales, as president of the National Committee, suggested that the formation of "a joint Committee of the Governments of the Empire, or a statutory body of Commissioners somewhat on the lines of the Development Commission," should be proposed to the forthcoming Imperial Conference. The question was accordingly laid before the Conference on April 13 1917, when a resolution was passed praying His Majesty to grant a Royal Charter for the constitution of an Imperial War Graves Commission, which should be empowered to care for and maintain the graves of those fallen in the war, to acquire land for the purpose of cemeteries and to erect permanent memorials in the cemeteries and elsewhere. The charter was passed under the Great Seal on May 21 1917, and the Commission, of which the Prince of Wales became president, was duly established.

Constitution.—The provisions of the charter stipulate that the members of the Commission shall be:—

"The persons for the time being holding the offices of: Our Principal Secretary of State for War (*ex-officio* Chairman), Our Principal Secretary of State for the Colonies, Our Principal Secretary of State for India; and First Commissioner of Our Office of Works and Public Buildings, . . . and such persons as may be appointed by the Governments of Canada, Australia, New Zealand, South Africa, and Newfoundland . . ." and "such other persons, not exceeding the number of eight in all, as may from time to time be appointed members of the Commission by Royal Warrant under the sign manual of the Sovereign for the time being."

The nomination by the British Overseas Dominions of their representatives and the selection of non-official members of the Commission were completed in Oct. 1917, under the chairmanship of the then Secretary of State for War (the Earl of Derby), and the persons nominated were appointed by Royal Warrant on the 26th of that month. In every case the Dominions nominated their High Commissioners or official representatives in London.

The first non-official members were: Sir William Garstin, Harry Gosling, Rudyard Kipling, Gen. Sir C. F. N. Macready (then Adjutant-General to the Forces, subsequently succeeded in that office by Lt.-Gen. Sir G. M. W. Macdonogh, who was appointed to fill one of the vacant unofficial memberships, thus indicating that the Adjutant-General for the time being should always be a member of the Commission), Gen. Lord Plumer, Adml. Sir Edmund S. Poe, Maj.-Gen. Sir Fabian Ware (subsequently appointed permanent vice-chairman).

One of the first duties which the newly formed Commission had to perform was, in the words of the resolution of the Imperial Conference on April 23, "to prepare an estimate of the probable cost of carrying on the work entrusted to them and to submit the same to the Governments of the United Kingdom and Overseas Dominions with their recommendation as to the proportion that should be borne by each."

The Commission's deliberations on this question resulted in the double proposal laid before the next Imperial Conference on June 17 1918, that £10 per grave should be taken as the probable cost of the construction of cemeteries, and that the cost of carrying out the decisions of the Commission should be borne by the respective Governments in proportion to the numbers of the graves of their dead. It is hardly necessary to emphasize the significance of the adoption of this proposal; a precedent may thus have been established with far-reaching effects; at any rate a most interesting experiment in coöperative administration among the nations of the British Commonwealth had been initiated. It is based on the principle that each shall be financially responsible in proportion to the amount of service rendered on behalf of the whole. In this connexion it is important to note that estimates are presented yearly in identical form to each of the participating Governments, the respective Parliaments being asked to vote a proportion of the total in accordance with the decision of the Imperial Conference of 1918 referred to above. The Commission administer the grants in aid thus received through a finance committee, which meets regularly at short intervals and on which the British Treasury is represented. The principle of complete coöperation runs through all the work of the Commission, the participating Governments being represented in the administrative personnel, both in London and abroad, on the same proportional basis as has been adopted for the sharing of expenditure.

Policy.—While their constitutional history was thus developing, the Commission were busy arranging for the discharge of their responsibilities. One of their first acts was to lay down as a guiding principle that the graves of all ranks and ratings should be treated on a basis of absolute equality.

With this principle as a foundation on which to build, the Commission, desiring that the various proposals which had been placed before them as to the best method of discharging their responsibility should not become the subject of controversy, invited Sir Frederic Kenyon to report to them, the following being the terms in which the matter was referred to him:—

"Sir Frederic Kenyon's duties will be to decide between the various proposals submitted to him as to the architectural treatment and laying out of cemeteries, and to report his recommendations to the Commission at the earliest possible date.

"1. He will consult the representatives of the various churches and religious bodies on any religious questions involved.

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"2. He will report as to the desirability of forming an advisory committee from among those who have been consulted, for the purpose of carrying out the proposals agreed upon.

"The Commissioners are of opinion that no distinction should be made between officers and men lying in the same cemeteries in the form or nature of the memorials."

The recommendations of Sir Frederic Kenyon's report, which were adopted by the Commission, may be briefly summarized as follows:—

1. That the principle of equality of treatment should be expressed by the erection of uniform headstones over the graves of all officers and men who, in the words of the charter, may have died from wounds inflicted, accident occurring or disease contracted while on active service during the war.
2. That each cemetery should have a great memorial stone and a tall cross as central monuments.
3. That isolated graves should be concentrated into selected cemeteries.

It remained for the Commission to put the scheme into execution. Officials were appointed and made responsible for the organization and carrying out of the work in the different areas, and by the spring of 1918 the new establishment was on a practical basis.[1] In France and Belgium the preparation of architectural designs was entrusted to Sir Edwin Lutyens, Sir Reginald Blomfield and Mr. Herbert Baker; in Egypt, Macedonia, Italy and the United Kingdom to Sir Robert Lorimer; in Gallipoli and Palestine to Sir John Burnet; and in Mesopotamia to Maj. Edward Warren. In each of these areas there were assistant architects responsible to the principal architects named.

Work.—The type of regimental headstone finally selected by a committee consisting of Sir Frederic Kenyon, Sir C. J. Holmes, Mr. D. S. MacColl and Mr. Macdonald Gill, was of a design frequently found in churchyards in the United Kingdom. The dimensions are: height 2 ft. 6 in., breadth 1 ft. 3 in., thickness 3 inches. Each stone as a rule bears at the top the badge of the regiment or unit. Then follow the military details with the name of the deceased and the date of his death, below which is carved the symbol of his faith, while at the foot of the stone is engraved a personal inscription chosen by the next-of-kin.

Of the two central monuments the great altar-like Stone of Remembrance, designed by Sir Edwin Lutyens, bears the inscription chosen by Mr. Rudyard Kipling, "Their name liveth for evermore." The other memorial is the great Cross of Sacrifice designed by Sir Reginald Blomfield, to the shaft of which is fixed a crusader's sword of bronze. (*See* Plate.)

The preparation of cemetery registers, which will present a complete record of the fallen, is also a feature of the Commission's work. Each register will as a rule contain a map showing the situation of the cemetery, a plan giving the position of the grave, and an alphabetical list of those buried or commemorated in the cemetery, with a short addition, generally giving, among other details, age and parentage furnished by the next-of-kin.

To these duties must be added that of honouring the dead who have no known graves. This is no small task, for of these there are more than 250,000 and the precise form of the memorials was still in 1921 under consideration.

Nor did the Commission's responsibilities end here, for the commemoration of the navy's dead was also entrusted to them. In each of the three ports which throughout Britain's naval history have been intimately associated with the sea service a site was chosen for the erection of a memorial (which will also act as a sea-mark), bearing the names of those lost or buried at sea. These memorials were designed by Sir Robert Lorimer in consultation with the Board of Admiralty.

With equal generosity Belgium made provision similar to that of France for the acquisition of land for British cemeteries on her territory. Other countries followed the lead of France and Belgium. Measures of similar intent were passed by Italy in June 1918, and by Greece in Sept. 1920, while in Nov. 1918 the Egyptian Government promised to present to the Commission as a free gift the land on which British or Dominion soldiers were buried, as also did the Government of Palestine in Nov. 1920.

[1] The head office was set up in London, which will remain the permanent headquarters of the Commission.

Several of the enactments described above were followed by treaties or agreements. In Nov. 1918 an Anglo-French Agreement was signed enabling the Commission to act in France. An important clause provided for the establishment of an Anglo-French Committee (of which distinguished French and British officers are members), to represent the Commission in their relations with the French authorities, and to present claims for land for cemeteries, or for memorials by which some gallant exploit or feat of arms may be commemorated.

The Commission is represented by similar agencies with similar powers in Belgium, Greece, India, Canada, Malta, Gibraltar, Palestine and Mesopotamia. The Canadian Agency is responsible to the Commission for the entire execution of its purposes in Canada, the United States of America and Siberia; a committee established in India, in consultation with the Indian Government, is in the same way responsible for that country and Aden.

The unprecedented nature of the task with which the Commission was charged is obvious; its complexity and magnitude will be realized when it is remembered that the 600,000 known graves for which they were responsible were scattered all over the world in many different countries with different laws and customs, some of them the enemy countries with whom special provisions were made in the Treaties of Peace to ensure the graves being respected; and there are no less than 15,000 burial places in different parts of Europe and the East where British sailors and soldiers rest, the great majority being in civil cemeteries containing small groups of graves, but some 1,500 of them being cemeteries of considerable size, the largest containing 12,000 graves. As has been seen, the permanent construction work carried out in these cemeteries is of a simple but durable kind, but the Commission's gardeners set to work immediately after the Armistice, without waiting for the erection of the permanent headstones, planting shrubs, grass and flowers, taking as their guiding principle the words of Sir Frederic Kenyon's report: "There is no reason why cemeteries should be places of gloom; but the restfulness of grass and the brightness of flowers in fitting combination would appear to strike the proper note of brightness and life." It is hoped that these cemeteries may become a permanent landmark in the history of civilization.

When the Commission's policy was first announced it met with some criticism, particularly as regards equality of treatment as expressed by the principle of uniformity. This criticism found expression in a motion in the House of Commons. The debate which took place on this occasion (May 4 1920) has been described as one of the most moving in the history of the British Parliament. The result, by which the motion was negatived without a division, must have removed from the minds of the commissioners any fear that the sympathy of the country was not with them in the course they were pursuing.

II. Forces of France and the United States.—While, as a rule, the Allies adopted similar methods of commemorating the fallen to those described above, the great differences in the numbers of their casualties and in the conditions obtaining in the different countries rendered certain divergences unavoidable.

France, on whose soil lay over three million dead, was faced with the problem of honouring her fallen soldiers without clogging the wheels of industry and agriculture, which were beginning to revive under peace conditions, even in the devastated areas where the graves lay thickest. The British helped to solve the difficulty by concentrating all isolated graves into cemeteries which would forever mark the British battle-line. The French adopted the further expedient of giving the next-of-kin the opportunity of having their dead re-buried at the State's expense in the churchyard or burial-ground of their native place, while those who were left would rest in great national cemeteries constructed by the State as a lasting monument to the heroism of the soldiers who died for France.

Many of the fallen soldiers of the American Expeditionary Force were borne back across the Atlantic to rest in their native land. The execution of this difficult task demanded careful organization, and it says much for the enthusiasm and the capacity of the staff of the Cemeterial Branch of the American

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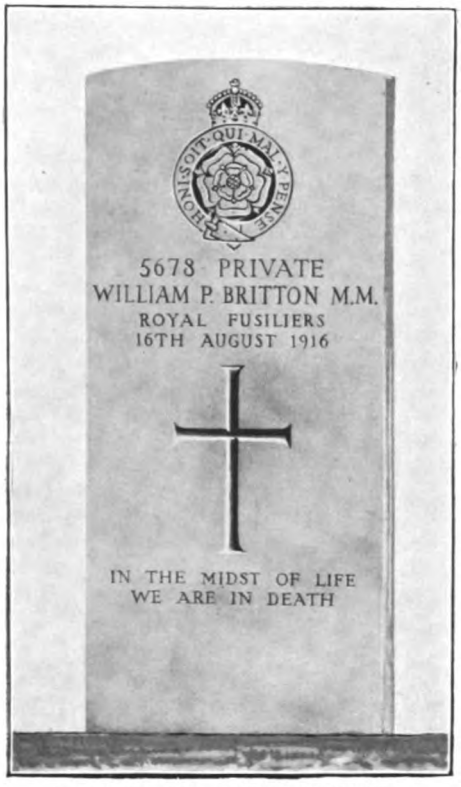
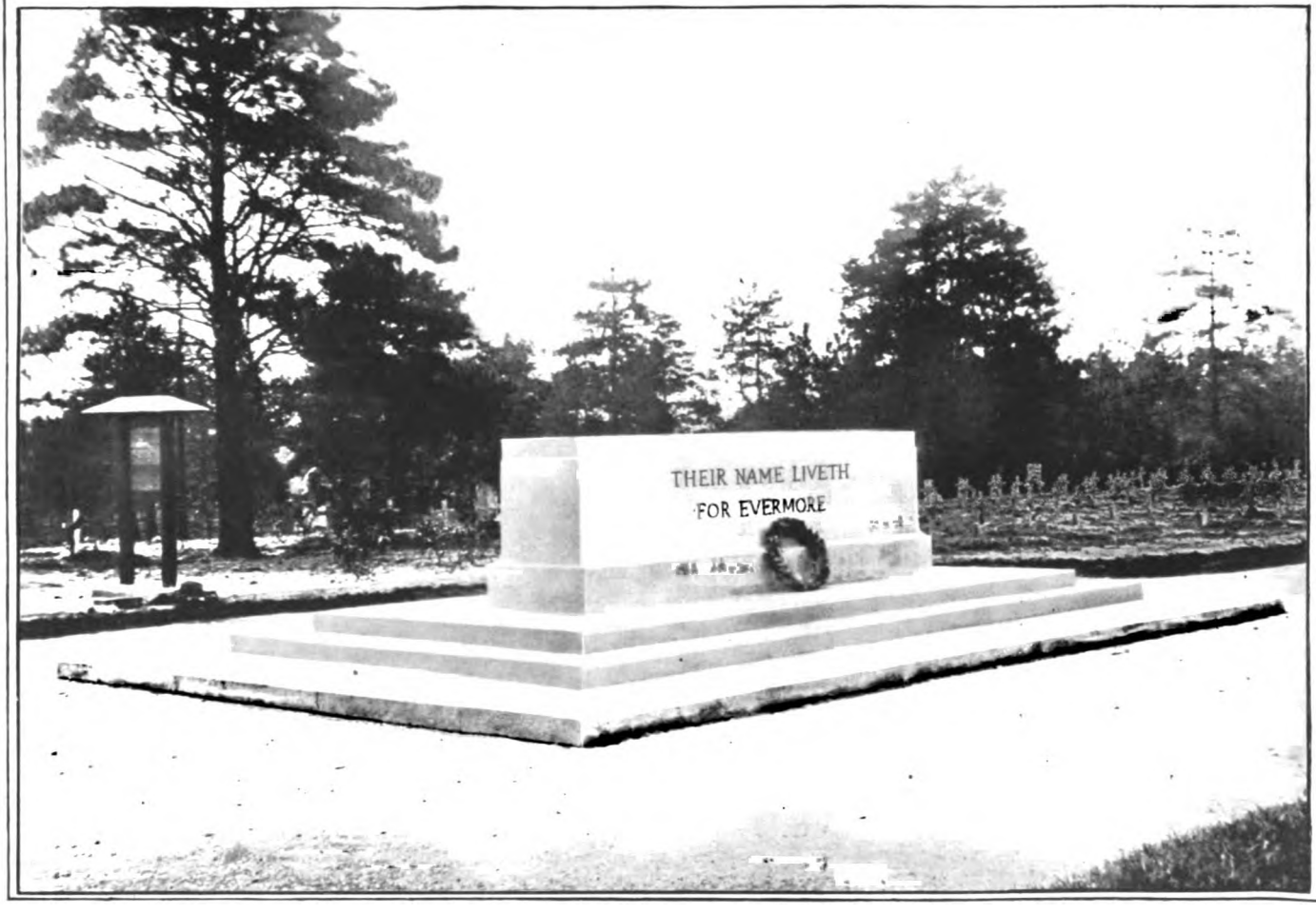
WAR GRAVES

"CROSS OF SACRIFICE" (BRITISH)



WAR HEADSTONE (BRITISH)



"STONE OF REMEMBRANCE" (BRITISH)

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War Department that it was carried out with so much success; it would have certainly been impossible but for the fact that American death casualties did not amount to much more than one hundred thousand, a comparatively small number compared with that of the British Empire, whose losses approximated to the enormous total of one million men. It is probable that the American War Department would have hesitated before undertaking a task even of the magnitude mentioned had it not been for the fact that, before a single American battalion had left the shores of the United States, a pledge had been given that no American soldier who died fighting for his country and for the liberties of nations should be left to lie on foreign soil except at the express wish of his next-of-kin.

Many Americans were taken from British military cemeteries, where they were buried under stress of battle with their British comrades-in-arms. It was hoped that the empty spaces left after the removal of such French and American soldiers would be marked by memorials which would remind posterity how the armies of France, America and the British Commonwealth fought and fell together in the defence of a common ideal.

Those Americans left to rest in France were grouped together in three or four great cemeteries, the land being acquired by the French Government on behalf of the sister Republic under the law of 1915. The plan of construction of these cemeteries is based on the principle of uniform treatment of the graves, a principle which has for some considerable time found favour in America in the planning of cemeteries. Indeed the United States may justly claim to be the first nation to put this conception into practice, the most notable example being Arlington National Cemetery, where the men who died in the Civil War and in the Spanish-American War of 1898 lie buried. It is possible that the conspicuous success with which Arlington Cemetery has been designed had a share in influencing the Imperial War Graves Commission in the construction of the British war cemeteries on somewhat similar lines. (F. W.)

WAR LOAN PUBLICITY CAMPAIGNS.—In connexion with this account of publicity relating to war financing in Great Britain, the article LIBERTY LOAN PUBLICITY CAMPAIGN and the *United States* section of the article SAVINGS MOVEMENT will afford a broad view of the activities in these two countries. Prior to the outbreak of war in 1914, Government loans in Great Britain were subscribed by a very limited circle of large investors, businesses and corporations. Publicity in connexion with the floating of them began and ended with the issuing of a prospectus, its publication in the Press, and its distribution by a limited number of bankers and stockbrokers. In order, however, to raise the vast sums of money required by the Government for the prosecution of the war, other and far bolder publicity methods had to be inaugurated during 1914–9. It was necessary to appeal to a very much wider circle of subscribers—a circle eventually no narrower than the whole population of the British Islands—and to urge investment in War Loans as a patriotic duty. The first attempts at the application of modern methods of publicity to the flotation of War Loans were on a limited scale, being hampered by official reluctance to depart from traditional procedure and a prejudice against any lapse from official "dignity." A slight expansion of newspaper advertising, at first not widely departing from mere "publication of prospectus" advertising, and the use of posters displayed in the streets and on hoardings, marked the beginning of a new state of things. The work of the War Savings Committee from 1916 onwards, together with news of the successful publicity work in the U.S., helped to reconcile British officialism to an increase of activity in this direction.

By the time the so-called "Victory" Loan was floated, early in 1917, newspaper advertising had increased both in volume and effectiveness. Many more posters appeared on the hoardings. The services of local authorities were invoked, and public meetings were held, up and down the country, at which speakers drew attention to the country's pressing need of money and appealed openly for subscriptions. A great mass meeting in Trafalgar Square, held under the auspices of ministers of religion, was an outstanding publicity feature in connexion with the Victory Loan and was the forerunner of many similar gatherings.

It was, however, in connexion with the campaign for National War Bonds, which were first offered to the public in Sept. 1917, that organized publicity on behalf of British war-loan subscriptions displayed the fullest measure of its possibilities and achieved its greatest success. The National war Bonds were short-dated securities continuously on offer—in contrast to earlier loans the subscription lists for which had remained open only for some weeks. They were introduced by Mr. Bonar Law, the then Chancellor of the Exchequer, in order to inaugurate a period of "continuous borrowing"—to provide a method by which the public could subscribe each week the weekly cost, or more than the weekly cost of the war. It was hoped by this means to avoid the dislocation of the money market and the inflation of currency (due to borrowing from banks for purposes of subscription) which had been found to attend the previous "closing date" loans.

Despite attractive terms the subscriptions for National War Bonds for the first two or three weeks were distinctly disappointing. Starting at an exceedingly low weekly total the receipts rapidly fell, and it says much for the extent to which publicity methods had already justified themselves that in Nov. 1917 the Chancellor of the Exchequer, faced with the prospect of the failure of the whole new scheme of continuous borrowing, saw fit to appoint Sir George (then Mr.) Sutton, the chairman of the Amalgamated Press Ltd., as Director of Publicity for the War Bond campaign—with an entirely free hand as to methods employed, and, within very wide limits, a free hand as to expenditure. The result was a complete change, from the first week of Dec. 1917, when the War Bond publicity campaign could have been said to be really started.

The backbone of the campaign was undoubtedly newspaper and periodical advertising. This advertising was practically continuous, though very widely varied. The appeal of it was cast and recast in a hundred ways. It struck first the finance note, the self-interest note, the explanatory "see what you get and what security" note, and then the loftier note of patriotism, of service, of exhortation to duty. The advertising was intensely human, written to appeal not merely to business men but to the people at large. It reached its highest pitch of emotional appeal during the terrible spring of 1918 when the Germans, pushing far into the Allied lines, threatened Amiens, and the whole British nation hung breathless upon the march of events. During those dark weeks the War Bond advertising told, almost day by day, the story of England in terms of Belgium; pointing out the inevitable and hideous consequences of defeat, and urging the duty of supporting with money the brave men then fighting.

Another point to be noted about the press advertising was its topicality. Appropriate "copy" was actually kept standing for immediate publication in the event of certain contingencies such as a great victory, or (on the other side of the picture) the air-bombing of important British towns.

It was recognized that in order to sustain interest in War Bonds over a long period the steady appeal of the press advertising required reinforcing by periods of special activity. The necessary stimulus was obtained by the organization throughout the country of special "weeks" such as "Tank Weeks"—"Business Men's Week"—"War Weapons Weeks"—"Feed the Guns Weeks." The main features of these were similar. They consisted essentially in the provision of some spectacular feature round which the appeal for subscriptions could centre. Tanks, for instance (then just newly invented), each with an officer and crew, took up their stand for a week at a time in the leading towns and cities. Officials of the Bank of England and of the Post Office accompanied the tanks, and very many million pounds' worth of bonds were sold by them.

The effect of the visit of a tank to a town was that for one week at least that town talked and thought of nothing but War Bonds. Local papers devoted columns to descriptions of the amount of business done, and local firms and business men vied with each other to subscribe the largest amounts.

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Leaflets (which were frequently dropped from aeroplanes in order to obtain the maximum of spectacular effect), posters, speakers, etc., were, of course, supplied by the Director of Publicity for each tank in each town.

"Feed the Guns" weeks were run on the same principle, the tanks being replaced by giant howitzers fitted with an ingenious device whereby the bonds sold could actually be stamped in the breeches of the guns themselves.

"Business Men's Week," which was held simultaneously throughout the country, and "War Weapons Weeks," which were worked town by town, were run somewhat differently. In both these cases the cities and towns of the country were assessed to subscribe amounts calculated on a basis of £2 10s. 0d. per head of population, and this amount instead of being expressed in figures was expressed as some definite weapon of war which the amount in question would suffice to purchase. Thus a large city would be asked to subscribe sufficient in a week to purchase one or more battleships, a smaller town enough to purchase a cruiser, a township enough to purchase a squadron of aeroplanes, a village enough for a howitzer.

This dramatic method of presenting each community with an opportunity to achieve concrete expression of its duty as a community brought splendid results. Scarcely a town or city in the country failed to perform its task, and during very many of the weeks sums far in excess of the assessments were subscribed. Liverpool, for instance, asked to purchase a battleship, invested sufficient during its week to purchase no less than six!

All these separate campaigns of special weeks were "led off" by spectacular displays in Trafalgar Square, London, which was transformed for each occasion into something resembling a huge circus. Tanks or guns, as the case might be, were "parked" and surrounded with skilfully built imitation trenches and entanglements; barriers and huts were erected, painted scenery was provided to form a background, giant posters almost hid the façades of the National Gallery and the buildings surrounding the Square, and hundreds of thousands of people were attracted of a class which could probably not have been reached by any other form of appeal. Vast business was done during these Trafalgar Square weeks, sums running into many millions being invested during each. So great was the enthusiasm roused that some business firms actually marched down their employees with bands and flying flags to make their purchases of bonds during the prevailing excitement.

Not content with waiting in Trafalgar Square for subscriptions to come to them, two of these huge tanks snorted and puffed, day by day, through the streets of the city, calling at the offices of the leading insurance firms to collect applications for War Bonds. As a tank does not move swiftly it was necessary to limit this privilege of a "personal" call to firms desirous of investing £50,000 or over.

Government carrier-pigeons were also used, with great success from the point of view of publicity, to bring in applications from a distance to Trafalgar Square.

Another important publicity aspect of these special weeks was the opportunity each provided for an important official opening. Thus "Business Men's Week" was preceded by a great public meeting in the Connaught Rooms at which the Chancellor of the Exchequer was the chief speaker and to which all the leading bankers of the kingdom were invited. It is probable that from the financial point of view no more influential gathering than this has ever taken place. "Feed the Guns Weeks" were introduced by another great meeting at the Guildhall, addressed by the Chancellor of the Exchequer and the Rt.-Hon. A. J. Balfour.

The extent of the response to these special weeks was enormous, as may be judged by one of them only, the "Business Men's Week," which brought in £160,000,000—nearly eight times as much as the average weekly total.

Apart, however, from greatly increased purchases, these special weeks, "booms," and "stunts" were very valuable as yielding a continuous "news" story. The problem before the publicity director was to maintain interest in War Bonds week after week and month after month; and had the campaign once been allowed to become a matter of routine, lacking new incidents, the "news" story of it would perforce have dropped out of the columns of the press. As it was, so great was the variety and so many the incidents that a full-size news agency had to be installed at headquarters, where a large staff was kept busily engaged in collecting news by telegram and telephone from all over the country and passing it on to the press.

A successful publicity device was the inter-town War Bond Race. The race, of course, was to secure the largest total of local holdings in War Bonds, and, promoted and fostered by the Publicity Director, it went gaily on for months—the varying position of the leading cities, now one leading, now another, forming for over a year an almost staple article of news.

Many other publicity devices were employed, among which the following may be noted:—

(1). Arranging with the Postmaster-General to adopt a cancellation mark carrying the words "Buy War Bonds," so that practically every citizen received a daily reminder of his duty on the envelope of every letter received. (2). A letter signed by the Chancellor of the Exchequer urging investment as a patriotic duty—sent out by the Bank of England with each dividend on a Government security. (3). A letter signed by the chairmen of banks to the individual depositors urging that deposits should be reduced and the money invested in War Bonds. (4). A letter sent out by limited liability companies simultaneously with the dispatch of their dividend warrants, urging that the amount of the dividend should be at once invested in War Bonds.

These letters ran, of course, into many millions, and the drafting, preparation, and printing of them was not the least arduous of the tasks which the Publicity Director and his staff had to face.

After the Armistice a closing date for War Bonds was announced, and a very extensive final appeal was organized which brought the total of investment in them up to the magnificent figure of £1,600,000,000—subscribed in under 17 months.

The publicity in connexion with War Bonds more than justified itself. It established the feasibility of the hitherto untried system of continuous borrowing; it secured a total of subscriptions far in excess of anything that the Chancellor of the Exchequer had contemplated; and it did, in fact, finance the war to a finish.

Publicity in connexion with post-Armistice loans—notably the Thanksgiving Loan of 1919 (popularly termed the "Joy Loan")—was conducted on similar lines. War, which altered and remodelled so much that had appeared fixed, certainly brought a new spirit and a new method into the floating of Government loans in Great Britain. The success achieved was so marked as to make it unlikely that any future Chancellor of the Exchequer would embark upon any big loan issue without first assuring himself of the services of the most influential publicity adviser. (G. A. S.)

WARRE, EDMOND (1837–1920), English educationist, was born in London Feb. 12 1837, the son of Henry Warre, of Bindon House, near Wellington. He was educated at Eton and Balliol College, Oxford, where he had a distinguished career, taking a double first (1856 and 1859). In 1859 he was elected a fellow of All Souls. He went to Eton in 1860 as assistant master, and in 1884 was elected Headmaster, a position which he retained until 1905. After a period of retirement he was in 1909 appointed provost of Eton in succession to Dr. James Hornby, but during the greater part of his provostship he was incapacitated by ill health from taking any very active part in the government of the school. He was an hon. chaplain to Queen Victoria (1885–1901), and later occupied the same office in the households of King Edward VII. and King George V. He was created M.V.O. in 1901, C.B. in 1905, and C.V.O. in 1910. He died at Eton Jan. 22 1920. He took much interest in sport at Eton, and the high standard of rowing to which the Eton eights attained was due in a large measure to his coaching. His 45 years' connexion with Eton thoroughly identified him with its traditions and ideals, and, without being remarkable either as scholar or as teacher, he wielded a personal influence which has seldom been surpassed.

WARREN, WHITNEY (1864–), American architect, was born in New York City Jan. 29 1864. After studying at the

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École des Beaux Arts, Paris, under Daumet and Girault (1885–1894), he began the practice of architecture in New York, later becoming associated with Charles D. Wetmore under the firm-name of Warren & Wetmore. They specialized in railway architecture, hotels, business buildings and residences, and were architects for the New York Central, Michigan Central, Canadian Northern, and Erie railways. Their numerous structures in New York City include the Chelsea docks and the hotels Belmont (1905), Vanderbilt (1910), Biltmore (1912), and Commodore (1916). During and following the World War, Warren supported actively the claims of Italy in the Adriatic. He was an intimate friend of d'Annunzio, and was appointed diplomatic representative in the United States of the "Free State of Fiume." In 1920 he was chosen by the International Committee to reconstruct the library of the university of Louvain, destroyed by the Germans in 1914. He was a member of the Institut de France, the Académie des Beaux Arts, the Royal Academy of St. Luke (Rome), and other foreign academies. He was the author of *Les Justes Revendications de l'Italie: la Question de Trente, de Trieste et de l'Adriatique.* Many of his addresses, delivered 1914–9, were published and widely distributed.

WASHINGTON, BOOKER TALIAFERRO (*c.* 1859–1915), American negro teacher and reformer (*see* 28.344), died at Tuskegee, Ala., Nov. 14 1915, as the result of a breakdown due to overwork. His last public address was delivered on Oct. 25 before the national conference of Congregational churches in New York City. At Tuskegee he was succeeded by Robert R. Moton. He was the author of *My Larger Education: Being Chapters From My Experience* (1911) and *The Man Farthest Down; a Record of Observation and Study in Europe* (1912).

See D. F. Riley, *Life of Booker T. Washington* (1916).

WASHINGTON, District of Columbia (*see* 28.349), the capital city of the United States, increased in pop. from 331,069 in 1910 to 437,571 in 1920, a gain of 106,502, or 32·2% as compared with 52,351 or 18·8%, in the preceding decade. Of the 1920 pop. 326,860 were white, 109,966 negro and 745 of other races (chiefly Chinese, Japanese, Filipino and Indian). With the entrance of the United States into the World War in 1917 Washington not only assumed new importance among world capitals, but it became the centre from which practically every significant activity in the United States, commercial and industrial as well as military and naval, was directed. Existing Government bureaus were expanded beyond precedent and many new ones were created. These activities brought to Washington within a single year 60,000 new residents, a large percentage of whom remained after the war came to an end. An acute shortage of housing facilities developed, and the Government was forced to commandeer every available building, as well as to construct a number of new ones.

Buildings.—In order to carry on the war work of the Government a number of temporary office buildings for the use of various departments were erected on the Mall between 3rd and 9th Streets. On B Street N.W., between 17th and 21st Streets, two large structures of the factory type, of cement and iron, were erected for the War and Navy Departments. One of the largest buildings in the capital, the Arlington Building, of stone and iron, was erected (1919) on the site of the old Arlington Hotel on Vermont Avenue and H Street N.W. for the use of the War Risk Bureau. Most of the other buildings constructed during the war period were of a temporary character, being designed merely to meet an emergency. Of this class were the Government hotels on the Union Station Plaza erected for war workers as late as 1919 and in use in 1921. There were in all 14 of these emergency buildings, two of which were used for administrative purposes. Among the new permanent buildings were the City Post Office (1914), near the Union Station; the building for the Department of the Interior (1917), occupying the block between E, F, 18th and 19th Streets N.W.; the Bureau of Engraving and Printing (1914), 14th Street between C and D Streets S.W.; the Treasury Department Annex, on Pennsylvania Avenue opposite the Treasury Building. The capacity of the Navy Yard was increased by the erection of three large buildings for a machine shop, gun shop, and joiner shop. New buildings were leased by the Government for the Department of Commerce, Department of Labor, Railroad Administration, Bureau of the Census, branches of the Department of Agriculture, and other executive organizations. Near Brightwood, about 4 m. north of the city proper, is the Walter Reed General Hospital, first established in 1905 for the U.S. army. To extend its capacity, a number of additional buildings were constructed during the war, mostly of a temporary or semi-permanent character. The grounds embrace 97 ac. and it is next to the largest army hospital in the United States, the maximum capacity being 2,650. The grounds and buildings cost $2,575,000. In the Mall, adjoining the Smithsonian Building on the west, is the Freer Art Gallery (1920), built at a cost of $1,000,000 and donated to the Government by Charles Lang Freer of Detroit, Mich. In 1921 the construction of the $5,000,000 Shrine of the Immaculate Conception, in the grounds of the Catholic university, was begun, and the erection of the Episcopal cathedral of St. Peter and St. Paul, at Mt. St. Alban, was well under way. When completed it will have cost $5,000,000. In a commanding position at 16th and S Streets N.W. is the House of the Temple (1915), headquarters of the southern jurisdiction Scottish Rite Masons. It is of white marble, of Egyptian and Grecian architecture, 212 by 217 ft. in size, and cost $1,000,000. The Pan-American Building, a white marble structure on 17th Street N.W., at the entrance to Potomac Park, was dedicated in 1910. It cost $1,100,000, of which the American republics contributed $250,000 and Andrew Carnegie $850,000. Near it are the Red Cross Building (1917) and the building of the Daughters of the American Revolution (1910), both in white marble. The Georgetown, or Key Memorial, Bridge, which spans the Potomac river at Georgetown, was expected to be completed in 1922, the estimated cost being $2,100,000. It is of reinforced concrete with seven arch spans, one of which is 208 ft. in length. Its total length, including piers, is 1,452 ft. 9 in.; the width of deck is 70 feet.

Streets and Parks.—Much improvement has been made in the thoroughfares and parks. The flats and lowlands along the Potomac river have been beautified and provided with picturesque driveways. Provision has been made for new parks and additions to those already existing. Asphalt pavement has been laid on 172 m. of city streets and avenues. The principal business section of the city now includes Pennsylvania Avenue from the Capitol to the Treasury Building. F, G, and H Streets running east and west, 7th, 9th and 14th Streets running north and south and Connecticut Avenue. A zoning law of 1920 restricts certain businesses to prescribed areas, and regulates the height and character of new structures.

Monuments.—The Lincoln Memorial, occupying an elevation in Potomac Park near the Washington Monument, was practically complete in the spring of 1921 at a cost of about $3,000,000. It is a rectangular edifice of white marble surrounded by 36 Doric columns, one for each state of the Union at the time of Lincoln's death. The principal interior feature is a marble statue of Lincoln by Daniel C. French; on the walls within are lettered the Gettysburg Address and phrases from the second Inaugural Address. The memorial was designed by Henry Bacon and erected under the direction of a commission appointed by Congress in 1911. Across the Potomac river, in Arlington National Cemetery, are the amphitheatre and chapel erected at the instance of the Grand Army of the Republic in memory of all soldiers, sailors, and marines who have fought under the flag of the United States, and also intended to provide a place of assembly for the observance of Memorial Day. The amphitheatre is an enclosure with a colonnade of white marble; the turf is left uncovered and open to the sky. The chapel has a seating capacity of 5,000. The two buildings were completed shortly after the outbreak of the World War at a cost of $825,000. Statues and monuments erected during the decade 1910–20 include Christopher Columbus by Lorado Taft, Union Station Plaza; John Paul Jones by C. H. Niehaus, Potomac Park; a monument to Maj. Pierre Charles L'Enfant who designed the plan on which the city has been built, in Arlington Cemetery; the Butt-Millet Fountain, Daniel C. French, sculptor, Thomas Hastings, architect, erected near the Washington Monument as a memorial to two men who lost their lives in the "Titanic" disaster (1912) and the James McMillan Fountain, Herbert Adams, sculptor, Thomas Hastings, architect. The Grant statue, nearing completion on the east front of the Botanic Garden, is the work of Edward P. Casey, architect, and Henry M. Shrady, sculptor, and will have cost about $240,000. During the World War the statue of Frederick the Great, in the Army War College grounds, was removed. Flannery's Abraham Lincoln, at John Marshall Pl. and D Street, also removed, was to be replaced.

Education.—The Wilson Normal School, 11th and Harvard Streets, was erected in 1913 at a cost of $257,000, and an expenditure of $1,493,000 was made for the site and building of the New Central High School (1916), at 11th and Clifton Streets. The enrolment in the graded schools in Jan. 1921 was 53,840, and in the high schools, 8,735. There were 2,096 teachers—1,442 white, 654 negroes. More than one-third of the pupils were negroes.

Manufactures.—In 1919 there were in Washington 595 manufacturing establishments (exclusive of Government industries) whose products were valued at $68,826,570, of which $37,886,470 was added by manufacture. There were engaged in those industries 14,101 persons, whose salaries and wages amounted to $18,856,410. In value of products there was an increase of 137·5% over 1914, and in salaries and wages an increase of 119·1%. Some of the principal industries in 1919 were: newspapers and periodicals, $11,898,000; bakery products, $10,626,000; meat-packing, $5,012,000; ice cream, $4,101,000. Statistics of governmental industries are shown in the table at the top of page 956.

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Census Year	Persons engaged		Expenditures			Cost of Materials
	Total	Wage-Earners	Total	Salaries	Wages	
1919	22,423	20,169	$59,074,889	$3,540,566	$29,794,728	$25,346,438
1914	11,639	10,614	17,862,758	1,122,927	10,614,466	5,902,954
1909	11,470	10,657	15,508,250	1,016,745	10,663,040	3,807,626

The figures are in each case for 11 establishments, and include principally engraving and printing, instrument manufacture, and the naval gun factory. The marked increase in the figures for 1919 was due to the abnormal activity brought about by the war.

History and Finance.—During the participation of the United States in the war there was employed in the Government departments a maximum of 117,760 civil service employees, but this number had been reduced in 1920 to 86,846. The personal U.S. income taxes collected in the city of Washington in 1918 amounted to $8,669,100. Local taxes collected in 1920 amounted to nearly $3,000,000 on personal property and $8,633,278 on realty. The total value of assessable real estate was $426,623,630. The amount contributed by Congress for municipal expenses was more than $8,000,000. In 1920 private building operations amounted to $22,638,862, and for the 10 years 1910–20 to over $151,000,000.

During the war the District of Columbia furnished 24,853 troops and subscribed $127,129,650 for the purchase of Liberty and Victory Bonds and War Savings Stamps, and for contributions to Y.M.C.A. and other war funds. (J. C. P.*)

WASHINGTON (State) (*see* 28.358).—The pop. in 1920 was 1,356,621, an increase of 214,631, or 18·8%, over the 1,141,990 of 1910, as against an increase of 120·4% in the preceding decade.

The density of pop. was 20·3 per sq. m.; in 1910 17·1. The urban pop. (in 35 places of 2,500 or more) was 55·2% of the whole, as against 53% in 1910. The pop. of the eight cities having more than 15,000 was:—

	1920	1910	Increase per cent
Seattle	315,312	237,194	32·9
Spokane	104,437	104,402	
Tacoma	96,965	83,743	15·8
Everett	27,644	24,814	11·4
Bellingham	25,585	24,298	5·3
Yakima	18,539	14,082	31·7
Walla Walla	15,503	19,364	−19·9
Aberdeen	15,337	13,660	12·3

The most significant change in the characteristics of the pop. was the increased number of Japanese and especially of Japanese women. In 1900 there were 5,617 Japanese, or 1·1% of the total pop., 96·7% being males. In 1910 the Japanese had increased 130·2% to a total of 12,929, which was still 1·1% of the total pop., 86·9% being males. In 1920 there were 17,114 Japanese, or 1·3% of the total. The rate of increase was 32·4% and the percentage of males had declined to 65·3. One reason for the proportional increase of females was the privilege, prior to the legislative session of 1921, of acquiring title to land in the names of native-born children of Japanese parents.

Agriculture.—During the decade 1910–20 the number of farms increased from 56,192 to 66,288; the acreage of improved land from 6,373,311 ac. to 7,129,343 ac.; the value of all farm property from $637,543,411 to $1,057,429,848. The average value of land per acre in 1910 was $44.18; in 1920 $60.22. The following table shows the change in acreage, production, and value of the chief crops for the decade 1909–19.

		Acreage	Production	Value
Wheat	1919	2,494,160	41,837,909 bus.	$91,206,642
	1909	2,118,015	40,920,390 "	35,102,370
Oats	1919	191,673	8,073,481 "	8,073,481
	1909	269,742	13,228,003 "	5,870,857
Barley	1919	84,568	2,249,856 "	3,374,792
	1909	171,888	5,834,615 "	3,331,930
Indian corn	1919	34,799	901,905 "	1,623,433
	1909	26,033	563,025 "	404,367
Potatoes	1919	55,132	5,866,710 "	12,320,093
	1909	57,897	7,667,171 "	2,993,737
Hay and forage	1919	1,064,130	2,013,913 tons	47,717,065
	1909	742,741	1,399,597 "	17,200,252
Sugar beets	1919	5,363	46,386 "	500,969
	1909	1,270	6,556 "	38,007

Crops of increasing importance are bulbs, flowers, vegetable seeds, flax, filberts, and English walnuts. Prohibition increased enormously the demand for berry-juices. Three-fifths of the loganberries produced in the United States come from Washington (1,157,778 qt. in 1919, valued at $208,402). The evergreen wild blackberry (supposed to have been introduced from Hawaii) is spreading through the river valleys, and the fruit is shipped in carload lots to the canneries.

In 1919 the state ranked first in the production of apples and third in hops (1,615,761 lb., valued at $727,092). The growth of the chief orchard crops between 1909 and 1919 was as follows:—

		Production	Value
Apples	1919	21,568,691 bus.	$38,823,641
	1909	2,672,100 "	2,925,761
Peaches	1919	1,544,859 "	3,321,449
	1909	84,494 "	118,918
Pears	1919	1,728,759 "	3,025,331
	1909	310,804 "	328,895
Plums and Prunes	1919	785,920 "	1,532,546
	1909	1,032,077 "	600,503

The following table shows the growth in number and value of domestic animals during the decade 1910–20.

		Number	Value
Horses	1920	296,381	$25,069,336
	1910	280,572	29,680,849
Mules	1920	23,091	2,930,813
	1910	12,185	1,776,297
Milch cows	1920	289,635	23,648,537
	1910	186,233	7,988,133
Sheep	1920	623,779	7,750,407
	1910	475,555	1,931,170
Swine	1920	264,747	5,049,249
	1910	206,135	1,674,927

In 1917–8 condenseries used 205,657,654 lb. of whole milk to produce 1,844,097 cases of condensed milk, valued at $8,870,825. Cream and butter were sent to the cities from 110 creameries. In 1919 in 19 factories the production of cheese was 2,004,365 lb., valued at $348,669.

During the decade 1910–20 the irrigated farms increased from 7,664 to 13,271; irrigated acreage from 334,378 ac. to 529,899 acres. The Reclamation Service of the Federal Government has impounded the waters in Keechelus Lake (Kittitas county) and other lakes to serve large projects in the Yakima valley. The Kittitas county project under the state law was designed to reclaim 70,000 ac.; the Klickitat county project to irrigate 90,000 acres. The largest enterprise is the Columbia Basin project, to utilize the waters of Pend Oreille lake and river for the irrigation of 1,750,000 acres.

Mining.—The value of gold production decreased from $840,000 in 1911 to $280,000 in 1919. The amount of silver produced increased from 230,000 oz. to 299,000 oz.; copper from 196,000 lb. to 1,320,000 lb.; lead from 848,000 lb. to 1,700,000 lb.; zinc from 25,000 lb. to 39,000 pounds. Coal mined in 1911 was 3,573,000 tons; in 1919 3,100,000 tons. During the decade 1910–20 five new cement plants were established in the state, and large quantities of Portland cement exported. Of increasing importance are clay products, such as paving brick, sewer pipe, and terra cotta.

Manufactures.—The following table shows the growth of manufactures 1909–14.

	1914	1909
Number of establishments	3,829	3,674
Wage-earners (average)	67,205	69,120
Capital	$277,715,262	$222,261,229
Salaries	11,504,088	9,826,579
Wages	51,703,052	49,766,368
Cost of materials	136,609,309	117,887,688
Value of products	245,326,456	220,746,421
Value added by manufacture	108,717,147	102,858,733

The chief items were lumber and timber products, flour-mill and grist-mill products, slaughtering and meat-packing, butter, cheese and condensed milk, printing and publishing, malt liquors, canning and preserving. In 1914 the state ranked twenty-third in value of products and twenty-seventh in number of wage-earners.

Water Power.—Chief Engineer Merrill, of the Forest Service, U.S. Department of Agriculture, has prepared a chart showing the distribution of water-power resources in the United States. The total represents 54,000,000 H.P.—Washington is shown to exceed all other states, with 16% of the total, California being second with 14·5% and Oregon third with 12·3 per cent. Efforts were being made in 1921 to secure Government control of trunk lines for the distribution of hydro-electric power.

Ports and Commerce.—During and immediately after the World War the commerce passing through the district of Puget Sound was second only to that of New York. A law approved on March 14 1911

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authorized the organization of ports, and where these are made coextensive with the areas of first-class counties they become ports of the first class. These have elaborate powers of taxation and management. Seattle, Tacoma, Aberdeen and other cities have taken advantage of this law to improve their harbours and to build great wharves and other conveniences to handle the increasing commerce.

Highways.—The state has embarked upon the task of providing an extensive system of improved roadways. These include the Washington link of the Pacific Highway, intended to extend from Alaska to the Straits of Magellan, another highway around Puget Sound to the Pacific; and highways across the Cascade Range and eastern Washington. The Federal Government maintains the Mt. Rainier National Park and the Olympic National Monument. Efforts were being made in 1921 to preserve the Mt. Baker and the Mt. Adam national parks. National forests include 12,000,000 ac. within the state. The Legislature has created a state Park Board authorized to receive lands for parks and to preserve strips of native forest growth along the highways.

History.—Ernest Lister, Democrat, became governor in 1913 and was reëlected in 1916. He died June 14 1919, and was succeeded by Lt.-Gov. Louis F. Hart, Republican. Governor Hart was elected to succeed himself in 1920. He recommended what is known as the Governor's Administrative Code of 1921, one of the most significant changes in the state government since its organization. It was enacted by the Legislature, and many boards of commissioners were abolished. The work formerly in their hands was entrusted to appointive officers.

Commerce with many nations developed rapidly during the decade 1910–20. In Seattle there were in 1921 24 resident consuls representing foreign countries. By far the greater number of vessels coming to ports of Puget Sound were under the Japanese flag. Branches of Japanese banks were established. In 1921 the Legislature passed a law restricting alien ownership of land, aimed especially at the Japanese. It provides that: an alien shall not own land or take or hold title thereto; no person shall take or hold land or title to land for an alien; land now held by or for aliens in violation of the constitution of the state is forfeited to and declared to be the property of the state; land hereafter conveyed to or for the use of aliens in violation of the constitution or of this Act shall thereby be forfeited to and become the property of the state. The word "alien" is so defined that it does not include an alien who has in good faith declared his intention to become a citizen of the United States, but does include all other aliens and all corporations and other organized groups of persons a majority of whose capital stock is owned or controlled by aliens or a majority of whose members are aliens. During the World War many yards were established for the building of steel and wooden ships. A special railway was built into the spruce forests of Clallam county to get materials for airplanes. The Federal Government established a permanent cantonment at Camp Lewis, near Tacoma. A naval training station was established on the campus of the university of Washington in Seattle.

Progressiveness was shown in such legislation as the working men's compensation law (1911), initiative and referendum (1913), recall of public officers (1913) and aid for destitute mothers (1915). To meet the high cost of government the Legislature in 1921 enacted laws levying a poll-tax on every person between the ages of 21 and 50, and a tax of one cent on each gallon of gasoline used by motor vehicles; the tuition charges in state institutions of learning, and the fees for licences for automobiles and for fish-dealers and others were also increased.

During the World War the state supplied to the army 45,154 men; navy 11,887; and marine corps 1,767. The state's subscriptions to the Liberty loans were: First, $17,070,650; Second, $38,481,100; Third, $42,907,950; Fourth, $70,189,650; Fifth, $45,024,150. (E. S. M.)

WASHINGTON CONFERENCE, 1921.—Preliminary invitations to a conference at Washington on the limitation of national armament were issued by President Harding on July 10 1921 to Great Britain, France, Italy, and Japan. On Aug. 11 formal invitations were sent to these Powers, to China, and later to Belgium, the Netherlands, and Portugal, President Harding having been authorized by Congress, in an amendment to the Naval Appropriations bill signed July 11 1921, to arrange for the Conference. The President made it plain that he regarded disarmament questions as closely linked with the Pacific and Far Eastern problems. As American delegates Mr. Harding designated Secretary of State Hughes, Elihu Root, Senators Lodge and Underwood; the British Empire was represented by Mr. Balfour, Lord Lee of Fareham, Sir Auckland Geddes and Sir Robert Borden, as principal delegates; France by Premier Briand, M. Viviani, M. Sarraut, and M. Jusserand; Italy by Sig. Schanzer and Sig. Ricci; Japan by Prince Tokugawa, Admiral Kato, and Ambassador Shidehara; China by Mr. Wellington Koo and Mr. Sze.

The Conference assembled Nov. 12 1921, was addressed by Mr. Harding, and elected Mr. Hughes as its chairman. The latter at once placed the American proposals on naval disarmament before the gathering; they were so precise and far-reaching as to cause general surprise. Reviewing the failure of previous attempts at disarmament and emphasizing the existing opportunity, Mr. Hughes proposed that there should be a naval "holiday": "for a period of not less than 10 years there shall be no further construction of capital ships." He then presented a definite plan for the scrapping of certain of the older capital ships and of capital ships under construction, and the restriction of capital ship replacements by an agreed maximum of tonnage, as follows:—for the United States and Great Britain 500,000 tons each, for Japan 300,000 tons—a "5-5-3" ratio. Discussion of the tonnage allowance for France and Italy was reserved for later consideration. The directness with which Mr. Hughes stated his case struck a note which evoked hearty response from the delegates and the public, and he was at once supported by the British delegation. "We can no longer content ourselves," Mr. Hughes said, "with investigations, with statistics, with reports, with the circumlocution of inquiry. . . . The world wants a practical programme which shall at once be put into execution." At the second plenary conference, held Nov. 15, the representatives of France, Japan, and Italy also accepted the principles of the Hughes proposals, leaving the technical details for consideration by the experts.

In the plenary session of Nov. 21 the subject of military armament was introduced by Mr. Hughes, who said that the United States had followed its traditional policy of reducing its own regular military establishment to the smallest possible basis. He recognized, however, the special difficulties existing in Europe. M. Briand explained the attitude of France as based on her need for security in Europe; expressing the readiness of his country to take any steps necessary to ensure peace, he emphasized the necessity of a genuine atmosphere of peace, a "moral disarmament," before physical disarmament could be attempted. This atmosphere, he maintained, was lacking—chiefly because of what France regarded as the warlike attitude of Germany, the carefully maintained system which made it possible for her suddenly to convert a huge number of "civilians" into troops, and the availability of her war industries. France, he claimed, had already reduced her army by a third and was planning to reduce it by a half. Complete demobilization, however, was impossible for her under the conditions existing in Germany and Russia. M. Briand concluded with an appeal for the moral support of France by other nations, and this evoked a sympathetic response from the other delegates. Sig. Schanzer of Italy, however, made plain the desire of his country that "the general limitation of land armaments may become a reality within the shortest space of time." The result of the attitude of France was to establish the impracticability of discussing any definite plan for the limitation of armies. A sub-committee was appointed, however, to consider the questions of air-craft, poison gases, and the rules for the conduct of war.

The agenda of the Conference were dealt with by two committees of the whole, one composed of the delegates of the five principal Powers to deal with limitation of armament, the other, composed of delegates of all nine Powers, including China, Belgium, the Netherlands, and Portugal, to deal with matters affecting the Pacific and the Far East.

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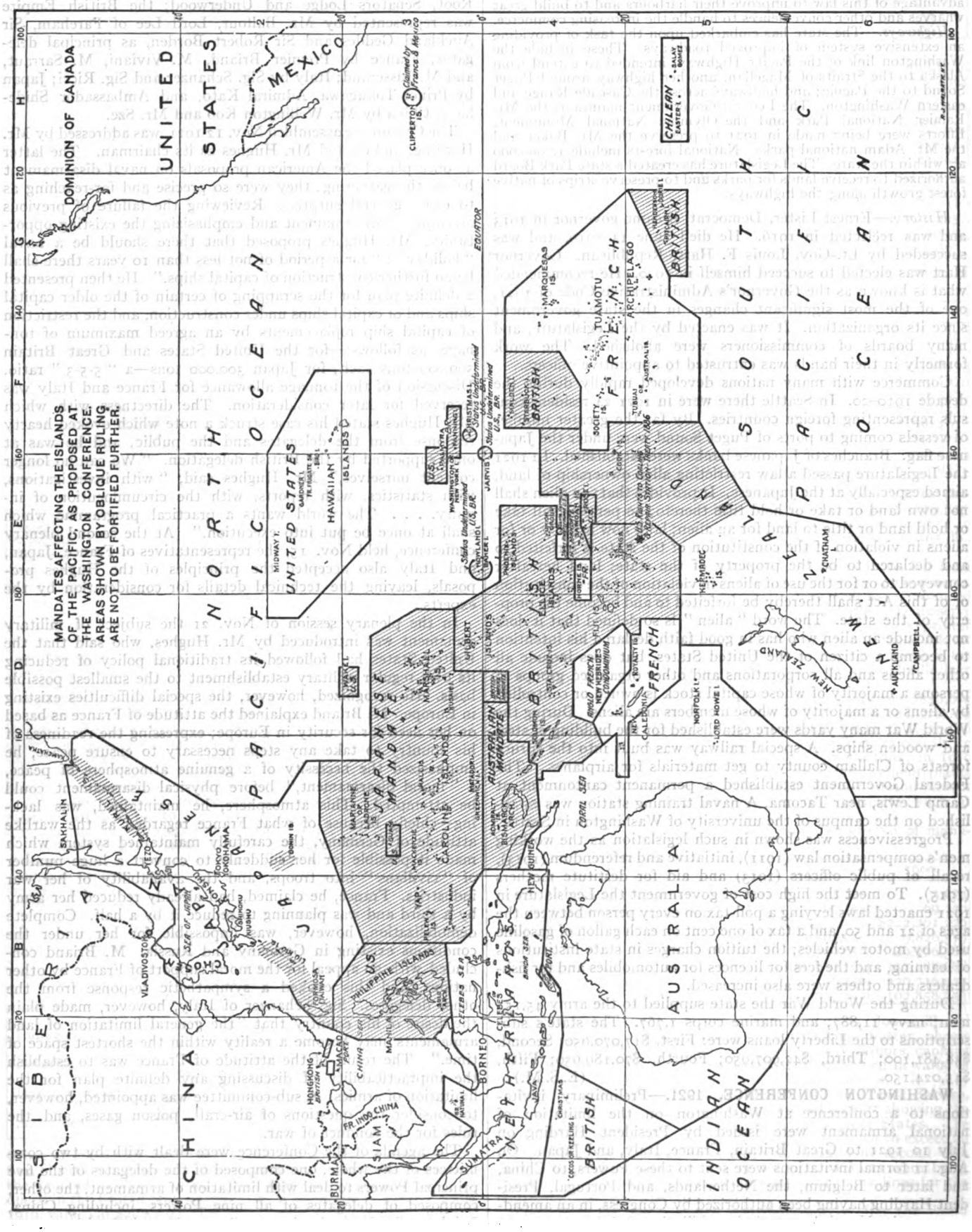
Meetings of these committees and their sub-committees, beginning with their first sessions, Nov. 14 and 15, were held in the Pan-American Building and were not open to the public. Lengthy



communiqués were published on the progress of the discussions, and their results were reported formally at the open plenary sessions, of which six were held. The decisions reached were in regard to navies, including submarines; poison gases; the Pacific Ocean and its islands; and Chinese affairs.

The committee on armament discussed fully the maximum tonnage and ratio of capital ships to which each Power should

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restrict itself; and on Dec. 20 a provisional agreement was reached. Japan maintained (Dec. 20) that 60 per cent of the quota proposed for the United States and Great Britain—on the 5-5-3 plan—was insufficient for her defensive needs, and asked that it be increased to 70 per cent; her delegates were especially unwilling to sacrifice the "Mutsu," a new capital ship (in large measure paid for by popular subscription) which, under the Hughes plan, would have to be scrapped. This obstacle was overcome by permitting Japan to retain the "Mutsu," on condition that an older ship, the "Setsu," should be scrapped. This change gave Japan two post-Jutland ships and an increased capital-ship tonnage, to offset which it was agreed that the United States should complete two ships still in process of construction, and that Great Britain should construct two new vessels not to exceed 35,000 tons each. In replacement tonnage the ratio was to stand thus: United States and Great Britain 525,000 tons each, and Japan 315,000 tons—a ratio of 5-5-3. This agreement was stated to be contingent upon a suitable arrangement for France and Italy, who had been offered a replacement tonnage of 175,000 each. But M. Sarraut, representing France, held out for an aggregate of 350,000 tons, to be constructed on a replacement basis from 1925 onwards. The controversy was finally laid before M. Briand, who had returned to France; he agreed to accept for France the capital-ship ratio of 1·75 as against 1·60 for the United States and for Great Britain, but made his consent conditional on the obtaining of a larger proportion of auxiliary craft and submarines, which were regarded by France as purely defensive weapons. "The idea which dominates the Washington Conference," he telegraphed, "is to restrict naval armaments which are offensive and costly. But I do not believe that it is the programme to deny to a nation like France, which has a large extent of coasts and a great number of distant colonies, the means of defending its communications and its security."

The French reply settled the problem of capital ships, but a warm controversy was provoked over submarines, Mr. Balfour, on behalf of the British delegation, proposing the complete abolition of the submarine, on the ground that it was an inhuman agent of warfare, effective only in illegal attacks upon commerce. Mr. Hughes proposed a reduction of submarine tonnage for the United States and Great Britain to 60,000 apiece, and approximately the *status quo* for France, Japan, and Italy (31,500 for the first two, 21,000 tons for the last). But the French delegates refused to accept less than 90,000 tons for submarines and 330,000 for cruisers and auxiliary craft. Mr. Balfour then made it plain that, failing action against the submarine itself, Great Britain could accept no limitation for anti-submarine craft.

As a result, the treaty, as finally agreed upon by the five major Powers, did not include limitation of total tonnage of submarine or auxiliary craft. Limits, however, were placed upon the total tonnage of aircraft carriers and upon individual tonnage of capital ships and cruisers, as well as upon the calibre of guns carried.

The failure of the British attempt to abolish the submarine was mitigated by the passage of a series of resolutions presented by Mr. Root and later embodied in a treaty. As accepted, they stated the rules of international law as to "visit and search" on the high seas, and declared that belligerent submarines are not exempt from these rules. They invited the adherence of all civilized Powers to this statement. In the third place, they recognized that the use of submarines as commerce destroyers was practically impossible without violation of these rules, and that prohibition of such use should be accepted as a law of nations; they declared the assent of the contracting Powers to such prohibition and invited that of all other nations. No definition of a merchant ship was adopted. In the fourth place, they declared that commanders of all ships transgressing international rules should be subject to punishment for piracy. Aircraft limitation was rejected by the Conference, after a technical report of the sub-committee had declared limitation to be impracticable, but an inquiry commission was appointed. The abolition of the use of poison gas in international warfare, on the other hand, was advocated by the Naval Committee Jan. 7 1922, on the motion of Mr. Hughes, and prohibition of poison gas was embodied in a treaty.

In respect of the problems of the Pacific one of the most important accomplishments of the Conference was the drafting of a new treaty, presented at the plenary session Dec. 10 1921, between the United States, Great Britain, France and Japan. It pledged each to respect the rights of the others in relation to their insular possessions and insular dominions in the Pacific, to accept mediation in case of controversy over these possessions, and to open frank discussions if their rights were threatened by any other Power. The treaty was to remain in force for 10 years, and upon its ratification the Anglo-Japanese Alliance was automatically to be terminated. A reservation accompanied the treaty embodying provisions to the effect that it should not be deemed an assent on the part of the United States to "mandates" granted in the Pacific under the Peace Treaty of Versailles, and should not preclude agreements relative to mandated islands.

The reservation also excepted from arbitrable controversies questions lying within the domestic jurisdiction of the contracting Powers. To the treaty was later appended also a second agreement, defining the phrase "insular possessions and insular dominions" in such a way as to exclude Japan proper from its scope. The representatives of the United States and Japan also signed a treaty regarding Yap, according to which the United States was to have free access there on a footing of entire equality with Japan in all that related to cable and radio service, and received certain privileges and exemptions in relation to electrical communications. Subject to various conditions the United States consented to the administration by Japan of the mandated islands in the Pacific north of the equator.

Chinese problems were presented Nov. 16 1921 by Mr. Sze in the form of ten points, which the Conference was asked to adopt. They called for recognition of the territorial integrity and political and administrative independence of China, the "open door" neutrality, and the complete removal of all political, jurisdictional, and administrative restrictions upon the Chinese Republic.

The general attitude of the Conference towards China was crystallized Nov. 21, when four resolutions presented by Mr. Root were adopted. They declared the intention of the Powers to respect the sovereignty, the independence, and the territorial and administrative integrity of China, their desire to maintain the principle of equal opportunity for the commerce and industry of all nations, and their agreement not to seek special rights or privileges. Details of specific arrangements to be enforced led to long discussions. A resolution was adopted (Dec. 24) providing for the voluntary withdrawal of foreign post offices from China Jan. 1 1923, on condition that China should maintain efficient service and continue the supervision of the foreign co-director general. The problem of extra-territorial rights could not be settled definitely; but it was referred to an international committee for intensive study and report within a year. The demand for the withdrawal of foreign troops from China was referred to a sub-committee, and finally it was agreed that, while the principle of withdrawal was accepted, the issues raised should be made the subject of inquiry, in order to determine the conditions upon which withdrawal must depend. On the other hand the Powers passed a resolution urging China to reduce the large military forces maintained by the military governors. The relinquishment of foreign leaseholds in China was not actually secured (though Great Britain announced her readiness in this respect if other countries would join her); but China's fight for "open diplomacy" was virtually won when a resolution was passed (Dec. 8) pledging the nine Powers not to enter into any agreement that might impair the force of the four Root resolutions. As regards the customs tariffs, the demand for China for complete autonomy was not granted, nor the request made, in view of the nation's financial necessities, that her quota be raised from 5% to 12½%. It was decided, however, that China's customs revenue should be increased by $46,000,000 silver annually, through an advance to 5% effective, a surtax of 2½%, and a surtax not exceeding 5% on luxuries. Other resolutions included agreements that foreign radio stations should transmit only Government messages, that there should be no unfair discrimination in railway rates, an expression of hope that the railway system might be unified under Chinese Government control, and an agreement for the establishment of a Board of Reference for Far Eastern Questions.

The question of the Japanese occupation of Shantung entailed long negotiations, which at times seemed dead-locked, especially those relating to the Tsing-tao–Tsinan-fu railway. Largely through the mediation of Mr. Hughes and Mr. Balfour a separate agreement was finally reached between Japan and China and signed Feb. 4. It provided for the return to China of the former German leasehold and 50-km. zone in Shantung, and the withdrawal of Japanese troops and gendarmes; China was to purchase the Tsinan-fu railway for $30,000,000, but, before complete redemption, there were to be appointed a Japanese traffic manager subject to the direction of the Chinese managing director, a Japanese accountant, and a Chinese accountant of equal rank. Japan renounced all rights

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to foreign assistance stipulated in the Chinese-German Treaty of 1898, and relinquished the maritime customs at Tsing-tao and former German public properties. As to Siberian problems, Baron Shidehara made a full statement to the effect that it was "the fixed and settled policy" of Japan to respect the territorial integrity of Russia, and to observe the principle of non-intervention in the internal affairs of that country, as well as the principle of equal opportunity for the commerce and industry of all nations.

The decisions taken by the Conference were embodied in seven treaties and various supplementary resolutions. (1) *Five-Power Naval Treaty*, designating specifically the capital ships to be retained by each of the contracting Powers and determining the ratio of capital ship replacement: 525,000 tons for the United States and Great Britain, 315,000 tons for Japan, 175,000 tons for France and Italy each—or 5-5-3-1·66. This treaty also limited the tonnage of individual capital ships to 35,000 and the calibre of guns to 16 inches; individual cruisers were limited to 10,000 tons and their guns to 8-in. calibre. Aircraft carriers were limited in general to an individual tonnage of 27,000, with a total tonnage of 135,000 for the United States and Great Britain, 81,000 for Japan, 60,000 for France and Italy each. With certain exceptions, the *status quo* was to be maintained with regard to fortifications and naval bases in the Pacific. (2) *Five-Power Treaty Relating to the Use of Submarines and Noxious Gases in Warfare*, embodying the resolutions described above. Accompanying these treaties were two resolutions for a commission of jurists to consider amendment of the laws of war and limitation of their jurisdiction. (3) *Four-Power Treaty*, between the United States, Great Britain, France, and Japan, relating to insular possessions and insular dominions in the Pacific, accompanied by the declaration of the United States. (4) *Four-Power Treaty*, between the same Powers, relating to the foregoing, and defining "insular" so as to exclude Japan proper from its scope. (5) *Nine-Power Treaty*, relating to principles and policies to be followed in matters concerning China, as described above. This was supplemented by ten resolutions embodying the decisions taken as to a Board of Reference, extra-territoriality, foreign postal agencies, foreign armed forces, unification of railways, Chinese military forces, existing commitments of China or with respect to China, the Chinese Eastern Railway. The treaty embodied the Root resolutions as its Article I, and strongly emphasized the principles of the "open door." (6) *Nine-Power Treaty*, relating to Chinese customs tariffs. (7) *Chinese-Japanese Treaty*, regarding Shantung. Two other treaties connected with the work of the Conference were: *United States-Japanese Treaty*, regarding Yap; and the *Six-Power Treaty*, allocating German cables in the Pacific. The Conference on Limitation of Armament was formally terminated Feb. 6 1922. On March 1 the U. S. Senate ratified, by a vote of 67 to 22, the treaty with Japan regarding Yap. (C. SEY.)

WATERHOUSE, JOHN WILLIAM (1847–1917), English painter (*see* 28.370), died in London Feb. 10 1917.

WATERLOW, SIR ERNEST ALBERT (1850–1919), English painter (*see* 28.381), died at Hampstead Oct. 25 1919.

WATER SUPPLY, MILITARY.—The problem of military water supply bears the same relation to similar work in civil life that military bridges do to those of ordinary construction; that is to say, although the ultimate object, and the underlying principles, are the same, the circumstances of construction are so different that the whole subject requires separate consideration. It has been long recognized that military bridges form a distinct branch of the art of war. Experience now points to the fact that water supply must be similarly treated. Of its great importance there is no question. The whole of the military operations in a campaign may turn on its adequate provision. The health and comfort of the troops and animals depend on this more than on any other supply question. Railways demand its provision, both in quantity and quality. It is therefore a matter both of operations and of administration, besides being an engineering problem of the utmost complexity.

In the following account of the most recent experience and practice connected with this subject, the purely engineering aspects of the problem will not be considered, and hydraulic calculations, sources of supply and the calculations entailed, well sinking and boring, pipe line design, reservoir dams and all other similar purely engineering technicalities will be omitted. It is proposed to consider the matter only in its military subdivisions.

I. *Personnel.*—The duties of officers and other ranks charged with water supply are broadly to carry out the engineering work involved in the obtaining and storage of water, and in the arrangements for insuring its purity till it reaches the custody of the troops supplied, and also to control all means of its distribution. There should be in all this organized work every care taken to ensure standardization of practice; there must be an adequate and competent executive staff, and efficient subordinates. On the staff of the engineer-in-chief of an army there should be an officer of high rank and of water experience, especially in charge of the whole control from the front to the base. There should be water engineers, under the chief engineers of the various formations, whose duties will be not only to carry out work actually ordered, but to reconnoitre, think out schemes, and generally to have such a grasp of the technicalities of the problem in relation to the whole military operations, that their advice may be of value to the army, corps and divisional commanders in considering the possibilities of operations. It is obviously of the very utmost importance that the general staff should keep the water engineers informed, to the fullest possible degree, as to impending developments, so that water policy may be framed accordingly.

As a general rule the field units of engineering carry out water supply as part of their normal duties, but in large operations they may be so fully occupied otherwise that it is necessary to provide special units for water duties. These would comprise (*a*) water supply companies, each about 8 officers and 250 other ranks, for general water work; (*b*) lorry or barge purification units, each 5 officers and 120 other ranks, for operating purification plant; (*c*) water control units, each 1 officer, 46 others, for provision of turn cocks, police at water points, etc.; (*d*) water transport companies, 7 officers, 300 others for distribution by rail, road or canal, and (*e*) well-boring sections, each 2 officers and 74 others for wells.

The equipment for these will vary according to the circumstances of the country. Obviously the water transport companies will have to be provided with many motor lorries fitted with tanks, and the purification companies with mobile laboratories. The above approximate sketch of the various units required will, however, indicate the nature of the equipment to be provided.

II. *Quantities to be Provided.*—In any water supply scheme the aim should be to provide as much water as can be *advantageously* used, for abundant supply means health and comfort. But concurrently, there must be rigid control of distribution so as to ensure reduction of waste. In giving, therefore, certain approximate estimates of quantities required, it must be noted that, in hot climates especially, circumstances may call for considerable modification.

Men require, in semi-permanent camps with water-borne sewage, baths, etc., 30 gal. per head per diem; in standing camps, without water-borne sewage, 15 gal.; in temporary camps, 5 gallons. The absolute minimum is 1 gal. at rest, and on the march for periods not exceeding three days at a time ½ gallon. Horses in temperate climates drink 6 to 10 gal. a day and the absolute minimum is 3 gallons. A horse drinks 3 gal. at a watering, and takes 6 minutes to drink it. In hot countries and with much work horses may require more than 10 gallons. Oxen and mules drink as much as horses, sheep and pigs about 1 gal. per diem, camels 10, with 20 every third day. A camel takes 20 minutes to water and drinks in two bouts with an interval of 10 minutes.

In hospitals and standing camps allow per diem, for each slipper bath 200 gal., W. C. 30, lavatory basin 20, urinal 40, yard tap 40, each vehicle washed 10 gallons.

On railways each broad-gauge locomotive needs 7,000 gal. per diem, each metre-gauge locomotive 2,500, 60-cm.-gauge 1,800. Horizontal stationary engines of compound modern type need 2 gal. per H.P. hour, and for the non-condensing type 4 gallons. For broad-gauge locomotives an alternative figure is 120 gal. per train mile. They require also for washing out about 3,000 gal. every 7 or 14 days. Boilers require about 20 gal. per H.P. hour under normal conditions. Petrol and oil engines require for cooling at rate of 7 gal. per H.P. hour and 35 gal. tank capacity per 6 H.P.

III. *Distribution under varying Tactical Conditions.*—(*a*) When a forced landing is contemplated, arrangements must be made for seaborne water, in quantities much in excess of requirements, for accidents are almost certain to happen to some of the water-bearing vessels. Even if it is known that water does exist on shore, such precautions are necessary, for, in event of hostile resistance, it is more than likely that a retreating enemy will damage the existing supplies. Parties of engineers, provided with the proper plant and tools, must be told off beforehand for water-supply work on landing, and extra water carts, pack animals with filled receptacles, etc., should accompany the troops.

(*b*) When disembarkation takes place on friendly territory, watering arrangements—standpipes, fillers for water bottles, troughs for animals—must be provided near the points of concentration. The sites for such filling points must be carefully chosen so as not to impede concentration. Such work as this should be carried out by an advanced party of engineers, assisted by any local help available.

(*c*) For troops on the march, in a country reasonably well supplied, the procedure is for an engineer officer with a party of men equipped for testing the quality, and noting the quantities of water, to go ahead, fix watering places for men and animals, if possible improve the local conditions and generally make all arrangements so that everything may be ready in plenty of time before the troops arrive. But if the march is in a land that has no natural supplies or where the quality and quantity is doubtful, the problem is different. The first thing to establish is an initial watering point (I. W. P.) or points, as far forward as possible before the advance takes place. Water must be collected there in temporary tanks and so arranged that lorries can be filled quickly therefrom and dispatched regularly.

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Adequate arrangements for the reception of the lorry-borne water must be provided at forward-water points, where the tank lorries can be quickly emptied into other improvised tanks whence they can be drawn by the troops in their water carts. At ½ gal. per man and 5 per horse per diem a division requires about 300 tons of water and this means 150 to 300 lorries according to the state of the roads, each lorry doing one trip per day. With pack animals, in countries where no roads are available, the same principles apply, only in addition to the contents of the receptacles carried for the troops, an allowance must be made for the carrying animals' own requirements.

(*d*) During position warfare there are three areas to be considered—forward, concentration, and back. The forward area, *i.e.* between front line and the rear of the heavy artillery zone, will require only drinking water for the fighting troops. This will be distributed (apart from any existing sources) usually from water carts or lorries filling at "points" in rear. Tank trucks on light railways and pipe lines to water points may possibly be used, but this is not so usual. While existing supplies should be utilized as much as possible, it is obvious that the greatest precautions against contamination are imperative. Distribution by water carts (holding 118 gal.) and water lorries, *i.e.* ordinary motor lorries fitted with two or more tanks, can be made where roads exist with sufficient security against hostile fire. They convey water from the supplies in rear to storage tanks of temporary construction. These "spill tanks" in the forward area should be small, numerous, and not too near each other so as to distribute risk of damage by hostile action. Sheltered positions, convenient for the troops, should be selected for their location. In some soils (*e.g.* in chalk) it is possible to mine underground tanks holding large quantities, and to bring supplies of water on light railway trucks. With heavy batteries in the vicinity of light railways such tank trucks can be used to deliver water to individual units. Storage for the daily supply must be arranged in such cases. A piped supply to a forward area is hardly practicable within 5,000 yd. of the line, where shelling is active. Such a system requires much care in maintenance, will be subject to great risk of damage and therefore to waste of water, hence it should not be adopted without full consideration of other alternatives. If adopted the general plan should be very simple, with as few branches as possible from main lines. It is better to construct radiating lines from the source rather than multiply branches. All pipes should be buried with 3 ft. of cover; although this involves their being out of sight, it is less disadvantageous than the exposure to shrapnel and frost. Protected shelters for pipe repairs and maintenance parties, together with supplies of tools and special fittings, must be arranged at intervals along the lines. As frequent breaks may be expected, frequent storage points must be provided; these will generally be a series of small tanks, say 400 gal. each, dug in and fed direct from the mains. Such points must be arranged to serve an area of the defence or made for the supply of dressing stations, etc. The ground must be well drained and all possible protection from shell fire must be given. The last stage of the travel of the water consumed by the troops in the front line must be by manual labour. Receptacles such as petrol tins may be used, and when filled may be carried to forward dumps on pack animals, tram lines, etc., so as to minimize hand carriage as much as possible, but in the last resort men have to be carriers. At the battle of Messines pipe lines were used to take water forward from catch pits on the Kemmel Hills, from sterilizing barges on the Lys, and from existing lakes, the quantity being 45,000 to 60,000 gal. daily. Arrangements were made to transport the water to the troops by pack animals and carrying parties. During the attack, water reached the troops within 20 to 40 minutes of the capture of positions. This is one instance out of many which illustrate the application of the principles above generally described.

It is in the concentration area (the line of demarcation between this and the forward area being taken as the rear of the heavy batteries) that the main source of supply and main arrangements for distribution to the forward area will be carried out. There will be in addition extensive arrangements for troops in reserve, casualty clearing stations, etc. Whether a comprehensive pipe system should be constructed, whether there should be a number of pumping stations, or whether there should be one or two main installations, are matters which will have to be carefully considered in the light of local circumstances and available labour and plant. In any case a thorough system of control with personnel trained in manipulating the various valves governing the branches, and a time-table giving equitable distribution, will have to be organized. The concentration area will be divided up into water areas with water "points" whence fighting units can draw their supplies by means of their water carts, but there will be casualty clearing stations requiring special attention where water should be laid on to standpipes near kitchens, ablution rooms, operating rooms, etc.

In the back areas the circumstances resemble those of a semi-permanent camp. The requirements will be for divisions in billets, reinforcement camps, schools of instruction, etc., and the arrangements only differ from those in regular encampments in cases where in villages, etc., it is found more convenient to have water cart points rather than piped supplies laid on to camping grounds.

(*e*) Before and after an attack the water supply arrangements include the supply during concentration, and keeping up supply as the troops advance. In the former case the work is very much as already described for position warfare. Every endeavour must be made to develop resources rapidly and secretly on all parts where attack is contemplated, and the most thorough training must be given to the technical troops in the rapid extension of the water system. In Palestine prior to the great attack, material was brought during night to the farthest advanced positions, and concealed in orange groves, etc., while the personnel was drilled in rapid laying of pipes and erecting of pumping plant. The supply after the initial advance will depend on the nature of the country and the initial success, and the most complete and accurate intelligence of the water resources of the country is of paramount importance. While the construction of pipe lines in the rear of an advancing army may be of the utmost value in securing a position won (as at the Somme in 1916), it is hopeless with a rapid advance (as in Palestine in 1918), so that in this case either independent sources of supply must be relied on, or transport by lorry must take place, and this places a tremendous strain on the transport organization and is, therefore, not lightly to be considered. Where pipe lines are decided upon, it is well to take them in entirely fresh installations rather than attempt to extend existing systems.

(*f*) A few details may be added of various constructional matters common to all phases of operations.

"Filling points" are tank and standpipe installations where water carts, lorries, "dixies" and water bottles are filled. Preferably there should be separate standpipes and approaches for carts and for lorries, so that the one may not impede the other, but all the standpipes should be such as can be equally used by either. There should be provision off the main road for waiting vehicles (within call of the "point" police).

As there is a limit to the number of horses that should be watered at one point, it is best to establish numerous small "watering points," with 200-ft. run of troughs as a maximum, and to locate the positions of the stables accordingly. The troughs should be near a road, but not next a main road where strings of horses would impede traffic, and, above all, horses must not cross a road to reach the troughs. The approaches to the troughs and the standings must be well made, drained and fenced in; otherwise the whole place becomes a morass. The frontage for each horse at the trough is about 2½ feet. In an actual instance 6,000 cavalry horses per hour were watered at 500 ft. of trough, using both sides. This works out at 12 horses per ft. of double troughing, each horse being 5 minutes inside the enclosure. Probably the best figures for general use are 6 minutes each horse and 2½ ft. frontage. If watering is to be on both sides the trough should be at least 3 ft. wide. Canvas troughs (600 gallons) are 36 ft. long, and should be in strong framing.

Where, as is often the case in Oriental countries, water lies deep below the ground, necessitating the use of pumping machinery, the watering of large numbers of animals becomes exceedingly difficult. In the Palestine campaign the water distribution unit was 1 lift and force pump, with hose, and 1 600-gallon trough, which unit with good management could water some 180 horses or 54 camels per hour. Only 18 camels can use a trough at the same time, and each relay takes 20 minutes to water. The requirements of a division are about 100,000 gallons a day, so each field company of Water Engineers carried 12 water units, or 36 per division. For the men's drinking water 10 large canvas tanks each holding about 1,500 gallons are needed. For storage, while at rest, large canvas bucksails, specially proofed and holding some 7,000 gallons, are useful, but it has been found better to construct tanks of masonry or planking and to reserve canvas tanks for mobile use. Copper vessels, holding 12 gallons, called *fantassis*, were used for camel transport.

Some notes may here be given about Oriental methods of raising water. The *shadoof* is a bucket hung by a rope to a horizontal swinging pole, slung from a vertical standard and weighted at the end furthest from the bucket. It can raise about 1,500 gallons an hour from a depth of 6 feet. The Persian wheel or *sakkieh*, a system of small jars working on an endless band round a vertical wheel above a well, and actuated by oxen or camels turning a horizontal wheel,—can raise 3,000 gallons an hour from 40 feet. The *charsa*, or skin bag, worked by a bullock hauling a rope attached to the bag over a pulley above the well, can raise 1,500 gallons from 40 feet.

IV. *Distribution in Standing Camps and Cantonments.*—This is a comparatively easy problem. Certain quantities of supply will have to be assumed, in accordance with experience in similar cases, at various points, and then the sizes of the pipes can be calculated by ordinary hydraulic rules. But it is well to keep the sizes of the pipes fairly uniform, giving rather larger than the calculated diameters, both because the data on which the calculations are based are at best conjectural, and because it is well to avoid a multiplicity of different sizes. In designing the system it should be arranged that "dead ends" of pipes are avoided, *i.e.* that the possibility of water remaining stagnant in an isolated length of pipe should be reduced to a minimum. Supply will be from an existing town main, or from some independent source (well, river, etc.) whence the water is pumped to an overhead service reservoir that overlooks and can supply by gravitation the whole system.

V. *Purification of Water.*—A safe water *may* be turbid in appearance and even disagreeable to taste and therefore repulsive; a dangerous water *may* be clear and palatable and therefore attractive. War experience has shown that few waters are so foul that they

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cannot be rendered safe by suitable treatment. The aim of purification is to obtain an effluent which is not only safe, but is palatable, of good appearance and attractive.

Water for horses is not usually purified. Almost any clear river or pond may be used in the crude state, and the instinct of the animals often leads them to refuse a contaminated water, even if it looks pure. In many cases in Flanders in the World War water from ponds and marshes, though foul and repulsive, was made quite potable by simple treatment. The military value of this fact is evident. Broadly speaking the purifying processes are those which remove suspended matter, and those which render innocuous bacteria which would be harmful.

English waterworks practice in civil life relies almost entirely on the action of the gelatinous film forming on the surface of a sand filter, for removing bacteria, but the processes of sedimentation, filtration and oxidation, which purify water in natural streams and lakes, can be imitated by artificial means working more rapidly than the ordinary sand filter process. Sedimentation can be accelerated by the addition to the water of an alum solution. Filtration can be effected by passing the water under some pressure through a porous medium; oxidation of bacteria by agents such as chlorine in measured quantities. In the field the steps taken are to precipitate the suspended matter by alum solution and then to treat the clear water by chlorination. The former process, though helpful in the latter treatment, is not in itself sufficient to produce a potable water. Chlorination is generally effected by introducing into the water a solution of calcium hypochlorite (bleaching powder) by means of the Horrocks apparatus. This is designed so that a test may be readily applied by men of intelligence to ascertain the condition of the water as regards free chlorine, and to calculate from this the amount of bleaching powder which must be introduced in order to destroy bacteria.

The apparatus for chlorination consists of a box containing six cups to be filled with the water, two tin spoons each holding 2 grammes of bleaching powder, a special cup for the chloride of lime solution, glass bottles containing a test solution of zinc iodide and starch (which has a certain colouring effect on water containing free chlorine), pipettes, stirring rods, etc. The method of using is to put varying quantities of the test solution in each of the six cups of water and observe after half an hour. From the coloration of the water, bleaching powder in proportionate quantities is added for every 100 gal. of water in the chlorinating tank.

Poisons can be removed from water by various chemical processes, though it may be easier and cheaper, and certainly safer, to transport other water by road or rail rather than trust to remedial measures. A contaminated well can be rendered usable in a few days by cleaning out and continuous pumping, and in the case of organic pollution by the addition of large quantities of bleaching powder, followed by pumping out after a period of rest.

VI. *Plant and Machinery.*—The British service water cart (Mark VII.) holds 118 gal. and consists of a galvanized iron cylinder, together with filtering apparatus, two pumps, a box for small stores, a sterilizing kettle, the whole being mounted on a wooden frame with cranked axle and wheels for horse draught. The two filters are placed on the frame in front of the cylindrical tank and can be used either separately or together. Each consists of a steel cylinder in which is contained a cloth-covered steel reel and a chamber for the clarifying powder.

Tank lorries are ordinarily improvised from ordinary motor lorries by mounting two 300-gal. tanks anchored to a wooden frame bolted to the chassis, with a 2-in. pipe connecting the tanks and a 2-in. draw-off. These tanks should have internal baffle plates to reduce the swaying action of the water in travelling. Another method is to sling canvas tanks from framing on the lorry.

The Norton tube well, a perforated tube with hard driving head, and driven by blows from a "monkey," is useful in obtaining supplies near the surface in certain soils. Used with a lift and force pump they are suitable for small installations, but they only yield 200 gal. per hour. They were very useful in the cavalry operations in the Sinai peninsula, where water was, by their use, frequently obtained in the dry beds of *wadis*.

The lift and force pump, which is an article of store, can lift water through a suction hose from 20–28 ft. and force it to a height of 60 ft. above its former level. It consists of a horizontal barrel 4½ in. bore with a double piston working with a 4-in. stroke and operated by a crank pivoted above the barrel and worked by manual power. The suction hose comprises four 12-ft. lengths of prepared hose, internally wired, and at the end there is a strainer, a perforated steel drum. The delivery hose consists of one 30-ft. length of 2-in. canvas hose. This pump is very handy and easily worked by unskilled labour.

Other pumps for manual power are the semi-rotary for small deliveries up to 30 gal. a minute (an ordinary piston and plunger pump) and the chain helice pump, which is an endless chain, or spirally wound band, with a weight at the end suspended and worked by a vertical wheel at the top of the well. The surface tension of small quantities of water adhering to the links of the chain, or the spiral band, is not broken in the rapid movement of the rising chain until it is discharged at the summit of the circuit. It is a very simple form of pump, but only suitable for small discharges.

Of the many patterns of power pumps there are comparatively few that meet the needs of an army in the field, in respect of being easily transported, reasonably free from chance of breakdown, and economy of fuel. It is important that the types used in the field should be few and that parts should be standardized so as to facilitate repairs. There should always be a number of spare parts accompanying each machine, and there should be other spares kept for general use at store depots. All suction and delivery connexions especially should be standardized. As a motive power, high-speed internal combustion engines are generally of most use, if properly connected with the pump and operated by competent personnel. Slow and medium-speed oil engines may be found very useful.

A pumping set will generally consist of (i.) prime mover, direct gear, or belt coupled to (ii.) pump with valves, strainer, suction piping and foot valves (iii.) starting gear for engine or motor, set of spanners, etc. Different classes of pumps will be required for delivery to tanks near the supply, hasty installations on pipe lines, deliberate installations for rest camps, etc., and pumping from deep wells. The variety of pumps suitable for each class is considerable. Mention, however, may suitably be made of the air lift pump, which, on account of its having no working parts below ground, and for several other reasons, is the most useful form of pump for military work. Such a pump can be mounted on a lorry and can go round a series of wells, pumping from each the day's supply into an extemporized reservoir and then going on to the next. It is a device for raising water by compressed air introduced in a vertical tube connected with the rising main, either concentrically with that pipe, or in a separate tube parallel to it. The utility and efficiency of this device has been amply tested in war, and much attention and valuable experience has been devoted to the theory and practice of its use.

As regards pipe-laying, cast iron pipes, though ordinarily used in civil water supplies, with their lead joints are unsuitable for military work because of the relatively heavy weight as compared with steel tubes of the same diameter; also they are brittle and unsuited for rough handling, and the jointing takes more time than the screwing up of steel tubes. The latter should, therefore, be invariably used in the field. As a rule they are not made of larger diameters than 6 in., but larger pipes can be obtained, and many miles of 10-in. and 12-in. pipes were put down in the Sinai peninsula in 1916. For most purposes wrought iron screwed and socketed piping is suitable; the British standard threads for the pipe ends should be insisted on, and the whole should be capable of standing a test of 300 lb. per sq. in. (690-ft. head). If in mountainous country (as with the British in Italy, where heads of 2,000 and 4,000 ft. had to be negotiated), the pipes must be of the *hydraulic* type, with special joints.

Many special fittings are required with a pipe system, elbows, tees, crosses, etc., and many devices for control and delivery, such as valves, taps and stop cocks. The main point to remember is that there is no economy in having inferior and cheap fittings, for the waste of water which follows their use costs far more than the extra cost of water and more reliable articles. (G. K. S. M.)

WATSON, JOHN CHRISTIAN (1867–), Australian politician, was born at Valparaiso, Chile, April 9 1867, when his parents were on their way as emigrants to Australasia. He was educated at the public school of Oomaru, N.Z., and as a boy began work as a compositor. He also made an early entrance into politics, attaching himself to the Labour party, which came into prominence during the great strike of Australian dock and transport workers. He was president of the Sydney Trades and Labour Council in 1890. From 1894–1901 he was a member of the N.S.W. Legislature, where he opposed plural voting and inclined towards protection as a means for keeping up the white man's wages. Consequently after federation, as a member of the Commonwealth Parliament he gave his support to Sir Edmund Barton and Mr. Deakin and exacted in return legislation in labour interests. For a short time in 1904, on the resignation of Deakin, he formed a Labour Ministry, but resigned after a few months, though he continued to lead the Labour party until a tariff, of which he could approve, had been passed by Mr. Deakin in 1908. He then retired from public life.

WATSON, SIR WILLIAM (1858–), English poet (*see* 28.414), was knighted in 1917. His later poems include *The Heralds of the Dawn* (1912); *The Muse in Exile* (1913); *Retrogression* (1916); *The Man Who Saw* (1917) and *The Superhuman Antagonists* (1919).

WATTERSON, HENRY (1840–1921), American journalist (*see* 28.418), was among the first to urge, in 1911, the nomination of Governor Woodrow Wilson as Democratic candidate for president. In Aug. 1918 he retired from active editorship of the Louisville (Ky.) *Courier-Journal*, remaining "editor emeritus." On March 2 1919 a special edition of this paper was published, containing tributes from his admirers throughout the world.

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In April he severed all connexion with the paper because of its support of the League of Nations which he opposed. He died at Jacksonville, Fla., Dec. 22 1921. He was the author of *Old London Town* (1910); *History of the Manhattan Club* (1915) and "*Marse Henry*": *an Autobiography* (1919).

WATTS, SIR PHILIP (1846–), British naval architect, was born in Kent May 30 1846, and was educated at the College of Naval Architecture, becoming a constructor to the Admiralty up to 1885. From 1885 to 1901 he was director of the War Shipping department of Armstrong, Whitworth & Co. at Elswick (subsequently returning as a director of the company in 1912); but in 1901 he was appointed Director of Naval Construction at the Admiralty. This post he held until 1912, when he was succeeded by Sir Eustace Tennyson d'Eyncourt (b.1868) and became Adviser to the Admiralty on Naval Construction. In this capacity he played an important part when the World War came, and it was his fate, as the designer of the first "Dreadnought," to see the use that was made of the fleet which he had brought into being in previous years. He was a member of the royal commission on the Supply and Storage of Liquid Fuel (1912), and of the Council of the Royal Society. He was created K.C.B. in 1905.

WATTS-DUNTON, [WALTER] **THEODORE** (1832–1914), English man of letters (*see* 28.422), died at Putney June 6 1914.

WAY, SIR SAMUEL JAMES, 1ST BART. (1836–1916), Australian lawyer and politician, was born at Portsmouth April 11 1836. He went to Australia in 1853 and was called to the South Australian bar in 1861, becoming Q.C. ten years later, Attorney-General in 1875 and Chief Justice of S.A. in 1876. He entered the House of Assembly 1875, and in 1890 was lieut.-governor. He administered the government of the Colony ten times between 1877 and 1890, and in 1897 became the first representative of the Australasian Colonies on the Judicial Committee of the Privy Council. He was created a baronet in Aug. 1899. He did much to help Australian sheep-breeding, and introduced the improved Shropshire sheep into Australia. He died Jan. 6 1916.

WEAVER, JAMES BAIRD (1833–1912), American lawyer and political leader (*see* 28.439), died at Des Moines, Iowa, Feb. 6 1912.

WEBB, SIR ASTON (1849–), English architect, son of Edward Webb, a distinguished engraver and painter, was born in London May 22 1849. His architectural education was in the office of Banks & Barry (the latter the son of Sir Charles Barry), but it was to his own self-study—and in particular to his power of sketching during his many travels, rather than to his pupilage instruction, that his expression in design and planning are to be ascribed. One of his earliest commissions, on establishing himself in practice, was the restoration of the important Norman church of St. Bartholomew's, Smithfield (1880), a work which lasted through several years. But Webb's peculiar distinction lies in the large number of important buildings for which he has been responsible. Many of these were the result of competitions and include the Victoria Courts at Birmingham, the Assurance offices in Moorgate St., and the Christ's Hospital school at Horsham, all carried out in partnership with Mr. Ingress Bell. His roll of important buildings is a long one, and may well be headed by the completion of the Victoria and Albert museum, South Kensington, and its close neighbours the Royal College of Science and the Imperial College of Technology. The first of these was the successful design in a very keenly contested competition. The plan has the merit of being simple and easy to grasp; the long vistas it presents, the octagon hall, and the galleries are treated boldly and with dignity of proportion. The Admiralty entrusted to Sir Aston the new Britannia Royal Naval College at Dartmouth, and, in conjunction with Mr. Ingress Bell, he carried out the Royal United Service Institution building, Whitehall, and that for the university of Birmingham. The National Monument to Queen Victoria, opposite Buckingham Palace, was, again, the result of a competition, and included a fine but simple lay-out of the Mall and other approaches to the site occupied by the central feature which embodies the noteworthy sculptural work of Mr. Brock. The unworthy setting and background offered to this fine monument presented by the cement-fronted elevation of Buckingham Palace, for which John Nash and, later, Blore were responsible, led to the long talked of recasting of the front toward the Mall, and this work was placed in the hands of Sir A. Webb. He also designed the entrance from Charing Cross to the Mall, which is ingeniously masked by a building with curved frontages, in order that the change in the line of access at this point may not be noticeable. He was responsible for a large number of private houses—including Yeaton-Pevery, Shrewsbury—and for churches—both new and restored—in Worcester, Burford and Witley, and the French Protestant church, Soho. In 1902 Webb was elected president of the Royal Institute of British Architects, and in 1905 was presented with the institute's gold medal. He was made a Royal Academician in 1903, received his knighthood in 1914, and in 1919, on the death of Sir Edward Poynter, was elected president of the Royal Academy. This was an unusual honour to be awarded to an architectural member, and one for which in the long history of that society there had only been one precedent—that of James Wyatt in 1805, and even in his case the election was never officially confirmed.

WEBB, SIDNEY (1859–), British Socialist and author (*see* 28.455). From 1909, when Mr. Webb, with his wife, Beatrice, was actively organizing opinion in favour of the Minority Report of the Poor Law Commission, he continued to play an influential part in the Labour and Socialist movement. He became one of the commissioners under the Development Act in 1913. His election upon the national executive of the Labour party in the early part of the World War brought him into a still closer connexion with the responsible leaders of Labour, and two years later the entire constitution of the Labour party was remodelled and a programme constructed (*Labour and the New Social Order*), which was closely in accord with Mr. Webb's views and policy. During the war Mr. Webb and his wife served on numerous departmental and other committees. In opposition to the majority report of the War Cabinet Committee on Women in Industry, Mrs. Webb put forward a Minority Report which was afterwards (in 1919) published separately. At the general election of Dec. 1918 Mr. Webb stood unsuccessfully as Labour candidate for London University (in which he held the professorship of Public Administration), being second in the poll. In the coal crisis of the spring of 1919 he was appointed a member of the Coal Industry Commission and also put forward in evidence a complete scheme of nationalization of the coal-mines. In the same year he was appointed to the Central Committee set up under the Profiteering Act of 1919. Among the publications of Mr. and Mrs. Webb after 1906, the following were the most important:—*English Local Government: The Manor and the Borough* (1908); *The Break-up of the Poor Law* and *The Public Organization of the Labour Market* (1909); *English Poor Law Policy* (1910); *The State and the Doctor* (1910); *The Story of the King's Highway* (1913); *The History of Trade Unionism* (new and revised ed. 1920); *A Constitution for the Socialist Commonwealth of Great Britain* (1920) and *The Consumers' Coöperative Movement* (1921). Mr. Webb also produced *Grants in Aid* (1911); *How to Pay for the War* (1916); *The Works Manager To-day* (1917); and *The Story of the Durham Miners* (1921). Mr. and Mrs. Webb were concerned in the founding of the weekly *New Statesman* in 1913, and have been since 1895 active movers in the development of the London School of Economics and Political Science (university of London).

WEBER, SIR HERMANN (1823–1918), British physician, was born at Holzkirchen, Germany, Dec. 30 1823, the son of a German father and an Italian mother. He studied medicine at Fulda, Marburg and Bonn, where he took his M.D. degree in 1848. His residence at Bonn brought him into touch with the English colony there, and through this connexion he received the position of house physician at the German Hospital, Dalston, London. When this appointment came to an end, he started in private practice, having become a naturalized British subject, and studied at Guy's Hospital with the object of obtaining an English qualification (1855). Weber came into great promi-

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nence as a pioneer of the open-air treatment for tuberculosis, and himself spent many winters in Switzerland in charge of patients. In 1899 he was appointed a delegate to the Berlin congress on the prevention of tuberculosis, and the same year was knighted. He retired from practice at the age of 80, but retained his health and vigour till his death, which took place in London Nov. 11 1918, in his 95th year.

WEDMORE, SIR FREDERICK (1844–1921), English art critic and man of letters (*see* 28.466), was knighted in 1912. He published that year his *Memories*, a book of reminiscences, social and literary. He also published *Painters and Painting* (1913) and a novel, *Brenda Walks On* (1916). He died at Sevenoaks Feb. 25 1921. His daughter, MILLICENT WEDMORE (b. 1879), herself the author of two volumes of verse, helped him to edit during the World War *Poems of the Love and Pride of England.*

WEEKS, JOHN WINGATE (1860–), American public official, was born at Lancaster, N.H., April 11 1860. He graduated from the U.S. Naval Academy in 1881, served two years as midshipman, then resigned from the navy and became a civil engineer. From 1886 he was assistant land commissioner of the Florida Southern Railroad. In the latter year he helped to organize the banking and brokerage firm of Hornblower & Weeks, Boston, Mass., of which he was a member until 1912. His interest in the navy meanwhile continued. In 1890 he joined the Mass. naval brigade, was made captain, and during the Spanish-American War commanded the second division of the auxiliary U.S. naval force on the Atlantic coast. From 1894 to 1900 he was a member of the Mass. military advisory board and of the military board of examiners; in 1896 he was a member of the board of visitors of the U.S. Naval Academy. He was elected alderman of Newton, Mass., in 1900, was reëlected for two terms, and then elected mayor (1903–4). In 1905 he was chairman of the Mass. Republican State Convention. During 1905–13 he was a member of the national House of Representatives and as a member of the committee on banking and currency took an active part in framing the Aldrich-Vreeland Currency bill. In 1913 he entered the U.S. Senate, succeeding Winthrop Murray Crane, but was defeated for reëlection in 1919. As a member of the Senate committee on military affairs during the World War he took part in investigations which resulted in a reorganization of the ordnance and quartermaster departments as well as the aircraft production board. In 1921 he entered the Cabinet of President Harding as Secretary of War.

WEISMANN, AUGUST (1834–1914), German biologist (*see* 28.499), died at Freiburg-in-Baden Nov. 6 1914. His latest publications were an estimate of Darwin's work and *Die Selectionstheorie*, both published in 1909.

WEISS, BERNHARD (1827–1914), German Protestant New Testament scholar (*see* 28.499), died in 1914.

WEKERLE, ALEXANDER (1848–), Hungarian statesman (*see* 28.500), was again appointed prime minister on Aug. 20 1917, and resigned in a public sitting of Parliament in 1918 (*see* HUNGARY). At the time of the Bolshevist rule in Hungary he was held prisoner as a hostage.

WELBY, REGINALD EARLE, 1ST BARON (1832–1915), English civil servant, was born at Harston, Leics., Aug. 3 1832. He was educated at Eton and Trinity College, Cambridge, and accepted a Treasury clerkship in 1856. There his financial ability soon showed itself and his rise was rapid, especially after W. E. Gladstone became Chancellor of the Exchequer. Finally in 1885 he became permanent secretary to the Treasury. He was made K.C.B. in 1882, G.C.B. in 1892, and a peerage was bestowed on him on his retirement. After that event he became an alderman of the London County Council and in 1899 was elected its chairman. He died in London Oct. 30 1915.

WELDING (*see* 28.500).—This article discusses Electric Welding and Gas-Torch Welding. For Thermit Welding, see the separate article THERMIT AND THERMIT WELDING.

(1) ELECTRIC WELDING.—An important development known as Spot Welding has taken place in recent years. It is a modification of the Thomson process, peculiarly applicable to uniting overlapped sheets of metal by welded "spots" or localized areas of union of the sheets in place of riveting them. It has the merit of leaving little or no projection or deformation on the outer surfaces of the sheets so united.

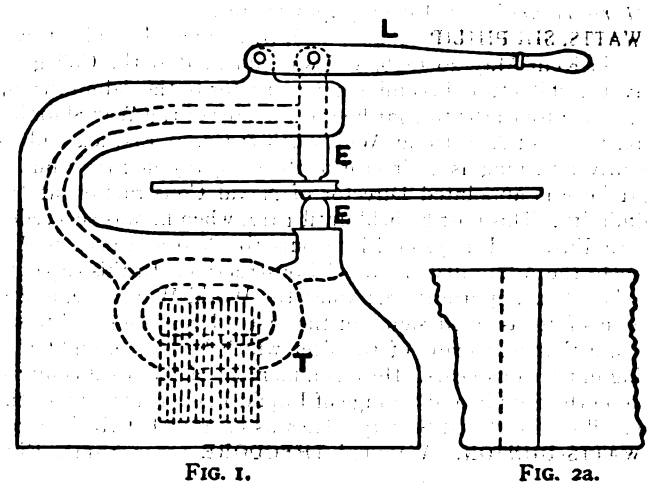

FIG. 1.

FIG. 2a.

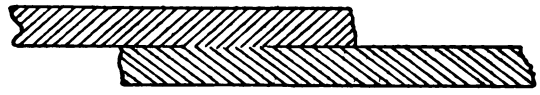

FIG. 2b.

The machine for such work is called a "spot welder," and usually has two electrodes arranged in a vertical line, one above the other. The electrodes consist of short, heavy, blunt copper bars, E E (fig. 1) (water-cooled in the larger machines); the upper electrode E is made movable up and down under control of a manually operated pressure lever, L, or by a piston actuated by air or water pressure controlled by a valve. The opposed ends of the electrodes, which bear upon and form contact with the sheets to be united, are usually chamfered or given the form of frustums of shallow cones. This reduces resistance loss in the electrodes and adds to their rigidity and durability. The electrodes, as in other resistance welders, are made the terminals of the heavy secondary circuit of a welding transformer, T, the usual single turn of large section. The current is large, but is delivered to the work at low voltage. The weld which unites the sheets is a spot, usually round in form, confined in extent to the area covered by the ends of the electrodes. The opposed faces of the sheets are thus locally and quickly heated to welding temperature, and the pressure of the electrodes causes complete union; such welded spots are successively made at intervals over any extent of surface of the sheets, as in riveting (see fig. 2, a and b). While spot welding has been found to be best adapted to the union of overlapped sheets or edges of comparatively thin metal, plates of ½ in. or more in thickness may be spot-welded by heavy welders constructed for the purpose. In some of these, for mechanical and electrical reasons, two spot welds are made simultaneously by the same current passed in series through two spots covered by two pairs of opposed electrodes connected in series in the welding circuit. Another form of welding, known as "projection" welding, is akin to spot welding, differing therefrom, however, in the use of electrode faces which do not in themselves determine the welded area or spot, and in permitting the instantaneous union of plates or pieces at many parts of their surfaces. This is accomplished by forming raised spots or projections on one or both pieces, which when brought together form the paths for current and consequent development of welding heat irrespectively of the other parts of the plates, and irrespectively also of the electrode contact with the sheets, such contact covering a wide extent of the pieces to be welded, and serving to press them together as the projections between them become heated and softened.

Roller Welding.—Roller welding, applicable to forming continuous lapped seams in sheet metal work, has attained in late years some considerable importance. In this operation the overlapped edges of the sheets to be united are passed steadily between an upper copper roll with an edge of the width of seam weld desired, and a conducting mandrel, plate, or similar copper roll forming the under electrode. The weld so formed is a line or strip of a width determined by the width of the contact surface of the welding roll. Thin steel tubes with lap welds are made by this method, and it has also found application in the construction of thin metal containers such as steel thermos bottles, the parts of which are united without solder.

Snap Welding.—This term is now commonly applied in connexion with the Thomson resistance process to welds made by light contact of the pieces during heating, followed by quick application

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of heavy pressure to force the heated surfaces together. With iron and steel the method secures a very strong weld and the heating is confined closely to the weld itself. Moreover, there is a saving of time and often of energy.

Percussion Welding.—If an electric condenser of large capacity be discharged by wire terminals of relatively small section made to approach each other in line, the discharge occurs with a flash of light at or before actual contact, depending on their potential difference. With sufficient capacity of condenser the restricted areas of the opposed ends of the discharge wires are brought superficially for an instant to a high temperature, and if immediately pressed into firm contact will weld or unite. In percussive or percussion welding the condenser (or, better, a polarization battery of limited capacity) is charged from any suitable source of electric energy and its terminals attached to the work pieces, which are then brought into percussive contact, as by arranging to have one of them fall toward the other from an appropriate height determined by experiment. The percussion may be assisted by a weight or spring suitably adjusted. The discharge occurs as above described, and the heated opposed surfaces are brought instantly together by the forcible impact. A weld may thus be obtained between the pieces. The rise of temperature is confined almost entirely to the thin layer of metal forming the joint. The heating effect is thus more local than in any other form of welding. It is applicable to small work and it extends to a considerable degree the practical possibilities of electric welding. The stored energy of an electro-magnetic circuit may also be employed for the instantaneous discharge demanded by percussion welding.

Electric Arc Welding.—Stimulated in large measure by the need of rapid ship construction in the World War, and the modern extension of electric supply, that form of fusion welding in which the electric arc is employed has in the past few years grown rapidly in importance and extent of application. Many forms of arc-welded joint in steel structures have already been to a degree standardized. The arc terminal applied to the work (usually the negative electrode when direct current is used) is a wire or rod of mild steel, mounted in a suitable holder manipulated by the operator, upon whose skill the perfection of the work largely depends. These electrode wires ordinarily vary in diameter according to the scale of the work or current strength used, and range from $\frac{1}{32}$ in. to $\frac{1}{16}$ in. or more. As the welding wire is rapidly consumed in the operation of fusing a joint, it is constantly fed forward. Automatic arc welders have been devised and in these the arc separation is controlled automatically and the wire also fed automatically from a reel. In operation the arc voltage may be from 10 to 20 volts and the current traversing the arc may be from 80 to 200 amperes or more. The welding is attended by much sputtering and projection of fused and superheated globules of iron from the end of the wire electrode toward the cooler and heavier masses of the work pieces. In fact, the deposition of metal on the work is possibly due to a jet of iron vapour from the electrode wire, carrying fused iron globules as a result of explosive boiling of the iron. This action would be a natural consequence of the central area of the end of the electrode wire being at the highest temperature, as it loses heat by radiation less readily than the outer surface of the wire at the arc. This central area reaches a temperature of about the boiling point of iron. The temperature of the arc is so high that the surface of the work pieces, however massive such pieces may be, is penetrated and fused so that incorporation of the metal of the work and that from the welding electrode wire takes place. The welding may be regarded as a progressive filling or plastering action by condensed iron vapour and fused iron. The operation is facilitated by coating the electrode wire lightly with mineral films, such as lime, which probably act by furnishing volatile material which adds to the stability of the arc. Depending on the strength of current in the arc and the skill of the operator, from 1 lb. to 2 lb. of metal per hour may be deposited in effecting the welds, and about 80% of the metal of the wire used enters the welds, the remaining 20% being vapourized, burned into oxide, or scattered in small globules. When plates of over $\frac{3}{16}$ in. in thickness are to be butt-welded they should be bevelled before abutting them, so that a groove of not less than 60° flare shall be provided, to be filled with the fused metal (see fig. 3.). Where the plates meet at an angle, as in fig. 4, the fused metal is deposited either at *a* or *b*, or both.

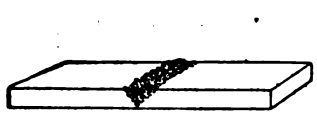

FIG. 3.

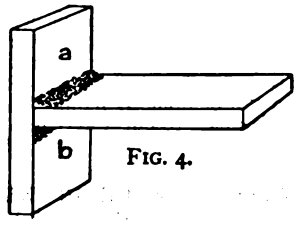

FIG. 4.

Arc welding can be carried on even upon the under side of the work (such as a boiler or tank *in situ*). In this case the electric arc is at the upper end of the welding wire, and the disadvantageous position results in the rate of forming the welds being about 60% of that in ordinary work. The actual rate at which seams can be made in arc welding naturally depends upon the thickness of the plates to be united, the kind of joint to be made and other conditions. With automatic machines on small work it may rise to about 2 ft. per minute, while in heavy work by hand operation it may not exceed 2 in. per minute. Ordinary arc welds on steel may possess a tensile strength of as high as 50,000 lb. per sq. in., but there is almost negligible elongation. Cast iron is amenable to arc welding when proper precautions are taken. Likewise bronze and copper may be arc-welded, a favourable condition for which is preheating of the work pieces. Arc welding has usually been done by the use of direct current, and special dynamo generators are constructed for supplying the current, such generators having been designed with regulating characteristics suitable to welding. The alternating-current arc is, however, adaptable to welding, provided the frequency is not too low. Arc welding covers a large field of application, constantly extending. It is employed in the construction of tanks, and is especially useful in caulking the seams of tanks which must retain oil or thin liquids without leak. It is revolutionizing the fabrication of many structures of iron and steel, and is much used for repair work. It is readily applicable to joining broken pieces and to replacing metal worn away in use, of which the restoration of rail surfaces of tramways *in situ* is now a familiar instance. It is generally found to be less costly in application than the other forms of fusion welding, such as that by the use of oxygen blowpipe or thermit welding. (E. T.)

(2) GAS-TORCH WELDING.—Gas-torch welding is variously known as "autogenous" welding, "oxy-acetylene blowpipe" welding, "hot gas flame" welding, "fusion" welding, and other terms which are more or less inaccurate, general, and confusing. The gas combinations more commonly used for torch or blowpipe welding are either oxygen-acetylene or oxygen-hydrogen. Of these two, oxy-acetylene is in more general use for welding, while oxy-hydrogen, on account of its longer flame, is generally used to supply heat for steel-cutting torches. The oxy-acetylene flame has a maximum heat under ideal conditions of about 3,400° C., and oxy-hydrogen about 2,000° C.

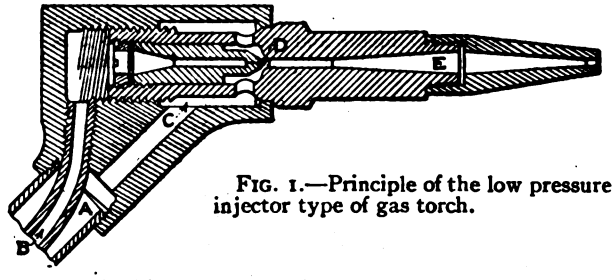

FIG. 1.—Principle of the low pressure or injector type of gas torch.

The use of a blowpipe or torch in some form was known to the ancients, but the high-temperature gas flame is a development of the last quarter of a century, and especially the past ten years. The application of the oxy-acetylene torch to metallic welding dates experimentally from 1901 and commercially from 1903; Edmond Fouché, Paris, who did considerable experimenting in conjunction with Picard, is generally credited with making the first really practical torch. The early torches used both oxygen and acetylene under high pressure, but this proved too dangerous, and a low-pressure or injector type was next used. Following this was the Gauthier-Ely positive or medium pressure torch, which used both gases under moderate and independent pressure. The injector and the positive-pressure types are the ones now in commercial use. The development of the latter is largely due to Augustine Davis and Eugene Bournonville.

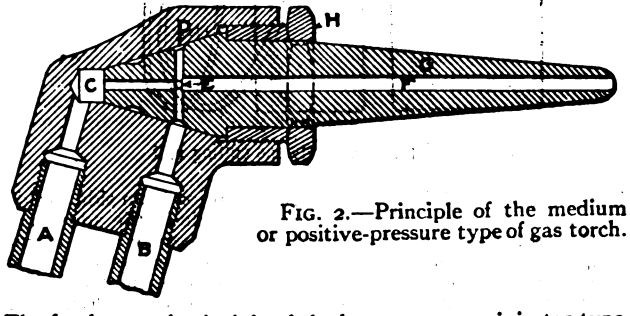

FIG. 2.—Principle of the medium or positive-pressure type of gas torch.

The fundamental principle of the low-pressure or injector type of torch is shown in fig. 1. The acetylene enters at A and the oxygen

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at B. The acetylene, at less than 1-lb. pressure, goes to chamber C, from which it is sucked by the oxygen, under 5 to 30-lb. pressure, pouring out of nozzle D, and is carried along with the oxygen into the mixing chamber E. The thoroughly mixed gases issue from the nozzle of the torch, where they are burned.

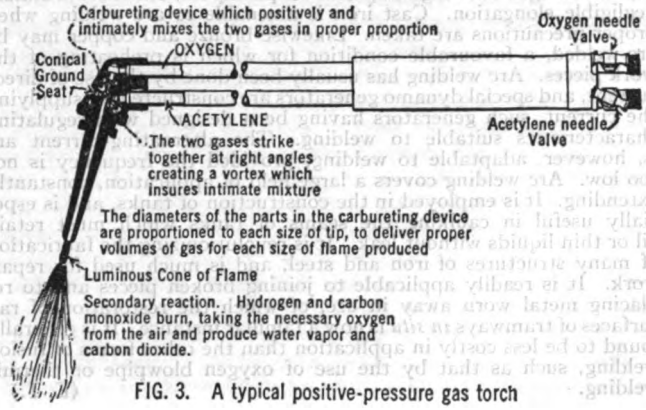

FIG. 3. A typical positive-pressure gas torch

The positive-pressure torch principle is illustrated in fig. 2. Here the oxygen, at from 1 to 14-lb. pressure, enters at A, and the acetylene, at from 1 to 24-lb. pressure, enters at B. The oxygen enters the small chamber C and thence out through the centre hole. The acetylene goes to chamber D and also out through the centre hole. The two gases start to mix at E and are thoroughly mixed in the channel F in the torch nozzle G. A typical positive-pressure torch is shown in fig. 3. Torches are made with tips set at various angles from 90° to straight, the latter being principally used in welding and cutting machines. Where the work is heavy the tips are water-cooled. In welding very thin metal the edges are often turned up or "flanged" and the torch used to fuse them together without using any additional metal. On heavier work the edges to be welded are V-eed out at an angle of from 60° to 90°, and this channel is filled in by using a welding rod or wire, care being taken to obtain perfect fusion between the old metal and new. Welding of this kind is progressive, as the welder gradually works along the channel, filling

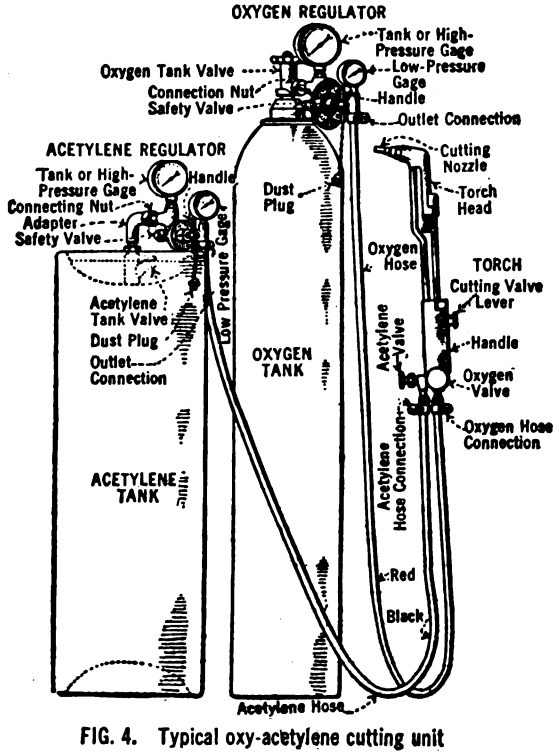

FIG. 4. Typical oxy-acetylene cutting unit

as he goes. The torch is given a weaving motion from side to side in order to fuse the sides of the V and to puddle in the added metal from the rod. On all torch welding work allowance must be made for expansion and contraction, and on repair work of complicated design, like an automobile cylinder, preheating with charcoal, gas-and-air torches, or other means is usually necessary. Preheating is also sometimes resorted to in order to save the more expensive gases. Nearly all of the common metals may be welded with the gas torch, though some are more difficult than others. Steel ship or boiler plate is about the easiest, though aluminium, cast iron, copper, and many alloys present no serious difficulties.

The set-up for a welding outfit is practically the same as that of the one for cutting shown in fig. 4. A cutting torch, however, differs from a welding torch in that it has a separate high-pressure oxygen vent. The cutting of steel and wrought iron is based on the fact that a jet of oxygen directed on to a previously heated spot of steel causes it to ignite and burn away rapidly in the form of iron oxide. The oxide runs or is blown out of the cut or "kerf," in a stream, provided the torch is fed along properly. The tips used for cutting may have one or several heating jets preceding or surrounding the cutting oxygen jet. Only steel or wrought-iron can be successfully cut on a commercial scale, though channels or slots may be melted in any metal. A typical job of steel plate cutting is shown in fig. 5, and a typical cutting torch in fig. 6. Cast iron is cut with difficulty, and only by using a special tip and highly preheating the oxygen in a positive-pressure torch or by using an excess of acetylene and an unusually large tip on the low-pressure types.

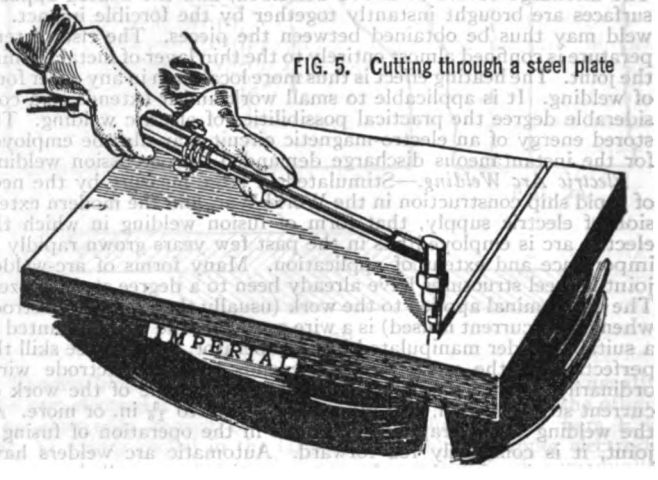

FIG. 5. Cutting through a steel plate

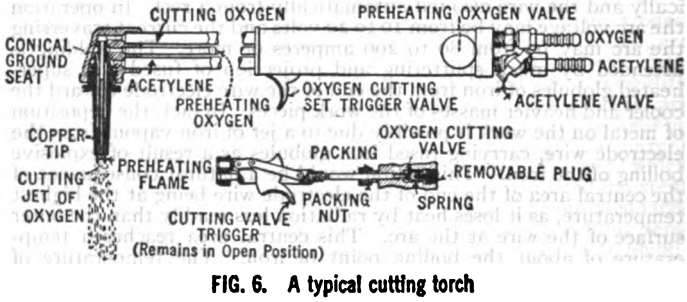

FIG. 6. A typical cutting torch

The same sources of gas supply are used in cutting as in welding. These are commonly cylinders or drums containing the gases under pressure up to 225 lb. per sq. in. and from 100 to 300 cu. ft. capacity for acetylene, and 1,800 lb. per sq. in. and from 100 to 200 cu. ft. capacity for oxygen or hydrogen. Acetylene, however, may be generated on the premises, in which case the pressure must not exceed 15 lb. per square inch. Obviously pressure as great as that mentioned for cylinders must be reduced for use in the torch and for this purpose regulators are used which automatically keep the gases supplied to the torch close to the pressure for which they are set. Gas-torch welding machines that are practically automatic are in use in many large plants for straight or circular seam welding of drums, cylinders, tubes, kettles and the like. Cutting machines are much more commonly used than welding machines. The cutting machines range from the simple, hand-fed, straight-line cutters to complicated motor-driven automatic machines that will cut rounds, squares, ovals or other patterns. One type of cutting machine is made on the pantograph principle, and by following a template or pattern the operator can use two torches and cut two separate steel plates at once. A cutting machine will, as a rule, cut a narrower and more even kerf than can be done by hand. Under favourable conditions a machine can be made to cut a kerf not over $\frac{1}{32}$ in. wide, while a careless or inexperienced operator with a hand torch may cut a kerf $\frac{1}{8}$ in. or more in width. (E. VI.)

WELFARE WORK IN INDUSTRY.—Human beings possess intelligence, and their well-being depends on psychological as well as on physiological make-up. Mental and physical activity are necessary to health. From the industrial point of view both require to be maintained in order to ensure the efficiency which represents for the employer a contented personnel, and for the employed not merely physical health, but a "worth while" life.

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The development of industrial processes brought about during the last century and a half by the application of mechanical power has introduced greater variations into the conditions of life and of work than formerly existed. During the period while control was being established over the efficiency of mechanical devices, the relation of the worker to these devices, and study of the efficiency of human beings in relation to altered conditions of work, were largely neglected. Nevertheless, industrial development in England, as elsewhere, has been followed step by step by "occupational" legislation, controlling employment in factories, mines, workshops and other places, aimed at protecting physical health. But knowledge of how to protect health lagged for many years behind the rapid alterations which were taking place; and the hurry onward to develop wealth-producing industries left no time for taking full advantage of what knowledge did exist. Certainly no organized effort was made during the 19th century to acquire new knowledge, and little or no recognition was given to the new psychological influences brought into existence even though their effect upon the workers was manifested in riots and strikes.

The commencement of the 20th century saw a few far-seeing employers coming to appreciate that their workers were individuals with whom personal contact must be established and maintained, and that modern industrial concerns were far too large to permit of this contact being established by a busy works manager. These employers delegated this side of their duties to definite persons, entrusted with supervision of the *welfare* of their workers. The result of this action was in every case markedly successful, and 30 British factories in 1913 sent representatives to a conference held at York. Nevertheless, previous to the World War the possibilities of welfare work were undeveloped. One of its results has been to attract more and more attention to its importance.

Welfare work, as such, may for convenience be considered alone. In practice it cannot be separated from supervision of health. The difference between health supervision and welfare is the difference between supervising the health of domestic animals such as prize cattle and of human beings. Mere provision of healthy surroundings and of means for personal hygiene does not meet the needs; there must be appeal to and coöperation with those concerned. The true spirit of industrial welfare work cannot be fostered merely by enforcing compliance with legal requirements. Welfare work means something different; it means educating and training each individual worker to take an intelligent interest not only in his own health and efficiency but also in that of his fellow workers, and in that of the industrial establishment of which he forms a part. Legal requirements can but seldom go further than fixing a minimum standard of accommodation needed; they cannot deal with the personal idiosyncrasy of workers, or establish a code of healthy etiquette, or ensure personal coöperation.

The unprecedented demand in the United Kingdom for munitions during the World War called for action to meet varying needs more rapid and elastic than that of ordinary peace requirements. In 1915, on the formation of the Ministry of Munitions, Mr. Lloyd George appointed the Health of Munition Workers' Committee who promptly recommended the adoption of welfare supervision for munition workers, using the following words of a well-known employer in support:—"If the welfare workers have the confidence of the employees, and are always in touch with them, they will naturally be the medium whereby matters occasioning dissatisfaction or misunderstanding can be investigated and put right. By suggesting and advising upon improvements in conditions of work that may be helpful on the business side, by initiating and supervising recreative and other clubs, societies and classes, by visiting the sick, by endeavouring to foster the spirit of good fellowship amongst all grades of employees, and by being ready to give advice and assistance in matters affecting individual employees personally and privately —by these and other methods welfare workers may find means of giving practical effect to the desire of employers to realize their obligations towards their workers." The Committee also issued a series of valuable memoranda dealing with workers' food and industrial canteens; employment of women and of juveniles; hours of work; industrial efficiency and fatigue; sickness, injury, and special industrial diseases; ventilation and lighting; washing facilities; and eyesight in industry. These various memoranda formed the basis of work undertaken by a special section established in the Ministry of Munitions entrusted with the welfare and health of workers.

Officers of the factory department (lent for the purpose by the Home Office) directed the work, which is historically important since thereby the foundations of industrial welfare were laid, and for the first time official propaganda going ahead of legal requirements and statute law were largely and successfully employed. The work was essentially advisory rather than punitive; it aimed at pointing out the lines reforms should take, and assisting and expediting in every way the carrying out of improvements. The following memoranda, issued by the Ministry of Munitions, indicate the scope of the work which was being initiated:—

I. Welfare for Women and Girls

The experience which has now been obtained in National and other factories making munitions of war has demonstrated that the post of welfare supervisor is a valuable asset to factory management wherever women are employed. Through this channel attention has been drawn to conditions of work, previously unnoted, which were inimical to the well-being of those employed. The following notes have, therefore, been prepared for the information of employers who have not hitherto engaged such officers, but who desire to know the position a welfare supervisor should take and the duties and authority which, it is suggested, might be delegated to her.

It has generally been found convenient that the welfare supervisor should be directly responsible to the general manager, and should be given a definite position on the managerial staff in connexion with the Labour Employment Department of the factory. She is thus able to refer all matters calling for attention direct to the general manager and may be regarded by him as a *liaison* between him and the various departments dealing with the women employees. The duty of a welfare supervisor is to obtain and to maintain a healthy staff of workers and to help in maintaining satisfactory conditions for the work. In order to obtain both a satisfactory staff from the point of view of health and technical efficiency, it has been found to be an advantage to bring the welfare supervisor into the business of selecting women and girls for employment.

Her function is to consider the general health, physical capacity and character of each applicant. As regards those under 16 years of age, she could obtain useful advice as to health from the certifying surgeon when he grants certificates of fitness. The management can, if they think fit, empower her to refer for medical advice to their panel doctor other applicants concerning whose general fitness she is in doubt. The selection of employees furnishes the welfare supervisor with a valuable opportunity for establishing a personal link with the workers. Her function is thus concerned with selection on general grounds, while the actual engaging of those selected may be carried out by the overlooker or other person responsible for the technical side of the work. In this way both aspects of appointment receive full consideration.

The management may find further that it is useful to consult the welfare supervisor as to promotions of women in the factory, thus continuing the principle of regarding not only technical efficiency but also general considerations in the control in the factory.

The welfare supervisor should ascertain what are the particular needs of the workers. These needs will then be found to group themselves under two headings:—

(*a*) Needs within the factory—Intramural Welfare.
(*b*) Needs outside the factory—Extramural Welfare.

Intramural Welfare.

The welfare supervisor may be made responsible for the following matters:—

(*a*) General behaviour of women and girls inside the factory.—While responsibility for the technical side of the work must rest with the technical staff, the welfare supervisor should be responsible for all questions of general behaviour.

(*b*) Transfer.—The welfare supervisor would, if the health of a woman was affected by the particular process on which she is engaged, be allowed, after having consulted the foreman concerned, to suggest to the management the possibility of transfer of the woman to work more suited to the state of health.

(*c*) Night Supervision.—The welfare supervisor should have a deputy for night-work and should herself occasionally visit the factory at night to see that satisfactory conditions are maintained.

(*d*) Dismissal.—It will be in keeping with the general suggestions as to the functions of the welfare supervisor if she is consulted on general grounds with regard to the dismissal of women and girls.

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(*e*) The maintenance of healthy conditions.—This implies that she should, from the point of view of the health of the female employees, see to the general cleanliness, ventilation and warmth of the factory and keep the management informed of the results of her observations.

(*f*) The provision of seats.—She should study working conditions so as to be able to bring to the notice of the management the necessity for the provision of seats where these are possible.

Unless the factory is a small one it would hardly be possible for the welfare supervisor to manage the canteen. The management will probably prefer to entrust the matter to an expert who should satisfy the management in consultation with the welfare supervisor on the following matters:—

1. That the canteen provides all the necessary facilities for the women workers; that is to say, suitable food, rapidly and punctually served.
2. That canteen facilities are provided when necessary for the women before they begin work so that no one need start work without having taken food.
3. That the canteen is as restful and as comfortable as possible so that it serves a double purpose of providing rest as well as food.

Supervision of Ambulance, Rest Room and First Aid.—While not responsible for actually attending to accidents, except in small factories, the welfare supervisor should work in close touch with the factory doctor and nurses. She should, however, be responsible for the following matters:—

1. She should help in the selection of nurses, who should be recognized as belonging to the welfare staff.
2. While not interfering with the nurses in the discharge of their professional duties, she should see that their work is carried out promptly, and that the workers are not kept waiting long before they receive attention.
3. She should supervise the keeping of all records of accident and illness in the ambulance room.
4. She should keep in touch with all cases of serious accident or illness.

It would further be useful if she were allowed to be kept in touch with the Compensation Department inside the factory with a view to advising on any cases of hardship that may arise.

Supervision of Cloak-rooms and Sanitary Conveniences.—The welfare supervisor should be held responsible for the following matters:—

1. General cleanliness.
2. Prevention of loitering.
3. Prevention of pilfering.

The management will decide what staff is necessary to assist her, and it should be her duty to report to the management on these matters.

Provision of Overalls.—The welfare supervisor should have the duty of supervising the protective clothing supplied to the women for their work.

Extramural Welfare.

The welfare supervisor should keep in touch with all outside agencies responsible for:—

1. Housing.
2. Transit facilities.
3. Sickness and maternity cases.
4. Recreation.
5. Day nurseries.

In communicating with any of these agencies it will no doubt be preferable that she should do so through the management.[1]

Records.

A. The welfare supervisor should for the purpose of her work have some personal records of every woman employee. A card-index system is recommended.

B. The welfare supervisor should have some way of observing the health in relation to the efficiency of the workers, and if the management approved this could be done:—

(*a*) By allowing her to keep in touch with the Wages Department. She could then watch the rise and fall of wages earned by individual employees from the point of view that a steady fall in earnings may be the first indication of an impending breakdown in health.

(*b*) By allowing her to keep in touch with the Time Office she should be able to obtain records of all reasons for lost time. From such records information can be obtained of sickness, inadequate transit and urgent domestic duties, which might otherwise not be discovered.

(*c*) By keeping records of all cases of accident and sickness occurring in the factory.

II. Welfare Supervision for Boys

The suggestions contained in this memorandum are founded on the experience of employers who have in actual operation the whole or part of the scheme. Nothing is suggested that has not been proved to be successful in its result.

The essence of the scheme lies in placing on some member of the staff the responsibility for the general well-being of the boys.

In large firms there is enough work to occupy the whole time of an officer.

In smaller firms various alternatives have been adopted:—

1. The services of an officer are shared by two or more firms.
2. An officer already on the staff is given special duties as regards the boys.
3. An officer is specially appointed, but has placed on him other duties in addition to those connected with the supervision of the boys.

Among the duties performed by such an officer the following are the more important of those usually placed upon him:—

Engagement.—1. He will keep in touch with the employment exchanges and the special advisory committees frequently attached to such exchanges. In this way he will secure valuable information relating to the health and school career of the boy.

2. He will interview boys and parents, explain to them the nature of the work and the importance of good time-keeping, and will take up references.
3. He will arrange for suitable boys to be brought before the heads of departments who will decide whether the boys shall be engaged. In some cases the actual engagement is left to him.
4. He will see that an Engagement Form is filled up; and in the case of indentured apprentices, carry through the indenture.
5. He will, especially during the first weeks of employment, keep in close touch with the boy, and assist him in the various difficulties which confront a boy on first entering industry. He will consult with the foreman as to the suitability of the boy for the work on which he is engaged.

Progress and Discipline.—1. He will receive reports from foremen on the boys' progress; will consider complaints, and, in the event of threatened dismissal, will see the boy before a decision is reached. (In no case has the Department discovered any evidence to show that foremen resent this procedure.)

2. He will see the boys from time to time and afford them opportunity of making complaints to him.
3. He will send reports to parents on the boys' general progress, wages, and time-keeping; and occasionally visit their homes.
4. He will discuss with heads of departments schemes of transfer, promotion and training. In the case of indentured apprentices he will see that undertakings are carried out.

Continued Education.—1. He will consider schemes for securing attendance at Continuation Classes.

2. He will offer inducements to secure regular attendance.
3. He will discuss with the Education Authority:—

(*a*) The question of technical training in the cases of boys who are learning a trade.

(*b*) The question of general education of other boys.

4. He will obtain from the head of the school reports on the boys' progress and attendance.

Health.—1. He will endeavour to become acquainted with the information contained in the report of the school doctor.

2. He will be present at the medical examination of the boys at the factory, and note the doctor's recommendations.
3. He will give special attention to ailing boys and cases of sickness, and endeavour to ascertain the cause.
4. Where lodgings are in demand, he will keep a list of suitable lodgings.
5. He will endeavour to secure that the boys obtain suitable food; and may be made responsible for the general supervision of the canteen and messroom, and for the arrangements for heating carried food.
6. He will be responsible for seeing that boys obtain First Aid in case of accident; and may be entrusted with the duty of supervising the First Aid equipment.
7. He will encourage boys to use overalls; will see that the washing and sanitary arrangements are adequate and in good condition, and will supervise order and decency in their use.

Thrift.—He will be responsible for the initiation and carrying out of thrift schemes, as for example:—

1. By the voluntary stoppage of a certain weekly sum from wages.
2. By weekly collection.
3. By payment of good conduct bonus to the boys' credit.

Recreation.—1. He will be responsible for organizing outdoor games; and for the management of a recreation room, if such exists.

2. He will consider the question of forming a Cadet Corps or Scout Troop.

Records.—He will keep systematic records of each boy.

The work was throughout closely interlocked with action taken from the summer of 1915 onwards by the Central Control Board (Liquor Traffic) to establish and maintain (by themselves or through agents) refreshment rooms for the sale or supply of refreshments. Employers in England were during the war stimulated to pursue welfare schemes and erect canteens by being permitted to write off expenses against excess profits duty.

[1] The work referred to above as "extramural" was the direct outcome in many of its features of the activities initiated by the Women's Employment Committee, appointed at an early period of the war by the Home Office and the Board of Trade.

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Welfare schemes were found to be best conducted through the assistance of welfare committees elected by the workers themselves and representative of all classes of labour employed. In this way is obtained from the beginning the support and coöperation of those for whom the work exists. A strong welfare committee is invaluable; through it an ambulance corps and shop committee for accident prevention can be formed; sickness and emergency funds can be raised and administered; recreation, mental and physical, can be organized; grievances real and imaginary, can be settled; order and discipline maintained; etiquette and a high moral tone established; and canteen complaints discussed and remedied.

A standard has been suggested for the staff necessary for a welfare department, as follows:—

Welfare supervisors for women and girls:—up to
300 workers, one welfare supervisor
a further 300 workers, one assistant supervisor
a further 450 workers, a second assistant supervisor
a further 600 workers, a third assistant supervisor
Total 1,650 women and girls, one senior welfare supervisor and 3 assistants. After this number one assistant should be added for every 600 workers.

Welfare supervisors or apprentice masters for boys:—up to
100 boys, one welfare supervisor
a further 200 boys, one assistant supervisor
a further 350 boys, a second assistant supervisor
a further 500 boys, a third assistant supervisor
Total 1,150 boys, one senior welfare supervisor and 3 assistants. After this number one assistant should be added for every 500 boys.

Welfare supervisors for men:—These officers are usually combined with those acting for boys; and in such cases the scale suggested in the case of women and girls may be taken as a guide. Examples of officers acting for men only are not yet sufficiently numerous to base a scale upon.

While activity on these lines (which came to an abrupt termination on the cessation of hostilities) was still in progress, the Home Office in 1916 consolidated much of the ground won by obtaining powers under the Police, Factories, etc. (Miscellaneous Provisions) Act, Section 7, enabling the Secretary of State by order to require occupiers of factories to make reasonable provisions relating to "arrangements for preparing or heating, and taking, meals; the supply of drinking water; the supply of protective clothing; ambulance and first-aid arrangements; the supply and use of seats in workrooms; facilities for washing; accommodation for clothing; arrangements for supervision of workers." Under these powers a number of orders were made referring to:—

Ambulance and First-Aid at blast furnaces, copper mills, iron mills, foundries and metal works.
Ambulance and First-Aid at saw-mills and wood-working factories.
Drinking water.
Dyeing, use of bichromate of potassium or sodium in.
Fruit preserving.
Glass bottles and pressed glass articles, manufacture.
Laundries.
Oil-cake mills.
Seats in shell factories.
Tanning, use of bichromate of potassium or sodium in.
Tin or terne plates, manufacture of.
All textile factories, printworks, bleaching and dyeing works, and rope-spinning works with reference to providing protective clothing, cloakrooms, messrooms, washing facilities, seats, First-Aid and ambulance.

Not only did the Home Office through these orders proceed to enforce the provision of welfare accommodation but the way was prepared for further action by issuing a series of valuable advisory pamphlets, well illustrated, which set forth in a practical way how the orders can be complied with. The titles of these pamphlets suggest their contents:—*Welfare and Welfare Supervision in Factories and Workshops; Messrooms and Canteens at Small Factories and Workshops; Protective Clothing for Women and Girl Workers; Seats for Workers in Factories and Workshops; First-Aid and Ambulance in Factories and Workshops; Ventilation in Factories and Workshops.*

Evidence of the way in which the extension of welfare work has been stimulated is to be found in the coming into existence of (*i.*) the Welfare Workers' Institute with headquarters at 11, Adam St., Adelphi, W.C.2, and (*ii.*) the Industrial Welfare Society, 51, Palace St., Westminster, S.W.1. Both bodies have a large membership and local branches in industrial areas; women supervisors mainly support the former and men the latter. Both publish good monthly journals, *Welfare Work* and *The Journal of Industrial Welfare*. The effect now exerted upon conditions of labour, social contentment and general betterment in industry is hard to overestimate.

Reference has so far been confined to the welfare movement in reference to factory employment, where it has been most pronounced; but action has not been confined entirely to this field. As long ago in England as 1872 the Metalliferous Mines Regulation Act called for the provision of accommodation for enabling persons employed in metalliferous mines to dry conveniently and change their clothes. In 1910 the Mines Accidents (Rescue & Aid) Act gave power to make orders relating to:—

(*a*) The supply and maintenance of appliances for use in rescue work and the formation and training of rescue brigades.

(*b*) The supply and maintenance of ambulance appliances and the training of men in ambulance work.

The Coal Mines Act of 1911 contained, too, an important clause providing for accommodation and facilities for taking baths and drying clothes where the majority of workmen employed in a mine desire such. Unfortunately this clause was a dead letter except at some half-dozen collieries. But under the Mining Industry Act, 1920, welfare work for miners should receive a great impetus. This Act provides a fund, derived from a levy of 1d. a ton on the output of each mine every year, to be applied for purposes connected with social well-being, recreation, and conditions of living of workers, and with mining education and research. This fund may amount to about £1,000,000 a year and its allocation is entrusted to an expert committee. The result cannot fail to be of intense interest.

For welfare work in the United States, see section V. of the article UNITED STATES.

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WELLHAUSEN, JULIUS (1844–1918), German biblical scholar and Orientalist (*see* 28.507), died in 1918.

WELLS, HERBERT GEORGE (1866–), English man of letters (*see* 28.514), published subsequently to 1910 a long list of notable novels, including *The New Machiavelli* (1911); *Marriage* (1912); *The Passionate Friends* (1913); *The Wife of Sir Isaac Harman* (1914); *The Research Magnificent* (1915); *The Soul of a Bishop* (1917); *Joan and Peter* (1918). He also produced, in fiction form, a discussion on immortality, *The Undying Fire* (1919); a philosophic work, *God, the Invisible King* (1917), and a number of books and pamphlets suggested by the World War. Of these, *Mr. Britling Sees it Through* (1916) was serious fiction, whilst *An Englishman Looks at the World* (1914), *The World Set Free* (1914), *The Peace of the World* (1915), etc., were war pamphlets. He also published two humorous stories in 1915, *Boom* and *Bealby*, and in 1919–20 he completed his encyclopædic *Outline of History*, which was first published in monthly parts. In 1921 he published *The Salvaging of Civilization*. (*See* ENGLISH LITERATURE.)

WEMYSS, FRANCIS WEMYSS-CHARTERIS-DOUGLAS, 10TH EARL OF (1818–1914), British politician, was born at Edinburgh Aug. 4 1818, and was educated at Edinburgh, Eton and Christ Church, Oxford. He entered the House of Commons in 1841 as Lord Elcho, as Conservative member for E. Glos., holding the seat until 1846. From 1847 to 1883, when he succeeded his father in the peerage, he sat for Haddingtonshire and from 1852 to 1855 was a lord of the treasury. Lord Wemyss was best known for the part he took in encouraging the Volunteer movement (1859). From 1859 to 1879 he commanded the London Scottish, and was also one of the founders of the National Rifle Associa-

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tion (1860), presenting it with the Elcho challenge shield for a yearly competition. He retained his vigour and energy almost till his death, which took place in London June 30 1914, at the great age of ninety-five. He was succeeded by his fourth but eldest surviving son, HUGO RICHARD, LORD ELCHO (b. 1857).

WERNER, ANTON ALEXANDER VON (1843–1915), German painter (*see* 28.523), died in Berlin Jan. 3 1915.

WERNHER, SIR JULIUS CHARLES, 1ST BART. (1850–1912), British S.A. financier, was born at Darmstadt in 1850, entered a banking house in Frankfort, and early in 1870 came to London as a clerk. On the outbreak of the Franco-German War he returned to Germany to take his place in the army, and was present at the fall of Paris. At the end of 1871 he was sent by Mr. Jules Porges, diamond merchant of London and Paris, on a mission to Kimberley. There he remained till 1880, when he was transferred to London as English representative of the firm of Porges and Wernher, interested not only in diamonds but in the gold mines of S. Africa. In 1888, when the Kimberley diamond mines were amalgamated by Cecil Rhodes and Alfred Beit, he became a life governor of the De Beers Corporation. Beit was now a member of his firm, and in 1889, when Porges retired, the name of the firm was changed to Wernher, Beit & Co. (*see* 3.659). Out of his enormous fortune, Sir Julius Wernher, who was created a baronet in 1905, spent large sums on public objects, including education; he gave £10,000 to the National Physical Laboratory and, with Beit, endowed the S. African University with £500,000. He died in London May 21 1912.

WERTHEIMER, CHARLES JOHN (1842–1911), art collector, was born in London Feb. 17 1842, of German-Jewish parentage. He early devoted himself to the collection of china, pictures and *objets d'art* of all kinds, travelling widely with this purpose in view, and amassing a wonderful collection. He suffered a considerable loss in 1907, about £40,000 worth of treasures being stolen from his London house on Feb. 12. He died in London April 25 1911. His collection was sold after his death and realized a very large sum.

His brother, ASHER WERTHEIMER (1844–1918), entered his father's art galleries in Bond Street, and later assumed control of the business. He made many noteworthy purchases, the most famous being the acquisition of the Hope collection of Dutch pictures (1898) and, in conjunction with M. Seligmann of Paris, the Cheremeteff collection of Sèvres porcelain (1906), which was exhibited in Bond Street. He died at Eastbourne Aug. 9 1918. By the terms of his will, the splendid series of portraits of the Wertheimer family by J. S. Sargent was left to the nation, after the death of his wife.

WESTERMARCK, EDWARD ALEXANDER (1862–), Finnish anthropologist, was born at Helsingfors Nov. 20 1862. Educated at a lyceum in his native town and at the university of Finland he became professor of moral philosophy at his own university; but he came to England about 1890 and in 1907 was appointed professor of sociology at the university of London. He made a special study of primitive marriage and ethical origins and has published *The Origin of Human Marriage* (1889); *The History of Human Marriage* (1891); *The Origin and Development of the Moral Ideas* (1906); *Marriage Ceremonies in Morocco* (1914) and other scientific papers.

WESTERN EUROPEAN FRONT CAMPAIGNS, 1914-8.—The story of the successive campaigns in Belgium and France during the World War, embracing the continuous struggle on the western front from Aug. 2 1914 to Nov. 11 1918, is dealt with below under four main sections, representing the phases into which it naturally divides itself:—viz. the "open" warfare campaign of 1914, which ended without decisive victory to either side in the open field and left the armies "stabilized" on a continuous line from Nieuport to the Swiss frontier; the three years of trench-warfare campaigns, 1915–7; the great German offensives of March–July 1918, which, breaking the stability of the trench-warfare system, re-introduced a condition of semi-open warfare; and finally, the allied offensive which synchronized at its outset with the last German attack effort, and closed with the Armistice at 11 A.M. on Nov. 11 1918.

I. THE CAMPAIGN OF AUG.–NOV. 1914

France's Defence Problem.—During the years which followed the Franco-Prussian War of 1870–1, a *guerre de révanche* for the reconquest of Alsace and Lorraine was very frequently discussed in France. But it implied aggressive action against Germany, and those who judged with reason and not with sentiment knew very well that such action was impossible. In fact, Germany, at every international crisis that arose, asserted, sharply and menacingly, her readiness to accept a challenge, while France prudently yielded and avoided a conflict.

It may be observed that, under similar military systems—that is, under laws of universal military service—the effort of France could not surpass the effort of Germany, for France counted less than 40 million inhabitants against the 65 to 70 millions of Germany. Presuming equality of national effort, the *vis viva* of France in relation to that of Germany would be in the proportion of 4 to 7; and this calculation makes no allowance for the fact that in Germany all factors combined to exalt the army, to intensify war preparation, and to produce solid cadres and reserves, while in France the tendency of politics was to depreciate the army and to lower its quality, to minimize its training periods, and to depress its military spirit. It is not unfair to say therefore that the possible warlike power of Germany was at least double the possible warlike power of France.

If, next, we cast a glance at the theatre of the possible war, we see at once that France had no natural frontier with respect to Germany, and was obliged to make good this defect by a system of fortresses and entrenched camps—a form of defence which it is exceedingly difficult to maintain at such a level as to be capable of resisting at any moment an artillery that itself is constantly evolving in the direction of increased power. On the side of Germany, on the other hand (even leaving out of consideration her first-class fortresses, for which money was never lacking), there was a line of defence of the very first order, the Rhine—impossible to turn even if the neutrality both of Holland and of Switzerland were violated, for its flanks rest on the Alps and the sea. There are not in Europe two lines of defence of this value, and it was reinforced by a chaplet of entrenched camps. Supposing then that, in spite of the conditions mentioned, France somehow contrived an initial superiority, her penetrative effort could in no case pass the Rhine, while, in a German penetration of France, Paris was within measurable reach.

From the point of view of numbers, the French alliance with Russia might seem at first sight not only to redress the balance but even to weigh down the scales heavily in France's favour. The effective utilization of these numbers was, however, subjected in practice to grave limitations. The strategic conditions of what came to be called the eastern front are discussed in the article EASTERN EUROPEAN FRONT CAMPAIGNS, and here it is only necessary to say that these conditions and in particular the paucity of railway communications and of rolling-stock in Russia—evident from a glance at any map of central and eastern Europe—left it within Germany's power to use by far the greater part of her forces in an initial campaign against France. These forces might, from the relation of the two populations concerned and the characters of their respective politics, attain a figure almost double those of France. In such a contingency, the French armies almost might be crushed under a very considerable numerical superiority; the Germans could sweep up to Paris; and there probably the war would end. Germany would rapidly bring back her armies to deal with Russia, aided both by the general E.–W. orientation of her railways and by their perfect technical preparedness. That the German plans did not always take this form, that the soundness of its principle was a matter of considerable controversy, within the German General Staff as well as in military publications, and that the numerical German superiority was not in fact attained, may be freely admitted. But, as the most dangerous alternative that France had to consider, this plan was found to be taken on the logical basis upon which the military policy of the defence should be build up. Whether Germany's own allies would coöperate in such an invasion, and if so, to what extent, was doubtful. Austria's main

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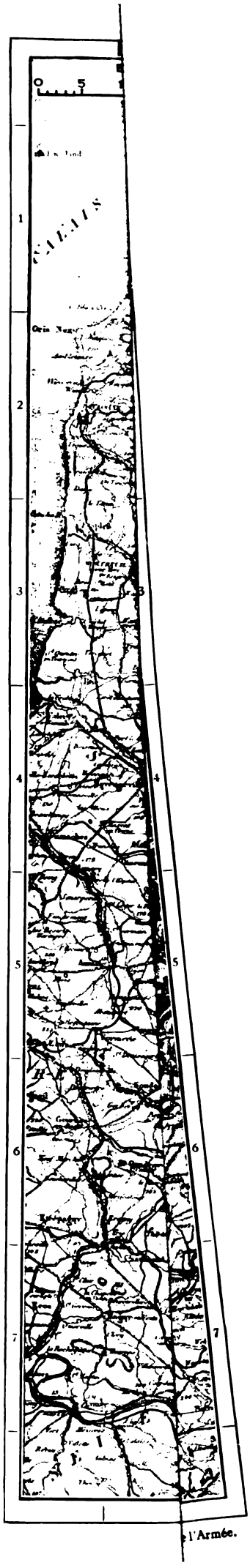

WESTERN EUROPEAN FRONT
CAMPAIGNS (NORTH)

PLATE I.

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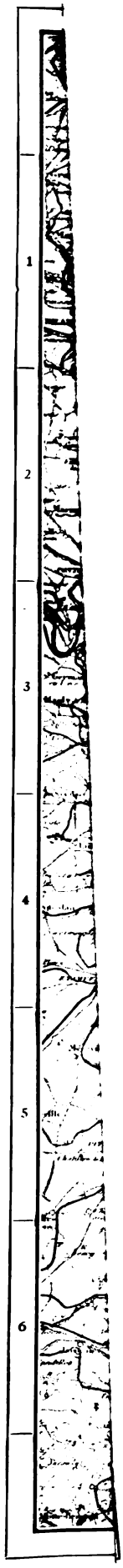

WESTERN EUROPEAN FRONT
CAMPAIGNS (SOUTH)

PLATE II.

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effort would have to be made in the East; and as regards Italy, it was known that her obligation under the Triple Alliance would become operative only if one of her Allies was defending itself against attack. On the other hand, the *Entente Cordiale* between England and France had enabled the latter to concentrate her naval effort in the Mediterranean, and the details of possible coöperation on land, for some years before 1914, had been studied by the British and French general staffs in concert. But England reserved to herself complete freedom to decide for or against intervention if and when the case arose. It was not till Aug. 2 1914 that Sir Edward Grey engaged that the British navy would protect the Channel coast of France, and not till the actual violation of Belgian neutrality by Germany that the British Government declared war on their own account.

Armies require, for their operations, zones with fronts proportionate to their effectives, for it is obvious that they should neither occupy a space so vast as to deprive them of the density necessary for powerful action, nor on the other hand be so overcrowded that their component parts cannot each contribute at the proper time its share in the effort towards a common object. The proper width of these zones depends on the balance of many factors between two reasonable limits; but, above all, it is necessary that all the elements that are to be brought into action at the same time should have at their disposal enough routes, more or less parallel, leading to the objective, and that these routes should be approximately *at deploying interval* apart. Now if Germany attacked France without violating any neutralities, the available width between Switzerland and Luxemburg was practically the same as it had been in 1870. The frontier had changed its position. It is true that Strasburg and Metz were comprised no longer in France but in Germany, and to that extent Germany had gained. But, apart from the fortresses, this frontier was only a conventional line, devoid of strategic interest. The space available for the deployment of the armies, and the distance in a straight line from one neutral frontier to the other, had not altered. Further, not all this space was equally utilizable; the Vosges region, for instance, which was very unsuitable for military operations, formed a large part of it. Thus if the available zone of the Franco-German frontier had seemed somewhat cramped even in 1870, it was far more so—and was becoming impossibly so—for the much larger armies of 1914. If the Germans violated no neutrality, it was out of their power to bring into play the *ensemble* of their attacking forces, and this fact gave to the French army—presumed to be numerically much inferior—an immense advantage. With its fortresses of Belfort, Épinal, Toul and Verdun, the French front of contact was very strong, and moreover, organized both to resist any brusque attack of the nature of a "bolt from the blue" and to enable the French army on mobilization to concentrate close up to the frontier without fear of being disturbed. Such, at any rate, was the adopted French view, though the experience of the war, which brought into play destructive engines of a power formerly unimagined, suggests grave doubts as to its accuracy.

In any case, it was clear that, if the Germans wished to obtain in a short time a success decisive enough to put France out of action, or at least to cripple her sufficiently to enable a large part of their forces to be sent against Russia, the violation of one or another national neutrality was a necessity for her—that of Switzerland if it was decided to envelop the French right, that of Belgium and of Luxemburg if the French left was to be the object of the manœuvre. It was not necessary to violate the neutralities of both flanks, but military opinion was divided as to which would be selected. Each had its partisans in the German General Staff, and neither possibility was ignored by the French. At first sight, the passage through Switzerland might seem the more difficult. But, examined more closely, it loses most of its difficulties. For, in effect, the operation would consist in slicing off such a corner of Switzerland as would give the necessary number of roads, railways and Rhine passages (which could, of course, be multiplied in the sequel). For this, the Jura region alone would be enough; and the Swiss forces, massed on the flank of the invaders, would be held in check by another army, presumably Austrian. For it must be borne in mind that the Swiss army could not have been mobilized and concentrated quickly enough to hold the line of the Rhine in sufficient strength to bar access, and that Switzerland possessed not a single fortress to support it. On the other hand, the probability of the Belgian route being the one chosen—as it was—was indicated by the systematic and prolonged German preparation of rail facilities on that front.

Thus, for many years, it had been regarded as certain that part of the German army of invasion would traverse either Belgium or Switzerland. But it was not possible to foresee the proportioning of forces that would be adopted by the Germans on the thus extended front, for the high development of their railway network, and the consequent flexibility of their concentration transports, gave every facility for changes of plan and variants. Further, it was naturally to be presumed that they would make efforts to secure in advance the agreement of the state whose territory they proposed to borrow, and the success or otherwise of these diplomatic moves would necessarily react on the proportioning of forces on the military front. And this was true whether the Germans sought by way of Belgium to reach Paris and deal France a mortal blow by capturing the capital, or by way of Switzerland to cut France in two. In either event, the French armies of the eastern frontier, once turned, would have no alternative but retreat.

The French General Staff naturally foresaw that, since the holding of Russia would devolve upon Austria, the French army would probably have to struggle alone against greatly superior German forces (possibly against a preponderance of almost 7 to 4, as previously stated). The first effort must be directed towards establishing a well-prepared and fortified front, proportioned to the forces available, and to locate this as near to the Alsace-Lorraine frontier, whence the enemy could launch a direct attack at any moment, as was possible without exposing the army to the risk of a surprise. In the next place, the possibilities of attack through both Belgium and Switzerland must be guarded against. To extend the line of battle sufficiently to secure both approaches, or even one of them, in an adequate manner, would involve such a weakening of the whole front as would enable the enemy to attack anywhere with a certainty of finding only a third to a quarter of the French forces against him. Any such plan was contrary to all the principles of war, and therefore unthinkable. A completely defensive line must extend from Dunkirk to the Vosges, the Donon, and thence, in order to guard the Swiss frontier as far as Bellegarde, to the Rhine; at the rate of one army corps to 7·5 km. of front, this line (750 km.) would require 100 army corps, without reckoning reserves, to secure it—or more than four times the whole of the numbers available. If the violation of Belgium could be taken as certain the Swiss frontier need not be considered; the line would then run from Belfort to Dunkirk, a length of 550 km.; but 73 army corps—more than the entire French army—would even so be required for its defence. However, if the French staff acted on this assumption, the German army would undoubtedly abandon the Belgian plan and advance through Switzerland; in which case the French army would be turned on the right in such a way that the forces sent to secure the northern frontier could not possibly arrive in time to stop the enemy from crossing the plains of the Saône and coming down into the basin of the Seine. Such a disposition was therefore impossible. The French force must occupy the centre of the line, in Alsace-Lorraine, which was the part most threatened, and be ready to oppose on the north or the south according to the enemy's decision. Accordingly, the following dispositions were made. They are the key to the whole of the first period of the war.

The choice of the first line of defence, to be held against direct attack, was determined by the necessity of fixing it at a sufficient distance from the fortress of Metz, the outer defences of which almost touched the frontier, so that the zone of action of the entrenched camp extended into French territory in the Woëvre plain, which could not be defended. The most advanced line of battle considered practicable was that of the Meuse slopes,

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which dominate the Woëvre and continue into the neighbourhood of Verdun. This accordingly became an entrenched camp, which had to be raised to the highest pitch of efficiency as a counter to Metz, the "loaded pistol pointed at the heart of France." The line of battle was based on Verdun, and, consolidated by forts constructed on the Meuse slopes, passed in its natural course through Toul and then through the good defensive positions afforded by the left slope of the valley of the Moselle. Between Épinal and Mirecourt these heights lay further from the river, and accordingly the French line drew away from Épinal to arrive at a hill called the Côte de Vivine. Thus the entrenched camp of Épinal, on the Moselle, lay in the advance of the battle-line, and enabled an offensive flank movement against the left of the enemy attack to be made under the protection of its artillery. Behind this first very solid line, which could be held by forces very inferior to those of the enemy, a whole series of positions were available in case of a retreat, in the valleys of the rivers flowing south and north.

The front being rendered secure from direct attack, there remained the question of the two flanks, in the event of an invasion by way of either Belgium or Switzerland. Facing the road from Switzerland there was a great concave arc of positions commanding the plain of the Saône and based on entrenched camps, *i.e.* Belfort, Épinal, Langres and Dijon. In front of these stood Besançon, in a position to divide and delay the invading stream. Facing the Belgium road, with Verdun, which acted as a sort of left shoulder, as the starting point, was a returning arc marked by the entrenched camps Reims, Laon and La Fère. In advance of these positions Maubeuge played a part corresponding to that of Besançon on the other side.

The enemy must take a certain line to traverse either of the neutral countries, even supposing that he met with no opposition. This would allow time for the French reserves to form, and for the first-line army to concentrate along the Verdun–Toul–Épinal line, to prepare positions facing N. on the left flank of an invader from Belgium or facing S. on the right of an invader from Switzerland, and to be ready to attack, in either event, at the favourable moment. Reason and prudence dictated these dispositions, in view of France's isolation, separated as she was from her Russian ally, and of the fact that Germany and Austria had the advantage of "interior lines."

The dimensions of the two flanks—from Verdun to Reims–Laon–La Fère, and from Belfort to Épinal–Langres–Dijon, respectively—were in accordance with the resources provided by the French recruiting laws in force for some years after 1872; but they had become insufficient for those given by the law of 1889, which greatly increased the military sacrifices demanded from the nation and added considerably to the war effectives. The result was that the flank facing an attack from Belgium, instead of ending at the Laon–La Fère system, which was becoming useless, was prolonged as far as Paris, which, as an immense fortified camp, must, by the mere fact of its presence, play a supremely important part, as was seen in 1914. Compared with this great entrenched camp, Reims itself was quite secondary. As for the other flank, it could be continued indefinitely beyond Dijon, by means of the formidable defensive positions provided by the mountains of the Côte-d'Or, which commanded the plains of the Saône. No new fortifications had been considered necessary. The line of battle opposed to Metz could also, because of the increased military resources, be prolonged N. of Verdun, still keeping the edge of the Meuse slopes up to Stenay and even beyond, so as to constitute a threat to the German right, on condition, however, that this right did not extend into Belgium. In the event of a turning movement by way of Belgium, the French left was not to go beyond the Verdun shoulder, and thence would trend away into a defensive, refused flank.

An alternative policy, that of entering Belgium and by reinforcement enabling the Belgians to hold the line of the Meuse, was the subject of a good deal of consideration in French military circles before the war. It involved, however, an extremely complex problem. The attitude of Belgium on the question of admitting French and British forces had been one of marked reserve, although there had been *pourparlers* at different times between the Belgian and the British authorities; and in fact it was not till Aug. 4 1914 that Belgium asked for the support of England, France and Russia, undertaking herself the defence of the fortified places. Yet, even had Belgium accepted British and French aid earlier and a united Allied front been formed along the Meuse, the strategic situation thus created would have been very difficult, owing to a cause which was operative whether the French advanced to the Belgian Meuse or not. The line of the Meuse runs N.–S. between Mézières and Maestricht, while the direction of the frontier between Mézières and the Vosges is substantially E.–W. A German concentration in the region Aachen–Trier would therefore occupy a zone midway between these two lines, and could act in the direction of either as circumstances dictated. Thus, whether the French army, flung northward, was to go as far as the Belgian Meuse or only to the French territory adjacent, was certainly a question of very great local significance, because the 300-km. line of defence from the angle to the sea, destitute of natural defences and weak in artificial, was distinctly inferior to the short, strong, well-fortified line Givet–Namur–Liége. But it did not alter the fact that the German forces concentrated between Aachen and Trier might, after perplexing the defence by demonstrations, fling their weight upon the line between Mézières and Verdun, break it by means of superior numbers, and so gain a position not only between the separated halves of the French but also nearer to Paris than either.

These conditions, together with Belgium's hesitating attitude, practically imposed the defensive principles upon which the French General Staff must proceed. Obscured as they were by the dramatic events of Aug. 1914,—by the glorious insistence of Belgium, the French offensives into Alsace, Lorraine, and the Ardennes, the tidal wave of the German I. and II. Armies traversing the Belgian plain and northern France,—it was nevertheless on these principles that the German effort was shipwrecked. For in Sept. 1914 the breakwater of the defence was established solidly on the line, marked substantially by the Vosges, the natural defences of Lorraine, the Côte de Meuse, Verdun, the Montagne de Reims and the advanced defences of Paris, which strategic reasoning had already indicated as the basic line of defence for France in the given conditions.

These conditions include other alternatives than the one selected by the Germans; and it may be asserted that, given the fact of Belgium's resistance and of England's intervention, the course taken by the Germans was—as against the alternative of a violation of Swiss neutrality, which would have occasioned much less concern to England than that of Belgium, and even as against that of a frontal forcing of the Lorraine defence, which perhaps was not as invulnerable as it was believed to be—the course which was the least disadvantageous for France.

(H. Bé.)

The French "Plan 17."—The characteristic of all French plans of concentration up to those bearing the No. 16 was that they were all applications of the defensive principles outlined above, differing only in detail, and providing for an initial defensive phase of operations out of which an appropriate counter-offensive would arise when the occasion was ripe. From 1912 onwards, however, a new school of thought had begun to prevail in the French General Staff. The teachings of Colonel (afterwards General) Loiseau de Grandmaison, the constant improvement of the mobilization scheme in details, the sharper tone of policy and sentiment after the Agadir crisis, all combined to create a "younger school" in the staff which did not admit that the army was so inferior in power or war-readiness that the defensive need be assumed *a priori*, as had hitherto been the case. Military France, like the rest of military Europe, was caught by a wave of enthusiasm for the offensive *per se;* doctrines and text-books were revised, senior officers, and generalissimo-designate, having predilections, real or alleged, for the defensive, were got rid of; and as soon as it became clear that the process of mobilization and concentration had been sufficiently accelerated, "Plan 17" was drawn up, with the immediate general offensive in full force as its keynote.

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"Plan 17," issued to commanders-designate of armies and their chief-of-staff in Feb. 1914, was based on certain assumptions which may be summarized as follows: On the right wing, the hypothesis of a German invasion through Switzerland was assumed to be so improbable that only an echelon of three reserve divisions, and these available for active operations towards Belfort, was allotted to that flank. On the left flank, the problem was far more delicate and difficult, as it depended on whether or not Belgian neutrality would be violated, and, if so, how far N. the right of the German forces would extend. It was involved with two other questions, that of the attitude of Belgium and that of the strength of the German army; neither of these was answered very definitely, and the assumptions of the plan proved substantially incorrect. Belgian aid was not counted upon—indeed, in one important detail provision was made for the case of the Belgians not interfering with a German march-through—and the German army for battle purposes was assumed to contain only some 20 or 21 active corps, the reserve divisions, it was thought, not being available till after an interval, and then only for subsidiary functions such as sieges and railway guarding. The conclusion drawn was that the German right, in case Belgian territory was taken in, would extend to the limit of the Ardennes —*i.e.* the Belgian Meuse—at the farthest, if as far. But the hypothesis of a frontal attempt of the Germans to break through between Longwy and the Vosges, without touching Belgian territory, was the basis of the plan; and the measures to be taken in case Luxemburg and the Belgian Ardennes came into the theatre of war were embodied in a "variant." It was supposed, in addition, that attempts might be made by the Germans in Lorraine or the Woëvre to break into the French concentration areas in the first days of hostilities; and a very strong protective system (drawn back in the Woëvre out of range of a sortie from the Metz outer defences) was provided against this emergency, the augmentations of the peace effectives brought about by the "Three Years Law" having made this possible. On to this protective system, constituted by one corps of each front-line army, the remaining corps were to graft themselves as they arrived, and the whole was to be ready for active operations on the 12th day of mobilization. It was assumed—correctly—that the Germans would attack, and—incorrectly—that their attack would be a simultaneous onset of fairly evenly distributed forces; and it was argued that a French offensive, debouching with startling rapidity, would create a situation with which the German military system was not elastic enough to deal.

These active operations, if Belgian territory remained untouched, were to be a general offensive of four armies with another immediately behind them, directed eastward from the Meuse below Verdun and northeastward from the Nancy–Vosges front, northward from Belfort; and, if Luxemburg and Belgium were infringed, an equally general offensive with all five armies in line, those of Alsace and Lorraine directed as before, but those of the Woëvre and the middle Meuse northeastward and even northward according to the positions found to be occupied by the German right. In either case the central army, besides helping its neighbours as required, was to drive back all sorties from Metz and begin the investment of that place.

The dispositions of the plan were as follows: The *I. Army* (five corps, two cavalry divisions and army artillery) was to attack with its main body from the concentration area west of the Vosges in the direction Baccarat–Saarburg–Saargemünd; the right, VII. Corps and a cavalry division based on Belfort, to advance into upper Alsace, rouse the population to a revolt, and hold as large a German force engaged as possible; between the VII. Corps and the main body, a smaller force in the Vosges was to maintain liaison and by descents into Alsace to coöperate with the advance from Belfort.

The *II. Army* (five corps, two cavalry divisions and army artillery), grouped initially about Nancy and Lunéville, on the left of the I., was to attack in the direction Château Salins–Saarbrücken. The improvised fortifications of Nancy in the first stage, and a group of reserve divisions issuing therefrom in the later stages, were to protect the left of this army against Metz; and the I. Army, developing its advance along the Vosges, was to guard the right, coöperating in the battle of the II. Army with all the forces not absorbed by the flank along the Vosges.

The *III. Army* (three corps, three reserve divisions, one cavalry division and army artillery) was to connect this "principal attack" in Lorraine with the other "principal attack" mentioned below, first by holding the Côte de Meuse between Verdun and Toul, next by repelling sorties from Metz and blocking up the west front of that fortress, and lastly by giving support to the attacks of the neighbouring armies.

The *V. Army* (five corps, two reserve divisions, one cavalry division and army artillery) had to deal with two alternatives, those of violation or non-violation of Belgian territory. In the latter case, it was to drive eastward from its concentration area N. of Verdun and the Argonne across the Meuse, dropping in its progress a flank-guard to watch the Belgian frontier; its objects were to defeat and drive northward all German forces encountered, and to storm or invest, according to circumstances, the fortifications of Thionville (Diedenhofen), guarded and assisted on its right by the III. Army. In the first alternative, it was to be so disposed that it could both attack northeastward on Neufchâteau and Florenville in the Ardennes, and guard its left rear with a special detachment.

The *IV. Army* (three corps, one cavalry division and army artillery), concentrated behind the III., was the general reserve. It was destined to be used either on the right or on the left of the III. Army according to which of the two "principal" attacks —Lorraine or Ardennes—needed additional weight. If the offensive of the V. Army was directed upon Neufchâteau and Florenville, the IV. Army was to come in between the V. and the III., and fight its way in the direction of Arlon. Behind the right were to be three reserve divisions, ready to follow up the VII. Corps and take over the guard of the Rhine as it advanced. Behind the left, but not definitely allocated to the V. Army, were to be three more reserve divisions about Vervins, with a somewhat indeterminate mission. A corps of several cavalry divisions was to form about Mézières in the first days of mobilization on the left of the protective system, and thereafter to operate eastward or northeastward into the Ardennes as required. Its supporting infantry was to occupy the bridges between Dinant and Namur if the Belgian Government did not do so.

This was the plan which was carried into effect when war came in August 1914. As early as Aug. 2, it was decided to act on the hypothesis of a German movement through the Belgian Ardennes, the seizure of Luxemburg by the German advanced guards on that day being a sufficiently suspicious indication. But during the following days the French General Headquarters were confronted with a mass of definite and indefinite information which it was hard indeed to appraise. On the protective line, apart from two severe local fights, at Mangiennes in the Woëvre and Lagarde in Lorraine—the first a French, the second a German victory—there were no events and no important indications. To the N. of the left flank, want of liaison, and, it must be added, of mutual confidence, made it difficult for the French to gauge exactly what the Belgian army would do, and especially what was happening at Liége. That fortress was attacked on Aug. 5, and its capture (*see* LIÉGE) was announced as a *fait accompli* on Aug. 7, yet for many days thereafter the gathering masses of the Germans between Aachen and the Ardennes seemed to make no move.

The British Expeditionary Force (four divisions and a cavalry division) was about to land in France, but it was not comprised in "Plan 17." A secret appendix to the plan, known to a few, provided for a hypothetical "Army W." landing from overseas and proceeding to the region of Valenciennes and Maubeuge, but the way in which this army (should it materialize) might best be employed could not be seen until the rôle of the French V. Army had become clearer. Meantime, it was to double the part of left echelon which was assigned to the French reserve formations about Vervins.

But meantime, the troop-trains were arriving in the concentration areas, and the broad "Plan 17" had to be replaced by an

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operation order "No. 1." On the morning of Aug. 8, therefore, General Joffre, general-in-chief of the "Armies of the North-East," issued his specific instructions.

The French Offensive.—The enemy, it seemed, had grouped his main forces in the region of Metz, in front of Thionville (Diedenhofen), and in Luxemburg, with some 12 divisions in Lorraine and Alsace and an undetermined force which included parts of 10 divisions in the Liége and Ardennes regions. This main force (Metz–Luxemburg) seemed to be pointing westward, but might equally well swing southward, pivoting on its fortifications. The French armies were, consequently, to take the offensive—which was to be as *foudroyante* as possible—and with all forces in combination to seek to bring the enemy to decisive battle, resting their right flank on the Rhine. In order to ensure simultaneity and unison in the battle effort, it was laid down that the left wing armies might have to hold back, so as not to become involved in battle with German masses traversing the southern Ardennes or northern Woëvre, or both, before the right wing had advanced and made effective contact with its opponents.

The *I. Army* (Gen. Dubail), composed as in "Plan 17," was, instead of merely coöperating with and flankguarding the II. (as in the plan), to become the main offensive element in Lorraine and Alsace. Its VII. Corps, with a cavalry division, was to break into upper Alsace at once from Belfort, to drive back all forces it met, and, progressively reinforced by the three reserve divisions from Vesoul, to gain ground towards the fortified barrier Strassburg–Molsheim, destroying bridges and blocking-up bridgeheads on the Rhine as it advanced. The main body of the army, with a frankly E.N.E. direction, was to push towards the front Fenestrange (Finstingen)–Saarburg–the Donon, and to drive back its opponents on Strassburg and into lower Alsace.

The *II. Army* (Gen. de Castelnau), composed as in the plan, was now to play the part of auxiliary to the I. Its first objective was to be the front Delme–Salins–Dieuze, and its axis Château Salins–Saarbrücken. It was to flankguard towards Metz, and, moreover, to leave two of its five corps in the region of Toul at General Joffre's disposal.

The *III. Army* (Gen. Ruffey), constituted as in the plan, was disposed in the Woëvre facing Metz, and was to be ready either to counter-attack any German forces emerging from the Metz region or to take the offensive northward, with its left on Damvillers, according to the situation. The two corps taken from Castelnau would probably be employed in concert with this army, either in repelling a counter-offensive from Metz or in a northward movement.

The rôles to be given to the *IV.* and *V. Armies* were now defined more precisely. The IV. (Gen. de Langle de Cary) was to group itself between Argonne and Meuse, and the V. Army (Gen. Lanrezac) to condense between Vouziers and Aubenton, ready either (*a*) to attack any German army which traversed the Meuse between Mézières and the line Damvillers–Montfaucon or (*b*) to cross the Meuse themselves for the Ardennes–Arlon offensive. The II. Corps, hitherto the left wing of the protective system and attached to the V. Army, was now added to the IV. Army and directed to hold firmly to the northern outliers of Verdun and the left flank of Ruffey's army. Beyond the flank of Lanrezac was the group of reserve divisions about Vervins; the cavalry corps operating E. of Mézières and Montmédy was expected, if and when forced back over the Meuse, to take positions about Marienburg and Chimay. The rôle of "Army W." was as yet quite unsettled, as also was that of the Belgians.

Such was the order which initiated the "Battle of the Frontiers," the opening of the World War on the western front. The intentions may be, and have been, criticized, but they are clear. The general offensive of the French right wing, fixed for the 12th day of mobilization (Aug. 14), was directed N.E. and E.N.E. into the Rhine lands behind Strassburg and Molsheim, with a subsidiary effort in Alsace which would make good a front facing Molsheim–Strassburg–Neu Breisach and the upper Rhine fortifications, and, in case of success bringing the I. Army to behind Strassburg, besiege that fortress. The general offensive of the left was to be timed to coincide with the decisive phase of the operations of the right, but placed according to the progress of the main enemy armies which were presumed to have their right flank not farther N. than Mézières and their left flank on or in the fortified region Metz–Thionville.

But the possibility of arranging for the whole system to take its time from Dubail was made doubtful by a geographical factor—the Meuse. Had the areas in which the IV. and V. Armies were to act formed a single region, it would have been different, but the critical question was how to get these two armies over the Meuse at the exact moment determined by events in Lorraine, which might also be the very moment at which the German masses from Luxemburg themselves arrived on the river. It was this disturbing factor, quite as much as any events to the N. of Mézières, which governed the development of the French scheme. The details of this development, so far as concerns the left wing, are extremely complex and must be studied in the documents reproduced in F. Engerand's *Briey*, Joffre's *Préparation de la guerre et conduite des opérations*, Lanrezac's *Le plan de campaigne français*, and the anonymous *Le Plan XVII.* (publ. Payot). Here only a summary can be given.

By Aug. 13, the eve of the day fixed originally for the general offensive, the order of Aug. 8 had ceased to apply integrally to the left wing. While Dubail and Castelnau were to advance on the front Donon–Saarburg–Saarbrücken, as previously indicated, and a new and stronger army of Alsace under Gen. Pau was to carry out that part of the scheme which the VII. Corps had just attempted with disastrous results (*see* FRONTIERS, BATTLES OF THE: section *Alsace*), Ruffey, de Langle de Cary and Lanrezac were directed according to a new scheme which was independent in time as well as place of operations in Lorraine. It was now clear that the German northern group was stronger than had been supposed, but the evidence of its intention to cross the Meuse above Liége and sweep round through the Belgian plain seemed less convincing than the probability of its descending southward, and the French Command, after much interchange of views with Lanrezac, decided to push part of the V. Army northward into the region W. of Givet as a defensive precaution, and with the remainder and the IV. and III. Armies to carry out a series of preparations which would suit either of two hypotheses. If the Germans moving westward through the Ardennes were well advanced, they were to be struck by an offensive against the front, flank and rear, as soon as they were thoroughly involved in the crossing of the Meuse; if, as now seemed more probable, they were grouped with greater density in the northern and northeastern parts of the Ardennes, there would still be time for the V. and IV. Armies to advance before battle, not only over the Meuse, but also over the Lemoy and the lower Chiers. In that event the III. Army, which, with various mobile forces belonging to Toul and Verdun and the corps of the II. Army reserved to the general-in-chief by the order of Aug. 8, could assemble a considerable force, was to divide into a defensive group facing Metz and an offensive group which would aim northward, conforming to the right of the IV. Army, which would make good the lower Chiers; while the V. Army, holding defensively on the Meuse at Givet, was to reach the front Beauraing–Gedinne–Paliseul–Cugnon.

On Aug. 14, the offensive in Lorraine opened. Its progress was slow, but not marked by any untoward incidents up to Aug. 19. It was independent of events to the left of the Moselle except in so far as sorties might emerge from the S. and S.E. fronts of Metz, against which contingency the defensive group of the III. Army, the two reserved corps near Toul, and the echeloned left wing of the II. Army, were an adequate safeguard. On the other wing, however, obscurity still prevailed. Though Lanrezac was becoming more and more uneasy as to his left flank, and the Belgians, standing on the Geete line, called for support, nothing positive as to the German dispositions revealed itself, but on the evening of the 15th the veil was, partly at least, torn away. The part of Lanrezac's army which was stationed in the angle of the Sambre and Meuse became engaged with a large force of the enemy at Dinant. This consisted in reality only of cavalry and light infantry, but was estimated by the French commander, Franchet d'Espérey, as an army corps at least. At the same time, information came in tending to show that the Germans in the Ardennes included sixteen divisions. Moreover, the impression was formed both by Franchet d'Espérey opposing them and by the French cavalry commander skirting their southern flank, that the Dinant Germans were flankguarding a much more considerable force engaged in passing the Meuse below Namur; and Lanrezac energetically insisted on the fact that such large enemy forces could not conceivably be intended to operate entirely on the right bank of the Meuse. A remarkable absence of troops, at the same time, was reported by the French aviators reconnoitring the Arlon region. Thereupon Joffre formed a new plan. The V. Army, except one corps (already attached to the IV.), and its two reserve divisions, reinforced by one of the reserve corps on the Moselle and by forces from Algeria, newly arrived, was to join the forces already in the angle of the Sambre and Meuse, and to coöperate with the Belgians and the British—both of which armies now for the first time figured in the scheme of operations—in attacking the front and outer flank of the German "northern" forces, while the IV. Army was to prepare to debouch from the front Sedan–Montmédy in the direction

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of Neufchâteau against the "southern" enemy group (formerly presumed to be the "main" one) advancing from Luxemburg on the front Sedan–Damvillers; and the offensive portion of the III. by Étain and Jametz, was to be ready to march on Longwy, to break into the rear of this force. But this manœuvre was merely sketched out by preparations, and next day the veil descended again. The supposed movement of German masses over the Belgian Meuse was unconfirmed, and indeed denied; and without for the moment devoting more attention to the details of the coöperation to be obtained between the three distinct and independent commands W. of the Meuse (especially as Sir John French indicated Aug. 21 as the earliest date at which the British could come into action), Joffre's headquarters merely sent the cavalry corps withdrawn from the Ardennes to get into touch with the right of the Belgian positions on the Geete and—as a precaution against minor inroads through the Belgian plain into the industrial region of Lille—began the transfer to Arras of some ill-equipped territorial divisions, which, under General D'Amade, had hitherto watched the Italian frontier. It was to the proposed offensive of the IV. and especially of the II. Army that Joffre devoted his principal attention. For, on the estimate which had been formed of the German strength—which, however, was radically incorrect because it ignored the presence of reserve corps in immediate proximity to active corps—it seemed to certain of the directing brains at Vitry-le-François that the more forces the Germans placed west of the Belgian Meuse the slighter would be the resistance to be expected about Neufchâteau and Longwy and the better the chances of cutting the enemy in two by the offensive directed on these points.

From day to day the situation developed without becoming quite clear (for the Germans veiled their dispositions with the utmost success), and Joffre held stubbornly to the conception of his Neufchâteau–Longwy offensive. Lanrezac's anxieties and those of the Belgians increased, but they served only to confirm the impression that the drive into the Ardennes would, if properly timed and directed, reap a great harvest; and the declaration of Sir John French that he would not be able to begin operations till Aug. 23, instead of Aug. 21, caused the scheme of a combined operation N. of the Sambre to recede still farther into the background. On Aug. 20, Joffre, estimating that all the German forces destined for the Meuse had by that time passed out of the region Audun-le-Roman, Arlon, Luxemburg, gave the orders which launched the IV. Army into the Ardennes and the III. on Virton and Longwy.

The period of *nuances* was at an end. On that very day, on the one flank, Dubail's and Castelnau's offensive, which had penetrated to Morhange, Saarburg and the Donon, met defeat (*see* FRONTIERS, BATTLES OF THE: section *Lorraine*). Castelnau drew back hastily towards Nancy–Lunéville; Dubail, in spite of the exposure of his long right flank in the Vosges (which Pau's methodical advance from Belfort had done little to shorten), took down his left more steadily; but almost in a moment both were back in their concentration areas, followed by the eager enemy. On the other flank, the German masses facing the Belgian army front, hitherto screened by their cavalry, had at last declared themselves on Aug. 18, and the Belgian army, threatened with separation from Antwerp, yet most unwilling to give up the expectation of British or French support on its S. flank, was falling back from one position to another. Its decision to close up northward and fall out of the main operations was, it must be recognized, put off to the last possible moment, but the disconnectedness of the Allied movements left no alternative. For at that date Sir John French was not ready; and in the angle of Sambre and Meuse, Lanrezac, a prey to new and not ill-founded anxieties regarding his liaison with de Langle de Cary, was, with Joffre's approval, standing fast till Aug. 23, the date British coöperation should arrive.

In spite of the anxieties and disappointments caused by these events, Joffre held firmly to his intention. On the morning of Aug. 21 the executive order for which the IV. and III. Armies were waiting was sent. For the situation was now clear, and the plan of breaking through between the German manœuvre-masses and their fixed pivot, which in one form or another had been consistently followed in the period of obscurity, seemed destined now to have its reward. But there was one fundamental miscalculation. The old error which had led the professional soldiers of Napoleon III.'s day to regard the Prussian citizen-army as a "sort of militia," had reappeared in the form of a contempt for "reserve" formations. It was a mere matter of calculation that Germany's resources permitted her to create such formations; but that they should figure in the *masse de choc* was regarded as incredible. Yet it was true; and thus, instead of meeting a battle-army of 42 to 50 divisions with an array of 73 French, 6 Belgian and 4 British, as anticipated, the Allies encountered in reality one of 77 divisions, *i.e.* an equivalent instead of a much inferior force. This was especially important as bearing on the prospects of success in the Neufchâteau and Arlon directions. Strength was encountered where weakness was expected, and the relatively small numerical superiority of the attack did not suffice.

The story of the battles of Longwy and the Ardennes, of Charleroi, and Mons, will be found in detail in the article FRONTIERS, BATTLES OF THE. Here it must suffice to say that the French offensive into the Ardennes and towards Virton–Longwy–Audun-le-Roman met with general failure, and in some places with disaster; that the German II. and I. Armies, swinging on Huy as a pivot, swept down upon the French V. Army at Charleroi and the British Expeditionary Force at Mons, and bore them back; and that on Aug. 25 at 22:00 hours (10 P.M.) Joffre's orders were issued for a general retreat. The German plan of campaign had prevailed, and the German Command had the initiative in its hands.

At this point, then, the story of the operations is most conveniently told from the point of view of that side which dictated their course.

The German Plan of Campaign.—For the Germans, a war against France was essentially part of a two-front war. The resources of the country not being equal to simultaneous offensives against France and Russia, the choice had to be made between (*a*) standing on the defensive against France while seeking a decision in battle in the East, (*b*) waging a defensive war on both fronts, and (*c*) striving to crush France while standing on the defensive in the East. Of these (*b*) was held to be excluded by the presumed impossibility, for an industrial state, of enduring a long war, as well as by obvious military objections; (*a*) was never completely excluded, and had until some ten years before the war been the fundamental war-plan of the German General Staff; while (*c*) had in those last years obtained general acceptance, owing to the difficulty, for Germany, of waiting till the slow-moving Russians could be brought to action and defeated in a battle of the first magnitude. Whether, in view of the increased strength of the defensive on the one hand and the increased war-readiness of Russia on the other, the adoption, once more, of alternative (*a*) was not the best policy for Germany in the circumstances of 1914, is an open question; but, in fact, (*c*) was maintained and carried into effect.

But this increased readiness of Russia made it imperative for the Germans to protect East Prussia by a force at least sufficient to offer a step-by-step defence of that province and also, with their main armies reduced to that extent, to obtain a decision of the war in the West at the earliest possible moment, so as to release the greater part of the forces which had gained it for service in the East. The proportioning of means to the two theatres, therefore, was a very difficult problem, admitting of many *a priori* solutions, which might bring either victory or ruin.

The solution that found most adherents was that of Count von Schlieffen, chief-of-staff of the German army, in the first years of the present century. On assuming office, he had both restudied the draft plans of campaign and the tactical doctrines in vogue, and he had come to these conclusions: (*a*) that an offensive of maximum power, carried so far as to put France out of action definitively, was the only way to secure freedom of action in the East; (*b*) that this offensive, to secure the result aimed at—nothing less would suffice—must be developed on so broad a front as to grip and out-wing the most northerly and the most westerly points of France's defensive dispositions; (*c*) that a maximum density must be sought for on the right wing, even at the cost of exposing Lorraine and the Rhine lands to invasion.

The first of these considerations led to the acceptance—contrary to all the traditions of the German army—of the principle that not only active, but reserve, Ersatz and every other category of soldier must be effectively used. Schlieffen even proposed an intimate mixture, practically an amalgamation, of active and other elements, and aimed at putting into the field—in case of a *single-front* war, it is true—no less than 114 divisions against France. The second consideration led to the idea of a swing through Belgium and northern France far wider than that which was actually carried out. The route of the outer flank, which in spite of its extension beyond all probable French defences was to have a defensive echelon following on, was to touch Dunkirk, Abbeville, Rouen and pass round by Chartres, far to the W. of Paris—which would be invested automatically—so as to march in upon Auxerre and Troyes from the east. The line Ghent–Maubeuge–Thionville was to be reached on the 22d and the line Amiens–Rethel–Thionville on the 31st day of mobilization; that is, not hurry but certainty and power were to be the executive rules.

The third consideration, however, led to an even more remarkable result than the second. Of the 114 divisions no fewer than 101 were to operate N. and W. of the Thionville pivot. Lorraine,

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Alsace and the Rhine lands being committed to 13, of which two were allocated to the fortresses. The *leitmotiv* of extreme density on the right occurs in all Schlieffen's drafts and schemes. "Macht mir nur den rechten Flügel stark" were his half-conscious dying words. In a second scheme, based on the *two-front* war, which provided for a defence force in East Prussia approximately equal to that which von Moltke actually placed there in 1914, the total force was lessened to that extent, but the ratio of about seven divisions N.W. of Thionville to one S.E. of that pivot was maintained.

When von Moltke, the younger, succeeded Schlieffen, the above plans were gradually blunted, first because the idea of making the active army a simple kernel for soldiers of all categories was accepted only in part, and secondly because the growing war-readiness of the French army, the fever of offensive spirit that had obviously seized it, and after 1913 its very high peace-strength, made it increasingly likely that the French would open the war with a determined offensive into Lorraine and the Rhine lands. In these circumstances so drastic a depletion of the forces to the left of Metz as that contemplated by Schlieffen did not commend itself to Moltke, who found a compromise in allocating one-quarter of the whole available force, instead of one-eighth, to the defensive (or defensive-offensive) front, and holding large quantities of empty rolling-stock on the Rhine in readiness to transfer a proportion of this quarter to the right wing as soon as circumstances should allow this to be done. The amplitude of the swing was, however, undeniably diminished thereby.

In one point, Schlieffen and Moltke were agreed—the necessity of pushing out beyond the line of the Belgian Meuse. In both schemes therefore the quick seizure of Liége and a deployment foreground beyond that fortress figured as an indispensable preliminary to the operations proper.

The German plan, to which effect was given in August 1914, provided as follows: (*a*) A protective system was formed all along the line, consisting, not as had been expected of complete formations, but of single brigades of infantry (with a proportion of other arms), brought up from their peace stations without waiting to receive and equip their reservists. These brigades took over from the local troops the positions of the line that their respective army corps were to occupy, and their reservists rejoined by parties. (*b*) There was a concentration of the remainder of each corps, after mobilization in the usual way, behind its own representatives in the protective system. This concentration of the active corps was completed by the 14th day of mobilization (Aug. 15). (*c*) Concentration of reserve corps, as a rule immediately behind or to a flank of the corresponding active corps, was completed by the 16th day (Aug. 17). (*d*) Concentration of other formations, Ersatz divisions and mixed Landwehr brigades, was completed from the 11th to the 17th day. (*e*) The six advanced, peace-strength brigades of the corps intended to assemble about Aachen were employed as a striking force under General von Emmich, which without waiting for siege artillery was to attempt to storm Liége at once, if the Belgians did not agree to let the Germans pass. The German ultimatum to Belgium was handed in late on the evening of Aug. 2 (1st day of mobilization), and required an answer within twelve hours. There is reason to believe that, on Belgium's refusal, a proposal was made to Holland to allow the use of the Maestricht tongue as a gateway into the Belgian plain, but, whether this be so or not, it was only on the evening of the 3rd day of mobilization that the striking force crossed the frontier.

The order of battle, and allocation of the German forces N. of the pivot, was as follows: I. Army (General-Oberst von Kluck), five corps, assembled behind the Maestricht tongue (Jülich–Krefeld area); II. Army (General-Oberst von Bülow), seven corps, including one attached from I. Army, assembled facing the Liége frontier (Aachen–Malmédy–Euskirchen); III. Army (General-Oberst von Hausen), four corps, assembled in the area St. Vith–Wittlich–Bittburg; IV. Army (Duke Albrecht of Württemberg), five corps, assembled in the area Luxemburg (seized Aug. 2)–Trier–Diekirch–Wadern; V. Army (Wilhelm, German Crown Prince), five corps, assembled in the area Metz–Thionville–Saarbrücken.

Thus twenty-six active and reserve corps (52 divisions)—with a number of Landwehr brigades to follow—were allocated to the five armies of the moving wing, of which nearly half were to cross the Meuse between Namur and the Dutch frontier as soon as the way was clear. The remainder were to traverse the Ardennes from E. to W. in echelon from the right (III. Army) and to prepare to wheel gradually S.W. in proportion to the progress of the I. and II. Armies on the other side of the Meuse.

The 2nd Cavalry Command was of three divisions in front of the I. and II. Armies; the 1st Cavalry Command of three divisions in front of the III.; the 4th Cavalry Command of two divisions in front of the IV. They were individually responsible to the Supreme Command, except when from time to time placed at the disposal of certain armies. Similarly, the armies were in principle directly subordinate to the Kaiser's headquarters, *i.e.* to General-Oberst von Moltke, Chief of the General Staff, unless temporarily paired, as was the case at the outset, with the I. and II. Armies, of which Bülow was in general charge.

The organization of the forces E. and S.E. of Metz was somewhat different. Rupprecht, Crown Prince of Bavaria, was appointed not only Chief of the VI. Army, but "Commander-in-Chief in the Rhine lands," a title with wider implications than that of an army commander, and his task included the protection of the left flank of "the Army" or "the main forces." He had under him his own VI. Army (five corps, of which four were Bavarian), the VII. Army of General-Oberst von Heeringen (three corps) and the 3rd Cavalry Command (three divisions), in addition to the war garrisons of Metz, Strassburg, and the upper Rhine defences (Neu Breisach, Istein). These 16 active and reserve divisions were to be supplemented a few days later by 6½ Ersatz divisions, and mixed Landwehr brigades, which were grouped in some cases in "Landwehr Commands."

In all, the formations assigned to the western theatre of war comprised 68 active and reserve divisions, 6½ Ersatz divisions, 17½ Landwehr brigades and 10 cavalry divisions.

The First Operations of the Germans.—The first operations to be carried out were: (1) The seizure of Liége and of as large a foreground as possible beyond; (2) the securing of the left flank of "the Army," and the attraction of as many French divisions as possible to Lorraine and Alsace, by the living and passive forces under Prince Rupprecht. Both these essentials having been provided for, the five armies (I.–V.) were to proceed at once to the main task, which was to be a great "wheel through Belgium into France, pivoting on Thionville–Metz," in which wheel the II. and I. Armies were to govern the pace. The II. Army was to swing on the arc Liége–Wavre, the I. following in echelon on the arc Tongres–Brussels, flankguarding towards Antwerp, whither, it was presumed, the Belgian field army would retire. No very distant objectives were fixed. When Liége and the region W. of the Meuse had been occupied, and the cavalry divisions of the I. Cavalry Command had fixed the situation of the Belgian army, of the British forces expected to land at Ostend, and of the French forces which might be pushed into Belgium from the S., specific orders could be given. Meanwhile, the problem was to deploy the two highly condensed armies of Kluck and Bülow on the W. side of the Meuse, in spite of Liége and of the Belgian field army. On this, as the I. and II. Armies were to give the time to the rest, the whole movement depended; but while the III., IV. and V. Armies awaited developments, the 2nd and 4th Cavalry Commands were to push through the Ardennes and towards Damvillers, in order to clear up the situation in the Meuse valley from Namur to St. Mihiel—a mission which naturally brought about a series of conflicts with the French cavalry, and, above Stenay, with the French protective infantry system in the Woëvre. In point of information, this cavalry activity probably yielded only confirmations of the obvious, but it was invaluable in veiling the army movements when later these were begun.

The Liége operation is described under LIÉGE. There was no surprise, Belgium having mobilized her available forces at an early

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date in the European crisis; and five out of six brigade attacks on the night of Aug. 5–6 failed. One, however, penetrated into Liége, and for some days neither the German nor the Belgian, British or French Commands seem to have been able to form a clear view of the situation, as the fort-ring held out. Reconnoitring patrols of the German 2nd Cavalry Command, which passed the Meuse near the Dutch frontier simultaneously with parts of the attacking force, learned nothing of the Belgian dispositions, and the main body remained near its bridge. On Aug. 8 the situation at Liége was clear enough to enable the cavalry to push westward, and in the days following it established the front of the Belgian field army as lying approximately on the Geete line from S. of Jodoigne to Diest. But on Aug. 12, the attempt of the Germans to work round to the left of this position was checked in a severe local action at Haelen. The Liége forts, meantime, had to be reduced by super-heavy siege artillery, one by one, and it was not till Aug. 15 that the masses of the German I. and II. armies were able to begin to cross into the area comprised between Liége and the Geete. The resistance of the Liége forts had put back the start of the great wheeling movement for four days.

Thus the difficult and essential preliminary operation of seizing a bridgehead beyond the Meuse did not pass off quite according to programme. It had often been alleged that the Germans had obtained a long start in their concentration by means of surreptitious mobilization. That this was not actually the case has been shown by a study published in 1920 by the Belgian General Staff; but even had such a mobilization taken place, it would not have helped to solve the problem of Liége. All that infantry could contribute to its solution, the first six peace-strength brigades contributed. The rest was a matter of siege artillery, and it must be regarded as a serious flaw in Moltke's plans that this artillery did not put in an appearance on Aug. 6 instead of on Aug. 10.

On the other flank, the operations in Lorraine and Alsace, which were to maintain the "pivot" of the wheel against French attack proceeded more favourably than had been anticipated—too favourably, as the sequel was to show. The problem was difficult, and *a priori* reasoning could not assist its solution materially. For here, much more than on the Belgian flank, events depended upon the independent will of a great enemy army which was equally capable of the offensive or of the defensive-offensive; and although the tendency of French military thought in the last years before the war had evidently been towards the former, it was not clear how far this tendency had actually gone. Prince Rupprecht's task included not only the maintenance of the Metz–Thionville pivot but the attraction of as large a force of the French as possible; and if their old policy of defensive-offensive still held good, then, in order to set up this attraction, he must attack. If not, although attack would not be necessary, a much larger proportion of the total force than that which Schlieffen had thought sufficient would have to be allotted to the front E. of Metz. For Schlieffen had reckoned with certainty on a defensive-offensive policy in his opponents, and had argued therefrom that no deep inroad of large forces into the Rhine lands would in fact be attempted by the French, when a tidal wave of seventy to a hundred German divisions was advancing through northeastern France. But the situation was quite different if the French offensive in full force was to be launched at the outset, while the tide in the N. was still dammed up. For these reasons, Prince Rupprecht was given about one-quarter of the total available forces, and instructed: (*a*) to take the offensive over the Lorraine frontier in order to draw upon himself as much as possible of the enemy's forces, in the event of these being handled according to the old policy; (*b*) to prepare a great defensive system, Metz–Lower Nied–Saar–Vosges–Strassburg, against the contingency of an immediate powerful offensive of the French; (*c*) in the latter event, to suspend the offensive initiated in accordance with (*a*), and to draw back from line to line till the Saar was reached, where a standing defence would be made in conjunction with counter-attack on the French left from the Metz–Nied system. In the least likely alternative of only minor forces of the French being met with in Lorraine, Prince Rupprecht might utilize the Metz system to cover the transfer of part of his forces W. of the Moselle for coöperation with the V. Army. Upper Alsace was to be held against light forces, but evacuated step by step if seriously invaded. The VI. Army with the 3rd Cavalry Command was assembled accordingly in Lorraine, the VII. Army (minus two expected Italian cavalry divisions) in Alsace; and mobilized and civil labour on a large scale was employed in creating the "Nied" position, which ran from where the newest Metz works touched that river to its mouth N.W. of Saarouis.

The French I. and II. Armies, ready for operations as soon as the Germans, spared the latter the necessity of testing their intentions by advancing on Aug. 14 in great force. Accordingly, the German VI. Army drew back from position to position, while the VII. Army, which had defeated the first inroad of the French VII. Corps at Mülhausen, likewise drew back gradually before the army of Pau, dispatching part of its forces by Zabern to the upper Saar to assist the VI. Army's defence, and preparing with the remainder to hold the line Schirmeck–Molsheim–Strassburg firmly. But this withdrawal, after making all preparations for the offensive in the first place, was only unwillingly and half-heartedly carried out by Rupprecht's headquarters. And when, on Aug. 17, news arrived from Moltke that the French advance into Lorraine was, after all, not their main offensive, Rupprecht determined to fight on the line of his rear-guards on Aug. 20. Thus, just at the moment when the French had decided to push their offensive without further hesitation, the Germans changed their policy into one of flank attack. The battles of Morhange (Mörchingen) and Saarburg followed (*see* FRONTIERS, BATTLES OF THE: section *Lorraine*), in which the Germans were victorious. A hot pursuit was initiated, and with that disappeared for the time being all possibility of drawing off any part of Prince Rupprecht's forces for the benefit of the "Army." Moltke's rolling-stock on the Rhine waited in vain. The Commander-in-Chief in the Rhine lands had brilliantly performed both his tasks, but he had become a commander of two ardent armies who could see only the enemy in front of him.

The German Advance through Belgium and France.—Once the Liége foreground had been secured, and the pivot of Thionville–Metz been made firm, there was no need, in Schlieffen's opinion, for overhaste in the development of the main operation, which required principally power. Moltke, on the other hand, sought to remedy the reduction of power on the striking wing by urging it to speed. This was not easy, for the administrative and technical marching arrangements required for drawing the five or six corps of the I. Army through the narrow tunnel between Liége and the Dutch frontier were complicated, while Bülow's II. Army displayed no great energy in crossing the Meuse above Liége. Thus the Belgian main army was left undisturbed on the Geete—the most forward position which it could safely adopt in view of the risk of being outflanked by a German movement through Dutch territory—till Aug. 19, when, threatened with severance from Antwerp, it began to retire westward with but little fighting. Even then, however, the task of the German I. Army was by no means clear. The possible arrival of a British Expeditionary Force on its outer flank was a standing menace, and until the true right flank of the system, Bülow's II. Army, had begun its advance in earnest its protective echelon (I. Army) could not operate to any purpose. On the evening of Aug. 19—the 18th day of mobilization—the outer flank of the wheel had only reached the line Thildonck–Tirlemont (I. Army)–Sart Ribsart–Mehaigne (II. Army), while the armies traversing the Ardennes were at Marche (III.) and Bastogne–Arlon (IV.) respectively. The V. Army was just beginning to draw out of the Thionville area towards Longwy. On Aug. 20, learning that a large French army had been assembled in the Charleroi region, Bülow prepared its encirclement by beginning to wheel-in not only the II. Army's right wing but the I. Army (then under his orders) as well; but as the coöperation of the III. Army moving on Dinant was intended, that army, as well as the I., had to be given time, and the concentric blow upon Lanrezac was fixed for Aug. 23, while the left wing of the II. Army was to attack Namur from both banks of the Meuse. Had these measures been carried out, the "vast wheeling movement" would, on the 22nd day of mobilization, have occupied the line Nivelles–Charleroi–Dinant–Neufchâteau–Arlon–Thionville instead of the line Ghent–E. front of Maubeuge–Sedan–Thionville, as Schlieffen had planned for that day. But the fact of being a few days in arrear was of small importance relatively to the fact that, instead of continuing to swing out, the German line would be beginning already to roll in. The essential principle of the movement, that of outflanking not only the momentary position, but also any and every position of the enemy's left wing, was sacrificed. The British Expeditionary Force, unlocated, lay outside instead of inside the scope of the wheel.

But during Aug. 20–23 events crowded upon one another at almost every point of the German line. The left wing of the II. Army stormed Namur, with the powerful aid of the super-heavy artillery (this time deployed from the outset), while the right became engaged front-to-front with Lanrezac (*see* FRONTIERS, BATTLES OF THE: section *Charleroi*). The I. Army, advancing in echelon to the battlefield indicated by Bülow, but seeking still to preserve both its rearward echelonment and its power of extending outwards, came into contact, with its left wing, with the British Expeditionary Force in the neighbourhood of Mons (*see* FRONTIERS, BATTLES OF THE: section *Mons*). Meanwhile, the German III. Army, drawing out of the W.S.W. direction in order to coöperate in the battle proposed for Aug. 23, had lost

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touch with the situation of Bülow's army (apparently through the neglect of the latter to keep Hausen posted as to events on the Sambre), and the IV. Army in the heart of the Ardennes had already begun to wheel forward and southward in order to protect Hausen's left when it received the full weight of the French IV. Army's offensive from the Chiers. Lastly, the V. Army, on which a defensive attitude was at first imposed by the Supreme Command, managed to convert its defensive, flushed by success in the battle of Longwy, into a flank offensive which threatened to create a gap between the five armies and the Thionville–Metz pivot, on which they were to wheel. (*See* FRONTIERS, BATTLES OF THE: section *Ardennes*.)

Thus, at almost every point, local situations and the initiative of army commanders and troops turned the smooth and regular tide into a series of eddies. On the German side, as on that of the Allies, the northern half of the battle of the Frontiers was a chain of fierce local battles which only a very strong Higher Command could take in hand, either to straighten the links or to reforge them in a different pattern.

From that point to the battle of the Marne, the contest is less between schemes, less even between armies, than between the capacities of the two Supreme Commands.

At the head of the German armies was a man in indifferent health, by nature kindly rather than insistent, one for whom responsibility was rather a burden than a source of strength. He carried, moreover, the strain of watching and attempting to direct affairs on the eastern front. His opponent was a different man and differently placed. Essentially authoritative in temperament, sound in health, and concerned with one task only, Joffre was a commander in the full sense where Moltke was a responsible adviser only. Leaving the details of planning to his staff, and in particular to General Berthelot, Joffre devoted himself entirely to the rôle of commanding. His personal activity in the days after the battle of the Frontiers is astonishing, but it is essentially of the moral and not the operative kind—deciding, encouraging, punishing—the rôle of King William I. in the war of 1870–1, and one which the Emperor William II. was unable to sustain in 1914. Add to the factors weighing against Moltke, the prestige and confidence of his army commanders, most of whom had won victories, none sustained defeat, whereas no French subordinate general had obtained an important tactical success, and it is evident that the higher control was necessarily firmer on the side of the French than on that of the Germans.

The prevailing impression on the German side after the battles along the frontiers was that a decisive victory *had* been won, and that the next phase was to be one of exploitation. The consequences of this impression, which soon penetrated to General Headquarters, were: (*a*) the decision to send six corps (two from each portion of the line) to the East Prussian front; (*b*) freedom of action granted to the V. Army to cut loose from contact with Thionville and join in the general pursuit by a movement round the N. of Verdun; (*c*) non-interference with Prince Rupprecht's pursuit in Lorraine; and (*d*) a new orientation of the I., II., III., IV. and V. Armies, which, abandoning the "wheel," were to advance in line in a general S.W. direction, with the I. Army heading for the lower Seine, the II. for Paris, the III. for Château-Thierry, the IV. for Epernay, and the V. for Vitry-le-François, the last-named flankguarding against Verdun and the first preserving a defensive echelon on its right.

The new orders were issued on Aug. 27, after the battle of Landrecies–Le Cateau had accounted for all undisclosed British forces and established the feebleness of the French cordon to the left of them, while the III. Army was well S. of Rocroi and the IV. bordered the Meuse from Sedan to Stenay. They were not executed with the certainty and confidence of an exploitation. The V. Army, in the act of letting go its connexion with Thionville–Metz, had on Aug. 25 exposed its left flank to a very sharp offensive of the defensive portion of the French III. Army now styled "Army of Lorraine," under General Maunoury, whose progress had been stopped only by orders from Paris. The French III. and IV. Armies, quickly rallied from their Ardennes–Longwy defeats, gave ground only slowly and with frequent counter-strokes (*see* FRONTIERS, BATTLES OF THE: section *Ardennes*), and the German III. Army was continually drawn southward, off its line of advance, to assist the IV. in real or supposed crises. Thus a great gap opened up between the III. Army and the II.; and the latter, uneasy as to its left flank, gradually drew away into a southerly direction, while Kluck's I. Army continued S.W. on Amiens. Almost immediately thereafter, the I. Army began to come into contact with French forces, distinctly superior in number and in quality from those hitherto met on this outer flank. While driving these back in various minor actions, and expanding ever westward in so doing, it was suddenly checked and caused to swerve southward by demands for assistance from the II. Army, which, unsupported on its left by the III., found itself counter-attacked, with a vigour that had not been observed since Charleroi, by Lanrezac (*see* GUISE, BATTLE OF). This crisis, like similar crises on a smaller scale in the area affecting the IV. and III. Armies, passed away after a time, but the disintegration of the German mass-movement had now reached a climax. Apart from regulating special questions between armies as they arose, the German Higher Command had not intervened in the conduct of operations since its instruction of Aug. 27. On the night of Aug. 31, the I. Army, in the vain hope of seizing the left flank of the British or of Lanrezac, had pushed its left far to the S. to the Aisne below Soissons, while its right was in the Lassigny hills and W. of Montdidier and even farther north. The II. Army had not progressed beyond the Guise–St. Quentin battlefield, its front facing due S. between Essigny-le-Grand and Vervins; the III. Army on the contrary was on the upper Aisne on both sides of Rethel, the IV. astride the northern Argonne between Semuy and Buzancy, the V. wrapping itself round the N. side of Verdun while still maintaining considerable forces in the Woëvre facing the E. front of that fortress, and the Côte de Meuse. Two corps had left for the eastern front, belonging not to the subsidiary armies in Lorraine but to the striking wing. One corps had been left to face the Belgians in Antwerp, one and a quarter corps to besiege Maubeuge, other detachments here and there to guard lines of communication or to invest small French forts such as Givet. The only new forces on their way to the West were the two divisions of the IX. Res. Corps and certain Ersatz brigades, all of which were needed to support the dangerously weak cordon of the III. Res. Corps facing Antwerp and to be on the spot in case of a Russian and British landing at Ostend, rumours of which at this time filled western Europe.

In Lorraine, the pursuit from the battlefields of Morhange and Saarburg had led the German VI. and VII. Armies in a southerly direction, substantially on Rambervillers and Charmes. Forced to condense into two main groups by the fort of Manonviller—a work condemned as useless by peace-time critics—and by the forest of Parroy, they had exposed their right flank to counter-attack by the restored army of Castelnau, which held the fortifications N. and E. of Nancy and the north flank of the so-called Trouée de Charmes. This French counter-stroke not only gravely imperilled Prince Rupprecht's army—for Manonviller resisted long enough to act as an anvil to Castelnau's hammer—but deprived the German Command in Lorraine of its initiative. With that loss, it forfeited all real power of holding larger French forces in its front; and though the German Supreme Command, in the same confident general instructions of Aug. 27 which initiated the southwestward pursuit of the I.–V. Armies, ordered the Bavarian Prince to break through the French line in the direction of Neufchâteau on the upper Meuse, it soon appeared that Joffre had the "inner line." He could take troops from Lorraine for other service, while his opponent could only continue costly holding attacks that did not hold.

On Sept. 1 the German Supreme Command gave up the conception of a general southwesterly pursuit, which, by its incidents, had not only lost its direction but brought the armies into a very irregular array and resumed the original conception of the wheel pivoting on Thionville, or rather, in the new situation, on the troops of the V. Army facing the N. side of Verdun. By now, however, with losses and detachments, the frontage of such a sweep was reduced by the front of a whole army, if not two armies. The appearance of French active and reserve forces N. of Paris made it clear that a protective echelon—such as had always been prescribed and rarely formed by the I. Army—would have to follow the rear of the army on the outer flank, and, moreover, the gap between the II. and III. Armies must be closed. The new general instructions, therefore, prescribed that the II. Army should steadily drive the French in a southeasterly direction, followed in echelon by the I., which was to watch Paris and break up the communications leading thither. But almost immediately after the I. Army, still well in advance of the II., received this order, one of its corps, exploiting a local advantage, crossed the Marne at Chézy and Château-Thierry, and Kluck determined to support it rather than withdraw it. The Supreme Command made no protest, all the more so as he reported evidences of real dissolution in the ranks of the retreating enemy. Kluck pushed on. The echelon facing Paris was maintained, but it was growing thinner and thinner. On Sept. 4 the Supreme Command, in increasing uneasiness, limited the offensive front still more. Not only was the I. Army to stand fast between the Oise and the Marne, but the II. Army was to wheel outwards and fill the space between the Marne and the upper Seine. The III. Army, now become the operating wing, was to march on Troyes and to the E. thereof, continuing in close liaison with the IV. and V. while the Lorraine armies were to renew their attempt to break through the upper Moselle front.

The final phases of the battle in Lorraine represent the endeavour of exhausted forces to carry out their part in this scheme. The central and western portion came to nothing, for although Kluck began at 23:00 hours (11 P.M.) on Sept. 5 to counter-march his army so as to fill the space between the Oise and the Marne, now guarded only by the last relic of his echelon, and Bülow gained ground between the Marne and the Seine as far as Montmirail and the marshes of St. Goud, General Joffre had, on the afternoon of Sept. 4, issued the command to his armies to face about and attack.

The Preparation of the Counter-Offensive.—While on the German side we see the battles of the frontiers followed by a high-

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spirited chase in which the driver was able to keep little more than the semblance of order in his team, on the French side the picture is one of an astonished and confused, but in no sense a routed citizen-army, too clear-sighted to believe itself betrayed and yet too ignorant of the ensemble to see where miscalculations had led to disaster. In the hands of one who had specialized in the art of inspiring confidence, whose silence even was imperturbable, and whose career had been spent not in technical subtleties of operations but in varied branches of administration, it had every chance of early recovery, provided that it was handled according to a definite policy and not exposed to incidents. This definite policy was laid down in a general order of Aug. 25, which began with the phrase: "As it has proved impossible to carry out the projected offensive, the next operations will be regulated so as to constitute on the left,—by means of the IV. and V. Armies, the British army, and new forces from the eastern front,—a mass capable of resuming the offensive while the others hold up the enemy for the required time." Following this cool and convincing statement, the detail paragraphs prescribe a retreat to the line Braye-sur-Somme–Ham for the British, to Vermand–Moy for the offensive portion of the V. Army, to La Fère–Laon–Craonne–St. Erme for the defensive wing of that army, to the middle Aisne for the IV. Army and to the Argonne–Verdun line for the III. "From this situation the offensive will be resumed," said the order. On the left of this line a barrage against cavalry inroads was to be formed between Picquigny and the sea, and either between Domart and Corbie or between Picquigny and Villers-Bretonneux there was to be formed a new army, soon to be designated the VI., and composed, as regards its staff and several of its divisions, of the troops which had just defeated the left of the German Crown Prince as it sidled past Étain. This was to be ready for action on Sept. 2, and the direction of its offensive would be either St. Pol–Arras or Arras–Bapaume, according to the position of the extreme right of the Germans. The British would attack on Bertincourt or Le Catelet, according to the situation, the V. Army wing on Bohain. The right of the V., the IV., and the III. were to defend the line laid down and eventually to attack from it. To the I. and II. Armies went the laconic instruction, "the rôle of these armies is, to endure."

But the pressure of the German pursuit in its first freshness did not admit of the British coming to a halt on the line ordered, and when the elements of the new VI. Army began to assemble about Amiens the battle had passed far to the south of them. Similarly, with the V. Army, the battle of Guise, which may be considered as a section of the proposed general offensive, led to small results because the British element was wanting on its outer flank. The controversies which have arisen as to the rapidity of the British retirement from the battlefield of Le Cateau to behind the Oise need not here be discussed, for it is more than doubtful in any case whether the state of the French army, in its ensemble on Aug. 31, justified the risk of incurring final defeat. Be this as it may, Joffre put aside all temptations to exploit the local successes at Guise on the Meuse, and in a new general order of Sept. 1 laid down that the VI. Army and the British having insufficiently checked the enemy's turning movement, the whole system must pivot about its right continuing to retreat, until the left of the V. Army should be free from the menace of envelopment. Then the armies would take the offensive, this time utilizing the position of the III. Army, protected by Verdun on the N. and the Côte de Meuse on the E., to strike the chief blow. The position from which the offensive would be resumed was now well back from Paris, which was to be left to itself (though Joffre suggested that its troops might coöperate in the general offensive), the V. Army behind the upper Seine (Nogent), the detachment Foch (IX. Army) and the IV. Army behind the Aube and S. of Vitry, the III. Army, augmented by defence troops borrowed from the Côte de Meuse and possibly by troops from the Lorraine front, N. of Bar-le-Duc. The British and the VI. Army were to constitute with Galliéni's local troops a Paris group which should hold the Seine from Melun to Juvisy, and the E. and N.E. fronts of Paris.

Thus was prepared the initial situation of the battle of the Marne. The scheme as outlined at first underwent many modifications, due to the ardent initiatives of Galliéni in Paris, and of Sarrail, commander of the III. Army, S. of Verdun, as well as to other causes. These are discussed in the article MARNE, BATTLE OF THE. Here it is not necessary to analyse too closely the form projected for the battle. Essentially, the fact to be retained by history is that a great army, in retreat after failure, could be energized, ordered to turn about, and launched to the attack, by a modern commander-in-chief whose influence must filter through a complex hierarchy before reaching the fighting soldier. Many had believed this to be an impossibility, and they were proved wrong. The operative scheme of the battle of the Marne and even its apparent barrenness of specific military results, are of insignificant importance compared with the fact that the battle of the Marne was actually fought. (X.)

The "Race to the Sea."—The establishment of the German defensive on the line of the Aisne, prolonged across the plain of Champagne, which ended the Marne battle, did not put an end to the Anglo-French offensive. The front between Compiègne and Verdun was stabilized here and there, but the battle of movement continued at the free extremity, that is, to the W. of Compiègne, and beyond. This new offensive has improperly been called the "Race to the Sea." In reality it was not a question of reaching the coast as quickly as possible, so as to obtain there an absolute protection against turning movements. If it had been so, the shortest line for the Allies, and the easiest to hold, would have been that of the Somme, from Compiègne to Montdidier and Amiens. To the estuary of the Somme, this line does not measure much more than 100 km., while the line from S. to N., which was that of the actual "Race to the Sea," ended N. of the Yser and was nearly double that length, presenting features of very various nature, among which some entirely lacked defensive value.

The truth is that the offensive, which was throughout the policy of the French Command, did not stop at the Marne victory. On Sept. 11, when the VI. Army (Maunoury) arrived at Compiègne, the Commander-in-Chief gave the order for this force to place immediately as many troops as possible on the right bank of the Oise. On Sept. 17 he indicated his plan by ordering the formation, on the left wing, of a force capable of parrying a flanking movement by the enemy as the best precaution to be taken. But Sir John French has stated that on the very next day (Sept. 18) General Joffre informed him that he was developing a new plan which aimed at attacking and enveloping the German right flank. The enemy, moreover, showed by his method of occupying the ground that the initiative no longer rested with him.

At the extreme end of the Allied line on the Oise the valley of the Aisne cleaves its way through a forest-clad massif, cutting it in two S. of the Aisne; the larger part of this mass consists of the forest of Compiègne and the northern part is the forest of Laigne. If the Germans, very skilled in turning forests to military account and manœuvring in them, had retained any hope of resuming the offensive against the Allied left flank, they would have occupied the forest of Compiègne in order to make it the starting point of their turning movement and force the Allied left to retreat towards Paris. But they abandoned that front; nor did they retain the forest of Laigne, on the plateau to the N. of Attichy. The offensive impulse in the World War was thus on the side of the Allies and they kept it until the fatal day of Russia's defeat on the eastern front. Until that time every attack which resulted in the gain of ground came from the Allies, who, save for a few occasions, methodically pushed back the enemy from one entrenched position to another. The Germans had later to defend their right flank, more and more threatened as it became more and more prolonged. And, as the best way of arresting the progress of the Allies would have been to strike at their offensive, they tried without ceasing to outflank them, while they were resisting in front.

Thus the "Race to the Sea," viewed as a whole, consisted in establishing an offensive Allied flank against the German right,

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and, this flank being always unsupported at one extremity, in German efforts to seize this extremity from two directions. These attempts, on either side, taking place farther and farther from Compiègne, appeared as a "Race to the Sea"; but in reality neither side was deliberately making for the coast. The S.–N. direction taken by the line of contact was not sought by either opponent; it resulted from the balance of forces.

It is evident that, whatever resources on either side were furnished by reserves and new formations, the extension of the front of contact over a length of 200 km. was only possible on condition of leaving much thinner forces on the stabilized front than had been required for the battle of movement, from Aug. 20 to Sept. 12. In proportion as the lines extended to the N., transferences took place, depleting the line from Belfort to Compiègne, as had already been done in the Vosges and in Lorraine, to enforce the regions where the struggle was being carried on in open country.

As regards such transferences, the advantage was with the Germans, because they occupied the interior of the angle whose apex points to Compiègne, while the Allied troops had to be moved around this point.

On the German side, the manœuvre brought 18 new army corps into the line. On the Allied side it resulted in the transference of the II. Army (de Castelnau) between the Oise and the Somme; the formation of the X. Army (Maud'huy), N. of the Somme, and the VIII. Army (d'Urbal), which included the Belgian army, brought back from Antwerp; and lastly in the shifting of the British army into Flanders. To these transfers and new creations must be added various formations constituted on the spot, of which the most important was a group of territorial divisions placed under the orders of General Brugère. Some of these formations had already joined in the offensive after the battle of the Marne, notably at Amiens, which they had cleared of the German units scattered through Picardy and Artois. This ensemble was placed under the command of General Foch, but was only brought to completion by degrees. The successive steps will now be described.

The first offensive action against the German right began on Sept. 11, in accordance with the order given by General Joffre. It was carried out by the VI. Army, with one additional corps on the right bank of the Oise. It immediately encountered energetic resistance on the Aronde, a small tributary prolonging the depression of the Aisne valley on the opposite side of the Oise. On the northern bank of this stream wooded heights extend between Compiègne, Lassigny and Noyon, and surround Ribécourt—names which all became famous during the war.

The VI. Army had a difficult task in the subduing of them, and could hardly have achieved it, threatened as it was with an attack in flank, without the help of the II. Army (de Castelnau), which, detraining in the Clermont–Beauvais area, had to cover 30 or 40 km. in order to outflank the German right. At the same time the cavalry and the territorial divisions of General Brugère extended the movement towards the north.

The resulting battles were prolonged until the end of Sept. with alternations of success and reverse, through Lassigny, Roye, and Chaulnes, as far as Péronne. From Péronne to Lassigny, where the wooded hills ceased, the terrain consisted of undulating plains, where no line of battle could be found. It was thus the balance of forces that determined the front of contact, which was gradually fortified on either side.

On Sept. 24 the French retook Péronne and lost it again. This little place, in a hollow, offering no possibility of outlook or of action outside its walls, had no military value. The positions which should have been occupied in the circumstances were the heights of the Somme above Péronne which formed a very considerable obstacle. The great value of this line, especially facing eastward, owing to the command of the country in that direction given by the heights, did not escape the German staff, and for a long time their efforts were directed towards preventing the Allies from securing the heights, by the defence of improvised fortifications, at some distance in front of them. Later it will be seen how these lines were linked up with that of the Ancre.

It will now be shown how, after the preliminary fighting, the German front became established between the Aisne and the Oise. A salient is always a weakness. The front was fixed from E. to W. along the Aisne; and the flank resolving itself into a new front running N. and S. the German line exhibited a right-angle salient pointing towards the forest of Laigne. It was very largely to smooth out this salient that the line was traced behind the forest in such a way as to form a great arc instead of a point. South of the portion of the line of the Somme between Péronne and Ham it was necessary to connect this arc with the fortified line S. of Péronne; the line Chaulnes–Roye–Lassigny was thus strongly indicated as the connecting line.

On Sept. 23 there was fighting near Lassigny, on Sept. 25 near Roye, and on Sept. 29 in the same places and also at Chaulnes, where the Allies were repulsed, as they were at the salient itself. On Oct. 1 the fighting-line extended to near Arras. It will be seen how it came to be fixed on the N. of Péronne.

The old fortress of Arras, which was no longer more than half fortified, but whose citadel had been maintained in good condition, was a *point d'appui* for the Allies. The interval, 40 km. wide, between Arras and the Somme, provided some features which were favourable to the establishment of a line. First, near Arras, there was the little valley of the Crinchon. The stream itself is unimportant, but its banks afford positions which are good in default of better ones. Next, a connecting line had to be ensured over about 15 km., from N. to S., across the undulating plateau, to the course of the Ancre, which forms a deep ravine both above and below Albert. The river bends in a S.W. direction as far as Corbie on the Somme.

Thus the line traced by the depression favourable to a line of resistance forms a series of zigzags: the Ancre near Albert, the Somme from Corbie to Péronne, the Somme from Péronne to Ham. It was because of this peculiarity that the Germans, when they were defending the line of the Ancre, opposite Albert, could not make use of the section of the Somme between Péronne and Ham, because it was 20 km. to the rear. Their solution consisted therefore of drawing a line through the Corbie salient, behind which lay Combles, transformed into a magazine and supply depot. This brought them in front of the section of the Somme between Péronne and Ham.

During the "Race to the Sea" the fighting round Albert and Arras (*see* ARTOIS, BATTLES IN) began at the end of Sept. and on Oct. 1 respectively. The X. French Army then came into the line. The Germans were already strongly entrenched on the Thiépval plateau, opposite Albert, where they were to pile up the defensive works which the British were to capture, one by one, two years later.

On Oct. 2–3 the X. Army (Maud'huy) made an effort to seize the German flank at its northern extremity by moving forward to Douai, where there had been for some time a detachment of the territorial army, which did not succeed in maintaining its hold. But the Germans opposed with heavy forces of infantry and cavalry. The French were pressed back; the enemy occupied Lens and made a vigorous but unsuccessful attack on Arras. For a long time afterwards the Allies' line left Lens in possession of the Germans, lying farther westward on a line from Arras towards Béthune. Arras was included indeed, but the important positions of Vimy and Notre Dame de Lorette, of which the Germans would not lose hold, were cut off. Their importance consisted in their facing N.E. and later their capture necessitated long and painful effort.

The German cavalry was in all the country which lay beyond in the N.; it occupied Ypres and Bailleul, and sent out patrols still farther forward. The situation was very difficult for the Allies, and its improvement was an urgent matter. The VIII. Army (d'Urbal) had its base at Dunkirk, but it was still inadequately constituted. The French cavalry and General Brugère's territorial divisions were maintaining an arduous and very fatiguing struggle. At that moment the British army, which could now be withdrawn from the Aisne, as that front was strong and solid and could be held by a small force, was summoned N. Reinforcements were also brought from the eastern area, and lastly the Belgian army, no longer of any use in Antwerp, came to take its place in the ensemble. The story of the siege of Antwerp and of the escape of the Belgian field army from the place is told under ANTWERP.

At the time of the fall of Antwerp Sir John French and General Joffre met at Doullens, on Oct. 8. The British II. Corps arrived on Oct. 12 near Béthune and Aire, and was able to attack the enemy's flank in a combined operation with the X. French Army. The III. Corps detrained at St. Omer on Oct. 12; the I. followed. Finally the IV. Corps, supporting the Belgian army in its retreat, would rejoin the rest.

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It is evident that if the organization and transport of the new army corps which were to swell the forces of Sir John French had been accomplished more quickly, and the N. of France occupied earlier, that region would have been more easily freed from the enemy invasion, and the blow at his flank aimed at by the Command would have resulted instead of the "Race to the Sea." But it must not be forgotten that Great Britain created this new army *ab ovo*—a stupendous military effort—and that armies cannot be improvised. Until about Oct. 8, the Germans had only cavalry in the regions around to the north of Lille. It was then strengthened by the arrival of a strong army corps, which came from the neighbourhood of Antwerp by way of Courtrai.

The Lille Question.—On Oct. 8 the enemy arrived before Lille. The fortress closed its gates and resisted with the few troops that it possessed. The Germans did not trouble to attack it in earnest. They contented themselves with bombarding the town from a distance and demolished about a thousand houses. On Oct. 13, after five or six days of bombardment, Lille yielded. This short resistance was not useless, for it enabled the British army to take up its position behind Lille and to consolidate it. The question of Lille gave rise to much discussion in France. The arguments cannot be examined here, but a few words must nevertheless be said on the subject. If it had held out longer, it might have formed part of the battleline, like Reims, in which case it would inevitably have been destroyed, and with it the industrial towns of Roubaix and Tourcoing. Should the sacrifice have been made? The British front would have gained about 15 km. on the E. but the general line would have passed along the Yser on the N. and through Arras on the S. just the same. It would, moreover, have been difficult to find a good connecting line to link up Lille and Arras, across country very ill-adapted for defence, especially in the southern half. If the defence of Lille had been included in the general scheme of operations from the beginning, a very strong garrison must have been left there, proportional to the extent and number of works of the entrenched camp. It would have had to be an immobilized force whose task was to immobilize an enemy force also, as at Maubeuge. But it would not, any more than Maubeuge, have hindered the enemy's turning movement. Thus, to assume the resistance of Lille, until the arrival of the British army at the beginning of Oct., is to assume that it could have sustained a siege and bombardment from the last week in Aug. onwards—that is, for over 40 days. The fate of other isolated fortresses, such as Liége and Antwerp, leaves no doubt that this would have been impossible.

On Oct. 12 a junction was effected between the Belgian army, retreating towards Ypres with the French marine fusiliers, and the II. British Corps (General Smith-Dorrien) in the region between Béthune and Bailleul, along the canal and the Lys, while the III. Corps (General Pulteney) marched on the left of the II. towards the line running from Armentières to Ypres, to occupy the heights of Messines, later so fiercely disputed. On Oct. 13 the British cavalry, which held the left of the advance, took the heights which stretch between Cassel and Messines (Mont Noir, Mont des Cots, etc.) and which are of great military importance. On Oct. 14 the II. Corps entered Bailleul. The same day General Byng's cavalry division arrived at Ypres, with a French territorial division.

Definition of the Front of Contact.—Although the struggle never ceased and a great German offensive was immediately prepared in Belgium against the left of the line, at Ypres, on the Yser, the "Race to the Sea" must be considered to have ended on Oct. 15 1914, the date on which the Allies occupied the whole front from Ypres to the sea. At that date the left, on the Yser, was at Nieuport, and possessed a bridgehead at Lombartzyde in advance of the line of the river and near its mouth. The Yser front passed through Dixmude. To the S. of that town it is delimited partly by the course of the river, which spreads out like a fan a little farther to the S., partly by the Ypres canal, after passing the ancient fort of Krocke. Then it goes beyond the canal to the villages situated farther E. on the stream of the St. Jean, in order to arrive at the heights which surround the basin of the Yser and its tributaries, reaching them at Gheluvelt, on the road from Ypres to Menin. It held the crest and the heights as far as Messines. The French were on the left, from Nieuport to Dixmude; the English on the right, on either side of Ypres: the Belgians were between the two, their feeble effectives occupying only a small portion of the front.

From the beginning the Yser front was well selected and lent itself well to defence, not so much owing to the obstacle formed by the Yser, as because the country behind, much cut off by water-courses, was very ill-adapted for an offensive by large masses. At the same time, this part of the front, which was entirely defensive, had not its full value until it was flooded. The dykes were burst open on Oct. 22, the floods then gained ground little by little as they rose higher. The effect was not obtained very rapidly, because the whole volume of water in the basin is not great. It did not hinder the enemy from crossing the river below Dixmude on Oct. 26, and penetrating thence to a depth of 4 km. till he was stopped by the lines in the rear, and especially by the railway embankment. But two days later the Germans were forced to retreat, partly by the Allied counter-attacks, partly by the water, which was spreading and rising. The part of the line which passed in front of the Ypres canal near the little river St. Jean could not be made very solid, but it was necessary in order to form a link with the Gheluvelt heights. But the true line of battle, which overlooked a large stretch of country to the E., was only attained in the last phase of the war, with the capture of the entire line of heights in the direction of Staden, at least as far as Westroosebeke, the point where the ridge is crossed by the high road from Ypres to Ghent. Also, during the whole of the first period of the struggle, the British army was always very vigorously attacked around Ypres and at Ypres itself. The most important *point d'appui* was the portion of the heights lying directly to the S. of Ypres, Wytschaete and Messines,—that is, the eastern end of the line of the Monts de Flandre, which run from Messines to Cassel and appear again farther on to the N. of St. Omer. These hills are of immense importance in the whole defence of Flanders. This was seen in the last phase of the war, when they fell into the hands of the enemy as far as Bailleul, and it took very hard fighting and the greatest energy to arrest his progress in this direction and to stave off still more fatal consequences.

Between the promontory of Messines and the cliff formed by the heights of Notre Dame de Lorette and of Vimy, above the plain of Lens, stretched a sector with a front of nearly 50 km. which afforded no continuous line of any length, and included only isolated strong-points, sometimes in a position favourable to the Allies, sometimes to the enemy. Those most useful to the Allies were the ridges of Messines and Vimy. The first was taken by the Allies on Oct. 15 1914; the second was at first occupied by the French, and later their success was repeated by the British. The French front line passed 2 km. to the west of Notre Dame de Lorette, the key to the position. The attack on this point began on Oct. 20; but the conquest of the whole ridge necessitated efforts which were renewed up to the middle of April 1917.

In the plain, about midway between Messines and Arras, is a point relatively stronger than the rest, owing to the canals and marshes which protect its approaches. This is the little town of La Bassée, occupied and strongly fortified by the Germans; and for a long time it delayed the progress of the British army. The difficulty of the advance towards Vimy was very largely owing to the part played by La Bassée in preventing the British in the plain of Lens from taking part in it, in striking at the rear of all their attempts in the neighbourhood of Lens, especially those which aimed at outflanking the town on the north. But hard as were the local struggles in the Messines–Vimy sector, no great action ever developed there until 1918: first, because as regards an Allied action a great offensive in the direction of Lille would have been very risky unless it was led up to by a more strongly protected movement either to the S. in the region of Arras, Peronne and Ham, or in the N. towards Belgium; secondly, because as regards a German action, the sector to be conquered to carry out a flank offensive against the Allied left was that of Ypres and the Monts de Flandre.

Such was the real meaning of the German project *Nach Calais!*, which cost the army of William II. so dearly. For the Germans, to engage themselves in the Messines–Vimy sector, in order to reach St. Omer, would have been to run into the jaws of a pair of pinchers formed on the N. by the Monts de Flandre and on the S. by the ridge of Vimy–Notre Dame de Lorette, extending to the S. of Béthune and Brie. It would have meant the formation of a salient, which would be more vulnerable the farther it was pushed in the direction of Calais. The result of all this was that almost up to the end of the war the front passing through Armentières and Arras underwent very little change.

It has already been related how the front was determined first between Arras and Albert, then S. of Albert in front of the Somme between Péronne and Ham, and lastly as far as the salient opposite the forest of Laigne. The attack on this very strongly fortified part of the German front was only begun in the early part of Dec. 1914.

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At that time the French still held Thiépval wood on the enemy slope of the Ancre. Farther S., some fluctuations occurred on the plateau, in the region of Chaulnes and Roye. But there was no great action other than the Anglo-French general offensive, which developed between July 1916 and March 1917.

All this leads to the conclusion that the last half of Oct. 1914 may be considered to mark the end of the "Race to the Sea," and the establishment of equilibrium, except for local fluctuations, along the whole length of the immense line of contact. (H. BE.)

II. TRENCH WARFARE, 1915–17

While weary British troops were handing over their lines in the salient to their French comrades at the close of the first battle of Ypres (*see* YPRES AND THE YSER, BATTLES OF) and they had time to think of other things than the grim struggle that had just ended, it dawned upon them that the war in the west had entered upon a new phase. The trench barrier had been completed from the North Sea to the Swiss frontier, and a war of movement and manœuvre, for which most of them had been trained, had become impossible. This was a development which had not been foreseen by the military world of Europe and it took it by surprise. For the Germans this surprise was less unpleasant in the winter of 1914–15 than for the French and the British. When their second great effort to win the war in the west had failed they had decided to adopt a defensive policy in France and Belgium while they attacked in the east. Therefore they could regard the difficulties of attack upon trench lines and the restrictions of manœuvre with some complacency, while they were better prepared for the new type of warfare than were either of their opponents, more particularly the British. The fortifications of the French and Russian frontiers had compelled the Germans to study closely the art and science of siege warfare and to make preparations for such warfare. They had assimilated the experiences of the Russo-Japanese War and had learnt from them to their profit. Therefore trench mortars, hand and rifle grenades, searchlights and pistol lights, and the possibilities of mining, were to them no novelty; and having the plant ready for the manufacture of the material required for siege warfare, and considerable stocks of such material already in store, it was not difficult for them to meet quickly the demands made by their soldiers in the trenches on the western front.

The British army was in very different case. Its chiefs before the war believed that it would be employed only in a war of movement, and the study of siege warfare had been confined to a small body of engineers, amongst whom it was largely theoretical. All the money to be found for the Army Votes had been used in the training and equipment of the Expeditionary Force, and there was none left for the provision of the material required for the attack of fortresses. The cost even of hand grenades, with which experiments had been made when the reports of British observers in Manchuria came home, was held to be prohibitive. For these reasons the winter of 1914–15 was for the British infantry in France and Flanders a period of unmitigated suffering. The ebb and flow of attack and defence had left the Germans almost everywhere along the British front in possession of the higher and drier ground, while in the low-lands of Flanders water was found at a few feet and even sometimes a few inches below the surface; under incessant rain, parapets melted away unless held up by sand-bags constantly replaced, but the British army had not sand-bags in sufficient quantities. The construction of communication trenches was all but impossible, and material had to be brought up to the front lines by parties floundering through the mud at night. Lying in sodden trenches, before an enemy who possessed weapons which they had not, the British infantry endured at this time a longer and in many respects a severer test of their constancy than in some of the worst crises of the war. The strain upon the French was less severe because a small part only of the French army had to endure the incomparable mud of Flanders, and from the first it was better provided with H.E. shell, while the greater military resources of France made it possible to meet the new conditions more readily.

Operations in 1915.—While the soldiers in front were enduring and slowly learning to mitigate the horrors of trench warfare, those behind were planning. There were not lacking active brains in Paris and in London who saw that the assaults upon the ever-widening barriers of barbed wire and the evermore serried lines of trenches must prove a slow and bloody business. These brains sought eagerly for a way round the barrier which would lead to a speedier and less costly victory, and so began the controversy between "Easterners" and "Westerners" which endured while the war lasted. There were signs early in 1915 of preparation for an Austro-German attack upon Serbia; and Mr. Lloyd George, inspired by his friends in France, proposed at once to save a weak Ally and to attack the weakest link in the opposing chain by transferring the bulk of the British army to the Balkans and reinforcing it with the New Armies as they became ready for the field. Both the French and the British commanders-in-chief hotly opposed this proposal. The lines of communication through Serbia were long and difficult, and it was very doubtful whether they could be made to maintain an adequate force. The transference of the British army to the Balkans must in any event have taken many months, during which it would have been condemned to an inactivity of which the enemy on the inside of the circle, with not only shorter but better communications, would certainly have profited. The Balkan enterprise was therefore condemned, and the immediate outcome of the controversy on the British side was the starting of the Dardanelles adventure.

Joffre's plan was simpler. He desired to attack on the western front at the earliest possible moment and with all possible force. It was argued at the time, and has repeatedly been argued since, that it would have been better to have awaited the development of the British army and the increase of the Allied artillery and the improvement of their stock of munitions, and to have employed the interval in gaining advantages over less formidable foes in other theatres of war. To these arguments Joffre's answer was that the Germans were in occupation of a great part of France, that near Noyon they were only 50 miles from Paris, on the Somme they were barely 20 miles from Amiens, the main junction connecting the British and French in Flanders and Artois with the remainder of the French troops, while farther N. they were little more than 40 miles from Calais. At the beginning of 1915 he was assured of a definite numerical superiority over the Germans in the W., but the Germans had not nearly reached the limits of their man-power, and they might at any time call a halt on the Russian front, and by reversing the process which they had carried out after the first battle of Ypres bring back troops to France. A successful German attack at any one of a number of parts of the western front might gravely cripple the Allied armies, for German guns might be brought up to within range of Paris or of Calais, or the enemy might again occupy Amiens. The French commander-in-chief maintained that the security of the western front must be a paramount consideration in Allied strategy, and that to secure the position in the W. it was necessary to drive the Germans farther back.

Sir John French was in general agreement with Joffre's views. He at first desired a combined naval and military attack upon the coast of Belgium, but on receiving representations from Lord Kitchener that neither the men nor the munitions required for this operation could be made ready in time, he abandoned this proposal and set himself whole-heartedly to coöperate in Joffre's plans. These plans comprised a grand attack by the British army N. of the La Bassée canal and by the French northern group of armies under Foch on the front between the La Bassée canal and Arras. The hope was that this attack would give the Allies the Vimy Ridge and compel the Germans to evacuate Lille. In order that Foch might have the forces necessary for such a battle it was agreed between the commanders-in-chief that the British should relieve the French troops, who had occupied the Ypres salient when Haig's men had been withdrawn from it after the first battle of Ypres. Sir John French had at the end of 1914 received one more regular British division, the 27th, made up by Kitchener from foreign garrisons, while another, the 28th, arrived early in January. The 1st Canadian

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Div. disembarked in France in the second week of February. This gave him a total of 13 infantry and 5 cavalry divisions, besides a number of selected territorial battalions. These reinforcements allowed him to form his command into two armies, the first under Sir Douglas Haig and the second under Sir Horace Smith-Dorrien, and at the same time to extend his front gradually N. into the Ypres salient.

A further integral part of the preparation for the spring campaign consisted of a number of attacks intended to divert the enemy's attention from the Artois front and to gain experience in the tactics of trench warfare. One of these attacks was carried out by the French during the winter against the salient of St. Mihiel, when they learnt that the position (which appears from a map to be almost untenable) could with the aid of trenches and barbed wire be made very formidable. Other attacks were made in Champagne on either side of the Perto and in Flanders. In the latter of these British troops coöperated by a minor attack opposite Wytschaete, which had very little success. In fact on the whole the Germans gained the chief success in this preliminary sparring, for in the middle of Jan. 1915 they made an attack upon the lines which had been held during the battle of the Aisne by the British army, N. of that river near Soissons, and drove the French back to the S. bank.

The British army, which like other European armies, had been trained to believe in the supreme virtue of attack, had since the beginning of the war, with the exception of the short period of the advance to the Marne and the Aisne, been compelled to fight defensively, and Sir John French desired to give it a wider experience of attack upon entrenchments. For this purpose he had been carefully saving up artillery ammunition by strictly limiting the amount to be expended in the routine of trench warfare, and he calculated that he would have sufficient at his disposal to allow him to engage in a considerable battle early in March. He entrusted the execution of this battle to Sir Douglas Haig's I. Army, which was directed to attack the German lines near Neuve Chapelle, an operation which it was hoped would result in a favourable position for the further battle which was to be undertaken later in coöperation with Foch. The battle of Neuve Chapelle opened on Mar. 10 with what was in those days held to be a very heavy bombardment. This bombardment was followed by an infantry assault, which was at first successful, and carried the village of Neuve Chapelle, but was soon brought to a standstill by the enemy's machine-guns. In this battle the British first experienced the difficulty of bringing up reserves at the right time through roads blocked by the débris of battle and over ground scarred by trenches and torn by shell-fire. On the whole, however, both the French and the British were impressed by the result of the bombardment, which was held to promise great things when there should be more guns and more ammunition. Preparations for further battles therefore went forward.

The Germans, guessing what was on foot, were not slow to interfere with these preparations. On April 17 a portion of Smith-Dorrien's II. Army attacked and gained a footing upon Hill 60, an important feature on the S. face of the Ypres salient. The Germans, counter-attacking, promptly regained possession of the hill and followed up this success by a far more serious enterprise on April 22. By then Foch's preparations for the attack on the Vimy Ridge were far advanced, and to obtain the troops he needed for the coming battle he had greatly weakened the French forces left in the N. portion of the Ypres salient. Against this portion the Germans launched waves of poison gas discharged from cylinders, which completely overwhelmed the French troops, who had no protection against this utterly unexpected barbarity. The flank of the 1st Canadian Div. was completely exposed, and for a short time a definite breach was created in the Allied line. Fortunately the Germans were unprepared for the extent of their success, and had not the troops at hand to take immediate advantage of it, while the gallantry of the 1st Canadian Div. and the 28th Div. held the enemy at bay until reinforcements could be brought up. The first complete British territorial division to arrive in France, the 46th North Midland Div., was fortunately in the neighbourhood, and these and other reinforcements, some contributed by Foch from the reserves he was holding in readiness for his battle, sufficed to save Ypres and to patch up a new line.

But the second battle of Ypres, if it did not give the Germans all the success they might have attained had they been ready to follow up the first success gained by the employment of a method of attack which no civilized nation had conceived to be possible in modern war, at least gained a great part of their purpose by weakening the forces and exhausting the meagre supply of ammunition which the Allies were accumulating for their projected battle.

That battle began on May 9 with an attack by the I. British Army under Sir Douglas Haig on either side of Fromelles, and an attack by the I. French Army, commanded by General d'Urbal but under the direction of Foch, on a much wider front which extended from the Scarpe to the N. of the Souchez. The British attack made very little progress and it was soon evident that the preliminary bombardment had not sufficed to destroy sufficiently the enemy's defences, or, what was of greater importance, to overcome his machine-guns. Sir John French, however, felt himself bound by his agreement with Joffre and Foch to keep the enemy occupied on his front as long as possible, and the battle of Fromelles became merged in the battle of Festubert by bringing the front of attack slightly S. into what it was hoped would prove more favourable ground. The experience of Festubert was, however, hardly more favourable than that of Fromelles, for again the German machine-gunners checked all real progress, while the lack of artillery ammunition became more and more felt. The situation was made more difficult in this latter respect by renewed German attacks in the Ypres salient upon the II. Army, now under the command of Sir Herbert Plumer. The situation of the British army in Flanders was somewhat eased by the arrival of five more divisions of territorials, followed by the first of the New Army divisions, the 9th, but it was lack of shell rather than lack of men which forced Sir John French to stop his attacks, and the battle of Festubert petered out on May 25.

Meanwhile, on the British right, Foch was making encouraging if slow and very costly progress. In the battle of Souchez the villages of Ablain St. Nazaire, Carency, Neuville St. Vaast and Thélus were carried by d'Urbal's men, who fought their way doggedly up the W. slopes of the Vimy Ridge. The French found the German machine-guns to be the chief obstacle to progress and the prime cause of casualties, particularly in the villages, in which the enemy's machine-gunners fought indomitably from cellar to cellar and in a certain elaborate series of works which became known to fame as the Labyrinth. The French had by this time embodied the flower of the manhood of the nation in their army, and the splendid gallantry with which Foch's regiments fought their way forward in the battle of Souchez, enduring tremendous losses but ever gaining ground, if only at the rate of a score or two of yards per day, towards the crest of the Vimy Ridge, was never surpassed in the whole long war. When the British ceased their attacks on May 25, Foch had made enough headway to encourage him to believe that he could gain the whole ridge, and he determined to continue the battle alone. But for this he wanted more troops, and an extension of the British front, which would set free Frenchmen, while both he and Joffre were fearful lest the New Army divisions preparing to leave England should be sent to the Dardanelles. The French commander-in-chief therefore wrote, at the end of May, a letter to Kitchener which contains the key to the developments of the following months. It ran as follows:—

"The retreat of the Russian army, consequent upon the temporary failure of its offensive, will doubtless allow the Central Powers to withdraw, at least for a time, a certain number of army corps which they will be able to use on another front, but it is probable that the greater part of these will be required to meet the situation created by the entry of Italy into the war.[1] The situation of the Russians, who will be for some time to come unable to undertake a decisive offensive, and the difficulties of ground which the Italian

[1] The Italian troops crossed the frontier at midnight May 24–25.

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theatre of war presents until the Italian armies are able to debouch into the plains, show clearly that the principal effort of the Allies must be made in France. The developments of Arras [1] have proved that it is tactically possible to break the German front, but that for success an even more powerful effort is required, and that it is necessary to attack simultaneously at a number of points. France has at the present time 2,200,000 men engaged on her N.E. front and has reached the limits of her man-power. She can maintain her armies at their actual figure but she cannot increase them. The solution of the problem is then in the hands of England. If she sends us her New Armies we shall be able to make not only an English and a French effort but an English effort and two French efforts simultaneously at the most favourable moment and with great power. The British forces, reinforced by the New Armies, will be given zones of operation proportionate with their strength. They will retain their present zone, extending it on both flanks to the N. of Ypres and to the S. of La Bassée canal, and they will take over the zone to the S. of Arras towards the Somme. They will thus lie on either side of the French X. Army, which will hold the front of attack which it has organized. The alternation of French and British troops has always given the best results. The principal effort of the English armies will be directed between the left of the French X. Army and the La Bassée canal and will extend to the N. of the canal; thus it will be linked up with the French attack in the neighbourhood of Arras.

"Of course, if the Germans are compelled to fall back before all the British forces are in line, their whole strength will be directed towards exploiting the success won in the direction of Antwerp and of Brussels. We owe it to ourselves and to our Allies to make a great effort now. It is therefore at the present time of the highest importance that the New British Armies should be dispatched as rapidly as possible and at dates and under conditions fixed beforehand, so that definite plans of operations may be drawn up in agreement by the two commanders-in-chief. I am firmly convinced that our action will be decisive, if it is combined and coördinated."

This letter shows that Joffre had not, at the end of May, much hope that Foch would capture the Vimy Ridge, but the latter's fiery spirit would not permit him to admit failure while the prize seemed to be within his grasp, and he persuaded the commander-in-chief to let him continue the battle. So the battle of Souchez, which had begun on May 9, dragged on until July 13. Twice Foch's men won their way to the crest of the ridge, only to be driven back, and at last Joffre called a halt and decided to prepare for the greater effort of which he had written to Kitchener. In that letter Joffre had indicated that he proposed to renew the attempts on the Arras front to take the Vimy Ridge, while the British army fought on the left of the French X. Army, but he had said nothing about the second French effort. This he designed to be the principal blow to be delivered in Champagne, to the E. of Reims. To obtain the French troops for this campaign he required the British army to extend its front to the right and left, and also to relieve de Castelnau's VI. Army on the Somme front. The remainder of the summer was occupied by these changes, which became possible as the New Army divisions arrived from England. The 2nd and 3rd of these reached France, disembarked at the end of May, and 6 more before the end of July, so that by then the 4 divisions and the cavalry division of Mons had in 11 months increased to 28 divisions and 5 cavalry divisions. These reinforcements enabled a British III. Army to be formed under Sir Charles Monro, which took over some 17 miles of front from a point to the S. of Arras as far as the Somme, eventually extending its lines to the S. of that river. Haig's I. Army prolonged its right S. of the La Bassée canal to the neighbourhood of Lens, and thus found itself facing the open plain of Loos, while Plumer's II. Army relieved the remaining French troops in the Ypres salient and brought its left into contact with the right of the Belgians.

While these movements were in progress, vast preparations were taking place on the battle-front. Guns, trench mortars, shells and military stores of all kinds had accumulated in hitherto undreamt-of quantities. Joffre and his staff had it in their minds at this time that they were engaged in operations in the nature of a huge siege, and that the essential was to blow a practicable breach in the enemy's lines through which the infantry could be poured to the assault. A study of the previous battles of trench warfare had convinced them that with sufficient guns and sufficient ammunition this was possible. The output of the French factories had been increased enormously, and though the British Ministry of Munitions had hardly yet begun to be productive, still the supply of heavy guns and shells for the British army had been greatly increased and it was equipped to reply effectively to the German gas. For these reasons the hopes which Joffre had expressed in his letter to Kitchener were very generally shared in the Allied armies. The one fly in the ointment was that there had been a renewal in the British Cabinet of the controversy between the "Easterners" and the "Westerners" and Mr. Churchill had pressed with all his eloquence and skill for a decisive campaign which should open the road to Constantinople. The result was a compromise, and three of the New Army divisions had gone to the East. Some compensation for this was obtained by the arrival of two more New Army divisions in France, and by the formation of a Guards' division, which had been made possible by the creation of new battalions of Guards and the replacement of those already in France by other battalions. This gave Sir John French an additional army corps, which he kept in his hands as a reserve.

Joffre opened his autumn campaign on Sept. 25. In addition to his great attack in Champagne, Foch with the French X. Army attempted once more to storm the Vimy Ridge, while Haig's I. Army attacked between the La Bassée canal and Lens, in conjunction with a secondary British attack to the N. of the canal and demonstrations on the front near Armentières. The general plan of the N. battle was that Foch, having carried the Vimy Ridge, should advance E. to the S. of Lens, while Haig pushed E. through Loos to the N. of Lens and joined hands with Foch beyond that town. In this way the Allies would avoid the mass of ruined buildings and miners' cottages which composed the town and would form admirable refuges for the German machine-gunners. The tactical methods to be employed on both the S. and N. battlefields were similar in conception, that is to say, there was to be a great rush forward of the assaulting infantry as soon as the attack had been adequately prepared by the artillery, and the reserves were to follow hard after the first-line troops. Only in the matter of the preparation of the attack was there any essential difference in the methods to be employed by the British and the French. The former had determined to replace an intense bombardment by a discharge of gas from cylinders similar to that from which they had suffered in the second battle of Ypres.

Of the British share in the general plan, the demonstrations in front of Armentières proved quite ineffective, while the attack N. of the La Bassée canal failed. On the front opposite Loos, however, the discharge of gas surprised the Germans and overcame the resistance of their first-line troops, though it caused some casualties among the British themselves and made it difficult to direct the attack. Despite this, the first wave of British infantry passed through and beyond Loos, when it appeared that they only needed the prompt arrival of the reserves to secure a very considerable success. Sir John French had, however, kept these back until he saw how the battle progressed, and when they arrived late in the evening the New Army division which formed two-thirds of the reserve found great difficulty in making their way through the confusion of the battlefield under conditions entirely strange to them, and were unable to confirm the first success won, so that, though Loos was held, German counter-attacks recovered a considerable part of the ground gained, and in particular the important Hill 70, which dominates Loos on the north. Worse still, Foch's attack on the Vimy Ridge failed almost completely and the Germans remained in possession of the crest. This alone condemned the N. attack to failure, for the British front of battle was not large enough to insure a breach in the enemy's defences sufficiently wide to be exploited successfully. The remainder of the battle of Loos, which lasted until Oct. 15, resolved itself into the repulse of a number of fierce German counter-attacks, which ended in mutual exhaustion, with the British in possession of the salient extending round Lens to the La Bassée canal.

The great battle in Champagne was an even more severe disappointment, because more had been expected. The first news

[1] The battle of Souchez.

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from the field aroused high hopes. The first two German lines of defence were carried on a wide front, and many prisoners and guns were captured, while on the fourth day of the battle the third German line, which was believed to be the enemy's last system of defence, was for a time breached near Sainte Marie; but again the solution of the problem of bringing up reserves at the right time and in good order was not found, while the enemy's reserves, which came up fresh through country which had not been fought over, arrived in time to fill the breach. The battle of Champagne ran on into Nov., developing into a series of struggles for tactical points of importance, but ended with no material change in the position won by the French at the end of the fourth day of the battle.

So the campaign of 1915 closed on the western front, with the Allies still asking themselves how it was possible to get through the trench barrier and drive the Germans from France and Belgium. The great bombardment followed by the assault in mass had failed, and some other method of attack was required.

Ere the year closed a new problem had developed in the Near East, which had its repercussion on the western front. German, Austrian and Bulgarian forces had overrun Serbia, and the Allied Governments had decided to send a relief expedition to Salonika. Part of the troops required for this new enterprise came from the Dardanelles, but more were needed and these had to be supplied from the western front. Five divisions of French troops under the command of General Sarrail were ordered off, and were accompanied by the three British divisions of the III. Army which had been holding the line S. of the Somme, the 27th, 28th, and 22nd. It was also decided to spare the two divisions of Indian infantry which had proved such a timely reinforcement at the time of the first battle of Ypres, the horrors of another winter of trench warfare in Flanders, and they were sent off to Mesopotamia. This reduction of the British army was made good by the arrival in France before the end of the year of the 2nd and 3rd Canadian Divs. and the 16th Irish Div., and of the 21st, 23rd, 24th, 25th, 26th, 36th and 38th New Army Divs., so that the strength of the British army in France and Belgium stood at 36 divisions and 5 cavalry divisions, a combatant strength of about 750,000 men. The Allies on the western front had therefore at this time about 3,100,000 men, opposed to 2,000,000 Germans. These figures gave rise to anxious discussion as to what superiority of numbers was necessary to ensure success under conditions of trench warfare, and whether and how the Allies could obtain the necessary superiority.

While these discussions were going on important changes took place in the Allied Command. Joffre had hitherto been nominally chief of the French General Staff. He was now definitely appointed commander-in-chief of the armies of the N.E., with de Castelnau as his chief-of-staff. In the British army Sir John French was brought home to command the troops in Great Britain and was succeeded by Sir Douglas Haig, with General Kiggell as his chief-of-staff, while Sir William Robertson, who had been chief-of-staff to French, became chief of the Imperial General Staff at the War Office.

Operations in 1916.—In Dec. 1915 the first serious attempts to obtain unity of action between the Allies took place, and a conference of commanders-in-chief and chiefs-of-staff of the British, French, Belgian, and Italian armies, attended also by representatives of the Russian and Japanese armies, was held at Joffre's headquarters. At this conference it was agreed to attack the enemy as early in 1916 as possible, sufficient time being allowed for the training of the New Army divisions that the British army was receiving, and for the reëquipment of the Russian armies. These plans, however, never matured, because the enemy anticipated them, and it is therefore unnecessary to refer to them further.

During Dec. 1915 and Jan. 1916 the Germans developed considerable activity along the front and made local attacks at Nieuport on the North Sea coast, against more than one point in the Ypres salient, at Givenchy on the Vimy Ridge front, on the Somme, and in Feb. on the Alsace front. The majority of these attacks took the form of experiments in various methods of bombardment which the Germans wished to test in view of a greater effort which they were planning. There had not been wanting signs that the enemy were preparing an attack on the Verdun sector; and considerable anxiety having been expressed as to the adequacy of the French defences on that part of the front, General de Castelnau was sent thither by Joffre, and he ordered certain improvements, but the time was lacking to give full effect to his recommendations (*see* VERDUN). In fact, the Allied defences at this period of the war were notably inferior to those of the Germans. The Allies had spent the greater part of 1915 either in carrying out the vast preparations necessary for an attack in trench warfare or in attacking, and had little energy or labour left for the elaboration of defences. The Germans on the other hand had been on the defensive throughout the year, and they enjoyed the great advantage of being able to employ upon their entrenchments forced labour from Belgium and the occupied provinces of France, and the large number of prisoners they had captured on the Russian front. Further, they had immediately behind their zone of battle the forests of Alsace and of the Ardennes, which provided them with an almost unlimited amount of timber. The Allies could only find labour either at the expense of the fighting troops or of the munition factories, and the British army was forced to import the greater part of the timber it required. It was not until much later in the war, when elaborate arrangements were made for the provision of native labour, and for the exploitation of the French forests, that conditions became at all equal in these respects.

It was the superior strength of their defences which enabled the Germans, while inferior in numbers on the whole front, to concentrate sufficient force for a great attack upon one part of that front. That attack opened on a front of nine miles on the banks of the Meuse opposite Verdun on Feb. 21, 5 German divisions attacking 2 French divisions. The enemy at once gained a startling success, penetrating the French defences, and on the fourth day of the battle capturing Fort Douaumont, one of the chief of the outlying works of the fortress of Verdun. This success was greater than any yet gained by the Allies in attack, though their relative superiority in men on the battle-fronts had been far greater than that of the Germans at the beginning of the battle of Verdun. The Germans won their successes mainly by the skilful handling of their medium and heavy guns, of which they had assembled a great number for the attack. They had before the war made a much closer study of the use of heavy and medium howitzers, both for field and siege warfare, than had either the British or the French, and they had numbers of gunners highly trained in their use, while careful experiments in bombardment, carried out before the battle, bore good fruit. It is to these causes that the tactical success won by the Germans in the first days of Verdun may be attributed. At Mons 5 German divisions had attacked 2 divisions of the British II. Corps, but the Germans had not had time to bring up their heavy artillery and at the end of a day's fighting had done little more than drive in the British outposts, while at Verdun, with the help of a mass of heavy guns, 5 German divisions had overcome 2 French divisions and gained such a position as menaced seriously the French fortress. The result was, therefore, a tactical victory for the German artillery.

Joffre dealt with the crisis promptly. De Castelnau was sent again to Verdun and arranged with Langle de Cary, who commanded the group of armies of the Centre, a command which included Verdun, as to the disposal of the reinforcements which were hurrying to the battle-field and as to the methods of defence. Joffre also sent with these reinforcements General Pétain, who arrived on Feb. 26 and assumed command in the battle-zone. The German attempts to gain ground beyond Douaumont were repulsed, and the French commander-in-chief had time to look round and survey the whole position. He had at once realized that the enemy was in deadly earnest. "*C'est la bataille,*" was one of his first remarks when he heard of the German attack. He had immediately requested Haig to relieve his X. Army on the Arras front, and had asked Kitchener to hasten the dispatch of British reinforcements to France. Two more New Army divi-

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sions and 1 Territorial division had reached France from England in January, while 3 more New Army divisions and 3 more Territorial divisions from England were to be in France before the end of May. The Dardanelles Expeditionary Force was being rapidly reorganized and refitted in Egypt by Sir A. Murray, and 2 British, 4 Australian, and 1 New Zealand divisions were expected to come from that country to the western front before the end of June. Haig had lost in Jan. one more division, which had gone to Salonika, but reinforcements would give him by the middle of the year an increase of no less than 15 divisions to his strength in Dec. 1915.

Both commanders-in-chief were agreed that the principles on which the plans of battle in 1915 had been drawn up required modification. It was seen that the analogy of the great siege did not hold, that something more was required than to blast a great breach in the enemy's lines and then to launch a great assault. The something more was the defeat of the enemy's reserves, which came up fresh and in good order to meet troops when the assault had been thrown into some confusion. It was agreed, therefore, that the first object of battle should be to draw in and exhaust the enemy's reserves, and that until that object had been achieved no decisive success could be expected. So long as the enemy continued to attack Verdun, it would, on this principle, be to the advantage of the French to endure these attacks provided always that the enemy gained no success which would affect seriously the strategical position on the whole front, and provided that the exhaustion of the French man-power was not excessive. Joffre therefore proposed to fight defensively at Verdun as long as possible, but to be ready to strike back as soon as the situation there appeared to him too dangerous, or as soon as the French army was approaching the limits of endurance. He therefore asked Haig not only to relieve the French X. Army but to prepare to attack N. of the Somme on a front as wide as the resources of the British army would permit, and undertook to support that attack with a French attack S. of the river on a scale which would depend upon the effect of the battle of Verdun upon the French army.

The Germans had at this time arrived at a very similar theory of battle. The chief of their General Staff, Falkenhayn, has said that he believed the strain of the war upon France to be such that a break might occur if the strain could be increased. This was not an unduly optimistic appreciation of the position if it be remembered that in the previous May Joffre had told Kitchener that France had then reached the limits of her capacity to expand her military forces. Materially Falkenhayn was not far wrong, but he understood the psychology of his enemies no better than other Germans, and he failed to appreciate the spirit of France. The maxim of Verdun—"*on ne passera pas*"—became for France an inspiration as potent as the influence of Jeanne d'Arc. The object of the Germans in the battle of Verdun was to bleed France white, while the object of the Allies during that period was to wear down the military power of Germany as the preparation for striking the *coup de grace*. So upon both sides the theory of the war of exhaustion developed.

During March, April and May the struggle for Verdun continued, the Germans in their several attacks gaining sufficient ground to encourage them to make a new effort now on the right bank of the Meuse, now on the left. During all this fighting the reputation of two of the defenders of Verdun increased steadily, and in May General Pétain succeeded to the command of the group of armies of the Centre, General Nivelle taking his place in command on the actual front of battle.

Between Jan. and July the British strength in bayonets and sabres grew from 450,000 to 660,000, and there was a more than corresponding increase in artillery and aircraft. This enabled Haig to fall in completely with Joffre's wishes, and as soon as the relief of the French X. Army was completed he set about preparing for the great attack on the front N. of the Somme. The growth of the armies made necessary the creation of a IV. Army under the command of Sir Henry Rawlinson. The III. Army was now commanded by Sir E. Allenby, and Sir Charles Monro, who had gone out to supervise the evacuation of the Dardanelles, returned to command the I. Army. British troops now held a continuous line from the Yser canal to the Somme, and were actively preparing to take upon themselves more of the brunt of the war on the western front, a burden of which nearly seven-eighths had hitherto fallen on their French comrades. This preparation entailed enormous labour, for it not only involved the accumulation of immense stores and piles of munitions of all kinds on the selected front of attack, the construction of miles of roads, railways and trenches and many other preliminaries of a great attack in trench warfare, but also the completion of the training of hitherto untried troops. The British army was, in fact, in process of becoming a national army. The old regulars were now little more than a small leaven of the whole lump, and though the new troops arrived in France with considerable knowledge of their duties as cavalrymen, infantrymen, gunners and airmen, they had had little opportunity of learning to work together as part of a great machine. The problem of training was the more complicated because of the great variety of new weapons and methods which had been developed since the outbreak of war; and to teach each part of the army the powers and limitations of every other part, and the whole to work together in combination, was a very heavy task. To this task Haig at once addressed himself, and formed behind the lines schools of instruction in every branch of trench and battle warfare, while careful arrangements were made for the training in attack of divisions when out of the line. All this busy work behind the lines did not mean any cessation of activity on the front, and during these months of preparation a long series of raids into the enemy's trenches were planned and executed, raids which gave the new troops valuable experience and kept the enemy on continual tenterhooks.

In the latter part of May the German Crown Prince redoubled his attacks on the Verdun front, and on the 21st the Germans stormed the Mort Homme hill on the left bank of the Meuse, for which they had been struggling for weeks. Pétain at once called Joffre's attention to the gravity of the situation, and pressed for an early beginning of the counter-offensive on the Somme, but Joffre was anxious to give Haig as much time as possible for the training of his troops, and made Pétain endure yet longer. Fire from the Mort Homme hill had long impeded German progress on the right bank of the Meuse, but with the hill in their possession the enemy in the beginning of June began to press hard on that bank and on the 7th captured Fort Vaux. Thereupon Pétain renewed his representation to Foch, who in consultation with Haig decided that the battle of the Somme should begin on July 1. The preliminary bombardment was begun a week earlier, on June 24, the day on which the Germans, after capturing Fort Thiaumont, stormed the village of Fleury and attained the farthest point in their progress towards Verdun. While this preliminary bombardment was in progress, a bombardment so intense that the guns could be heard in England, no less than 70 raids were carried on the British front between Ypres and the Somme, and gas was discharged into the enemy's lines from 40 different points. The troops which were about to attack the German trenches from Gommécourt to the Somme included the flower of British manhood, and no more splendid body of men has ever gone forward to battle. British aircraft had already gained the ascendancy over the enemy's airmen, and the British army was now well equipped with machine-guns, trench mortars, bombs, gas-projectors, and all other new appliances which experience of trench warfare had shown to be necessary; the tunnellers had proved themselves to be more than a match for the enemy's mines, and for the first time in the war there was a sufficiency of heavy and medium guns and an assurance of an adequate if not abundant supply of shells. Expectation therefore ran high.

The results of the first attack were a heavy disappointment. The main attack was delivered by Rawlinson's IV. Army between the Ancre and Maricourt, about a mile N. of the Somme, where they joined hands with the French VI. Army commanded by General Fayolle, who was to attack astride the river under the general direction of Foch. This main attack was combined with

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a subsidiary attack by the IV. Army N. of the Ancre, and yet another by the III. Army upon the Gommécourt salient. Upon July 1 both the subsidiary attacks and the whole left of the main British attack failed completely and with heavy loss, but the right of the main attack and the whole of the French attack made such good progress as to warrant the continuance of the battle. The British failures were in the main due to want of experience in the artillery. More than two-thirds of the British batteries engaged had been created since the outbreak of war, and at that time they did not possess sufficient ammunition to gain such practical experience in intense bombardment as the Germans had given their gunners before the battle of Verdun. The chalky soil of the Somme hills lent itself to the construction of deep dugouts, of which the enemy had a great number, and to prevent his men from coming out of these in time to meet the British infantry special and very accurate methods of artillery preparation were required. In default of these the infantry yet again found themselves checked on the greater part of the front by the deadly German machine-guns, and it was mainly through the devoted valour of the infantry through the first days of the battle that the gains made by the right of the IV. Army were confirmed and extended. The first successes won by Foch's men along the river itself were greater and were obtained at less cost, partly because the Germans, overrating the effect of the battle of Verdun, had not expected attack from that quarter, and partly because of the better preparation of the attack by the French artillery, the French having a far larger number than the British of trained gunners for the expansion of that arm. The lesson of the first days of this great battle is that the creation of new armies during the course of a war is an even more intricate and difficult business than had been imagined, even by those who, knowing some of the difficulties, had undertaken the creation of Kitchener's armies with devotion and enthusiasm.

One of the results of the events of the first days of the battle was that Sir Douglas Haig decided to divide his fighting front between two armies. He directed Rawlinson with the IV. Army to exploit the advantages won on the right, and formed on his left a V. Army under Sir Hubert Gough which was to keep the enemy busy on its front and act as a pivot to the IV. Army. The battle was fought out in three phases, the first being the struggle up the slopes from the valleys of the Ancre and of the Somme to the S. crest of the Somme plateau, the second the struggle for possession of the plateau, the third phase consisting of the advance down the N. slopes. The first phase was consummated by a brilliant night attack by the IV. Army on July 14, and on July 17, the British and French troops N. of the river were abreast of the French S. of the Somme, who had for some time been established opposite to Péronne. The whole front of attack could again move forward together. The second phase constituted a long series of fierce struggles, the Germans bringing up more and more troops and disputing every yard of ground, so it was not until Sept. 9 that the British, with the French on their right, were able to look down upon the N. slopes of the plateau and the plains beyond.

By this time two of the objects for which the battle had been fought were gained. The Germans, forced to transfer troops to the Somme, had to relax their pressure on Verdun. The French retook Fort Thiaumont on June 30, while throughout July they slowly regained part of the ground which had been won from them, and on Aug. 17 drove the enemy out of Fleury. Verdun was no longer in danger, and Pétain and Nivelle were able to plan at leisure counter-attacks on a more extensive scale. The second object of the battle of the Somme, the exhaustion of the enemy's reserves, was being obtained as surely. When the battle began, the front attacked by the British was held by 6 German divisions, that attacked by the French by two. In the 2 months 36 German divisions had been engaged on the British front, 18 on the French. In the 6 months of Verdun the Germans had employed 43 divisions in battle, so that their defence on the Somme was far more exhausting than their attacks at Verdun.

At the end of Aug. the failure of Falkenhayn's plans was publicly admitted by his supersession by Hindenburg, with Ludendorff as his chief assistant. The latter, after visiting the fields of Verdun and the Somme, found the German position on the western front to be one of great gravity, and the chief problem confronting him to be how to stop "the progressive falling off" of the German fighting power. The situation of the Allies had improved marvellously since June, when men were wondering how long it would be before the Germans entered Verdun. Not only had Verdun been saved and the Germans been forced to fight desperately on the defensive, but the Italians had driven back the attacking Austrians in the Alps and had then passed themselves to attack on the Isonzo. On the Russian front Brussilov had won great victories on the Bukovina, and Rumania had entered the war, too late certainly to profit by Brussilov's success, but none the less adding apparently another ally to those who confronted the Central Powers. The whole machinery of the Allies was, for the first time, simultaneously at work, and Joffre's strategy appeared to be triumphant.

It was in these encouraging circumstances that the third phase of the battle of the Somme began on Sept. 15. The attack of that day was made famous not only by the successes won, which were considerable, but by the fact that tanks then made their first appearance in battle. There has been much controversy as to the wisdom of this step (*see* TANKS). The experts have maintained that the value of this invention was discounted by premature use, that it should have been kept in reserve to surprise the enemy when large numbers of the new weapon were ready, and that it should have been first used on ground more favourable than a shell-torn battlefield. It was decided to employ tanks in the Somme battle for two reasons. Firstly, so much having been gained at great cost, the moment seemed to have come to press the enemy with every available means. The chief obstacle to the progress of the infantry continued to be the German machine-guns, and tanks were reputed to be the ideal means of overcoming machine-guns. If it would have been foolish not to have pressed the advantage won, it would have been criminal to have withheld from the sorely tried infantry the protection and aid which was at hand. The second reason was that experience was required in the use of tanks in battle. It was necessary to learn both how the tanks would comport themselves when put to the highest test, and how they would work in combination with infantry and artillery. The effective coöperation of infantry, tanks and artillery undoubtedly went a long way towards winning the war in 1918, but it is a legitimate belief that this coöperation would not have resulted unless experience had been gained in 1916.

Despite the employment of tanks, and despite the splendid valour of the infantry of the New Armies, the resistance of the enemy was not broken in the third phase of the battle of the Somme. The days were growing shorter and the weather became uncertain, while the enemy, drawing troops from all parts of the front to prevent his line from breaking, fought with fine courage. By Nov. 17, when rain and mud put an end to the battle, the Germans had engaged no less than 127 divisions. The enemy's reserves had indeed been worn down; in the valley of the Ancre he was hemmed by Gough's V. Army into an awkward salient, but the weather had broken and it was too late to reap the harvest on the battle-front. The first fruits of the Somme were garnered elsewhere.

On Oct. 24 Nivelle began an attack on the right bank of the Meuse, and on the following day recaptured Fort Douaumont. This conspicuous success was followed by the recapture of Fort Vaux on Nov. 2. The battle ended in a complete victory for the French, 6 French divisions overcoming 7 German divisions at surprisingly small cost. Nivelle and Mangin, who commanded the army corps engaged, became the heroes of France. The victory was largely due to the skilful handling of massed artillery, and the Nivelle method became famous. Its fame was extended when, on Dec. 14, a second attack won an even more brilliant success, which made Verdun quite secure and brought in 11,387 prisoners and 115 guns, again at small cost.

When the statesmen of Paris and London compared the results of these two battles at Verdun, which had resulted not only in

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important gains of ground but in the capture in a few days' fighting of more than 17,000 prisoners, with the slow bludgeon work of the Somme in which the British army in four and a half months had captured 38,000 Germans at a tremendous price, they began to think that they had at last discovered the man for whom they were looking so anxiously.

Operations in 1917.—On Nov. 11 1916 Joffre assembled his second conference of commanders-in-chief to consider plans for the following year. It was agreed that the Germans were in great difficulties on the western front, and that the situation of the Allies was more favourable than it had ever been. The fighting strength of the British army had grown to about 1,200,000 men, and it was known that considerable further reinforcements would reach France during the first few months of the year. The fighting strength of the French army had been increased by the incorporation of native troops to about 2,600,000, so that, including the Belgians, the Allies disposed of about 3,900,000 men against about 2,500,000 Germans.

Joffre declared that the French army could maintain its strength for one more great battle, but that thereafter it must progressively decline, as France had no longer a sufficient number of men of military age to replace losses. He therefore warned Sir Douglas Haig that during the coming year the burden must fall more and more upon the British army, a position which the British commander-in-chief readily accepted. Germany had recently created a number of new divisions, some of which had been employed against Rumania, but it appeared probable that the transfer of these divisions to the western front would be delayed if Russia was able to be active on the eastern front, and of this the great improvement in the supply of munitions for the Russian army held out promise at this time. It was also agreed that, in view of the probable decline in strength of the French army later in the year and the promised reinforcement of the British army, the relative superiority of the Allies on the western front would be greater in the spring of 1917 than at any time which could be foreseen with certainty. For all these reasons it was decided to take the earliest possible opportunity of pressing the advantage won by the battle of the Somme, and of continuing the process of exhausting the enemy's reserves as preparation for an effort which should be decisive. All the armies of the Entente were to be ready to attack in the first fortnight of Feb., the British army between the Vimy Ridge and Bapaume, the French armies between the Somme and the Oise; and the French attack was to be followed soon after by another in Champagne to the W. of Reims. It was further understood between Joffre and Haig that these attacks would, if necessary, be followed by further attacks by the British army in Flanders. During the winter the British army was to do its utmost to press the enemy on the Somme battlefield, and to prevent him from recovering from his embarrassment there.

The underlying ideas of this plan were primarily that the policy of exhausting the German reserves should be resumed at the earliest possible moment, and secondly that the utmost effort should be made to complete the work begun on the Somme. The commanders-in-chief believed the situation to be such that victory could be won in 1917, but they were under no illusion as to the possibility of ending the war by one great blow to be delivered in the spring. Joffre followed up the results of this conference by issuing general instructions embodying the decisions reached, and in these instructions he directed that the first British and French attacks, that is to say, those to be delivered between Vimy and Bapaume and between the Somme and the Oise, were to be ready by Feb. 1.

No sooner were Joffre's plans completed than a series of intrigues against the French commander-in-chief came to a head. A number of officers of the French General Staff regarded with dismay a proposal to give more and more of the task of consummating victory to the British army and less and less to the French army. They found many supporters among the politicians in Paris, and these were reinforced by others, who feared that the "war of exhaustion" and the process of wearing down the enemy's reserves would end in exhausting France before it exhausted Germany. The cry therefore went up that it was time to have a change in the Higher Command. Foch, whose bloody assaults upon the Vimy Ridge had not been forgotten, was held to be too much of a "hammer and tongs" fighter, and he was placed on half-pay, while the state of the defences of Verdun before the German attack began was brought up against Joffre. So he was given a marshal's baton and an honorific position in Paris, and Nivelle reigned in his stead.

The new commander-in-chief at once made a drastic change in Joffre's policy and plans. He proposed to increase the weight of the French attack; and in order that he might obtain the French troops necessary he proposed that the British should relieve the French VI. and XX. Armies and extend their front S. across the Somme as far as the Amiens–Roye road. In return he proposed that Haig should modify his plans for keeping up the pressure on the Germans on the Somme battlefield during the winter, and that the date of the combined attacks should be postponed until Mar. 15. This meant a delay of six weeks in launching the attacks planned by Joffre, and the enemy would be given time to recover from the effects of the Somme. But it became clear, as Nivelle's plans developed, that there was to be an even more complete change of plan than this. He proposed to apply on a great scale the methods he had employed with such success at Verdun, and to return to the policy which had been discarded after the failure in Champagne in 1915. He intended, by skilful employment of a great mass of artillery, to overcome the enemy's resistance in his front lines, and then to pour in to the assault a great reserve which should break through the trench barrier completely and so change the whole strategical position on the western front.

Early in Dec., 1916, there had been a change of Government in Great Britain, and Mr. Lloyd George had become Prime Minister. He had made up his mind that the Somme had been a costly failure, and was eagerly looking for some method of winning the war which should be speedier and less costly in life than that of a "war of exhaustion." He therefore welcomed a general who promised a short, sharp and decisive battle, which would be over, one way or the other, within a comparatively short time. So at a conference held at Calais at the end of Feb. 1917, it was agreed between the British and French Governments that the British army should be placed under the general direction of Nivelle for the forthcoming operations. This decision violated a fundamental principle of military organization. A general of division is not, while still in command of his division, placed also in command of an army corps which includes other divisions, for the good and sufficient reason that if his attention is absorbed by the details of one unit or of one part of the front, he cannot simultaneously give proper attention to the other units or to other parts of the front. The right course would have been to have given Nivelle the general charge of the whole western front and to have appointed another commander-in-chief for the French army. The results of this mistake soon became apparent. On the last day of the Calais Conference news arrived from the British V. Army that there were signs of a German withdrawal in the valley of the Ancre. Some time before, the British airmen had discovered that a great new system of defensive works had been constructed by the enemy covering Douai, Cambrai and St. Quentin, the system which became known to the Allies as the Hindenburg line; and not long after the report from the Ancre came in there were indications that the Germans were preparing to retire from the whole of the Somme battlefield into this line. But Nivelle, not being in close touch with happenings on the British front, did not believe in a German retreat, and issued to Haig orders which were not compatible with the changed situation, and in certain matters went far beyond the agreement reached in Calais. This led to friction, which was adjusted at a further conference in London. By then it had become apparent that the Germans were in retreat on the whole front between Arras and the Aisne near Vailly. The Germans, relieved from pressure on their front during the winter, had prepared for their retreat systematically and brutally. The whole country which had been in their occupation W. of the Hindenburg line was

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devastated, villages were burnt, roads and railways destroyed, fruit trees cut down and everything of any value was removed, and mines which exploded at a touch were prepared with diabolical ingenuity. In these circumstances a rapid pursuit became impossible, and the Germans were able to delay the advance of the Allies by rearguards, while they removed their heavy artillery and established their main bodies in the Hindenburg lines.

This manœuvre, planned and successfully carried through by Ludendorff, effected a great change in the situation to the benefit of the Germans. Not only did it materially shorten their front and thereby enable them to increase their reserves, but their troops exchanged the battered defences of the Somme battlefield with its awkward salients for the strongest lines which had yet been built upon the western front. Further, the enemy had withdrawn from a considerable part of the front which Nivelle had intended to attack, and this made necessary a further postponement of his battles, but he still adhered to the main features of his plan. In the altered circumstances grave doubts arose in the minds of some of the senior French generals as to the feasibility of this plan, and when these came to the ears of the French War Minister, M. Painlevé, he assembled a Council of War on April 6, on the very eve of the offensive, at which criticisms of the plan were presented by certain of the commanders who were to take a leading part in its execution. Nevertheless, the French Government decided not to interfere with Gen. Nivelle. It is difficult to conceive of a more unfortunate prelude to a great battle. However, these doubts and hesitations of the leaders were not known to the rank and file of the army or to the French people; and when, on April 9, the spring campaign began by an attack by Allenby's III. Army on the enemy's lines E. of Arras, and by the Canadian corps with one brigade of the 5th Div. on the Vimy Ridge, and met with an immediate success, hopes soared high. The French public was deeply impressed by the rapid capture of the Vimy Ridge, which had for so long resisted Foch's attacks, and great things were expected when the French army advanced.

The second of Nivelle's blows was delivered by the group of armies of the centre, now under Franchet d'Espérey, against the German front in the neighbourhood of St. Quentin; but Franchet d'Espérey was here in contact with a part of the main Hindenburg line, and he had neither the time nor the means to prepare effectively for an attack upon their formidable defences. The operations of the centre group of armies, which had been intended to be an important part of Nivelle's programme, dwindled therefore into little more than a demonstration, which took place on April 14 and had no material results. Nivelle's main battle, which took place on the front between Reims and Anizy, began on April 16. It had been planned that the assaulting troops should on the first day of battle break through the first three German lines. The attack was made by Mangin's VI. Army and Mazel's V. Army, with Duchesne's X. Army and a mass of cavalry in reserve ready to exploit their success. Antonine's IV. Army struck in to the E. of Reims on the 17th. The left of Mazel's attack failed almost entirely; and elsewhere, though the first German line was captured, little progress was made beyond it. The dream of a rapid rupture of the enemy's front had to be abandoned, and a fresh plan of battle had to be formed.

One of the first results of the failure of Nivelle to realize his hopes was that he had to request Haig to press his attacks to the E. of Arras with all possible vigour, so as to keep the largest possible number of Germans occupied in that quarter. This entailed a prolongation of the battle of Arras into a period when gains became small and were only purchased at great price. None the less Haig decided that the situation made it necessary to support the French with all his power, and he fought on till May 17, by which time the British front was established some 4 m. to the E. of Arras and in the plain to the E. of the Vimy Ridge. While Haig was thus battling in the N., Nivelle on the Aisne front had brought his X. Army into his front line, and by slow and bitter fighting had won his way up the Chemin des Dames ridge, of which he captured the eastern portion. Early in May it was quite evident that there was no prospect of such a break-through as had been planned, and on the 15th the French Government replaced Nivelle by General Pétain, while General Foch, recalled from semi-retirement, became chief of the staff in Paris. Pétain's first task was to wind up the operations on the Aisne front, and the battle ended definitely on May 20.

The spring campaign had proved a failure in comparison with what might have been, and still more in comparison with what Nivelle had promised, but its results were far from being insignificant. The German retreat in March, which was a direct consequence of the battle of the Somme, had at last brought about the attainment of one of the objects for which Joffre had been striving for so long. The Allies had now more elbow room on one of the most vital parts of their front, that which covered directly the roads to Amiens and Paris. Had the Germans in March 1918 started from the positions which they held in Feb. 1917, and had their attacks progressed at the same rate, they would have entered Amiens on the second day of the battle, which would have ended with the German guns bombarding Abbeville and communication between the French and British armies severed. It is therefore not too much to say that the retreat which was forced upon the Germans by the battle of the Somme saved the Allies in the following year. But how much greater might the results have been if the plan formed by Joffre and Haig in the previous Nov. had been followed—if the Germans had been pressed on the Somme battlefield during the winter, and if they had been attacked early in Feb. before their plans for retreat had been completed. Despite all the difficulties with which the successful conduct of that retreat by the Germans had confronted them, the Allied armies had in the battles of April and May captured 62,000 prisoners, 446 guns, and 1,000 machine-guns, and had gained positions of the first importance; 57 divisions had been compelled to fight upon the French front and 99 on the British front. Had Nivelle been content to follow Joffre's example, and to prepare methodically for the exhaustion of the German reserves without overtaxing the endurance of the sorely tried French army before attempting to break through the enemy's lines, he might have claimed a conspicuous success for his first campaign. But the hopes which he had roused had been extravagant, and the dejection when they were not realized was correspondingly great. The dejection was increased by the news of the Russian revolution, and by exaggerated reports of the losses in the Aisne battles; and it was hardly alleviated by America's entry into the war, for it was well understood that American troops could not be ready to take their places in the firing line during 1917. The immediate consequence of this dejection was the outbreak of a series of mutinies in the French armies, which so affected the *moral* of the French troops that Pétain found it necessary to appeal to Haig to keep the enemy engaged while he restored the confidence of his men.

If the attention of the Germans was to be occupied by the British armies it was necessary that they should be forced to fight. Upon any part of the British front S. of the point where it bends S. from the Belgian frontier N.W. of Lille it was possible for the Germans to repeat their manœuvre of March and avoid a battle by retiring into another system of defences, for in doing this they would be merely abandoning a portion of French territory which was of no great value to them, while they might by this method economize sufficient troops to enable them to fall upon the French. On the Belgian front they could not fall back without risking their hold upon the ports of Ostend and Zeebrugge, which were to them important bases for their submarine campaign, and without endangering the security of the chief aerodromes from which their air attacks upon England were made. For these reasons Haig decided to press the enemy with all his available means upon the Belgian front, and on June 7 he began this campaign with the battle of Messines. This battle was most skilfully and thoroughly prepared by Sir Herbert Plumer, and was fought and won by his II. Army. The battle began with the explosion of a number of huge mines, the secret of which had been preserved by constant and devoted watchfulness on the part of the miners, who had tunnelled beneath the enemy's lines many months previously and awaited patiently the opportunity

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for their use. The effect of these explosions, combined with a very skilfully planned bombardment of massed guns of all calibres, was such that, except in the right of the attack in the neighbourhood of Messines, the infantry, for once, had little to do. The whole of the Messines-Wytschaete ridge was captured at comparatively very light cost, and the Ypres salient, a name of ill omen for the British army since Oct. 1914, disappeared.

The strength of the British army in combatant troops was now at its greatest. Haig had 64 divisions and 10 cavalry divisions under his orders, and a mass of heavy artillery, tanks and aeroplanes. It was well that this was so, for the army was to be called upon to endure greatly while Pétain and his men got their second wind. Nor was it only the situation on the western front which called for resolute action, for the condition of the Russian army was far more critical than that of the French army. Kornilov had, on July 1, begun an offensive, and if he was supported and encouraged by success in the W. it was still possible that the Russians might continue to be a powerful factor in the war.

With these heavy responsibilities on his shoulders, Haig began on July 31 the second battle of Ypres, with a great attack by the V. Army, which had been moved N. for the purpose. This attack was combined with a subsidiary attack by the French IV. Army under General Antoine on the British left. The object was to gain possession of the Passchendaele ridge, so as to be able to sweep with gun-fire the plains beyond it toward Zeebrugge and Ostend. This achieved, a combined naval and military attack, which had been secretly prepared in England, was to be made on the Belgian coast, which it was hoped would gain possession of the ports and so relieve the British Admiralty of some of the many anxieties caused by the German "U" boats. In preparation for the landing the British took over from the French the lines on the Belgian coast near Nieuport and moved other troops up to the coast behind these lines. The position at Nieuport, which consisted of a narrow strip of ground, with the Yser at its back, was not easy to hold against determined attacks, and before the British preparations for defence were completed the Germans attacked and captured the lines E. of the river. This was an inauspicious beginning, but worse followed, for the weather broke immediately after the battle began and then followed a rainfall unprecedented for August.

The plan of battle was to deliver a series of blows, each with an objective limited by the support which the artillery could give without changing position. It was believed that the experience of Messines and of Verdun had shown that this would allow the infantry to reach their objective without heavy loss. Ludendorff, however, met this method of attack by a new method which he called the elastic system of defence. He made no attempt to hold his front lines in strength, but withdrew the bulk of his infantry from the zone which would be most heavily bombarded and relied mainly upon machine-guns in concrete "pill-boxes" to break up the British infantry attack, and upon counter-attacks by the troops whom he had held back. But it was less this method of defence than the mud of Flanders which prevented British progress. The opening battle of July 31 gave the British possession of the whole of the Pilken Ridge, of the German first line of defence between Nordshoote and Klein Zillebeke, a front of 10 m., and of most of the German second line, but it was not until Sept. 20 that the enemy's third line was penetrated, and not until Oct. 4 that the British were established on the high ground between Broodseinde and Becelaere. The difficulty of getting guns and ammunition forward through the slough of mud prevented the delivery of a rapid succession of blows, each with a limited objective, as had been planned, and in the event a more terrible strain was imposed upon the British troops than in any other battle of the war. As in the case of the battle of the Somme, the first fruits of the third battle of Ypres were reaped elsewhere than on the battle-front. The Germans, forced to send more and more troops into the fiery furnace which blazed in the Ypres ridges, were compelled to leave the French alone, and Pétain had time to restore the confidence of his army. Part of his method was the delivery of very carefully prepared attacks on a comparatively small front, supported by a great mass of artillery which should leave the infantry little more to do than to occupy the ground won. The first of these attacks was delivered by Guillaumat's II. Army on the Verdun front, and was completely successful, ending with the French in possession of all the ground which the Germans had won in 6 months fighting in 1916. This was followed by a more important attack delivered on Oct. 23 by Maitre's VI. Army, which gave the French the whole of the Chemin des Dames ridge, and resulted in the capture of 11,000 prisoners and 200 guns. Then and not till then Pétain expressed himself as satisfied that his immediate purpose was achieved.

The British troops, struggling in the mud of Flanders, could not be told the reasons which had called for a supreme effort from them, and the terrible struggle through the mud, unrelieved by any conspicuous success, was a heavy strain upon them. As events turned out it would probably have been wiser to have brought the third battle of Ypres to a close immediately after the French had won the Chemin des Dames, but at that time the British were within a short distance of the crest of the Passchendaele ridge, while information received at G.H.Q. showed that the strain upon the German army had been far greater and that there had been a very appreciable lowering of the *moral* of the German troops. Haig had yet another blow in preparation. The continued bad weather and the slowness of the progress had caused the abandonment of the project of landing on the Belgian coast, and all hope of driving the Germans from the Belgian ports had gone, but there still appeared to be an opportunity of profiting from the exhaustion of the German reserves before the winter gave them a period for recovery, as it had after the battle of the Somme. A final reason for continuing the struggle was that on Oct. 24 an Austro-German attack had been launched in Italy, and at Caporetto had broken through the Italian lines. It was therefore of importance to keep up the pressure upon the Germans on the western front. So the third battle of Ypres was continued, until the ridge and village of Passchendaele were captured on Nov. 3.

A fortnight later Byng's III. Army attacked the German front opposite Cambrai. This battle opened a new era in trench warfare. One of the outstanding difficulties which the trench barrier had created was that it had hitherto eliminated one of the chief resources of generalship, surprise. The time and labour required to prepare for a great bombardment, and the accumulation of the huge stores of material of war on the selected front of battle, made it impossible to conceal intentions from the enemy. But at Cambrai these difficulties were overcome by using a great number of tanks, brought up secretly to take the place of the bombardment in breaking the enemy's defences. The attack was made upon one of the strongest parts of the Hindenburg system, but the tanks successfully broke through, and the surprise was complete. At Messines the guns had left nothing for the tanks to do, and in the third battle of Ypres they had been defeated by the mud of Flanders, but at Cambrai they came into their own. One thing alone was lacking as far as their part in the battle went. The coöperation between the tanks and the artillery in the later stages of the attack was not complete, so that numbers of tanks fell easy victims to the German guns, a lesson of which advantage was taken in 1918. Of greater importance was the fact that 6 French and 5 British divisions had been transferred to Italy to help the Italian army to stem the disaster of Caporetto, so that Haig had not the troops to complete and extend the first successes won at Cambrai. It is a typical illustration of the advantage which their central position conferred upon the Germans that several of the British divisions which would have been invaluable at Cambrai had not reached the Italian front at the time when the Austro-Germans were checked on the Piave and the battle of Caporetto came to an end. So the German counter-attacks won back a good part of the ground which Byng had gained in the first advance, and the battle of Cambrai ended on Dec. 7 in one more disappointment for the Allies.

The campaign of 1917 on the western front had been fatally hampered by the change of plan which had been made by

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Nivelle when he succeeded Joffre. That change had permitted Ludendorff to prepare for and carry through the retreat into the Hindenburg line, and had postponed the date of the Allied offensive from Feb. 1, the date fixed by Joffre, until April 9—a delay of nine precious weeks. As Joffre, had anticipated, it had been necessary for the British army to bear the brunt of the fighting, but it would have done so under very different conditions if the Germans had been hustled back into the Hindenburg line, as they were in Sept. 1918, and if Messines had been fought at the beginning of April, and the third battle of Ypres had begun on May 30 instead of July 31. The battle of Cambrai might then have synchronized with the last offensive of the Russian army, and the combined effect might well have been such as to have saved that army from dissolution, for adequate French and British reserves would have been available in France to support Byng's attack, and the war might have ended victoriously in the autumn of 1917. As it was, the battles of 1917 showed clearly that the solution of the problems of trench warfare at which Haig and Joffre had arrived was correct. It was first necessary to exhaust the German reserves and then to strike a surprise blow or series of surprise blows. Cambrai had shown how surprise might be achieved. But all this experience, which had been purchased at great cost, had been acquired too late to be put to profit in 1917, owing to the fatal delay in opening the campaign of that year. The collapse of Russia was definite and complete, and the Germans were transferring their divisions from E. to W. as rapidly as their railways could carry them. The French divisions had since the middle of the year been gradually reduced in strength, as France had no longer the men to replace the losses in the ranks, and now Pétain found himself compelled to cut down the number of his divisions. The British army was not receiving from home the men to fill the gaps caused by the bloody fighting of Passchendaele; and Haig, early in 1918, was compelled to follow the example of the French and reduce the strength of his divisions, while 11 British and French divisions had been removed to Italy. True, American troops had reached France, but it was improbable that they would be able to take their place in the line of battle before the middle of the summer. In April 1917 there were in France and Belgium 64 British, 108 French and 6 Belgian divisions, or 178 in all, opposed to 128 German divisions. At the end of the year there were 59 British, 98 French and 6 Belgian divisions, a total of 163, opposed to 175 German divisions. Further, the British and French divisions were considerably weaker at the end of the year than they had been at the beginning, though this was offset, to some extent, by a corresponding reduction in the size of the German divisions. Most important of all, there were still large German reinforcements, which might amount to as many as 40 divisions, and did, in fact, amount to 32, ready to come across from the Russian front. The Allies could only obtain reinforcements in the shape of formed divisions by withdrawing troops from Palestine and Salonika, and to this their statesmen were opposed. So fate decreed that at the very time when the Allies had at last found out how to breach the trench barrier, they were thrown willy-nilly on the defensive, and had to prepare to meet the greatest effort which Germany had yet made in the west. (F. B. M.)

III. German Offensive, 1918

The military situation of the Central Powers at the end of the year 1917 and the beginning of 1918 has been thus described by Ludendorff in his *Memories of the War*:—

"Throughout the latter half of 1917 I had strained every nerve to bring about the results that had now been attained, sparing myself no more than I spared others. The western front had held, the Italian army was defeated and the Austro-Hungarian armies in Italy were inspired with new courage. The Macedonian front was holding out. In the east the armistice negotiations were finished and the way to peace lay open to the diplomatists. Negotiations at Brest Litovsk were to begin about Christmas. There was a prospect of our winning the war. Only in Asia Minor had there been any hitch, but the great events in Europe had pushed into the background."

Under the influence of this hopeful outlook the German Supreme Command decided in favour of a decisive battle in the western theatre of war in the spring of 1918. This decision was justified in the first place by the collapse of Russia. Fortune had favoured the Central Powers there, apart from their own military successes. Yet these might be regarded by them as having made good fortune deserved. The problem of a "war on many fronts" had been clearly comprehended, and the principle of first completing the work that had to be done in the east had been consistently maintained. But the fortunes of war are seldom all on one side—as Hindenburg and Ludendorff were to discover. The peace negotiations in the spring of 1918 dragged on so long in Trotsky's hands that not only did a new appeal to arms, though a brief one, become necessary, but the final result was merely an "armed peace." This involved keeping strong German forces tied up in the east to secure the treaty and profit by it, and prevented the best use being made of these forces in the decisive battle of the war on French soil. But the fact remains that the chief presupposition—indeed, the indispensable one—on which the Supreme Command founded their project was the breaking up of the enemy in the east. By the end of March 44 divisions had gone to the west, followed in April and May by 15 other divisions, among which were 3 of cavalry.

It was a question of considerable importance whether, and to what extent, the participation of the Austro-Hungarian forces in the coming decisive battle would be possible. The Italian army, though not destroyed by the short autumn campaign of 1917, had been so thoroughly beaten, and was so unstrung morally, that it might reasonably be neglected as a military factor for the next few months. The offensive there had also had the important result of drawing off 11 French and English divisions from the French theatre of war to Italy. The duration of Italy's collapse was, of course, uncertain. It would presumably end automatically when the Central Powers dropped their menacing attitude. All the more was it important to maintain this. But it was not considered necessary to keep German fighting forces in the Italian theatre of war to this end. The *moral* of the Austro-Hungarian army had risen so markedly since the success of the last offensive that it seemed equal to carrying out this task without German support. The 6 German divisions in Italy were accordingly withdrawn during the winter, and were in the French theatre of war by the end of March. The German Supreme Command would have liked to use the Austro-Hungarian army to still greater advantage in the general scheme by bringing over a number of good fighting divisions and some heavy artillery to take a direct part in the forthcoming battles in France. This had been agreed upon in principle at a conference between Ludendorff and General von Arz on Nov. 3. The matter was further discussed in writing up to the beginning of Jan. 1918. But in the meantime other influences were at work, opposing the designs of the two Supreme Commands. According to Gen. von Arz the Austrian Emperor and Empress were averse to sending Austrian troops to fight on French soil against the French; and the non-German nations of the Austro-Hungarian Monarchy, supported by the Social Democrats, were strongly opposed to taking part in the war in the west. The German Supreme Command, on being informed of this, sent Gen. von Cramon, their representative with the Austro-Hungarian army in the beginning of 1918, "a definite order to insist upon a binding declaration." Arz replied that no Austro-Hungarian divisions would be available until peace had been concluded with Russia and Rumania, but that artillery could be sent, though it would be deficient in munitions. This offer was accepted.[1] General von Cramon succeeded in persuading Hindenburg and Ludendorff, in spite of the doubts which these proceedings had aroused in them, to make another request for the coöperation of Austro-Hungarian divisions in the western theatre of war. But Cramon's intervention with General von Arz in the meantime did not succeed. General von Arz explained to him in the end in strict confidence that it would not be agreeable to those in high places if infantry were sent to the west. As a last resource now the German Supreme Command tried to stir up its ally to an attack in Italy. On March 15

[1] Von Cramon, *Unser Oesterreichisch-Ungarischer Verbündeter*, p. 6. The number of heavy batteries sent was 46.

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Hindenburg implored General von Arz to arrange for an immediate offensive by the Austro-Hungarian armies in Italy, to relieve the German army in its difficult decisive battle. After some hesitation Arz replied on March 27 that he would rally all the means at his disposal and deliver a blow against Italy at the end of May which should completely break her.

Germany was thus left to carry out the decisive battle on French soil on her own resources. There were three enemies to be reckoned with: England, France and America. The British had borne the chief burden of the fighting during the latter half of 1917, when the great battle in Flanders had towered over all other events in significance. In spite of the lost ground in the Ypres sector, and the unavoidably heavy loss in fighting power, it could in the end be registered as a German victory in so far as the English had failed to achieve their strategic aim, the destruction of the German submarine base in Flanders. For the estimation of future prospects, at least as important as this happy issue was the apparent failure of the British attack system—with its unreserved employment of masses in a battle of *matériel*, and its methodical conduct of the offensive as a series of thoroughly prepared attacks with objectives limited in space and, once chosen, rigidly adhered to. It was believed that this system revealed a lack of capacity for operative manœuvring inherent in British leadership and in the British army. The tank battle at Cambrai in Nov. was looked upon as a further proof of this. Should the Germans succeed in bringing about a war of movement again in the west, their conviction was that they would prove themselves superior to the British.

Contrasted with the powerful effort that the British had put forth to gain the victory in Flanders, the ends for which their French allies were striving in the second half of 1917, after the failure of the great Aisne offensive, were apparently more modest. The local attacks to which they confined themselves at Verdun and later in the Laffaux corner turned out favourably for them, it is true, and inflicted considerable losses on the Germans. But on the whole their cautious strategy led to the deduction that the moral depression of the French nation and the army, which had set in after the battle of the Aisne, and was not hidden from the Germans, had not been overcome. Not that the German Command was likely to regard the spirit of France as permanently paralysed; on the contrary it was considered certain that the French army, in the following spring, would enter the struggle for final victory completely refreshed and stronger than before. In comparison with England she was the militarily stronger opponent, more skilled in strategy and tactics, and more dangerous.

When it had to be decided upon which of the two the German blow was next to fall, a success over the British therefore suggested itself as being more easily and certainly obtainable. Added to this there was the consideration—decisive from a political standpoint—that the principal enemy, England, would probably be more inclined for peace when she herself had suffered a crushing defeat. In this respect the estimated value of the respective opponents had altered considerably from that made by Falkenhayn, which had passed muster two years earlier. The war in which England was fighting with her own forces on the European continent was, since the battle of the Somme, no longer a "side show." She was, on the contrary, now conducting it with all her available forces, with the utmost tenacity and with her own weapons. For the rest it might be assumed that when the German "hammer blow" fell on the one enemy, the other would not stand idly looking on, but would either directly assist his ally or proceed to a relief offensive. One hammer blow would not suffice. A general battle was therefore launched. Ludendorff dwelt on this in making his report to the Kaiser on Feb. 13 1918 at Schloss Homburg, when he said:—

"The battle in the west which the year 1918 will bring presents the biggest military problem ever set before an army. France and England have grappled with it in vain for 2 years. . . . It must not be imagined that we are going to have another such offensive as in Galicia or Italy. It will be a stupendous struggle, beginning in one place and continuing in another, and will take up a long time."

As regards the relative strengths of the two sides, the German High Command cherished no illusions as to any marked numerical superiority for their own forces. The strength of the German army in the west was brought up to 194 divisions by the addition of divisions brought up from the eastern and Italian theatres. The Entente forces in France in Feb. 1918 were estimated at 167 divisions. If the 11 French-English divisions in Italy, which were easily available, were added to these, there remained only a slight superiority in the number of divisions on the German side. In artillery the German western army was not even quite as strong as its opponents. Ludendorff based his decision on the theory that the totals of the two fighting forces would balance each other. A factor which counted for much with the Germans was the physical condition of the army. An offensive attack best suited the character of the nation and the tradition and training of the troops. It was the more powerful form of warfare. Germany owed to it all her previous tangible successes. The ordinary citizen could see, through all his heartfelt longing for peace, that his efforts could only be rewarded when Germany had overthrown her enemies. Here and there, it is true, the same disintegrating influences which were undermining the war spirit at home could be seen at work in the army. But the influence of the good elements, which far outweighed the rest, stamped the whole as an excellent body of men. Their "will to win" was not indeed inspired purely by victory for its own sake. The attack was longed for also as a deliverance from the terrible battering which they had endured for years with resignation and with courage.

It now became supremely important to find out the precise moment at which the American forces would actively intervene. In a review of the situation drawn up by the German Supreme Command in the winter of 1917–8 it was stated:—

"The United States are forming an army of about 50 divisions, of which three only have as yet landed in France. One of these is at the front to be trained. The two others are in need of more training behind the front. By the spring of 1918 the American forces in France may reach a strength of about 15 divisions. The mass of the divisions will only be suitable for use on quiet fronts. Only the 3 divisions now in France may be expected to take part in a spring offensive. The corps of officers is not yet trained for war on a large scale. On these grounds the independent use of large American units in difficult positions will be out of the question at present. The drafting of reserves and the arming and equipment of the American troops are good. Training is still inadequate. But the first regiment put in at the front fought well during a German attack, and it is therefore to be expected that the American soldier, after more training and experience, will prove himself a worthy opponent."

In another calculation, made in Dec. 1917, the Supreme Command estimated the whole of the American forces that had been landed in France up to the spring at 450,000 men at most. A larger number was not to be expected on account of the lack of shipping for transport. The mass of this army could not be ready for an attack by the spring of 1918. The value of the Americans at first would therefore lie in their power to set free English-French divisions on quiet fronts. As a matter of fact this calculation of the American strength was too generous. The total number of Americans landed in France up to the end of March 1918 has been stated by the American Secretary of War at just under 370,000. Of these only 144,000 were included in the 5 fighting divisions. The fact that the Germans did not at once realize the full extent of the increase in American transports, from April onward, in response to the urgent demands of England and France, does not actually affect their review of the situation at the end of 1917 and the beginning of 1918. When Hindenburg and Ludendorff resolved on the decisive attack they were entitled to hope for so crushing a victory over the English and the French by beginning operations early that the palm of victory could not be snatched from them again even by very considerable masses of American troops, whose intervention would only become effective in the later war of movement. Supposing—as a basis for the actual starting-point of the offensive—the Germans to be in possession of the line Doullens–Amiens by the beginning of April, which was within the realm of possibility, the annihilation of the British army might be completed within that month. Meanwhile the battle against the French would have broken out in full force. During the months of May and June a decisive defeat had to be inflicted on them also. If that succeeded, the

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Americans—whose troops were for the most part not yet sufficiently trained for a war of movement—would merely be swept into the general debacle. Entirely inexperienced in the leading of great masses, they would hardly change the decrees of fate.

The Germans had of course to take into account the fact that even a complete military victory by the Central Powers in 1918 on the continent would not end the war, so long as the will of Lloyd George in England was unbroken. Again, should the Entente by a great effort succeed in readjusting the situation on the continent, the war of starvation could be carried on with greater effect in proportion as the submarine menace diminished. The question was therefore whether the Central Powers, after subduing their enemies on the continent of Europe, could still hold out economically. The opening of the Ukraine had come so late that it was extremely doubtful whether its resources would be available in time to stave off the threatened economic collapse of the nations of the Quadruple Alliance. Ludendorff had no illusions upon this point, being convinced that it was absolutely essential to have his military offensive in the west accompanied and supported simultaneously by a political offensive on a large scale on the English home front. This would be directed toward bringing about the fall of Lloyd George and persuading the English nation to accept rather Lord Lansdowne's efforts in the direction of peace. It was for the political leaders to call into being and carry out a propaganda offensive of this nature. The commander-in-chief could only demand it—and this he did.

As early as the middle of Jan. 1918, Ludendorff had handed in to the Imperial Chancellor, with a strong personal recommendation, a memorandum for a German political offensive drawn up by Colonel von Haeften. But this urgent warning to the political leaders of the State met with no response. The politicians were unmoved. Once more, on June 3 1918, Ludendorff made another passionate appeal to the Chancellor to undertake a political offensive against the English home front, again sending a memorandum by Colonel von Haeften, which this time included a detailed plan of campaign. But it was unavailing.

The question arises here whether the German Supreme Command would not have done better, at a moment when they were militarily strong, to attempt their utmost to induce the political heads of State to prepare the way for peace. Ludendorff's published memoirs show that it was never opposed to efforts aiming at an honourable peace that would safeguard the existence of the German Empire. But all the attempts in this direction made by the political leaders found the Allied Governments unresponsive, and were regarded merely as signs of internal weakening in the Central Powers. Ludendorff was to see for himself, shortly before the beginning of the great spring offensive, how little the attitude of the Entente statesmen had changed and how hopeless and damaging the renewal of any such attempt would prove. According to a credible report from a neutral country, Washington's readiness to enter into official peace negotiations depended upon the following preliminary conditions: the unconditional evacuation of northern France and Belgium; the payment of reconstruction expenses; Alsace and Lorraine to be made independent; the annulling of the treaty of Brest Litovsk, just concluded in the east; reference of all eastern questions to a peace conference to be summoned by the Entente; and a complete change of the Government system in Germany on lines to be laid down and enforced by President Wilson later. A commander-in-chief who, in the spring of 1918, should have pressed the political leaders to pave the way for peace negotiations under such conditions, without having tried for a decision on the field, would have been cursed by his fatherland.

Plan for a Break-through at St. Quentin.—Suggestions for an offensive had been made by the higher command of Prince Rupprecht of Bavaria's army group after the English offensive in Flanders had died down in the beginning of Nov. 1917. The suggestions culminated in the proposal to launch the main attack from the Armentières–La Bassée front in the direction of Hazebrouck against the right flank and rear of the British, on the assumption that they would certainly concentrate their forces in Flanders in the coming spring for a renewed break-through operation in the direction of the German submarine base. The Allies would then obviously be in a difficult operative position. The mass of their fighting forces would be crowded up on the extreme N. wing of the whole western front. To bring up strategic reserves would take time. On their left flank and rear lay the sea. For the British in particular, strategically less trained as they were, it would not be easy to deploy their closely packed masses in the direction of the right flank and to cover their threatened communications, all the more so as a large part of their non-mobile fighting material was rigidly fixed. Tactically the prospect of breaking through the front was a good one, since the attackers would be faced by few positions technically very strong. It was, however, recognized that the country would be a difficult one in which to follow up the attack, which would be hemmed in between two commanding ranges of hills, and still further confined to the left by the La Bassée canal. It would therefore have to advance mainly in the wet Lys depression, and the ascent to the Bailleul and Hazebrouck heights would have to be carried by fighting. On account of the wet ground the operation would probably have to wait until the middle of April. General Ludendorff fully acknowledged the advantages of the proposed operation, but laid stress on the serious difficulties presented by the ground, and above all on the point that the attack, being dependent on the weather, could not be made early enough. He considered that an attack in the region of St. Quentin offered better prospects. When the line of the Somme–Péronne–Ham had been captured, the attack could proceed in a N.W. direction, resting its flank on the Somme, and might succeed in rolling up the British front. The higher command of Crown Prince Rupprecht's army group held to its own point of view, however, that the attack on the line Armentières–La Bassée in the direction of Hazebrouck—code name "St. George"—was to be preferred on tactical and strategical grounds to any other offensive setting in farther to the south. Their reasons were thus stated in a memorandum of Nov. 20:—

"In consideration of the general political situation and the appearance on the scene of the Americans, the attack should clearly be made as soon as possible. On the other hand a decisive effect can only be attained if the objective, *i.e.* the mass of the British army, is securely united in massed groups in Flanders. This condition of security can only exist when the British in Flanders are preparing to attack. Our offensive can only set in when this has become a certainty. The British *must* attack in Flanders again in the coming year. They are forced to do so by our submarine base. We may therefore count on it with certainty and make a strategic use of the situation. Side by side with these considerations arises that of the difficult nature of the ground in the Lys depression, which makes it imperative *not to attack too early*. From previous experience and observation it would appear that considerable difficulty may be expected with the ground and the water up to about the middle of April. . . . The British in Flanders have similar ground conditions to consider. If *they* proceed to the offensive, *our* attack at Armentières–Estaires would presumably be possible also. We should do best therefore—both as regards the operative effect and the state of the ground—to wait until the British attack in Flanders. It will then be necessary at first for us to give way before the enemy offensive in Flanders and—so far as possible—on the French front also. If we accept the defensive battle, we shall have to tie up such strong forces in the process that we shall not be powerful enough for an attack. We can without hesitation afford to retire as far as the line Vladsloe–W. of Roselare–Werwicq, as the submarine base will still be covered."

Opposition was also raised in some quarters to an attack from the La Bassée canal front to the corner of Bullecourt, on the ground that it would come up against a strongly fortified system, and that no rapid result at the start could be expected. The enemy would, it might be assumed, gain time for bringing up his reserves from the north and the south. "Unless the circumstances change considerably in our favour there is a danger of the operations resulting in a pocket being formed in the front and not in a decision in the war of movement."

The idea of an attack delivered from the II. Army's front—code name "Michael"—was criticized as follows by the higher command of Prince Rupprecht's army group:—

"Decisive operations by the II. Army can only aim at a break-through of the enemy front and the attainment of the best possible results in the war of movement against the enemy's reserves. The

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Somme—an unusually powerful obstacle—will serve as a support for the left flank. The main idea of an operation on the II. Army front must therefore be to break through the enemy front in the first place, in order to protect the left flank against the French and roll up the enemy front toward the north. The operation would then be continued in the area between the Somme and the Pas de Calais against the enemy forces there, as a war of movement with a N.W. direction. The enemy would have his back to the sea. There would be a prospect of a decisive victory if the operation were pushed far enough forward. The progress of the operation in detail after the successful break-through would depend upon the measures taken by the enemy, and cannot be foreseen. Operations of this order presuppose strong forces, considerably stronger than would be necessary for the "St. George" scheme. The advantages of this scheme are that in the II. Army area operations are possible at all seasons; that the enemy positions—excepting those S. of St. Quentin—are not strongly built up and are but thinly occupied at the moment; that the question of strong enemy reserves need hardly be considered, as the British will make their attack in Flanders, and the French are not likely to make theirs against the II. Army. If the French should prepare an attack at St. Quentin, the German attack would have to set in farther to the north. The disadvantages are that the operations would lead through the ruined tract of country 'Alberich,'[1] and would involve crossing the wide area of the Somme battle, strewn with positions and craters; that the II. Army front runs from N.W. to S.E., while the direction desired for the main operation is N.W. It therefore becomes considerably more difficult to roll up the enemy front towards the N.W. after the successful break-through.

"The attack would first have to be made in a W. direction as far as the Somme, and could only later develop toward the N.W. A certain amount of time would necessarily be wasted before the operation of movement came into swing. This would give the enemy an opportunity of bringing up his reserves, the network of railways being favourable for the purpose."

Although General Ludendorff and the chief of the general staff of Rupprecht's group of armies, General von Kuhl, were agreed on the main point that the offensive should be directed against the British, the chief of the general staff of the German Crown Prince's army group, Count von der Schulenburg, held at first a directly opposite view, considering an attack on the French to be the better policy. "England, with her dogged self-confidence," he said, "is not likely to end the war on account of a partial defeat of her army. She will be more inclined for peace when the power of the French is broken by a heavy defeat." Count Schulenburg's proposal was "to attack in the Argonne and to the E. of it, and simultaneously to carry out a strong attack from the St. Mihiel region in a W. direction. The objective of the attack would be Verdun, and, if possible, the destruction of the portion of the French army enveloped by the attack. The wooded, indistinct character of the deployment area would make it easier to hide the preparations for attack. The attacks would have a good chance of success if managed as a surprise. The French would never get over the loss of Verdun. If the seizure of the fortress were combined with a decisive victory over a portion of the French army, which would mean depriving the French of the possibility of a really promising offensive in 1918, the French nation and its army would be swept by a great wave of depression:—

"The British are certain to attack in Flanders if we attack the French at Verdun. A French offensive may be predicted with equal certainty if the British are attacked. If the Supreme Command is not in a position to execute a big attack, and at the same moment fight a defensive battle in another place, there remains the possibility of evading the enemy attack on the threatened front by retreating. This could be carried out by the VII., I. and III. Armies, and also to a limited extent in Flanders presumably, but not E. of the Argonne or on the V. Army's front."

The armistice concluded with Russia on Dec. 15 made a considerable difference in the general situation. Russia no longer counted as a military factor, and the balance of power in the western theatre of war had now readjusted itself in favour of the Germans in consequence. All the reports received pointed to the conclusion that the Entente Powers would for the present limit themselves to a strategic defence, and would refrain from a great offensive until strong American forces became available. This was all the more probable because the effect of the submarine war so far could not apparently be considered so successful as to force Great Britain to undertake the destruction of the German submarine base in Flanders at an early date. This change in the situation removed the principal presupposition on which Gen. von Kuhl's proposed offensive at Armentières–La Bassée in the direction of Hazebrouck was based. The close massing of the British main forces in Flanders in the coming spring could not be relied on. It was far more likely that the Allies would distribute their reserves behind the front and place them in readiness round important railway junctions. It could not be denied that the operative conditions for a break-through in the St. Quentin region might also be unfavourably affected. The possibility of a French relief offensive had still to be faced.

In these circumstances Ludendorff refrained from laying down any definite direction for the attack against the British for the time being, reserving his decision until he could see how the situation developed. On one point only did he insist—the moment of the offensive must be fixed as early as possible on account of the Americans. With this in view the Supreme Command issued an order on Dec. 27 1917 for the preparation of several attacks on different parts of the front. The preparations were to be pushed forward so as to be complete by the end of March.

Count Schulenburg's original proposal—an enveloping operation at Verdun—had not yet been rejected, but was for the present only to be treated as a rough draft, the German Crown Prince's group using it as a foundation for an offensive from Champagne and the W. of Verdun on Clermont, and Duke Albrecht's group for an attack over the Meuse, S. of Verdun (code name "Castor and Pollux").

On one point the Supreme Command was now quite clear. The offensive must not take the form of a battle of *matériel*, such as the Allies had over and over again attempted, invariably without results. German aims would not be furthered by an offensive which condemned the forces to months of strain. The break-through must be made to lead up to a decisive operation in the open field. This could only be done if the enemy's trench system were overrun so rapidly that the reserves he had brought up could not arrive in time to intercept the blow behind the dinted-in front. A prompt and complete success was only conceivable at the moment of the surprise. This could only be attained by observing the strictest secrecy with the troops concerned in the attacks. Each army must be convinced that the attack which it was preparing was intended to be the one actually selected. To this end all preparations for attack, in respect of laying out communications, shelters, aerodromes, etc., were to be spread over the whole army front as far as possible. The placing of the troops in readiness was to come later, and was to be undertaken outside the selected battlefield by various large groups which could be quickly and secretly formed up for deployment in different directions by train and by night marches. Another feature was to be the deception of the enemy, who was to be perplexed by the semblance of an attack on the whole army front (artillery registration and so forth), by partial actions with limited objectives, and by feints of great attacks in other places. All the attack preparations were to be carefully observed on the ground and from the air, to see that they were not attracting attention. Although it might be impossible to prevent the enemy from discovering the direction of the attack in time, it might reasonably be hoped to keep him in uncertainty as to the movement and the scope of the attack, and the form which it was to take. Success therefore depended very considerably on the most rapid execution of the attack itself.

On Jan. 24 the Supreme Command decided which of the attacks should be carried out. The choice fell on the "Michael" operation in the zone of the XVII., II. and XVIII. Armies. At the same time the XVIII. Army was ordered to be transferred to the German Crown Prince's group of armies with the Omignon brook for its northern boundary.

In preparing for the Michael attack, the XVIII. Army's direction was to the N.E. of Bapaume; the II. Army's to the N. of the Omignon brook, and the XVIII. Army's to the S. of the Omignon brook on both sides of St. Quentin. The XVII. Army was to prepare a simultaneous attack S. of the Scarpe (code

[1] "Alberich" was the code name for the destruction of the ground surrendered on retreat to the Siegfried positions in the spring of 1917.

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name " Mars South "), and the VII. Army another S. of the Oise across the front of the Crépy group (code name " Archangel "). The Michael operation was to take place about March 20, the Mars South and Archangel attacks a few days later after the regrouping of the necessary artillery and mine-throwers. The aim of the Michael attack was to be a break-through of the enemy front as far as the Somme on the line Ham–Péronne, and an advance, in conjunction with the Mars attack, on the right back of the Somme through Péronne–Arras. The Archangel attack had merely to make a diversion, and try to seize the heights E. of the Oise-Aisne canal.

The Supreme Command also gave instructions that preparations for the attack over the Lys depression at Armentières–Estaire (St. George I.) and towards the Ypres salient (St. George II.) by the VI. and IV. Armies were to be pushed forward so as to be completed by the beginning of April. The idea of an enveloping attack at Verdun (" Castor and Pollux ") was allowed to drop, as the chief of the general staff of army detachment C. had held out only very moderate hopes of success for an offensive S. of Verdun across the Meuse. On the other hand, in the event of a great French attack in Champagne, there was some thought of letting the III. Army fall back within certain limits, while the I. Army delivered a flanking counter-attack.

Ludendorff thus held fast to his plan of directing his offensive blow against the British. In choosing the Michael instead of the St. George operation, he was influenced chiefly by the fact that it would be independent of seasons and weather conditions and could therefore be carried out earlier. The tactical attack would, moreover, fall on a particularly weak spot in the enemy's front.

The idea of a diversion on a large scale, to take place either before or simultaneously with the Michael operation, was abandoned, as it seemed necessary to use all the available forces for carrying out successfully the one great blow as planned. On the other hand the Supreme Command arranged for deceptive measures to be taken at various points on the armies' front, *e.g.* a lively artillery battle on the St. George and Archangel fronts; partial actions on the I. and III. Armies' fronts, particularly at Verdun; a long-range artillery battle on the Lorraine front. These commenced in some cases in the beginning of March, and were continued in the days immediately preceding the battle and until after it was well started.

On March 10 Hindenburg sent out a definite order fixing the morning of March 21 for the attack. According to this order the centre of gravity of the operations lay in the XVII. and II. Armies both at the beginning and during the later development. After achieving the first great tactical aim—the cutting off of the British in the Cambrai sector, the offensive was to be carried N. of the Omignon brook in the direction of Albert–Arras and beyond, where the British front was to be dislocated by the VI. Army. The XVIII. Army was only required to cover the left flank S. of the Omignon brook, and to this end to take possession of the Somme and of the Crozat canal. Its deeply echeloned right wing could be extended northward to Péronne in case of necessity. An additional order from the German Crown Prince's army group in the meantime paved the way for the idea of a new move by the XVIII. Army by contemplating the possibility of its advance over the Somme and the Crozat canal. General von Hutier, commanding the XVIII. Army, at once grasped this idea —it had probably occurred to him before—and, in a document handed in to the army group on March 15, proposed as the XVIII. Army's task " as soon as the Somme and the Crozat canal had been crossed, to draw upon itself the French reserves designed for the support of the British and beat them, and to break the communications between the British and the French. . . . The sooner the army reached the line Chaulnes–Roye, the more chance would it have of meeting the French while they were still deploying, and the better the prospect of bringing about the war of movement." The Higher Command of the army group passed on the proposal with the additional note: " the more the French counter-offensive spends itself on Rupprecht's army group, the more effectually will the proposed operation hit the French. The enemy will be quick to recognize its decisive meaning and the threat to his capital. We may, therefore, expect a very strong resistance, and on that account the operation must be launched by powerful forces."

Ludendorff's attitude toward this proposal is not known. It would appear from a conversation over the telephone with General von Kuhl on March 20 that he had already weighed the possibility of accommodating himself to the idea if circumstances so shaped themselves, since he now intimated his intention of fixing the centre of gravity for the advance of the XVII. Army in the direction of St. Pol, and that of the II. Army in the direction of Doullens–Amiens—in case the XVIII. Army should meet with strong French opposition on the line Bray–Noyon if not earlier.

The peace training of the German General Staff was based on the strategic and tactical principles of its former chief of many years' standing, Count Schlieffen. Although a declared champion of the Cannae idea, the Count had also definitely accepted the break-through in his reflexions and teachings, though only under the conditions of a war of movement. In choosing the spot for the break-through Count Schlieffen considered the tactical weak spot within the enemy's lines to be of the first importance as a clue. At the same time there must be the possibility of following up a successful assault and break-through by an operation in a useful direction. He therefore considered a simultaneous attack against the whole enemy front to be the best means of breaking through, as by this their forces would be tied up, the reserves engaged and the shifting of troops to another place prevented.

When Ludendorff in 1918 was faced with the problem of the break-through, it was *not* under the conditions of a war of movement. The outward appearance of the war had fundamentally changed in the war of positions which had lasted for years. The defence was established along the whole front in a modern field position constructed according to a technique based on experience. The German attacking force was therefore confronted everywhere with the task of overcoming the opposition of the enemy in its tactically strong positions. For this he needed—at whatever point the break-through was attempted—the means employed in siege warfare, in particular a large quantity of heavy artillery and flame-throwers. For all that, however, the enemy positions were not everywhere equal in their tactical power of resistance. The ground, constructional work, density of occupation, formation of reserves, and value of the defence troops, showed many points of difference, and admitted of the sorting out of strong and weaker portions of the front. Ludendorff formed his decision quite in the spirit of Schlieffen's teaching. He, too, spied out the enemy's weakness. For the choice of the English front the leading political motive was probably primarily responsible, but the decision also happened to be in agreement with the military considerations. For although the British and French troops, in respect of their power of resistance, in tactical defence might be assessed at equal value, the British were inferior to the French in the skilled handling of masses, in the art of defensive battle and in power of strategic manœuvre. The weak points within the 140-m. British front in question, Armentières–La Bassée and St. Quentin, had undergone an exhaustive critical examination by the Higher Command of Rupprecht's army group. If Ludendorff decided to attack at St. Quentin it was because he would be hitting the enemy at his weakest point.

Military critics have raised the objection that Ludendorff let himself be swayed too much by tactical considerations and neglected the demands of strategy, seeing his own task from the very beginning only as a battering performance, consisting of a succession of independent hammer-blows. There is nothing to support such views. Rather is it evident that Ludendorff, here as always, was basing his strategy on the prospect of a promising tactical battle in complete accordance with the Schlieffen ideas. The attack delivered from Lens in the direction of St. Pol, as recommended by the French Gen. Buat, was extremely difficult tactically and did not offer any guarantee of a prompt initial success. But on this everything depended. Moreover, Ludendorff, in placing the attack where he did, had had visions of one great definite strategic aim, to break through the front of the

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British army on its S. wing, cut it off from the French, and by pressing on its right flank and attacking it from the front cause it to waver and fall to pieces and force it back to the coast. What was that but a "Cannae operation," in which a natural obstacle—the sea—took the place of Hasdrubal? A second natural obstacle—the Somme—was to serve the German left wing, advancing in deeply echeloned formation, as a protection against a French flank attack. The difficulties presented by the unavoidable traversing of the ruined Alberich area, and the Somme battlefield with its craters, were fully recognized, particularly as regards shelter and the bringing up of fresh drafts. These difficulties would diminish, however, as soon as the operation reached out into the country as yet untouched by battle, to the W. of this zone. Only in case that did not succeed would the disadvantages of this wilderness as a permanent stopping-place become evident.

On one point indeed, and that the most vital, did Ludendorff's procedure differ from Schlieffen's form of strategy. The German attack was directed, not against the whole enemy front, but against a limited section only. The perfectly obvious reason for this was that the fighting forces and battle requirements came nowhere near being sufficient for such an undertaking. The question is, whether it would have been possible and desirable to carry out the Schlieffen idea in a general sense, if not literally. The aim of the attack on the whole front was to engage all the enemy's forces, particularly his reserves, who might otherwise in due course intercept and choke off the break-through, just as it became ripe for operative development. Ludendorff saw the danger of this quite clearly, and sought to avert it by feint attacks on as many parts of the front as possible, by threats of a great attack and by partial actions on a small scale. These measures undoubtedly had a great temporary effect. Pétain refused to send more than 3 divisions to Haig's hard-pressed front on March 24, on the ground that Ludendorff's main attack was to be at Reims, where the artillery battle had already begun. But the effect of these measures lasted only a short time, of course, and were limited as to material. The enemy's reserves were not absorbed, but could still, though after much delay, be moved and brought up to the decisive battlefield. It would certainly have been more in accordance with the Schlieffen idea if, alongside of these feint attacks and reaching beyond them, a serious diversion had been undertaken shortly *before* the main attack began. It would have had to be carried out by a strong but strictly limited number of troops, to give promise of a prompt initial success and to have a limited objective. For this purpose, so far as the British front was concerned the "St. George" operations across the Lys depression were not possible, on account of the season and weather conditions. In Flanders the circumstances were similar. There remained only the VI. Army front between the La Bassée canal and Arras. It may be questioned whether the attack, which was tactically very difficult here, would have succeeded to a sufficient extent in its object of tying up the strong enemy reserves. There were, in any case, important reasons for the decision not to make a preliminary diversion at this point in order to have a more powerful force to put in to the decisive battle itself.

On the French front things were essentially different. It was of the utmost importance that if the proposed operation were to succeed it should be secured from a strong flank attack by the French, and not be brought to a standstill by a relief offensive on a large scale. It is known that Ludendorff had intended the VII. Army to execute a diversion. But this was to take place *after* the great offensive had begun, and could not therefore have the effect of drawing off strong reserves of the enemy in a wrong direction and holding them fast there. The diversion would also be too closely in touch with the main attack as regards space. Several places had been proposed for a German diversion on the French front, such as the Chemin des Dames region and Champagne. Verdun was less suitable on account of the large force that would be required. The front of Duke Albrecht's army group in Alsace (Breuschtal) also seemed suitable. If the attack were made there the French reserves would be far away from the critical point of the coming decisive battle.

As far as the actual number of good attack divisions was concerned there were ample forces available. The spring offensive opened on March 21 with 62 divisions. Up to the close on April 5, 92 divisions had been put in, and even so not all the divisions available for attack purposes had been used up. This powerful mass would probably have been even more effective if it had not been used exclusively and directly for the break-through operation itself, but had been devoted in part to putting the French reserves into fetters at another place. General Buat even goes so far as to say that only by a series of diversions, delivered simultaneously or in rapid succession in different places, could the operative success of the break-through have been guaranteed. He admits however—and herein lies the point of the decision—that this method was impracticable for Ludendorff owing to lack of sufficient forces. For it was a question not only of having in readiness the required number of divisions but the massing of artillery, flame-throwers, airmen, munitions, motor columns and numerous other necessities of war. Of these the Supreme Command had not enough available for the furnishing of a powerful diversion immediately before or at the time of the main attack, if this was delivered on the scale planned. A diversion was therefore only conceivable in the event of a reduction of area or material in the main attack. But any reduction of this sort would have lessened the chance of a great and rapid victory on the spot selected, the indispensable condition of the undertaking.

The conclusions are that not only was the application of Schlieffen's theoretical ideal form for an operative break-through—the attack on the whole front—out of the question for Ludendorff, but the attempt to conform to the underlying idea in a modified form by executing a diversion on a large scale was not to be recommended in the spring of 1918, since the forces were insufficient. In practice the disciple was forced by existing circumstances to fall short of the master's theoretical standard laid down in time of peace.

But is it, as Buat thinks, the fact that the idea of the operative break-through was foredoomed to failure? Strategy is a system of makeshifts. This fundamental saying of Moltke's was fully appreciated by Count Schlieffen. Ludendorff had to act in accordance with it. If the enemy's reserves could not be tied up in another place and kept away from the scene of the main battle, and if, therefore, they might be expected to turn up there sooner or later, the work of the battle and the execution of the operative scheme would certainly be made more difficult. Whether the attacker, in spite of this, would have the strength to achieve not only a tactical victory, but the complete strategical success, which involved the destruction of the enemy, was the supreme question which only the god of battles himself could answer. If the reward due to his passionate efforts was withheld, he would have to moderate those efforts and reconcile himself to closing down the offensive and accepting the battle of *matériel* and its attendant overstraining of his forces. The first great hammer-blow would then at least have had the effect of a diversion. It would have accomplished its aim according to the Schlieffen idea of operations by shattering and absorbing a large portion of the enemy fighting forces. It was then for the command to show its skill in launching, as quickly as possible, a new attack to bring about a decision with the yet unused forces from another well-selected and prepared position.

This then was the problem of the break-through as it presented itself to the German Supreme Command.

The Great Battle.—As the Germans had not the means for equipping all the divisions on the western front equally, and as the essential value of the different divisions also varied for reasons connected with drafting, they were forced to limit themselves to a certain number of those which seemed most suitable for the purpose of the attack. These were the so-called mobile divisions. Altogether 52 of these divisions were made available for the beginning of the Michael operation. Besides these there were 10 divisions in the line directly taking a part in the attack, making in all 62 divisions. They were distributed as follows: XVII. Army, 15 mobile divisions and 2 divisions in the line; II. Army, 15 mobile divisions and 3 divisions in the line; XVIII.

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Army, 19 mobile divisions and 5 divisions in the line. The Supreme Command had kept 3 mobile divisions for the time being at its own direct disposal. These were brought up to the region of Douai shortly before the beginning of the offensive so as to be more readily available for carrying out the Mars attack, for which they were originally intended.

The bringing up of the attack formations that were destined at once for the offensive began at the end of Feb. and was completed according to plan. On March 10 the bringing up of munitions began. During the last few nights the artillery, flame-throwers and divisions were formed up for deployment. On the morning of March 21 came the attack, delivered simultaneously by all three armies on the whole front—over 47 m. wide—from Croisilles to La Fère. It came as a surprise to the British III. and V. Armies. Contrary to the expectations cherished, the offensive made less progress in the first days in the case of the XVII. Army and the right wing of the II. Army than on the left wing of the II. Army and particularly in the case of the XVIII. Army, on account of the powerful British resistance. The cutting-off of the Cambrai salient failed because of the enemy's timely evacuation. In consequence of this the Supreme Command on the afternoon of March 22 ordered the XVII. Army to extend the success of the II. Army by an attack aimed particularly in the direction of Bapaume, and to prepare for the attack on both sides of the Scarpe (Mars) with strong forces to the N. of it.

When it became evident, on the morning of March 23, that the XVIII. Army and the left wing of the II. Army were advancing unchecked towards the W. and would in all probability reach their nearest objective, the Somme, on that very day, an order was issued for continuing the operation, as soon as the line Bapaume–Péronne–Ham should have been won. "The XVII. Army will attack with strong pressure in the directions Arras–St. Pol, the left wing in the direction of Miraumont. The II. Army will take the direction Miraumont–Lihons; the XVIII. Army will take the direction Chaulnes–Noyon and will send strong advanced troops through Ham." The three divisions held in reserve were now given to the XVII. Army.

Through this order the whole operation was pushed a long way to the left. The XVIII. Army, which was originally to have extended its front northward to Péronne on reaching the Somme, thereby releasing forces from the II. Army to carry on the attack N. of the river, had now instead to cross the Somme and advance its right wing in a slightly S.W. direction toward Chaulnes. There were thus portions of the II. Army left S. of the Somme as well as the XVIII. Army. The Somme was therefore no longer used as a support against a French flank attack, for the offensive now took a N. direction along the whole front, N. and S. of the river, with the operative aim of separating British and French.

This most fateful decision of March 23 arose from the tactical consideration of exploiting the XVIII. Army's comparatively easy success to the benefit of the general battle situation, by making a rapid forward push. Had the XVIII. Army stopped at the Somme and the Crozat canal, as was originally intended, extending with its right wing only northward to Péronne, its fine initial success would have had no effect on the advance of the attack farther to the N., which had up till then not quite come up to expectation. If, on the other hand, it had carried its attack across the Somme and the canal toward the W., in conjunction with the S. wing of the II. Army, the enemy, who was still holding out against the XVII. Army and the N. wing of the II. Army, would have been threatened on his right flank. From the strategical standpoint the decision was even more difficult and more vital. The fundamental idea of the Michael operation had from the first always been that of beating the British and the British only. The French were only to be held off from intervention by flank action. To this end the whole of the XVII. and II. Armies were to find a field for operations to the N. of the Somme. The reinforcements sent by the Supreme Command were also to follow in this direction, being mainly disposed in echelon in rear of the II. Army's left wing for the purpose of taking over the flank protection down the Somme from Péronne. At a later stage there were probably some portions of the XVIII. Army similarly engaged N. of the Somme. This whole strategical idea would have fallen to pieces if the strong natural obstacle of the Somme had been relinquished as a support at this point. It was clear that the left wing of the armies, entrusted with the offensive solution of its task on the far side of the Somme and the canal, would very soon not only draw upon itself considerable enemy forces, but would gradually have to prepare for a counter-offensive steadily increasing in strength. It had therefore to be reinforced from the reserves, which thus, as well as a portion of the II. Army, were no longer available for use in the direction followed by the main operation. But despite these apparent disadvantages the decision must be approved from the strategical standpoint also. The position of the XVII. Army and the north wing of the II. Army, as it was on the morning of March 23, made it doubtful whether the strong enemy resistance here could be broken in time to arrive at operations in the open field at all before the arrival of enemy reinforcements. There was a danger that not only the British but the French might throw strong forces on to the battlefield N. of the Somme, and so block the break-through in or close behind the British trench system. This was made easier by the contact with the positions E. of Arras, which had been maintained. The Somme—at Péronne or farther to the W.—would then serve the defender just as well for a safe support as the attacker had hoped it would serve him. It would also form an excellent obstacle for the front farther on up to Ham. As the direct intervention of the French, according to the way in which things turned out, had to be reckoned with, everything depended on hindering them from carrying it out systematically. The French must be caught up into the whirlpool of destruction. But this could only be done by forcing their Bray–Noyon front and attacking impetuously in the open.

In the days that followed Gen. Ludendorff held stubbornly to his operative aim of separating the British and French. The distribution of the reserves that had been brought up later was organized accordingly. The centre of gravity of the XVII. Army's advance, originally directed toward St. Pol, was now, on March 24, shifted more to the S. toward Doullens. The course of the battle on the whole front, up to March 25 inclusive, justified the expectation of achieving its ambitious aim. As the XVII. Army had pushed its way through the whole system of enemy positions and had advanced with its S.wing to beyond the Ancre, it too began to operate in the open field. The situation was now such as to warrant the attempt to dislodge the enemy front, both at Arras and farther to the N., by frontal attacks; and the Mars attack on both sides of the Scarpe was fixed for March 28.

The first faint doubts as to the possibility of carrying out the main operation to its full extent might have been aroused by the experiences of the XVII. Army on March 26. Its S. wing, on which everything depended, gained very little ground beyond the Ancre. As, however, in the meantime the II. Army's right wing had achieved the difficult crossing at Albert, there was hope that the XVII. Army's advance would also quickly get into its stride again. On all the rest of the front the brilliant progress of the offensive so far, particularly the impetuous forward push of the II. Army in the direction of Amiens and that of the XVIII. Army toward Montdidier, raised expectations of a continuation full of promise. Ludendorff proposed to bring about the separation of his opponents by a gradual concentration of the II. and XVIII. Armies against the French, and to this end the Somme below and at Amiens had to be reached and also the Avre. But the far-reaching aims of the Supreme Command were not to be realized. On March 27 the XVII. Army's offensive came to a standstill, and the next day brought the failure of the Mars attack on both sides of the Scarpe. At this point, therefore, the operation against the British was finally abandoned. Ludendorff decided to attack their front as soon as possible in a different place, and ordered the immediate preparation of an attack on the VI. Army's right wing on the Lys front in the direction of Hazebrouck. It would, however, probably be 8 or 10 days before this could begin. Otherwise the continuation of the Michael operation, as it had turned out, seemed to promise success only

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in the direction where there was still movement, that is, on the S. wing of the II. Army and with the XVIII. Army. As the intervention of the French so far gave the impression of being precipitated, it was concluded that the opponent had not yet fully organized his forces. The point was to keep him from doing so now. The coöperation of the II. Army's N. wing, now held fast on the Ancre, in the forward wheel toward the Somme below Amiens, could indeed no longer be counted upon. It seemed, therefore, all the more urgent to get possession of Amiens, the strategically important railway junction, by the quickest means, and also to cross the Avre. The centre of gravity of the offensive was therefore laid exclusively on the inner wings of the II. and XVIII. Armies in the next few days, all reserves being switched off in that direction. However, no real progress could now be made in the direction of Amiens. A last attempt on April 4 broke down before the enemy resistance, which had visibly increased.

The close of the Great Battle left the Germans in possession of a narrow salient stretching far out toward Amiens. This position had its dangers, which necessitated perpetual watching, and kept strong forces tied to the spot. On April 24 the II. Army tried to improve its positions between the Somme and the Avre by a partial attack, which after a passing success at Villers-Bretonneux ended in a recoil. After this for a long time no important battle actions took place on this section of the front.

The Michael operation had not achieved the full operative success, but had nevertheless dealt the British a heavy blow and crippled their fighting power for a long time to come. More than 40 British divisions were seriously affected, and also about 20 divisions of the French army which had been drawn in.

In the light of subsequent criticism, the question arises whether General Ludendorff's leading idea would not have had more chance of being realized if the decision of March 26 had limited the objectives aimed at in one direction or the other. Persistence in the double intention of dividing the opponents and simultaneously dislodging the British at and N. of Arras by frontal shock had the effect of dissipating the still available attack energy of the reserves, and made it impossible to focus on a single object the largest possible part of the forces still capable of a great effort. In view of the general outlook the only limitation worth considering was one which would have facilitated the progress of the Michael operation by temporarily renouncing the Mars attack and the proposed frontal attacks farther N. which went with it. The danger then would have been that the British, not being threatened from the front, would throw all their available reserves on to the battle-field as it now stood, and also release forces from their front for the same purpose. It would be the task of the XVII. Army and the portion of the II. Army fighting on the Ancre to continue their attacks and so draw these forces upon themselves, preventing a flanking attack against the German main operation in the direction of Amiens. It was for the moment less important to gain much ground in the direction of Doullens, provided that the decisive blow on Amiens on both sides of the Somme were kept going. Supposing that the 5 divisions which had been put into the attack on both sides of the Scarpe had been used in the continuation of the Michael operation with the XVII. Army and on the right wing of the II. Army from March 27 on, it would have been possible by this time to shift a number of reserves toward the S. to the decisive wing. A portion of these reserves did gradually find their way to the wing S. of the Somme a few days later, together with a number of divisions which had been engaged in the previous fighting. But they arrived too late, and the offensive had meanwhile come to a standstill. The conclusion is that events might have shaped themselves more favourably, from an operative standpoint, if the decision of March 26 had limited itself to the separation idea, laying increased stress on this at the cost of the intention to break up the whole British front at the same time.

Finally, there is no doubt that the Germans, by their last attempt to get possession of Amiens, put too great a strain on their available forces. However strong the grounds for this, it should have been of supreme importance to the Germans to avoid the wearing effect on their fighting force of a battle of material. This would have been easier to accomplish if a decision had been made by the end of March to close down the Michael operation. Instead, the attack on April 4 placed the inner wings of the II. and XVIII. Armies in the salient over against Amiens on both sides of the Avre in so difficult a fighting position that, whatever the result, the reserve strength which was still coming in had to be committed and was used up.

German Attacks—April, May, and June.—Closely connected with the Michael offensive, which came to a standstill on April 5, was the VII. Army's Archangel attack which followed. Between April 6–8 the right wing of this army threw back the enemy from its positions S. of the Oise through Amigny and Coucy le Château to beyond the Ailette. The ground gained made an improvement in the difficult rearward communications of the XVIII. Army's left wing. Following immediately upon this came the resumption of the great operations by the Georgette attack on the Lys front. General Ludendorff had had this attack in view since the end of March, and had prepared it at first as a diversion only. When it became clear in the beginning of April that the Michael offensive would not lead to a complete operative success, the Georgette attack was extended in its scope and aims to an operation for forcing a decision. It was proposed to break through the British–Portuguese front in the direction of Hazebrouck–St. Omer and then to continue the operation through St. Omer–Béthune and as far to the S. as possible. The VI. Army was to attack on the front Armentières and the La Bassée canal with its centre of gravity on Hazebrouck; the left wing at first only to wheel in on the general line Aire–Béthune–La Bassée canal; the centre to push through toward Hazebrouck and the heights W. of it and to seize the canal crossings between St. Omer and Aire; the right wing to take possession of the commanding heights to the E. and S. of Godewaersvelde and then to take the direction of the barrier of heights at Cassel. The IV. Army, attacking one day later from the line Hollebeke–Frelinghem, was to attach itself with a strong left wing. Armentières was to fall by envelopment. Beyond all these there was a proposal for the IV. Army to attack in Flanders from the Houthoulst Forest in the direction of Poperinghe, with the object of cutting off the Ypres salient.

The enemy's situation seemed favourable to the Germans. The British had hardly any more fresh reserves to draw on, so that the only reserve to be considered consisted of divisions worn out by fighting. The Portuguese stationed on the Lys were not credited with any great power of resistance.

Seventeen divisions from the VI. Army and 4 from the IV. Army were placed in readiness, and the necessary artillery was brought up, some of it being obtained by regrouping from the Michael front. In the course of the operation 14 more divisions, mostly from the zones of the XVII. and II. Armies, were put in.

The attack by the VI. Army, beginning on April 9, took the opponent at first by surprise. On this same day the whole stretch of the Lys at Sailly was conquered. But the battles of the next few days, though successful, were obstinate and costly, and already it appeared doubtful whether the attack would develop into a break-through. The left wing had not succeeded in taking Festubert and Givenchy or in reaching the canal. On the other hand there could be no question of stopping the offensive immediately, as the inner wings of the VI. and IV. Armies were still fighting in a difficult tactical position. Their position improved, however, with the seizure of the Neuve Église and Bailleul heights, but in general the gains of ground were only local. The advantages of the initial surprise were forfeited and the opponent found time to organize his resistance more and more thoroughly. The hope of being able to set the interrupted operation in motion again by a surprise assault on the Belgian front, delivered by the IV. Army from the Houthoulst Forest, vanished when it became known on April 16 that the enemy was eluding the carefully built-up attack from the Ypres salient by slipping away behind the Steenbeek. The IV. Army higher command considered that on account of the difficult ground the attack across the Steenbeek had no chance of success unless it were newly organized, and postponed

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the execution from day to day. As since April 17 the French had been established at Wytschaete the arrival of further French reinforcements had to be reckoned with.

On April 20, therefore, General Ludendorff ordered the beginning of the offensive. With a view merely to improving the tactical situation of the inner wings of the VI. and IV. Armies the attack on Mt. Kemmel was carried out on April 25. The piecemeal capture of Festubert and Givenchy did not succeed.

On May 1 Ludendorff came to the decision to place Rupprecht's army group and also the XVIII. Army on the defensive for the time being. The Georgette operation had, apart from destroying the Portuguese, undoubtedly inflicted another heavy blow on the British army. Its losses in the defeats of March and April might be estimated at not less than half-a-million men. The fact that Foch was forced to send about 18 French divisions and 6 cavalry divisions to Flanders suggested that the British alone were not in a position to resist the pressure put upon them. It was also an important point for the German Supreme Command that it had for many weeks had the lead in the western theatre of war and had forced the opponent to stand on the defensive. Yet it could not record any operative success in this new place. Then, too, the Michael and Georgette offensives had used up a large number of forces—113 divisions—and this fact weighed heavily. Taken in conjunction with the difficulties about drafts there was no doubt that the balance of forces was gradually becoming unfavourable to the Germans.

It is indeed questionable whether the German command had it in its power to raise this strategically unsatisfactory result to the level of a striking success. With the forces actually available, and those that were put in, it would hardly have been possible, even if certain errors in the subordinate command had been avoided. The greater part of the divisions used did not belong to the mobile divisions, which had been trained and equipped for the attack, and others were worn out by fighting. There was, therefore, a certain lack of the necessary freshness and tenacity in attack. If the German Supreme Command had decided at the end of March to stop the Michael offensive and desist for the time being from the attack on the Archangel front, there would have been fourteen more unused divisions available at the beginning of the Georgette attack. With this additional strength considerably more pressure could have been exercised, particularly by the IV. Army, to the N. of Armentières and N.E. of Ypres.

With the situation as it stood at present the difficulties in the way of forcing the decision of the war before the Americans made themselves felt were growing. In spite of this Ludendorff remained unshaken in his aim, clearly recognizing that the Germans could now only achieve a success through their own initiative and by working against time. All the clever advice that subsequent criticism felt obliged to offer Ludendorff is met by the objection that by none of it could the victory of the Germans have been achieved. If the Allies were now allowed time, and were able at a self-chosen moment to use their fighting force, with its ever-growing superiority in personnel and material, for their own final blow, the war might be given up as lost at once.

The necessary forces were lacking for an immediate fresh German offensive. During the next few weeks it was imperative that the mobile divisions, some of which had been overtaxed, should be allowed to rest and freshen up again. By May 27 the German reserves had been brought up to 81 divisions again, exclusive of the transport movement from the east. Of these 58 had been resting.

The direction which the operations were to take had now to be decided. The French and British now formed a united front, and the former plan of beating each separately was no longer in question. At the end of April there were from 10 to 12 French infantry divisions and 6 cavalry divisions established in Flanders. In front of the German XVII. Army at Doullens was the French K. Army with from 5 to 6 divisions. At Amiens and S. of it stood a group of from 12 to 14 fresh French divisions. As Foch had also released about 20 divisions by putting in territorials and Americans and economizing on numerous sectors, he now had at his disposal a reserve of over 60 French divisions. About half of these he kept to defend the coast and at Amiens, the other half being apparently distributed in readiness before the fronts of the remaining army groups. An offensive to force a decision against those sectors of the front held almost exclusively by the French from the Somme to the Swiss frontier promised the Germans a far-reaching operative success, at whatever point it might be attempted. The one sharply-defined objective in this connexion was Paris. But on the way there an encounter with the French army, prepared to defend it to the uttermost, was certain; and a defensive battle for them would have various advantages. On the other hand if a German attack should sooner or later find itself stuck fast on the way to Paris or in Champagne—as might almost certainly be predicted—the Germans would be in an unfavourable position for operating, with their line bent more or less far forward toward the S.W. or S. There seemed more prospect of success in resuming the offensive on the Michael—or Flanders—front, where the objectives were not fixed so far away. After all, the Germans had covered half the distance from St. Quentin to Abbeville in March well within a week. If they could succeed in doing this again with the same bulk and expansion, they would throw the enemy forces opposing them into the sea. But even with less success at first they might hope so to cramp their opponent's freedom of movement that his power of prolonged resistance would weaken, and he would be completely crushed by renewed hammer-like blows. The German Supreme Command therefore sought to gain their strategical aim as before in an attack on the northern part of the enemy's front. Clear on this point, it was again confronted, as in the spring offensive, with the choice between carrying out the operations in Flanders or farther S. against the Arras–Amiens front.

Acting on the suggestion of the Higher Command of Prince Rupprecht's army group, General Ludendorff in the beginning of May decided on the Flanders attack. The determining factor was the knowledge that an attack from the Michael front in the direction of Doullens would tactically be extremely difficult, depending for its success on a simultaneous side-attack from the region of Béthune, for which the forces were not adequate. But as there were still strong French reserves in Flanders at the time, Ludendorff decided not to lead the attack against Poperinghe–Hazebrouck until a diversion in another place had drawn off considerable portions of this reserve from the Flanders front, leaving it weakened in consequence. At the suggestion of the Higher Command of the German Crown Prince's army group, a diversion—offensive within a limited area from the VII. Army front on the Chemin des Dames across the Aisne as far as the Vesle—code name "Blücher," was given preference over an attack by the I. Army in Champagne, E. of Reims, because its clearly defined aim offered the promise of a line suited both to a prolonged defence and a continuation of the attack. The VII. Army's task was limited to carrying the offensive over the Aisne sector on both sides of Soissons and over the Vesle as far as the heights to the S.W. and S.E. of Soissons and S. of Fismes, while the right wing of the I. Army was to accompany the attack westwards past Reims and nearly up to the Ardre. There was also an idea of letting the XVIII. Army push forward its left wing across the Oise to split up the counter-offensive.

By choosing the Blücher attack Ludendorff was again faithful to his principles in selecting a markedly weak spot in the enemy's front. There were at this time in the front line only 6 French divisions—of which 2 were worn out and 1 weakened by illness—and 2 British divisions which had been defeated in March and April. As regards reserves, there were supposed to be 2 fresh French divisions and 2 that had previously been beaten in the region between Compiègne and Reims. As against these the VII. Army had 29 divisions, the I. Army 4 divisions at its disposal. The Supreme Command reserved the right of taking back strong artillery forces from Rupprecht's army group and the powerful fighting divisions drawn back behind their front. This time, too, the attack was to break out as a complete surprise, and be relieved by opportune feints on different parts of the other armies' fronts. Owing to the comprehensive preparations the Blücher attack could not be launched until nearly the end of May.

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It began on May 27 and succeeded beyond all hopes. By the evening the VII. Army's centre had reached the Vesle on both sides of Fismes, the wings holding back somewhat. The morning of the 28th brought an emphatic reminder from Ludendorff that the object was to get possession as quickly as possible of the high ground W. of Braisne, S. of Fismes and Bazoches and N.W. of Reims. The right wing was to advance by means of a sharp attack to a line on the high ground between the Oise and Aisne canal and the Aisne in a W. direction. The successes of the 28th enabled fresh orders to be given for advancing the objectives of the centre and left wing to Fère en Tardenois–the heights S. of Coulanges–the S. front of Reims. If the opponent evacuated the territory between the Aisne and the Oise, the XVIII. Army was to draw up forces on the S. bank of the Oise about Noyon and to gain ground in the direction of Compiègne. On May 29 the successes on the VII. Army's front were spreading rapidly, and orders were given at noon for the attack by the left wing of the XVIII. Army and the VII. and I. Armies to be continued in the direction of Compiègne–Dormans–Epernay and the block of hills between the Vesle and the Marne, S. of Reims, taken as a protection against Chalons. The progress of the VII. Army corresponded to these instructions. The I. Army, which had had difficulties to contend with, received an order on the morning of May 30 to reënforce its right wing from the centre, and shoot out its fighting line to the S. and S.W., thereby facilitating the envelopment of Reims. The VII. Army meanwhile had reached the Marne on the 30th with its centre, and on the following day gained a good deal of ground in the direction of Villers Cotterêts, but the two wings of the attack did not seem able to make any further progress. The Supreme Command was for the moment inclined to send portions of the VII. Army over the Marne to push forward on Epernay, with the idea of getting the attack of the I. Army into swing again. But this scheme was dropped in consideration of the state of the troops and the strength of the enemy's resistance. The I. Army was to have a rest, and then be required only to undertake partial actions with limited objectives and to capture Reims. The Supreme Command was now anxious to get the centre of gravity fixed on the W. front of the VII. Army in the direction of Villers Cotterêts and La Ferté Milon, in order to attract powerful French forces. Reënforcements were therefore sent up from the zones of the other army groups. But the VII. Army attack in a W. direction made no more progress to speak of in the beginning of June, as the French had established themselves here in great force by hurrying fresh troops on to the scene.

The continuation of the offensive now depended on the progress of the attack launched on June 9 from the S. front of the XVIII. Army on the Matz brook and the Aisne above Compiègne (code name, "Gneisenau"). But this attack by the XVIII. Army did not have the anticipated success, which would have justified the immediate opening of the Flanders offensive, but came to a standstill on April 11. A blow delivered by the VII. Army against Villers Cotterêts to the S.W. of Soissons on the following day also failed, and as the immediate continuance of partial actions by the I. Army did not look like succeeding either, a lull set in along the whole new front of the German Crown Prince's army group in the middle of June.

The Blücher attack was not looked upon as an operation to force a decision, but rather as a diversion. The fact that the original limited objectives were exceeded in consequence of the unexpectedly favourable course taken by the attack is not incompatible with the leading idea, which aimed at holding and destroying the greatest possible number of the enemy's forces. This aim was fulfilled. The total number of the French engaged in the defence against the Blücher offensive was estimated in the beginning of June at over 40 infantry and 3 cavalry divisions. On the Marne the wavering French lines were only saved by fresh American divisions. This time the Germans spared their troops by avoiding costly independent battles of only local importance. At the same time the development of the tactical success should not have brought about an unfavourable operative situation at the close of the offensive. But this was exactly what happened. As the wings had not succeeded in getting the region of Compiègne and Reims, with its hilly country, under their control, a new sack-like bulge had been formed in the German position, with the flanks bent far back, to maintain which strong new forces would have to be put in. The rearward communications of the VII. Army were particularly unsatisfactory owing to the lack of railways. This unfavourable operative situation could perhaps have been avoided if from the beginning strong pressure had been used to push forward the right wing along the Oise to the Marne, and the I. Army to Reims, at the cost of some of the excessive amount of ground gained in the centre. Later attempts to work up the operation from the centre were impaired by the gradually failing fighting strength of the troops. According to Ludendorff a subordinate command also failed to carry out a swift and powerful advance through Soissons. The advance of the VII. Army's right wing along the Oise, which began later, was inadequately provided with the means of attack, and the Gneisenau attack by the XVIII. Army W. of the Oise, which followed, was apparently even less well prepared; neither could retrieve the results which could presumably have been obtained without much effort at the very beginning of the offensive, had the forces on the VII. Army's right wing been differently grouped. The disadvantageous strategic situation at the close of the attack corresponded with the tactically difficult fighting position in which the tired-out German divisions were confronted with the active defence offered henceforth by the French and Americans.

The German Offensive in July.—The effect of the Blücher attack very soon made itself felt on the front of Rupprecht's army group, where no little relief was felt. The enemy's fighting activity diminished, and a portion of French reserves intended for the support of the British vanished from the scene. All the same, this degree of slackness on the enemy's part did not seem to the German Supreme Command to warrant the carrying out of the planned and prepared attack on the Flanders front (code name "Hagen") for the present. They hoped first, by carrying out another of the diversions on the front of the German Crown Prince's army group, to rob the British of the last of their French support, and even in certain circumstances to force them to send direct help themselves to their hard-pressed ally.

On June 14 Ludendorff arranged for the German Crown Prince's army group to attack with the VII. Army across the Marne, E. of Château-Thierry and between the Marne and Reims (code name "Marneschutz"), and with the I. and III. Armies between Reims and the Argonne (code name "Reims"). July 10 was the date aimed at for the beginning of the offensive. About 10 days later, after a rapid regrouping of the necessary artillery and so on, the Hagen attack was to be executed by Rupprecht's army group in Flanders. Ludendorff in his *Memoirs* gives the reasons for selecting new points of attack on the French front as follows: "The greater part of the enemy's reserves were to be found within the curve formed by the XVIII. and VII. Armies in the direction of Paris, only weak forces being left between Château-Thierry and Verdun. The Supreme Command intended this time also to attack the enemy where he was weakest."

The underlying idea of the VII. Army's far from simple operation on both sides of the Marne toward Epernay was inspired by the desire to escape from the tactically constrained position brought about by the pocket on the Marne. By flattening out the left flank of the pocket by eastward pressure, not only would the army's rearward communications be widened, but the danger which perpetually threatened the right flank would be diminished. While the necessity of supporting this flank on the sector from Villers Cotterêts to the Marne during the attack was pointed out to the VII. Army, the forces needed for such support were not placed at its disposal. It is not by any means clear on what grounds the decision was taken to extend the diversion very considerably toward the east by calling in the III. Army. It was probably in the hope mainly of splitting up the enemy defences along as wide a front as possible. General Buat points out that the offensive, if successful, would have opened up brilliant strategic possibilities, such as extending the successful advance in the direction of Bar le Duc and rolling up

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the whole defensive position in the Argonne and toward Verdun. A shortening of the German position from Château-Thierry through Chalons to St. Mihiel would have been infinitely valuable.

On the other hand the 44-m. front required such large forces to occupy it that, contrary to the original intention, it was necessary to fall back on some of the divisions set aside for the Hagen attack in rear of the Rupprecht group's front. The inevitable consequence was the postponement of the date provisionally fixed for the Flanders attack to the beginning of August. Also the preparations for the combined Marneschutz–Reims attack proved so extensive and took up so much time that the date had to be put forward to July 15 at the cost of preserving secrecy. Once more the execution depended upon surprise.

Through carelessness and treachery the German plans became known to Foch to a great extent during the first half of July. He had found time for adequate preparation of his defence, which was skilfully adapted to meet the German conduct of the attack. In this way the offensive in the case of the I. and III. Armies came to a standstill everywhere in front of the French main position. The VII. Army succeeded, after a successful crossing of the Marne, in shattering the main line of defence in several places. But here, too, far-reaching results were unobtainable. On July 15 the German Supreme Command ordered the cessation of the attack for the III. Army, and on the 16th refused to allow the I. Army to continue after an attempt had proved vain. The VII. Army continued to advance with great difficulty until July 17 in some places. The offensive blow had in fact completely failed, because it fell upon an enemy who was not taken by surprise but was prepared to offer a resistance as obstinate as it was skilled.

Ludendorff lost no time in drawing his conclusions from the unexpected turn in the general situation, and immediately ordered the withdrawal of the right attacking wing of the VII. Army behind the Marne. He was determined to regroup his forces with all possible speed for the Hagen attack in Flanders. Hardly had the necessary steps been taken, however, when, on the morning of July 18, Foch's flank attack fell on the insufficiently supported W. front of the VII. and IX. Armies. Owing to the disproportionate initial success of this attack, the execution of the Hagen attack had to give place to the pressing necessity of putting fresh forces into the VII. Army and bringing it back behind the Vesle. This was the turning point in the conduct of the war in 1918, and at the same time in the whole of the World War. The German offensive had met first with a sudden interruption, then with its final close, owing to the initiative of the opponent. From this time onward the German Supreme Army Command was subject to the strategical law of the enemy.

If we pass in review the many plans of attack entertained by the German Supreme Command—the Flanders attack, for instance, was, if circumstances permitted, to be followed by an offensive on Paris or Amiens—the impression is easily formed that the leader of the German operations was no longer pursuing a definite operative aim, as at the beginning of the spring offensive and for some time afterward, but had as his sole object the shattering of the enemy by independent hammer-blows delivered one after another at tactically advantageous points. But all these hammer-blows represented not the end but the means by which the final decisive operation should be prepared, facilitated and brought to a successful issue with the highest degree of certainty and the least effort. One misgiving undeniably arises in considering this method. The limitation of the available attacking forces and fighting material made it impossible to make the individual blows follow each other so quickly that the enemy would have no time to recover between each, to a certain extent, to make good the losses he had suffered, to prepare his defence against fresh blows, or even recover so far as to proceed to counter blows himself. The question is therefore whether a different procedure, after the close of the May–June offensive at latest, might have had more chance.

Possibly the necessary forces for the Hagen attack in Flanders, which was to have been the decisive operation, might have been mobilized by the middle of July if it had been decided to sacrifice the whole of the territorial gains, which were exhausting and difficult to maintain permanently, made up till then in the Michael and Blücher offensives, by a retreat movement on a large scale by which the fronts of the XVII., II., XVIII. and VII. Armies would return to their starting positions. With these forces a new and overwhelming surprise attack in a totally different form might have been sprung on the enemy, which would prevent his throwing his released forces straight on to the Flanders front and there avoiding a crash. What Hindenburg and Ludendorff had achieved with unexampled skill in Nov. 1914, immediately after the great retiring movement through S. Poland, by advancing from a newly selected position to a flank attack on the right wing of the Russian main army, could have been repeated in the summer of 1918 on French-Belgian soil when the general situation was strategically favourable.

In view of the complete failure from the outset of the attempt to realize their daring and far-reaching projects, there has been too much of a tendency to accuse the German Supreme Command of misjudging the situation, overestimating the working value of their own instrument of war and underestimating the enemy. Yet it was under no illusions as to the difficulties that it was essential to overcome. It was clearly recognized that time was now, more than ever before, a factor on the side of their enemies. The British had regained their strength, the French were not yet sufficiently shaken, and the Americans were bringing unexpectedly large masses of troops to France with amazing rapidity. To set against these factors the German commander-in-chief could count on no more reënforcements of any kind. No additional force for attacking purposes could be extracted from the divisions left in Russia and Rumania, which had already given up all their men under the age of 32. The drafting reserve from home was becoming more and more meagre, bringing in only 28,000 men for the infantry in June as against 44,000 in May. It was composed mainly of returned lightly wounded men, and those who had recovered from sickness. The average strength of the German battalion in the field had sunk by the middle of July from the original 850 men to 660. The actual front strength was even considerably lower than this number. The process of disintegration within the army caused by the prevalence of revolutionarily minded elements, did not escape the notice of the Supreme Command. Taking all in all, there was no doubt that the fighting value of the troops was no longer on the same level as at the beginning of the spring battle.

In spite of this there was no compelling reason to doubt the adequate striking power of the jagged though not blunted weapon of the German army, so long as its intentions and plans were kept absolutely secret, as before, and the blow was once again aimed at one of the enemy's weak spots.

Unfortunately for the Germans, their method of attack had now lost its magic effect on the enemy, who had found times and means to organize his resistance accordingly. The July offensive had been made with the greatest circumspection and thoroughness of preparation, just as before; and the attacking forces were certainly not deficient in courage or endurance. But an essential factor in the success of the undertaking was lacking—no commander-in-chief can do without luck. Hitherto the luck had been generally with Ludendorff. Now, at the decisive moment of the World War, it deserted him, and went over to his opponent—his equal in determination and will-power, and now his superior too in strength. If Ludendorff had had the luck at Reims in July 1918 which attended him at Tannenberg, history might have acclaimed him the greatest commander of all time, because he had remained true in spite of everything to himself and his belief in his star. But this was not to be. (W. F.)

IV. The Allied Offensives of 1918

The fourth and last phase of the war was ushered in by the failure of the German Champagne-Marne attack of July 15 and the success of the Allied counter-attack at Soissons on July 18, the results and far-reaching consequences of which came as a surprise to German and Allied commanders alike. Von Hertling, the German Chancellor, has written: "We expected grave events

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in Paris for the end of July. That was on the 15th. On the 18th even the most optimistic among us understood that all was lost." To make clear the significance of that statement it is necessary to review briefly the condition of the opposing armies previous to the Soissons attack.

It was indeed well known to both sides that the German army was nearing the end of its offensive strength, but just how nearly German *moral* had been drained neither side fully appreciated until later for, superficially, it was good. The French army, on the other hand, was well known to be at its lowest ebb of *moral*. The French soldier, since April 1917, had ceased to be a war machine unit who could be depended on blindly to follow his leader and had assumed a certain independent thinking rôle. Discipline had slackened and orders to attack or defend stubbornly had lost their force unless the soldier wished to attack or defend stubbornly. Pétain considered, early in July, that, although he had a number of rested divisions in reserve, he had not a single division which could be relied upon to push home and exploit an attack successfully. Of such as he had the Moroccan Div. was rated the best. The superiority of the British *moral* had been offset by the numerical weakness of their battalions, and, although they were holding their own doggedly, their confidence in their allies had suffered a severe strain and grew still further impaired as the lower units became intermingled. The American army was, of course, as yet an undetermined factor.

It was therefore with a certain amount of reasoned justification that Ludendorff, aware of these conditions, to which moreover he added an amazing underestimate of the strength of the American effectives in France, conceived that one more push directed against the French army would put it into headlong flight and thus pave the way for a similar stroke against the British. The adverse factors in the Champagne-Marne project were, first, that the method of attack, the so-called "Riga model," now lacked the element of surprise, since the methods of concentration for it were now too well known to make concealment possible, and its success was further discounted because Pétain had discovered the tactical means of effectively stopping such an attack; second, that Ludendorff had overcentralized his command. No army group commander or army commander was called on or permitted to exercise judgment or decision; he could only carry out the plans devised by Ludendorff and his staff by methods similarly devised and prescribed. In the lower ranks of officers this benumbing influence was, if anything, still more strongly felt. Meanwhile, synchronously with his success in thus centring the power of decision in his own hands, Ludendorff had become preoccupied with a multiplicity of problems which had no immediate relation to the conduct of the army on the western front. Germany's allies, her own internal questions, the Russian and Near East situations, were all constantly taking his time and distracting his attention from the western front, although nothing on that front could be done without his dictation. A further cause of weakness was that propaganda, among soldiers and civilians alike, had been overdone. Although the soldier indeed still responded to propaganda, it was only to the most extreme statements. Therefore in order to stiffen in the men the will to fight more resolutely in the attack planned for July 15 they were told that the French were already beaten and exhausted; that the British were ready to go out of the war; that the American army could not get to France, and that, even if it could, it could not fight; that the Champagne-Marne attack was to be the "peace-assault" which would end the war if successful, although as a matter of fact the utmost which Ludendorff really expected of it was that it would pave the way for a similar attack on the Lys. When therefore this attack of July 15 failed, and the French army showed itself anything but a beaten force, and when, three days later, the supposedly non-existent Americans established alike their presence and their fighting ability by marching through the German lines S. of Soissons in a fashion which compelled the evacuation of the whole Marne salient, the scales dropped from the eyes of the German soldier. To him the war was now lost; it was time to go home. Thereafter, curiously enough, while no longer crediting his own official propaganda, the German soldier became most receptive to Allied propaganda, and looked to it for the truth.

On the Allied side conditions and conceptions were in general more correctly adjusted. The French leaders knew the weaknesses of their opponents, but were also cognizant of their own, and they were more successful psychologists in dealing with their own men. The British army, having again been recruited up to fighting strength, felt that it had nothing further to fear from the worn-down German army so long as the French line held. The American army, supremely confident in every rank, longed only for the opportunity to disprove the belittling judgments of its opponents and to remove the doubts of its allies as to its fighting capacity. Further, the Allied High Command had the supreme merit of being not only in capable hands but, to a rare degree, decentralized. The attention of its leaders was not distracted from its own field by the necessity of solving distant problems in politics or diplomacy, and was backed in all the principal Allied countries by statesmen who in every way supported and aided the military chieftains, without, on the whole, unduly interfering with the conduct of the armies. Although the Supreme Command was nominally in the hands of Marshal Foch, he was a coördinator of efforts rather than a dominant military commander; and in fact he lacked the staff which would have been necessary for such a control as that exercised by Ludendorff over the German armies.

The plan for the Soissons counter-attack of July 18 was not a new one. As early as the German offensive on the Aisne (May 27), it had been proposed by a member of Gen. Pétain's staff, had been approved by his chief, and its details had been worked out. Marshal Foch had likewise favoured it, although hesitatingly, because of the attitude of the authorities in Paris. The difficulties of execution at that time lay in finding divisions of "attack-class" for the spear head at the crucial point. By the middle of July, with the increasing number of American divisions, which had gained and were gaining battle experience, that difficulty disappeared. On July 11 Pétain, on Pershing's insistence, again urged this plan upon Marshal Foch, purposing now to make it immediately after the long-awaited German Marne attack. Foch gave it his approval, not indeed with any hope of gaining thereby any decisive advantage, but rather regarding it as a desirable counter-stroke to the German assault.

The striking success of this counter-attack, which in two days gained and held control of the German communications in the Marne salient, and thereby compelled its evacuation, brought to the Allied leaders, as it did to many in Germany, the discovery that the tide of victory had already turned. On July 24 Foch arranged a meeting of the commanders-in-chief at Bombon, to discuss the means of following up this success and of preserving to the Allies the initiative thus unexpectedly gained.

The chief misgiving of the French Government at this time, now that Paris had been rendered secure through the driving of the Germans back from the Marne, was the lingering apprehension that the enemy might still drive a wedge between the French and the British armies at Amiens. It was therefore particularly welcome that Field-Marshal Haig should propose an attack on the Amiens salient to be made by the newly formed Australian corps, now in that sector and desirous of making the attack, together with the Canadian corps, which had not yet been engaged in the year's battles. At this meeting also it was decided to assign to the American army the reduction of the St. Mihiel salient as its first distinctive operation, but meanwhile to employ this new army in completing the reduction of the Marne salient. All the commanders-in-chief at this meeting expressed themselves as favouring a continuation of offensive action, yet still with the idea of keeping the German army busy, of wearing it down, of seizing favourable occasions and localities for attacks to gain prisoners and material and reconquer useful bits of territory, rather than with any thought of a systematic plan for ending the war by victory before winter.

During the two weeks following this conference the German army was forced back slowly from the Marne salient, now become

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a mere pocket, which was, however, held stubbornly because in this area there had been captured from the French, in May, vast quantities of munitions and military supplies of all kinds and of materials which were urgently needed in Germany, but which there had not been time or facilities for removing. In addition a vast amount of German material had been brought up for the maintenance of the army on the Marne front, and for the July 15 attack. Much of this was irreplaceable, and the German army had to fight to gain time to remove as much of it as possible.

Ludendorff, who had been present with his army during the Champagne-Marne drive, was not especially disheartened at its result and had gone to Flanders hoping to recoup his failure in Champagne by hastening the preparations for his offensive next in contemplation in the Lys salient. It was there that he received news of the Soissons reverse. He immediately realized the threatening consequences to his armies of this Allied counter-thrust, and returned to Avesnes to arrange the necessary withdrawal from the salient.

Materially this retrograde movement did not seriously compromise the German army, since, except during the penetration by the three assault divisions (two American and one Moroccan) S. of Soissons on July 18 and 19, the withdrawal was made slowly and in good order, inflicting as heavy losses on the attackers as the Germans themselves suffered. But Ludendorff soon recognized that the Lys offensive would have to be indefinitely postponed and the troops destined for it used in easing the situation in the Marne salient, where the Allied forces—French, British, American and Italian troops—were now pressing vigorously from all points. What Ludendorff apparently failed to gauge correctly at this time was the resultant damage to the *moral* of the German army; neither did he yet, seemingly, share the conviction, which had now been brought home to the German people and to Germany's allies, that all hope of ending the war by a German victory was gone, and that the only question left impending was whether it would end by a compromise or by the utter defeat of the Central Powers. Had the German High Command faced at this time the logic of the situation and made a decision to do, after the "Second Marne," what most German officers have since agreed should have been done after the first battle of the Marne, namely, to retire to the line of the Meuse and re-form, subsequent history might have differed materially from the actual events.

As proposed by Haig on July 24, the Australian and Canadian corps on Aug. 8 attacked side by side the German salient facing Amiens, supported by a French corps on their right and a British corps on the left. This attack was one of the most brilliant and tactically interesting episodes of the war, and showed Ludendorff again that the much disparaged tanks were, on ground suitable for their employment, a potent factor in a surprise attack. Although the sector against which the assault was launched was held by first-class troops, the German divisions were overrun and virtually annihilated as organized units. This attack dealt a stunning blow to the pride of the German High Command, a deadly one to the weak *moral* of the troops, and produced a corresponding exhilaration in the British army, all ranks of which could now clearly see that a complete and final inversion of rôles had taken place.

The shock was felt throughout Germany and reacted strongly upon the Government. The unsuccessful Marne attack, with the subsequent withdrawal from the Marne salient, although manifestly a lost battle, had, nevertheless, been one initiated by the German High Command on a battle-field of its own choice. The battle of Amiens could not be so interpreted. The Allies had here initiated the attack and it had been completely successful. Ludendorff correctly names Aug. 8 as the "Black Day" of the German army in the war. So grave was the crisis felt to be that a conference of army leaders and members of the German Cabinet was called to meet at Spa on Aug. 13. It was there agreed that further prosecution of Germany's war aims was hopeless, and that a peace would have to be negotiated at the first favourable opportunity, that is, at the first turn in the military situation even temporarily favourable to Germany. That looked-for turn never came. Under the persistent Allied attacks the German army reserves steadily dwindled, munitions and supplies lessened, and *moral* evaporated.

The day following the Amiens success Foch decided not to put the American army—which now had some 1,250,000 men in France—in on the Vesle, where the situation was virtually stabilized, but to assign it at once the task of reducing the St. Mihiel salient (*see* WOËVRE, BATTLES IN).

The battle of Amiens was followed up by a French attack between the Oise and the Aisne on Aug. 20, which forced the German line back on Chauny. Still more serious for the enemy was the attack by the British III. Army, on Aug. 21, N. of the Somme, on the line Bapaume–Péronne, which brought another crisis. By the end of Aug. the military situation had become sufficiently defined to enable the Allied leaders to look beyond a mere driving of the German army back to its strongly fortified lines of the previous winter, popularly known as the Hindenburg line, and to make plans for its rupture in a way to reap the largest strategical as well as tactical fruits of victory.

For this the British army, now fully restored in man-power and in high *moral*, and the American army, untouched by war weariness or reverses, inspired by an almost religious fervour of belief in the righteousness of the cause in which it was fighting, were of necessity regarded as the chief Allied weapons. The French army was tactically a trained and skilled army, but could no longer count on any large reserves of man-power to replace losses, and the general feeling among the French that their country had already been "bled white" in the war led to the not unreasonable contention by Government and people that, while France must still do her share to the end, her army must from now on be spared as much as possible, since in any event French losses in man-power would far exceed that of any other nation in the war.

Foch, therefore, determined on two main offensives: the British, supported on their right by the French, were to break the Hindenburg line in the direction of Cambrai–St. Quentin; the Americans, after completing the reduction of the St. Mihiel salient, which had been assigned as their first task, were to break through the German lines of defence N. of Verdun, supported on their left by French armies, and to advance in the direction of Mézières. In other words, the German line in northern France, constituting as it did a huge salient, was to be attacked in the simple orthodox manner by pinching in the two flanks. Of these two the Americans had possibly the harder task, for the Verdun front was well adapted to and thoroughly organized for stubborn defence, and, inasmuch as the railway communications through Sedan–Mézières were essential to the German army so long as its front lay W. of the Meuse river, the Verdun front, only 50 m. in front of this railway line, was bound to be defended with all the vigour and skill still remaining in the German army. Connecting these two attacks, the French army was to continue its operations to throw back the Germans beyond the Aisne and the Ailette. Such was the Allied plan formulated in Foch's directives of Sept. 3.

By the end of Aug. the German High Command ordered the evacuation of the Lys salient, and it was completed Sept. 6.

On Sept. 2 the attack of the British III. Army N. of the Somme was extended northward, E. of Arras, to include the I. Army reinforced by the Canadian corps; and as a result the whole German army fell back to the so-called Hindenburg line, which the Germans themselves designated the *Siegfried Stellung*. There they hoped to gain time to reorganize the depleted units.

This withdrawal, and the accumulating evidences of increasing demoralization in the German army, made it evident to Allied military leaders that offensive operations on a still larger scale could be safely initiated; and Marshal Foch, in a conference with the British and Belgian commanders-in-chief at Cassel Sept. 9, arranged for a fourth offensive, on the extreme northern part of the western front, to force the Germans back towards Ghent.

On Sept. 12 the American I. Army, as previously agreed upon, attacked and captured the St. Mihiel salient.

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During the latter part of Sept. German H.Q., harassed and preoccupied by the crucial events which were taking place in other theatres, either gave insufficient heed to the precariousness and difficulties of the German military situation on the western front or were too stunned by their sudden and general reversal of fortune everywhere to be able to grasp and cope with them. Ludendorff, it is true, had two lines in rear reconnoitred: one from the Dutch frontier–Bruges–Valenciennes; the other Antwerp–Brussels–Namur–the line of the Meuse; but neither line solved the problem, nor could it be held in the face of a victorious pursuing enemy. The desideratum was to find a secure position for the army's winter respite from active operations, and time for the resting, reorganization and recruitment of the armies. It was possible to accomplish this only by a timely withdrawal, to the line of the Meuse at least, if not to the frontier. But Ludendorff still clung to the idea of holding every foot of French territory until the last possible moment.

On Sept. 26 the final Allied offensive, prepared by the directives of Foch, began. The American army under Pershing and the French IV. Army under Gouraud attacked on the Verdun and Champagne fronts (*see* MEUSE-ARGONNE, BATTLE OF). On Sept. 28 the Belgians, supported by a French army under Degoutte and the British II. Army under Plumer, attacked the line from the coast southward beyond Ypres (*see* YPRES AND THE YSER, BATTLES OF, *Part iv.*). On Sept. 27 the British III. and I. Armies, including the Canadian corps, had attacked on a front of 13 m. in the direction of Cambrai, and on the 29th the British IV. Army under Gen. Rawlinson, after a heavy bombardment lasting two days, attacked the St. Quentin sector.

The American and Belgian attacks had the advantage of coming as a complete strategic surprise; but, in the case of the Meuse-Argonne front, the depth of the fortified zone behind the front lines enabled the German reserves to be brought up and increasingly strong resistance to be made. Both British attacks were made against strongly organized positions held by the best troops the Germans still had; but on the front of the British I., III. and IV. Armies the enemy was already virtually on his rearmost prepared line, the attack was not unexpected, and both opposing armies appreciated thoroughly the consequences of victory and defeat. If driven from the Hindenburg line the weakened German army must thereafter fight in the open. The contest was therefore bitter to the point of desperation, but, even with the aid of the elaborate system for defence afforded by the long-prepared Hindenburg line, the struggle proved unequal, and the German army was forced back with heavy losses, to begin its retreat through the open country.

The German High Command had not appreciated the risk of accepting battle on the Hindenburg line, or else had overestimated either the strength of the position or the remaining fighting capacity of the troops. Once the line was broken, however, they awoke to the situation. On Sept. 28 Ludendorff and Hindenburg agreed that the end had come; on the 29th the Foreign Minister was informed of the army's desperate plight; on Oct. 1 Hindenburg and the Kaiser went together to Berlin, and on Oct. 4 the first peace offer was sent to President Wilson.

On the battle-front the Allies were not permitting events to lag, and this same day renewed efforts were made on all fronts. The French V. Army under Berthelot had advanced from the Aisne and on Oct. 6 reached the Suippe. On Oct. 7 Foch ordered the attack on the right flank, extended to include the heights E. of the Meuse. On Oct. 8 the British I. and III. Armies renewed their attacks, and in three days drove the Germans back beyond the line of the Selle river–Le Cateau.

Between the two sectors of the Allied main right and left flank offensives lay the strong defensive German positions W. and S. of Laon. On Oct. 9 these positions were abandoned by the enemy, and the whole German line between the Scheldt and the Aisne began its retreat. By Oct. 10 the American I. Army had penetrated to the last line of German defences on its front, the *Kriemhilde Stellung*, and cleared the Argonne forest, while on its left the French IV. Army reached the Aisne.

On Oct. 10 a new directive of Foch gave more distant objectives to the armies; the Northern Flanders Group was to advance toward Belgium; the British armies, debouching from the front Solesne–Vassigny, were to push both in the direction of Mons and toward Avesnes; on their right the French I. Army was to push up the Oise; while the French and American armies between the Aisne and the Meuse were to continue their northward movement. The Marshal defined the purposes of these converging attacks to be to force the Germans back on the rough Ardenne forest, where communications were lacking and a modern army would have difficulty in maintaining itself.

On Oct. 12 the French X. Army of Mangin, on the left of the V., reinforced by an Italian corps, passed the Aisne and occupied the Chemin des Dames. On Oct. 14 the army group under King Albert renewed its attack on the front from the Lys to Dixmude. The Germans were unable to hold; Lille had to be abandoned, and, under the combined pressure of this and the British attack, the whole German line N. of Cambrai rolled backward in disorder, toward the Scheldt, closely pursued. The Americans also attacked on the 14th, with important gains W. of the Meuse.

On Oct. 17 the British IV. Army and the French I. Army attacked the hastily improvised German line between Le Cateau and the Oise. On the 20th the III. Army attacked the line of the Selle, supported by the I. Army astride the Scheldt. Both attacks succeeded.

The conditions of the fighting are best understood by referring to the German reserves. From 69 divisions in reserve when the attack of Sept. 26 was begun the German army had been reduced by Oct. 15 to 26 divisions in reserve, of which only 9 were rested. Of the divisions in line many were unfit for combat, but could not be replaced.

Toward the end of Oct. the dissatisfaction in Berlin and elsewhere with the Government had become intense. The people felt that the war had been mismanaged and that they had been deceived. In an attempt to appease them Ludendorff was dismissed on Oct. 25, and his place as quartermaster-general was taken by Gen. Groener. But it was too late to save either the Cabinet or the Monarchy, for with the disaster to the army from the vigorous Allied attacks of Nov. 1 and following days the Kaiser was forced to abdicate on Nov. 9.

On Nov. 1 the Allied armies began their final drive. On the right the American I. Army on the Meuse-Argonne front effected a clean break through the German lines, and began an active pursuit which was only stopped by the Armistice on Nov. 11. On the left of the American armies the French IV. Army was equally successful. Farther N. the British I. Army attacked the line of the Rhônelle river and completed the evacuation of Valenciennes. This attack was followed on Nov. 4 by a general attack by the British I., III. and IV. Armies, on a 30-m. front, from Valenciennes to the Sambre, N. of Oisy. In spite of serious natural obstacles, having to force the crossings of the Sambre on the right and to penetrate the forest of Mormal in the centre, the line was advanced 5 m. on Nov. 4. This battle finally broke the German power of resistance, and the German army began a retreat along the entire northern front, though it still offered stiff resistance to the British I. Army on Nov. 5 and 6.

On Nov. 9 the important railway centre and fortress of Maubeuge was taken and the II. Army crossed the Scheldt on its entire front. On Nov. 11 the Canadian 3rd Div. captured Mons. Farther N. the Belgian army stood before Ghent.

On Nov. 9 Foch had telegraphed all commanders-in-chief: "The enemy, disorganized by our repeated attacks, yields on the entire front. I appeal to the energy and initiative of the commanders-in-chief and of their armies to render decisive the results gained." On the same day the German delegates presented themselves at Rethondes to ask terms for an armistice, which were accepted on Nov. 11.

During the last week's fighting the outbreak of the revolution in Germany, interrupting as it did the service of communication and the forwarding of supplies, had combined, with the pressure on the front, the depleted and disorganized condition of the troops, and the absence of any available reserves to replace broken and worn combat units, to render further resistance on

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the part of the Germans an impossibility. Had the Armistice not been concluded a great *débâcle* would have been the result.

Preparations had been made to extend the attack on Nov. 14 to include the Lorraine front E. of Metz, an attack which the German army was as little prepared to meet as it was to resist the advance of the whole Allied line to the north. But this proved unnecessary to secure the Allied war aims. (A. L. C.)

WESTER WEMYSS, ROSSLYN ERSKINE WEMYSS, 1ST BARON (1864–), British admiral, was born in London April 12 1864, the 3rd and posthumous son of James Hay Erskine Wemyss of Wemyss Castle, Fife. He entered the navy in 1877, was promoted lieutenant 1887, commander 1898, captain 1901, rear-admiral of 2nd Battle Squadron 1912–3, and of the 3rd fleet 1914, vice-admiral 1916 and admiral of the fleet 1919. He commanded a squadron during the landing of the British troops in Gallipoli (1915), was commander-in-chief in the East Indies and Egypt (1916–7), Second, and shortly afterward First Sea Lord of the Admiralty (1917–9), and member of the War Cabinet (1918). He was created K.C.B. (1916), G.C.B. (1918), and raised to the peerage (1919).

WEST INDIES, BRITISH (*see* 4.607* and separate articles on the various islands).—For administrative purposes, British Guiana and British Honduras are usually regarded as an integral part of the British West Indies, with which they have much in common. These two colonies are, therefore, included here. The area of the group remained unchanged in 1921, no new possessions having been acquired by Great Britain in the Caribbean and no territory alienated. The total pop., according to the latest estimates available in 1921, was:—Bahamas, 59,049; Barbados, 200,368; Jamaica, 891,040; Turks and Caicos Is., 5,615; Cayman Is., 5,564; Antigua, 32,865; St. Kitts, 22,415; Nevis, 11,596; Anguilla, 4,230; Dominica, 40,315; Montserrat, 10,182; Virgin Is., 5,557; Trinidad and Tobago, 386,707; Grenada, 74,490; St. Vincent, 53,210; St. Lucia, 51,505; British Guiana, 305,991; British Honduras, 43,586.

The Supply of Labour.—Though Barbados has a redundant population, the labour supply in the rest of the West Indies was insufficient for agricultural requirements, and the position had been aggravated by the emigration of British West Indians to Cuba, to which island they were tempted by the promise of higher wages, which did not, however, always materialize. Toward the end of 1919 this form of emigration began to assume serious proportions, no fewer than 21,573 labourers leaving Jamaica for Cuba, whilst only 6,457 returned. Recruiting for Cuba was also actively carried on in Barbados. With the slump in prices in 1921, however, the tide set in to some extent in the opposite direction, many labourers returning to their homes. In the British West Indies it was beginning to be realized that it is only by the payment of suitable wages, improved housing conditions and the offer of other amenities, that labourers can be induced to remain in their island homes. In British Guiana the shortage of labour was particularly acute, and with a population averaging only 3·3 to the square mile, no development of the hinterland on a large scale was possible.

In 1913, Mr. James McNeil and Mr. Chimman Lall visited the British West Indies to report on the system of indentured immigration prevailing in British Guiana, Jamaica and Trinidad, and though their report was favourable, Lord Hardinge, the then Viceroy of India, announced in the Indian Legislative Council in April 1916 the determination of the Government to abolish the indenture system. It was at first proposed to terminate the system gradually in order that the colonies might have time to adjust themselves to the change; but in practice emigration from India was completely suspended in the same year. In 1919, the need for labour having become acute in British Guiana, a deputation comprising representatives of all classes of the agricultural and commercial communities visited England to urge upon the India Office and leaders of Indian public opinion, who were then in London, the desirability of the resumption of Indian immigration on a free colonization basis. Representatives of the deputation and of the West India Committee subsequently visited India, where they interviewed prominent leaders and the members of the Government, who agreed to send a commission to British Guiana to report on the suitability of that country for receiving immigrants. The appointment of this commission was, however, delayed, it being felt desirable to await the views of the public in India regarding the proposals for dealing with the Indian question in Kenya Colony before proceeding further with the matter. In July 1921 an offer of the Indian Government to send a deputation to British Guiana was under consideration.

Government and Administration.—The question of political federation of these scattered colonies, which was discussed periodically, had failed up to 1921 to awaken any marked degree of enthusiasm in the several communities. Indications were not wanting, however, to show that a better understanding was being gradually brought about, in spite of the continued difficulties of communication. This was no doubt attributable to the work of a series of intercolonial conferences from 1899 to 1921, the main object of which had been to bring about a greater degree of uniformity in all matters of common interest concerning the British West Indies. All proved eminently successful, the Customs Conference in 1919, for example, having resulted in the adoption of uniformity of definition and arrangement of the West Indian tariffs, whilst the conference on law in 1916 was followed by the establishment of a West Indian court of appeal for the colonies lying to windward of the Caribbean. A further step in the direction of closer union has been the formation of an Associated West Indian Chamber of Commerce, which held conferences in Trinidad in 1917 and Barbados in 1920. In 1920–1 Grenada, St. Lucia, and St. Vincent individually petitioned the King for the substitution of representative government for the crown colony system. In the case of Grenada, the Secretary of State for the Colonies, to whom the matter was referred, consented to advise the King to approve of the introduction of the elective system into the constitution, the council to consist of the governor, as president, six official, three nominated unofficial and four elected unofficial members, the electives to be chosen by the people on the basis of the system of elected representation, already operative throughout the island in municipal affairs in the case of the district boards. The petitions of St. Lucia and St. Vincent, on the other hand, were rejected on the grounds that the signatories were not sufficiently representative in character.

In 1920 the Prince of Wales made Barbados his first port of call in his empire tour in H.M.S. "Renown," and visited in succession Trinidad, British Guiana, Grenada, St. Lucia, Dominica, Montserrat, Antigua and Bermuda on his homeward voyage. His Royal Highness, who was received with manifestations of the greatest loyalty wherever he went, took the opportunity of refuting the suggestion that Great Britain might be willing to dispose of her West Indian possessions to a foreign country in part settlement of her debt.

The World War.—The British West Indies contributed generously in men, money and produce toward the prosecution of the World War. Many hundreds of West Indians came over to England independently to enlist, and a contingent comprising 15,601 officers and men was recruited voluntarily for active service. The numbers of men recruited in the various islands, British Guiana and British Honduras, were:—

	Officers	Men
Barbados	20	811
Bahamas	2	439
British Guiana	14	686
British Honduras	5	528
Jamaica	303	9,977
Trinidad and Tobago	40	1,438
Grenada	4	441
St. Lucia	5	354
St. Vincent	..	305
The Leeward Is.	4	225
	397	15,204

The men were embodied in the British West Indies Regt., which served with distinction in France and Flanders, and also

** These figures indicate the volume and page number of the previous article.*

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in Egypt and Palestine, where they participated in the victorious advance to 'Amman. The total casualties were: Killed or died of wounds, 185; died of sickness, 1,071; wounded, 697. Private contingents were also sent over for enlistment by the Trinidad Merchants' and Planters' Contingent Committee and the Barbados Citizens' Contingent Committee for recruitment in the United Kingdom. In order to provide for the welfare of the West India and Bermuda military contingents, and of men coming over independently to serve in His Majesty's forces during the war, the West Indian Contingent Committee was formed in London at the instance of Mr. Bonar Law, the then Secretary of State for the Colonies, in 1915. The total contributions made by the British West Indies toward the cost of the war, relief funds, etc., amounted to over £3,250,000, the most notable amount included in that figure being the annual contribution of £60,000 for 40 years voted by the Jamaica Legislature.

Trade.—The war brought about a remarkable revival of prosperity to the British West Indies. the total trade of those colonies rising from £25,809,884 in 1913 to £43,637,324 in 1919. The chief staples, sugar, rum, molasses, cacao, cotton and arrowroot, all commanded greatly enhanced prices, the only industry, indeed, that reaped no benefit being that of the production of lime and lime products in Dominica, which was adversely affected by the lack of shipping facilities and by import restrictions in the United States. Some anxiety was caused in 1912 by the decision of the Imperial Government to withdraw from the international convention for the suppression of sugar bounties and cartels, but the remaining high contracting Powers, having decided to adhere to that agreement, no ill effects resulted. Though Great Britain withdrew from the convention she decided to adhere to the principles of it and not to give a preference to sugar produced within the Empire or to cane over beet. In Aug. 1918 she gave to the signatories of the convention six months' notice of her intention to resume complete liberty of action in respect of her policy with regard to sugar, and the Finance Act of 1918 provided for the granting of a preference of one-sixth off the duties on sugar, molasses, tobacco, coffee, cacao and other products imported from within the Empire into the United Kingdom, and a preference of 2s. 6d. per gal. on rum.

Following an inquiry by a royal commission, of which the late Lord Balfour of Burleigh was chairman, in 1909, a conference was held at Ottawa in 1912 between representatives of the Dominion and the British West Indian colonies, the Bahamas, British Honduras and Jamaica excepted, to consider the question of closer trade between Canada and the West Indies, and on April 9 in that year an agreement was signed providing for a reciprocal trade agreement, the basis of which was a mutual preference of 20% on the chief products of the countries concerned, with a minimum preference on flour in favour of Canada, of 12 cents per 100 lb. and 15 cents on 96° test sugar not over No. 16 Dutch Standard in colour in favour of the British West Indies. Certain concessions which the Canadian refiners had enjoyed of importing foreign sugar at the British preferential rates were withdrawn. The agreement came into force on June 2 1913, and Grenada gave her adhesion to it in the same year.

In 1920 a further conference was held at Ottawa at which all the West Indian colonies, and also the Imperial Government, were represented. A new agreement was signed on June 18 1920 and brought into force in May 1921, under which Canada agreed to give to British West Indian products a tariff preference of 50%, whilst the British West Indies similarly agreed to extend to Canadian products tariff preferences of 50% in the case of Barbados, British Guiana and Trinidad, 33⅓% in that of British Honduras, the Leeward Is. and the Windward Is., 25% in Jamaica, and 10% in Bahamas, the Legislature of which colony afterwards voluntarily increased the preference to one of 25%. Certain products were again specifically dealt with, the preference on Canadian flour entering the West Indies being not less than 1s. per 196 lb. and that on West Indian sugar being not less than 83.712 cents per 100 lb. on 96° test. The Government of Canada further agreed to endeavour to arrange for a weekly freight, mail and passenger service, with steamers of 5,000 to 6,000 tons burthen, capable of steaming 12 knots per hour, between St. John (New Brunswick) or Halifax (Nova Scotia), down the islands lying to windward, British Guiana and back, the colonies contributing £27,000 per annum; also a service of freight, mail and passenger steamers of 3,500 tons burthen, capable of steaming 10 knots, from Canada to Nassau (Bahamas), Jamaica, Belize (British Honduras), and back, fortnightly, the colonies concerned contributing at the rate of £13,000 per annum toward any loss involved in the event of the service proving unremunerative. The Canada-British Honduras service was inaugurated in Jan. 1921. A declaration appended to the agreement recommended for favourable consideration the laying of British-owned and British-controlled cables as soon as possible, to connect Bermuda with Barbados, Trinidad, British Guiana, the Windward Is., the Leeward Is., and Turks Is. or Jamaica.

Communications.—In the matter of steamship communication the British West Indies were decidedly worse off after the war than before it. In 1915 the Royal Mail Steam Packet Co. terminated the transatlantic contract steamer service on the ground that they had been precluded from using their terminal port at Southampton. In the same year the fortnightly intercolonial contract service was also terminated by mutual agreement between the company and the colonies concerned. For some time thereafter the company continued to berth small passenger steamers for the West Indies at irregular intervals; but this service was also brought to an end in 1920, and passengers between the West Indies and the mother country were afterwards compelled to travel by foreign steamers, cargo boats, or *via* Canada or the United States. An intercolonial service was performed in 1921 by direct steamers running between St. John (New Brunswick) and Halifax (Nova Scotia), down the islands, and back. Under the Canada-West Indies trade agreement referred to above this service was to become a weekly one. The British Government, toward the close of the year 1920, agreed to contribute two-thirds of the cost of a temporary transatlantic steamer service for three months if the West Indian colonies would provide one-third, but this proposal was not acceptable to all the colonies concerned, mainly because it was felt that the steamers which it was proposed to use were unsuitable. In 1921 the British Government further offered to contribute £90,000 per annum toward a subsidy for a transatlantic steamer service, and proposals were made for the invitation of tenders. This proposal was, however, rejected by Trinidad, which in 1921 enjoyed a fortnightly mail and passenger service provided by the Royal Netherlands West India Mail, free of expense to the colony. The Dutch line agreed in June 1921 to allow their steamers to call at Barbados as well as Trinidad.

Agriculture.—In 1919 Visct. Milner appointed a committee to consider the desirability of establishing a tropical agricultural college in the West Indies, and in the event of their decision being favourable to report on the subject generally. The committee issued their report in 1920, favouring the establishment of a West Indian agricultural college in Trinidad. The proposals having commended themselves to the majority of the West Indian colonies, the agricultural college committee was called together again in the autumn of 1920 with a view to making the necessary arrangements for the incorporation of the college and for carrying out the plans generally. The objects for which the college was established are to afford to young men opportunities for instruction in the principles of agriculture and in the cultivation and preparation for market of tropical produce of every kind, including especially sugar and its by-products, rum and molasses, cacao, coffee, cotton, coco-nuts, rice, citrus and other fruits (notably bananas), and dyewoods, many of which commodities constitute the raw materials employed in the manufactures of the mother country; for the training of scientific investigators in matters pertaining to tropical agriculture amid suitable surroundings; for creating a body of British expert agriculturists well versed in the knowledge of the cultivation of land in the tropics, and of scientific advisers possessing an intimate knowledge of the means of combating pests and diseases, the control of which is fundamentally essential to the successful development of agriculture in the tropics. Attached to the college will be a model sugar factory, the various units of which have been contributed by the principal British sugar machinery manufacturing and allied firms.

Industries.—Sugar remained the principal staple. This industry was developed by the extension of the central factory system, whereby the canes from the surrounding estates, as well as those grown by peasant farmers, are dealt with at a central base, the concentration thus effected permitting of the instalment of machinery by which the maximum amount of sugar can be extracted from the cane. Thanks to the devoted care given to cultivation, and to the assistance of the local agricultural scientists who make it their constant aim to combat insect pests, the cacao industry, which is mainly centred in Trinidad and Grenada, continued to prosper. The Jamaica banana industry suffered from a succession of hurricanes in 1915, 1916 and 1917, but afterwards showed rapid recovery. The cultivation of citrus fruit on the other hand made little progress—except in Dominica, where the lime industry continued steadily to increase after the war—owing to the prohibitive import duties in the United States and the inadequacy of shipping facilities for fruit between the West Indies and Canada and the United Kingdom. The Sea Island cotton industry, which owed its development in the West Indies to the ravages of the boll-weevil in the United States, received a check in 1920, through the appearance of the still more dreaded boll-worm in St. Kitts and Montserrat, to which it was brought by a Brazilian vessel. A comparatively new industry, which made rapid progress, was that of rice. Formerly rice was imported into British Guiana in large quantities for the consumption of East Indian immigrants. Now that colony not only produces enough rice for its own requirements but also a substantial surplus which is available for export to the neighbouring colonies. The exports of rice from British Guiana rose from 45,223 lb. in 1905 to 18,110,400 lb., besides 4,390,051 lb. of paddy, in 1920.

Almost as rapid has been the development of the petroleum industry in Trinidad. The existence of petroleum deposits in Trinidad has long been recognized. As far back as 1864 the Trinidad Petroleum Co., promoted by Mr. H. B. Sheridan and the 11th Earl of Dundonald, started drilling for oil at La Brea. Oil was struck, but competition with the new oilfields in the United States proved too

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formidable, and this and other causes forced the company into liquidation. Two years later, a civil engineer, named Derwent, started boring at Aripero. He, too, struck oil, but failed to make a financial success of the venture. No further steps were taken toward winning oil until about 1900, when Mr. Randolph Rust, a local resident (Mayor of Port of Spain in 1921), imported modern oil-boring machinery and successfully struck oil at Aripero in 1901. Other prospectors came on the scene, and in 1910 followed the successful flotation of the Trinidad oilfields, and Trinidad enjoyed such a boom as no West Indian colony had experienced, at any rate for many a long day. On April 27 in the following year Sir George Le Hunte, the then governor, opened the valve at the end of the pipe line on Brighton pier, thus inaugurating the new industry, which has since been developed at a rapid rate. With many new wells being drilled it was certain that the production of oil, which in 1920 amounted to 72,905,947 gal., would undergo material expansion.
(A. E. A.)

WESTINGHOUSE, GEORGE (1846–1914), American inventor and manufacturer, was born at Central Bridge, N.Y., Oct. 6 1846. In 1856 his father moved to Schenectady, N.Y., and began to manufacture farm implements. The boy early displayed inventive talent and when 15 designed and constructed a rotary engine. He entered the Union army in the Civil War in 1863 but in 1864 was appointed third assistant engineer in the navy. At the close of the war he resigned and entered Union College, but in his sophomore year, on the advice of the president, he withdrew to devote his time to mechanical invention. In 1865 he had invented a device for replacing derailed cars and also a reversible steel railway frog, but from lack of capital was unable to develop a business in Schenectady. In 1868 he went to Pittsburgh and arranged for the manufacture of his devices, which he himself sold to the railways. In 1869 he patented his air-brake and organized the Westinghouse Air Brake Co. In 1872 he invented the automatic air-brake (*see* 4.414). This brake was quickly adopted by railways in America and gradually in Europe. He also developed a system of railway signals, operated by compressed air with the assistance of electrical contrivances. In 1885 he acquired certain patents for alternating current machinery. In June 1912 he received the Edison gold medal for "meritorious achievement in connexion with the development of the alternating current system for light and power." In 1893 this system was installed at the Chicago Exposition. Later his Pittsburgh establishment built dynamos for the power plants at Niagara Falls, for the rapid transit systems of New York City, and for the London Metropolitan railway. Westinghouse also devised a method for conveying gas through long-distance pipes thus making it a practicable fuel. In 1910 he was elected president of the American Society of Mechanical Engineers. He died in New York March 12 1914. He was president of some 30 corporations with a capital of about $200,000,000, employing more than 50,000 persons.

WESTLAKE, JOHN (1828–1913), English jurist, was born at Lostwithiel, Cornwall, Feb. 4 1828. He was educated at Trinity College, Cambridge, where he graduated in 1850. He was called to the bar in 1854, and attained a great reputation as an authority on international law. In 1874 he became a Q.C. and bencher of Lincoln's Inn, and in 1885 successfully contested the Romford division of Essex in the Liberal interest. In 1888 he became professor of international law at the university of Cambridge, a position which he held until 1908. He was also an hon. president of the Institute of International Law, and from 1900 to 1906 a member of the Hague arbitration court. He died at Chelsea April 14 1913.

His works include *A Treatise on Private International Law, or the Conflict of Laws* (1858; 5th ed. 1912); *Chapters on the Principles of International Law* (1894); *International Law*, Part I., *Peace* (1904; 2nd ed. 1910); Part II., *War* (1907).

WESTON, AGNES (1840–1918), English philanthropic worker, was born in London March 26 1840. In 1868 she took up hospital visiting and parish work in Bath, and through beginning a correspondence with a seaman who asked her to write to him, developed into the devoted friend of sailors, superintendent of the Royal Naval Temperance Society and founder of the Royal Naval Sailors' Rests, or clubs for sailors, at Devonport and Portsmouth. She published *Life Among the Bluejackets* in 1909. She died at Devonport Oct. 23 1918. Shortly before her death her work for the navy had been recognized by the bestowal of the G.B.E.

See S. G. Wintz, *Our Bluejackets, Miss Weston's Work* (1894).

WEST POINT (*see* 28.558).—The following important buildings were completed at West Point after 1910: the Administration Building, East Academic Building, Riding Hall, two new cadet barracks, cadet chapel and chaplain's quarters, artillery barracks and artillery stable, cavalry barracks and cavalry stable, eight sets of officers' quarters, two apartment buildings, each containing eight sets of officers' quarters, and a cadet laundry. By Act of May 4 1916, the number of cadetships authorized at the academy was increased to 1,332. By authority of the War Department, April 1915, candidates were permitted, in lieu of passing the regular entrance examination, to qualify for admission upon the presentation of satisfactory certificate of previous academic work in accredited institutions. By Acts of 1919 and 1920, the pay of cadets was fixed at $780 per annum and one ration per day or commutation thereof at the rate of $1.08 per day. The World War and the demand for trained officers led the War Department to direct the graduation of the First or Upper Class April 20 1917, and of the Second Class Aug. 30 1917. The next year the need for officers resulted in the graduation of three classes, the first, June 12 1918, and the second and third together, Nov. 1 1918. A class of new cadets was admitted at an irregular time, Nov. 2 1918, and provision was made for a temporary one-year course. After the Armistice the War Department directed, May 12 1919, that the course of instruction be fixed for three years, but the following year Congress specified that the course should be four years. The academic authorities thereupon reorganized the curriculum in the light of the most recent military and educational experience.

The new schedule contained the following salient features: (1) The upper classes on duty undergo military training June 15 to Aug. 30 at a regular army cantonment away from West Point; (2) The new Fourth Class enter the academy July 1 and receive at West Point preliminary military training until Aug. 30; (3) During the academic year, extending from Sept. 1 to June 15, tactical drills and supervised athletics alternate daily (except Wednesdays and Saturdays) after 4 P.M. for all cadets; (4) Academic instruction be given during periods between 8 A.M. and 4 P.M. in the following subjects to the respective classes—*Fourth Class*, mathematics, English, French and surveying; *Third Class*, mathematics, English, French, political history, drawing and theoretical tactics; *Second Class*, natural and experimental philosophy, chemistry and electricity, Spanish, military hygiene; *First Class*, military engineering, law, military art and history, ordnance and gunnery, economics and government. Ten Saturdays throughout the year were set apart for lectures to the whole corps by eminent men.

The number of graduates of the academy 1910 to 1920 inclusive was 1,959. The superintendents since 1910 have been: T. H. Barry (b. 1855) 1910–2; C. P. Townsley (b. 1855) 1912–5; John Biddle (b. 1859) 1916–7; S. E. Tillman (b. 1847) 1917–9; Douglas McArthur (b. 1880) 1919–22.
(L. H. H.*)

WEST VIRGINIA (*see* 28.560).—In 1920 the pop. was 1,463,701, as against 1,221,119 in 1910, an increase of 242,582 or 19·9%. The urban pop. (for places of 2,500 or more) increased from 18·7% in 1910 to 25·2% in 1920. The density of pop. was 60·9 in 1920; 50·8 in 1910. The following table shows the growth of the ten largest cities for the decade 1910–20:—

	1920	1910	Percentage increase
Wheeling	56,208	41,641	34·9
Huntington	50,177	31,161	61·0
Charleston	39,608	22,996	72·2
Clarksburg	27,869	9,201	202·9
Parkersburg	20,050	17,842	12·4
Fairmont	17,851	9,711	83·8
Bluefield	15,282	11,188	36·6
Martinsburg	12,515	10,698	17·0
Morgantown	12,127	9,150	35·5

Agriculture.—Of the land area of the state 62·2% in 1920 was in farms and 57·7% was improved. The number of farms, which was 96,685 in 1910, decreased to 87,289 in 1920 (9·7%). The total farm acreage decreased from 10,026,442 to 9,569,790 (4·6%), but the total value of all farm property increased from $314,738,540 in 1910 to $496,439,617 in 1920 (57·7%). The value of farm lands and buildings increased from $264,390,954 to $410,783,406; implements

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and machinery from $7,011,513 to $18,395,058; and live stock from $43,336,073 to $67,261,153. The number of farms reported as being mortgaged grew from 9,525 in 1910 to 10,274 in 1920. Of these 7,878 in 1910 and 9,031 in 1920 reported the amounts represented by the mortgages—$5,592,533 and $11,205,953 respectively. The average debt per mortgaged farm was $1,241 in 1920 and the average rate of interest 5·9%. Native-born white farmers predominate in the state. Of the 87,289 farms in the state in 1920 86,785 were operated by white farmers, of whom only 752 were foreign-born, and there were only 504 coloured farmers, compared with 708 in 1910. Of the native white farmers 71,181 were owners, 1,071 managers and 13,781 tenants. The number of horses on farms in 1920 was 169,148, compared with 176,530 in 1910. Mules increased from 11,577 to 14,981; cattle from 560,770 to 587,462; and chickens from 3,106,907 to 4,027,510; while sheep decreased from 566,952 to 509,831; and hives of bees from 111,673 to 89,873.

The value of all crops for West Virginia in 1919 was $96,537,459, compared with $36,167,014 in 1909. The 1919 value of the corn crop was $29,768,131; oats $3,054,668; wheat $8,395,097; hay and forage $23,746,574; potatoes $6,461,619; tobacco $2,731,338; apples $7,540,491; peaches $1,518,784. The variations in production of the chief crops in 1909 and 1919 is shown in the following table:—

	1919		1909	
	Ac.	Bus.	Ac.	Bus.
Corn	568,219	17,010,357	676,311	17,119,097
Oats	169,915	3,054,668	103,758	1,728,806
Wheat	298,036	3,747,812	209,315	2,575,996
Buckwheat	31,095	537,883	33,323	533,670
Potatoes	34,526	2,809,398	42,621	4,077,066

The extension of agricultural teaching, which was established at the West Virginia University in 1913, has been an important factor in the development of scientific agricultural methods.

Mining.—In mineral productions West Virginia ranks second among the states of the Union. The total value was $125,111,280 in 1913 and $133,633,229 in 1914. Oil production, which in 1900 was 16,195,675 bar., declined to 9,095,296 in 1907. It increased again to 12,128,962 bar. in 1912, but steadily declined thereafter. The production in 1916 was 8,731,184 bar., valued at $21,914,080. In 1918 it was only 7,866,628 bar. (the lowest since 1893), but in 1920 it reached 8,173,000 barrels. In the production of natural gas West Virginia since 1906 has ranked first among all the states. The production, which had reached 119,100,392 thousand cub. ft. in 1906, steadily increased (except in 1908 and 1914) to 308,617,101 thousand cub. ft., (valued at $57,389,161) in 1917; but in 1918 declined to 265,160,917 thousand (valued at $41,324,365), and in 1919 to approximately 201,500,000 thousand (valued at $40,304,500).

In 1909 West Virginia, overtaking Illinois, became the second coal-producing state of the Union, but in 1920 dropped to third. Coal production in West Virginia, which had reached 22,647,207 short (net) tons in 1900, and 61,671,019 in 1910, continued to increase steadily, reaching in 1914 71,707,626 short tons, valued at $71,391,408, and furnishing employment to 78,363 persons. The industry became especially active when the United States entered the World War. In 1916 the production increased to 86,460,127 short tons, valued at $102,366,092, and in 1918 to 89,935,839 short tons, valued at $230,508,846. In 1919 it was 75,500,000 short tons, and, together with coke production 1,454,000 short tons, gave employment to 91,566 persons. In 1920 it was 87,500,000 tons. The production of coke, which steadily increased until 1910, when it reached 14,217,380 short tons, valued at $7,525,922, thereafter steadily diminished to 1,391,446 short tons in 1915, again increased to 3,349,761 in 1917, and in 1919 decreased to 1,454,000 short tons. The increase of coal production after 1910 was partly due to strikes in Ohio and other middle-western states. The determination of the United Mine Workers to unionize the mines of West Virginia led to a bitter and prolonged labour war, which began in 1912 in the Cabin Creek and Paint Creek collieries of the Kanawha valley, and resulted in losses aggregating nearly $6,000,000. This secured for the union a foothold in West Virginia. In Sept. and Nov. 1919 organized miners from the Kanawha region threatened an armed invasion of Logan County to force the unionization of that field. In order to prevent possible disturbance Gov. Cornwell asked for and obtained a regiment of Federal troops. In 1920 an attempt to unionize the miners along the Norfolk & Western railway finally precipitated an armed conflict between detectives and union miners at Matewan, in Mingo county, resulting in the death of seven detectives and the mayor and the terrorization of the community, and necessitating a call for Federal troops and the establishment of military control.

Manufactures.—In 1914 West Virginia was in importance of manufactures the 28th state. The number of establishments was 2,749, with an invested capital of $175,995,011, and a production valued at $193,511,782. The number of persons employed was 79,353 (11% more than 1909), earning $51,377,760. The leading industries were lumber and timber, steelworks, rolling-mills, tinplate and terneplate, glass, leather, railway cars and shop construction, flour milling and the manufacturing of clay products. The state ranked second in the production of glass, and also in the production of tinplate and terneplate, and eighth in the value of clay products. The Federal Government constructed on the Kanawha in 1918 two large plants, a projectile plant at Charleston and a high-explosive plant at Nitro, at an expenditure of over $60,000,000.

Transportation.—Transportation facilities continued to improve after 1909. The railway mileage, which in 1912 reached 3,557 m. by the completion of the Virginia railway (139·6 m.), by the construction of the coal and coke railway from Elkins to Charleston (196·75 m., recently acquired by the Baltimore & Ohio Railway Co.), and by the completion of the Hampshire-Southern branch of the Baltimore & Ohio to Moorefield and Petersburg, was further increased in 1913 by the extension of the Monongahela River railway southward to Fairmont (1913) and by several shorter branches. The railway mileage in 1919 was 3,892.

Banks and Banking.—The condition of the banks in West Virginia in 1920–1 was as follows:—

	National Banks, 1920	State Banks, 1920–1
Number	122	227
Capital	$11,573,000	$17,597,932
Surplus	$7,739,000	$11,047,231
Loans	$100,545,000	$150,617,886
Deposits	$134,436,000	$170,370,924

Education.—In 1920 the total school pop. was 448,670, the total school enrolment 341,977, the average daily attendance 253,395. The *per capita* cost of education was $25.18 based on enumeration, $44.57 based on average daily attendance. The total number of teachers was 11,406. The average annual salary paid teachers in all grades was $581. The total number of school-houses was 6,956. The expenditure for all common schools was $11,291,563 and for state educational institutions $1,850,906, making a total of $13,141,469 for the educational system of the state. The value of all public school property was estimated at $25,639,697, and the value of state educational institutions at $2,775,000. In 1920 a compulsory school law was enacted. The development of the high schools has been a prominent feature of recent educational growth. This was partly due to the appointment of a state high school supervisor in 1909 to direct the establishment and standardization of the high schools. In 1921 the state had 172 classified high schools with 1,129 teachers, and an enrolment of 20,000 (about 3,000 graduating each year), and high school property valued at $10,000,000. In 1920 the high schools received state aid amounting to $118,000. The enrolment of candidates for degrees in West Virginia University increased from 800 in 1909–10 to 1,596 in 1919–20, and the total enrolment for the same period increased from 1,200 to 2,800, or 1,992 exclusive of short-course students. The members of the faculty increased from 62 to 141, of whom 56 were full professors, 17 were associate professors and 27 were assistant professors. The total number of women students increased from 619 to 975 in the same period. Under the Act of 1919 the control of all educational affairs of the state, from the lowest school to the university, was vested in a state board of education composed of the state superintendent (as executive officer) and six members appointed by the governor. The board has an advisory council of three coloured citizens.

Finance.—The receipts of the state for the fiscal year June 30 1920 was $19,901,931, the disbursements $19,570,122. The total bonded indebtedness Jan. 1 1921 was $11,663,700. In 1919 the total assessed value of real estate ($769,648,033), personal property ($371,602,428) and public utility property ($349,522,672) was $1,490,773,133. In 1909 the Legislature enacted a business licence tax which by July 1920 produced $226,204. In 1915 it placed on corporations and companies a special excise tax, which was increased by an additional excise tax in 1919. The two Acts produced for 1919–20 approximately $600,000.

Constitutional Amendments.—An amendment providing for prohibition was ratified in 1912 by a majority of 92,342. Another amendment proposed in 1917 and ratified in Nov. 1918 provides that an itemized and classified budget shall be prepared by the board of public works, and presented to the Legislature for its guidance in determining appropriations. A third amendment ratified in Nov. 1920 provided for two periods of every regular session of the Legislature—one of 15 days in Jan., primarily for presentation of bills, and another of 45 days in March–April, primarily for consideration and action on bills. The same amendment increased the salaries of members of the Legislature to $500 a year. A fourth amendment, ratified in Nov. 1920, authorized the Legislature to provide for a system of state roads under control and supervision of state officers, and to bond the state to a maximum of $50,000,000, if necessary.

Administrative Changes.—By Act of 1911 a state Department of Agriculture was created in 1913 and placed under the Direction of the commissioner of agriculture, an elective officer who is also a member of the board of public works. The office of highway inspector, created in 1907, was abolished in 1911; and a state bureau of roads (four members) was created in 1913. By Act of 1913 a public service commission of four members (reduced to three by Act of 1915) was created. At first it had jurisdiction over the newly established workmen's compensation fund, which later was administered by a state commissioner. Under the Yost law of 1913 the state tax commissioner is *ex officio* state commissioner of prohibition.

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By Act of 1919 a department of public safety (state police) was established to relieve the military arm of the state and to aid in establishing the system of private peace officers. By Act of 1915 the membership of the House of Delegates (previously 86) was increased to 94.

Welfare Legislation.—A state tuberculosis sanatorium established by Act of 1911 was opened for patients in 1913 at Terra Alta. A similar institution for coloured people was opened in 1919. Revision of laws relating to medicine and health in 1913 marked the beginning of a new era in sanitary legislation. In 1914 a hygiene laboratory was established. In 1915 a state department of health was created, with a commissioner as executive officer, two new divisions, vital statistics and child welfare, were added by Act of 1919.

History.—Apart from the economic and educational movements above described, the outstanding event of the decade ending 1920 was the adjustment of the long-standing "Virginia debt question." It arose from the formation of West Virginia as a separate state in 1863 and at various times had been a prominent issue in state politics. A U.S. Supreme Court decision of 1911 tentatively fixed West Virginia's share of the old debt at $7,182,507.48 (leaving the question of interest for later adjustment), and by a later judgment of 1915 against West Virginia fixed the total obligations at $12,393,929.50 ($4,215,622.28 and accrued interest from Jan. 1 1861), with a decree that this total amount should draw interest at 5% until paid. In Feb. 1917 Virginia filed application for a writ of *mandamus* against the Legislature of West Virginia to compel the levy of a tax to pay the judgment; but the court deferred action in order to give West Virginia a reasonable opportunity to act without compulsion. The total amount of principal and interest on Jan. 1 1919 was $14,562,867.16. Of this amount West Virginia, by Act of March 31 1919, arranged to pay $1,062,867.16 in cash and the balance by an issue of "listable" 3½% bonds in favour of Virginia, payable in 1939 (or earlier). Bonds amounting to $12,366,500 were delivered to the Virginia debt commission at Richmond, Va., on July 3 1919. The remaining bonds ($1,133,500) were held in escrow pending the filing of remaining outstanding Virginia debt certificates.

The state continued Republican in politics, but party division resulted in the election of a Democrat to the governor's office in 1916. The governors since 1909 have been: William E. Glasscock, 1909–13; Henry D. Hatfield, 1913–7; John J. Cornwell, 1917–21; Ephraim F. Morgan, 1921– .

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WHARTON, EDITH [NEWBOLD JONES] (1862–), American writer, was born in New York City in 1862. She lived much in Italy and France. She married Edward Wharton, a Boston banker, in 1885. She began her literary career as a writer of short stories, her first story, "Mrs. Manstey's View," appearing in *Scribner's Magazine* in 1891. Her first long novel, *The Valley of Decision*, appeared in 1902, the scene being Italy toward the close of the seventeenth century. Her novel, *The House of Mirth*, appeared in 1905 and was highly successful. In 1908 it was translated into French by Paul Bourget, who called it the greatest American novel. It was dramatized with the help of Clyde Fitch, but had slight success. After the outbreak of the World War she edited in 1915 *The Book of the Homeless*, sold for the benefit of Belgian refugees; and later for services she was made a chevalier of the Legion of Honour of France. Her works include *The Greater Inclination* (1899); *The Touchstone* (1900); *Crucial Instances* (1901); *Madame de Treymes* (1907); *The Fruit of the Tree* (1907); *The Hermit and the Wild Woman* (1908); *Tales of Men and Ghosts* (1910); *Ethan Frome* (1911); *The Custom of the Country* (1913); *The Age of Innocence* (1920).

WHITBREAD, SAMUEL (1830–1915), English politician, was born at Cardington, Beds., May 5 1830, the son of Samuel Charles Whitbread, M.P. for Middlesex and grandson of Samuel Whitbread, M.P. for Beds. (*see* 28.597). He carried on the family tradition both in brewing and in politics, controlling the brewery founded by his great-grandfather from 1867 to 1889, and then becoming chairman of the company to which it was transferred. Like his father and grandfather he sat in the House of Commons as a Liberal, representing Bedford from 1852 to 1895. He died at Biggleswade Dec. 25 1915.

WHITE, ANDREW DICKSON (1832–1918), American educationalist (*see* 28.599), died at Ithaca, N.Y., Nov. 4 1918. His later works included *Seven Great Statesmen in the Warfare of Humanity With Unreason* (1910) and *The Work of Benjamin Hale* (1911). In 1913 he published a new edition of *The Warfare of Science and Theology in Christendom.*

WHITE, EDWARD DOUGLASS (1845–1921), American jurist, was born on a plantation in the parish of Lafourche, La., Nov. 3 1845. His father was seventh governor of Louisiana. He was educated at Mount St. Mary's, Md., Georgetown (D.C.) College, and, after the outbreak of the Civil War, at the Jesuit College in New Orleans. During the latter part of the war he served as a private in the Confederate army. He studied law in the office of Edward Bermudez, later chief justice of Louisiana, was admitted to the bar in 1868, and practised law in New Orleans. In 1874 he was elected to the state Senate, and four years later was appointed associate justice of the Louisiana Supreme Court. In 1891 he was elected to the U.S. Senate, and before completing his term was appointed, in 1894, associate justice of the U.S. Supreme Court by President Cleveland. In 1910 he was appointed chief justice by President Taft. Many of his notable opinions were delivered in connexion with the Sherman anti-trust law. Of special importance were his opinions requiring the dissolution of the Standard Oil Co. and the American Tobacco Co. in 1911. As chief justice he administered the oath of office to President Wilson in 1913 and 1917, and to President Harding in 1921. He died at Washington, D.C., May 19 1921.

WHITE, SIR GEORGE STUART (1835–1912), British field-marshal (*see* 28.599), died in London June 24 1912.

WHITE, SIR WILLIAM HENRY (1845–1913), English naval architect (*see* 28.602), died in London Feb. 27 1913.

WHITEAVES, JOSEPH FREDERICK (1835–1909), British palaeontologist (*see* 28.602), died at Ottawa Aug. 9 1909.

WHITLOCK, BRAND (1869–), American diplomat and writer, was born at Urbana, O., Mar. 4 1869. He was educated in the public schools, became a newspaper reporter in Toledo, O., in 1887, and was appointed political correspondent on the Chicago *Herald* in 1890. Three years later he accepted a clerkship in the office of the Secretary of State of Illinois, where he remained until 1897. Meanwhile he read law and was admitted to the bar (1894). In 1897 he returned to Toledo and practised law until 1905, when he was elected mayor. He was reëlected for three succeeding terms, but in 1911 declined the nomination for a fifth term. In 1913 he was appointed by President Wilson minister to Belgium and in 1919 his post was raised to ambassador. This office he continued to hold under President Harding until the close of 1921. Before he had been in Belgium a year the World War broke out and the German invasion took place. Although the other diplomatic bodies followed the Belgian court to Havre, Whitlock insisted on remaining in Brussels in order to render any possible aid to the oppressed people. It was largely due to his urgent advice that Brussels did not resist and thus escaped even more ruthless devastation. In the early days of the war he gave protection to many German residents who had been unable to leave the country. By his firm attitude toward the German military officials he saved many innocent Belgians from death; but his activities in behalf of Edith Cavell were unavailing as he was misled at the last moment by false promises by the Germans. After the formation of the Commission for Relief in Belgium, its operations were placed wholly under his direction. Food and clothing were provided for destitute civilians whose means of sustenance had been destroyed. His ceaseless work in their behalf won the gratitude of all the Belgians; and although worn out by the physical strain he refused to quit his post until the signing of the Armistice in Nov. 1918, when he returned to America for a short rest. He was decorated with the Grand Cordon of the Order of Leopold by King Albert (1917), and was made burgher of Brussels (1918) and of Liége (1919) and Honorary Citizen of Antwerp (1919).

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The Belgian Government awarded him the Civic Cross of the First Class (1919). He was elected a member of the American Academy of Arts and Letters.

An excellent account of the German occupation is given in his *Belgium; a Personal Narrative* (1919). His other writings include *The 13th District: a Story of a Candidate* (1902); *Her Infinite Variety* (1904); *The Happy Average* (1904); *The Turn of the Balance* (1907); *Abraham Lincoln* (1909, in the *Beacon Biographies*); *The Gold Brick* (1910); *On the Enforcement of Law in Cities* (1910; enlarged form, 1913); *The Fall Guy* (1912); *Forty Years of It* (1914, a description of "democracy's progress in a mid-western city") and *Walt Whitman: How to Know Him* (1920).

WHYMPER, EDWARD (1840–1911), British explorer and mountaineer (*see* 28.617), died at Chamonix Sept. 16 1911.

WHYTE, ALEXANDER (1837–1921), British divine (*see* 28.617), retired from the ministry of Free St. George's in 1916, and from his position as principal of New College, Edinburgh, in 1918. He published *The Apostle Paul* (1903) and *Thirteen Appreciations* (1915). He died at Hampstead Jan. 6 1921.

WILBERFORCE, ALBERT BASIL ORME (1841–1916), English divine (*see* 28.630), died May 13 1916.

WILBRANDT, ADOLF (1837–1911), German novelist and dramatist (*see* 28.631), died at Rostock June 10 1911.

See E. Scharrer-Santen, *Adolf Wilbrandt als Dramatiker* (1912), and *Jahrbuch und Deutscher Nekrolog*, XVI., Totenliste 1911, p. 84.

WILEY, HARVEY WASHINGTON (1844–), American chemist, was born in Kent, Ind., Oct. 18 1844. He was educated at Hanover (Ind.) College (A.B.1867; A.M.1870), Indiana Medical College (M.D.1871), and Harvard (B.S.1873). He was professor of Greek and Latin at Butler College, Indianapolis, (1868–70); state chemist of Indiana and professor of Chemistry at Purdue University (1874-83); and chief chemist of the U.S. Department of Agriculture (1883–1912). He was elected president of the American Chemical Society in 1893, and from 1899 was professor of Agricultural Chemistry at the George Washington University. He frequently represented the United States in scientific meetings abroad. He was specially interested in preventing food adulteration, and antagonized many food packers by opposing the use of benzoate of soda as a preservative. In 1911 his enemies urged his dismissal from the Department of Agriculture on the technical charge that an expert in his department had received recompense exceeding the legal rate. Later in the year President Taft wrote a letter wholly exonerating Dr. Wiley, but failed to take the obviously proper steps to remove from the Department a hostile member, with whom Dr. Wiley had to come into constant contact. Accordingly, Dr. Wiley resigned in 1912. Henceforth, he devoted himself largely to the cause of pure food by lecturing and writing.

His numerous publications include *The Sugar Industry of the United States* (1885); *Principles and Practice of Agricultural Analysis* (1894–7; revised edition, 1906–14); *Foods and Their Adulterations* (1907; third edition, 1917); *Influence of Food Preservatives and Artificial Colors on Digestion and Health* (1904–7, with several collaborators); *1001 Tests of Foods, Beverages, and Toilet Accessories, Good and Otherwise* (1914); *The Lure of the Land* (1915), and *Beverages and Their Adulteration* (1919). He also edited a series of *Health Readers for Schools* in 1919.

WILLARD, DANIEL (1861–), American railway official, was born at North Hartland, Vt., Jan. 28 1861. He graduated from the Windsor (Vt.) high school in 1878, studied for a year at the Mass. Agricultural College, Amherst, and in 1879 began his railway career as track labourer in Vermont. He rose to fireman, then to engineer, and for twenty years held various positions on several roads, including the Minneapolis, St. Paul and Sault Ste. Marie in its early days. In 1899 he was made assistant manager of the Baltimore and Ohio R.R., and two years later assistant to the president of the Erie R.R., of which he soon became first vice-president and general manager. From 1904 to 1910 he was second vice-president of the Chicago, Burlington and Quincy R.R., and after 1909 was also president of the Colorado Midland and vice-president of the Colorado and Southern. In 1910 he was elected president of the Baltimore and Ohio. In Oct. 1916 he was appointed a member of the Advisory Commission of the Council of National Defense, and the following March chairman of the commission. After America's entrance into the World War, he was appointed in July 1917 a member of the special committee of the Council of National Defense to secure mediation in case of strikes on war contracts. In Nov. 1917 he was appointed by President Wilson chairman of the War Industries Board, charged with devising and expediting means of producing the Government's industrial requirements for effective warfare. In Jan. 1918 he resigned in order to devote personal attention to the Baltimore and Ohio Railroad. After the Government had taken over the railways as a war measure a Federal manager displaced him as operating head of his road, but he remained president in charge of its corporate affairs, in which position he continued when the U.S. Government gave up control of the railways.

WILLARD, EDWARD SMITH (1853–1915), British actor, was born at Brighton Jan. 9 1853 and first appeared in *The Lady of Lyons* at Weymouth at the age of sixteen. He toured first with E. H. Sothern and then joined various stock companies, coming to London in 1875 and playing Antonio in *The Merchant of Venice* with Charles Rice in 1876. After a varied experience in Shakespearean and other plays he was engaged by Wilson Barrett in 1881 for the Princess's theatre, London, and until 1886 played leading parts in many melodramas, the most notable amongst them being "The Spider" in Henry Arthur Jones's *The Silver King*. In 1889 he produced Jones's *The Middleman* at the Shaftesbury theatre, London, afterward taking it to America. He played Professor Goodwillie in Barrie's *The Professor's Love Story* in 1894 at the Comedy theatre, London. After 1903 he acted only in America, repeating these and other roles; but in 1911 he played Brutus at the Gala performance of scenes from Julius Caesar at His Majesty's theatre, London. He died in London Nov. 9 1915.

WILLCOCKS, SIR WILLIAM (1852–), British engineer, was born in India in 1852 and educated at Roorkee College, India. From 1872 to 1897 he was engaged successively in the Indian and Egyptian Public Works Departments. He designed and carried through the Assuan Dam in 1898, and for this work the C.M.G. was conferred upon him, followed by the K.C.M.G. in 1902. His most important undertaking, however, was the irrigation of Mesopotamia, begun in 1911 at an estimated cost of £26,195,000. The scheme provided for the irrigation of 3,500,000 acres. His published works include *Egyptian Irrigation* (1889); *The Irrigation of Mesopotamia* (1905) and *From the Garden of Eden to the Crossing of the Jordan* (1918). In Jan. 1921 he was put on trial before the Supreme Consular Court of Egypt on a charge of sedition and criminal libel, on account of statements made by him impugning the trustworthiness of the data concerning the Nile irrigation published by Sir Murdoch Macdonald, adviser of the Egyptian Ministry of Public Works. He was found guilty March 11, and on April 16 he was bound over to be of good behaviour for one year.

WILLETT, WILLIAM (1856–1915), English builder, was born at Farnham, Surrey, in Sept. 1856. He made a name for himself in London as a designer of beautiful houses; but his chief claim to fame was his conception and promotion of the system of "daylight saving." Though scoffed at in his lifetime, his idea was taken up and put into practice in 1916, and honour has been paid to Willett's memory, which was denied to him in life. He died at Chislehurst March 4 1915.

WILLIAM II. OF HOHENZOLLERN (1859–), German ex-Emperor and ex-King of Prussia (*see* 28.667). When the hour of the downfall of the German Empire and the Prussian dynasty, following upon the military collapse of Germany, arrived in Nov. 1918, the ex-Emperor's flight to Holland bore in the eyes of his countrymen the aspect of a pitiable incident, rather than of a tragic climax. For a considerable portion of the rest of the world, which had frequently overestimated his personal, as distinguished from his official, significance, his conduct and bearing on the eve of the war, throughout its course, and at the moment of his country's disaster, may indeed have come as something of a revelation. There followed a series of disclosures as to his exploits in previous years, above all that piece of personal diplomacy, the Treaty into which he tricked the still

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more inadequate Emperor of Russia at their meeting at Björkö on the Russian Imperial yacht (July 23, 24, 1905), and the equally characteristic "Willy-Nicky" correspondence (mainly in 1904–5), so-called on account of the signatures which the two Imperial correspondents appended to their letters. Only the Kaiser's share in that correspondence has (1920) been published.

The Björkö Treaty, which was signed by the Tsar without consultation with the minister responsible for the foreign policy of Russia, represented an attempt by William II. to imitate Bismarck's Treaty of Reinsurance with Russia (1887–1890), which the great Chancellor had concluded behind the back of his ally Austria-Hungary, and which was allowed by his successor, Caprivi, to lapse in 1890 as being "too complicated"—*i.e.* too full of duplicity.

In William II.'s Treaty of Björkö, Russia and Germany engaged "to make foreign disturbers of the peace quiet, and in case of necessity to stand by one another with their armed strength." Count Lamsdorff, then Russian Minister for Foreign Affairs, was "profoundly excited and upset" when he read the document, since, as it stood, it imposed upon Russia the obligation of fighting on Germany's side if Germany were involved in war with Russia's ally, France. It is true that Russia also pledged herself to make every effort to gain France over to this new alliance, the object of William II. being to organize a continental coalition against Great Britain. When Count Witte, on his return from signing peace with Japan at Portsmouth (U.S.A.), was informed by Count Lamsdorff of the terms of the Treaty, he asked: "Does not his Majesty (Nicholas II.) know that we have a treaty with France?" "Of course his Majesty knows that," Count Lamsdorff replied, "but the fact must have slipped from his mind, or, what is more probable, he was befogged by William's verbiage, and he failed to grasp the substance of the matter" (Count Witte's *Memoirs*, English ed. 1921). Count Witte and Count Lamsdorff were afterward able to obtain the abandonment of the Treaty, while Prince Bülow and the German Foreign Office, conscious of the absurdity of their master's achievement, were content to let the Imperial agreement be treated as *non avenu*. In the Willy-Nicky correspondence, which he conducted in bad English, William had endeavoured to hold Nicholas to the bargain by adjuring him, "God is our testator" (*sic*). The correspondence represents an attempt on the part of William to exercise a kind of tutorship over Nicholas even in Russian home affairs and to instill into his mind suspicions both of France and of Great Britain.

During the years immediately preceding the World War William II. was only gradually recovering from the *contre-temps* which overtook him in 1908, when Prince Bülow, then Chancellor, repudiated the utterances published on William's behalf in the *Daily Telegraph* (Oct. 28 1908) and exacted from him by the threat of resignation a public promise that he would in future abstain from such personal incursions into the realm of foreign policy. The Emperor nevertheless continued when he visited foreign courts to impress upon those with whom he came into contact his conviction that he was an autocrat in the conduct of Germany's foreign relations.

At the end of Oct. 1910 he visited the Belgian court, accompanied by the Empress, and addressing the King of the Belgians said: "May our relations of confidence and friendly neighbourliness be drawn ever closer! May welfare and blessing be shed by Your Majesty's reign upon your Royal house and upon your people! That is my desire, which springs from the depths of my heart." At the Hotel de Ville he addressed the Mayor, M. Max, who four years later was to be sent to a German prison by the invaders of his country, and spoke of the "sober and industrious" Belgian people, expressing at the same time "our profound gratitude and our warmest wishes for the prosperity of Brussels and for a happy future." When the Emperor delivered these speeches he knew that Count von Schlieffen's plan for violating Belgian neutrality in the event of war with France lay cut and dried in the pigeon-holes of the German General Staff, and it was a plan which he himself had endorsed. In May 1911 he paid his last visit to England, and was present as the guest of King George V. at the unveiling of the monument to Queen Victoria in front of Buckingham Palace, when the King, whose advisers remained ignorant of certain of the Emperor's wilder intrigues and schemes, referred to "the strong and living ties of friendship between the thrones and persons of the two sovereigns."

In Feb. 1912 Lord Haldane visited Berlin in order to discuss proposals for a concurrent limitation in the increase of British and German naval armaments. As Lord Haldane states in his book *Before the War*, the visit was the sequel of a personal initiative of William II. through the medium of Sir Ernest Cassel. The Emperor had been concerned at the state of tension, dangerous to peace, which had attended the Morocco negotiations with France in the previous year. That critical episode had arisen out of the despatch of the German gunboat *Panther* on July 11 1911 to Agadir, not long after William II.'s return from his visit to England. In the meetings of German ministers with Lord Haldane, at one of which (between Lord Haldane and Adml. von Tirpitz) the Emperor was present in the self-imposed capacity of audience or chorus, he manifestly endeavoured for Lord Haldane's benefit to play for the time being the part of a constitutional monarch, exhibiting the balance of the ministerial advice from one side (Tirpitz) and from the other (Bethmann Hollweg) by which he had to guide his course. Lord Haldane's conclusion was that William II., and with him Germany, suffered from the lack of a constitutional system with a responsible government, the ministers being chosen more or less arbitrarily by the Emperor "and chosen in varying moods as to policy. . . . Thus the Kaiser was constantly being pulled at from different sides, and whichever minister had the most powerful combination at his back generally got the best of the argument. He had constantly to fix one eye on public opinion in Germany, and another on public opinion abroad. It is therefore not surprising that Germany seemed to foreigners a strange and unintelligible country." Lord Haldane's opinion gives one aspect of the situation, but hardly takes sufficient account of the wayward personal initiative of William II., springing either from his own conceptions (as at Björkö) or from casual outside influences which his ministers were unable to control. Incidentally it may be mentioned that except, perhaps, for the Eulenburg episode in 1905–7 there was no so-called Court party, although military influences were frequently at work. As Prince Bülow said, the mischief which was done by sudden personal interventions of the Emperor was manifest, but nothing was known of the mischief which had been prevented.

In home affairs there was a fresh Imperial outburst about Alsace-Lorraine in May 1912, when the Emperor threatened the Burgomaster of Strassburg with the withdrawal of the new constitution of the Reichsland, which had been granted in the previous year. The threat was ill-considered, but Bethmann Hollweg defended it in the Reichstag.

In March 1912 William II. paid a visit to the Emperor Francis Joseph at Schönbrunn, and in April he met King Victor Emanuel at Venice by way of preparing for the renewal of the Triple Alliance, which took place on the following Dec. 5. There was a visit of King Ferdinand of Bulgaria to Berlin in June, and in July the Emperor met the Tsar at Baltic Port. An incident which excited considerable attention was the presence of William II. for the first time at manœuvres of the Swiss army, and the favourable popular reception of the Imperial visitor at Berne, Basle and Zürich (Sept. 3–7 1912). A good number of German-Swiss officers had studied military affairs in Germany, and William II., for obvious reasons, seized every opportunity of encouraging the professional sympathies between the two armies, which bore fruit during the World War in the partiality of the Swiss General Staff.

It is noteworthy that during the critical years of the Balkan wars and negotiations, particularly in 1913, William II. kept more than usually in the background. His government was cooperating at the London Ambassadors' Conference for the localization of the conflict and the restoration of peace. He

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was, nevertheless, cultivating close personal relations, afterward to bear fruit during the World War, with his brother-in-law, Constantine, who had succeeded his assassinated father on the throne of Greece in March 1913. He sent Constantine flattering telegrams on his military prowess, and was consequently able in Aug. 1913 to induce the King of Greece to remove the last obstacle to the Peace of Bucharest (Aug. 10) by withdrawing the Greek claims, as against the Bulgarian, to the Thracian *Hinterland* of Kavala. King Carol of Rumania, at whose request the intervention had taken place, telegraphed to his kinsman, "thanks to you, the peace will be final."

King George V., with Queen Mary, and likewise the Tsar Nicholas II., were present in Berlin at the marriage on May 24 1913 of William II.'s only daughter, Princess Victoria Louise, with Prince Ernest Augustus of Cumberland, at last acknowledged as Duke of Brunswick, a marriage which was described as marking the reconciliation between the Guelphs of Hanover and the Hohenzollerns after the feud which had lasted since the conquest of Hanover by Prussia and the expulsion of the dynasty in 1866. These festivities were followed on June 16 and 17 by brilliant celebrations of the 25th anniversary of the accession of William II., with copious references by German sovereigns and official personages to the military strength of the German Empire under his sway as the guarantee of European peace.

A curious incident occurred in the same month. The Emperor disclosed the fact that one of his predecessors on the Prussian throne, Frederick William IV., had in a political testament recommended his successor, if opportunity arose, to annul the Prussian Constitution which he had granted, or rather imposed, in 1848. William II. announced that he had magnanimously burned this document.

A visit which excited considerable speculation at a later date, when, during the World War, the future of the Russian borderlands became a question of practical politics, was that which William II. paid on June 12 1914 to the ill-fated heir to the Austro-Hungarian monarchy, Francis Ferdinand, and his wife, the Duchess of Hohenberg, at Konopisht Castle in Bohemia. The Emperor was accompanied by Adml. von Tirpitz. It is most probable that, apart from the sustained and ultimately successful efforts of William II. to win the reluctant personal sympathies of Francis Ferdinand (partly by encouraging his ambition to make his wife—who was not of royal birth—Empress when he should succeed to the throne), the object of the visit was to enlist his host's support for the extension of Austrian and inferentially of German naval power and influence in the Mediterranean. The story that the Emperor broached vast schemes for providing, after a contemplated European war, kingdoms for Francis Ferdinand's two sons by resuscitating the Greater Poland of the Jagiellos and by creating a great South-Slav State stretching to Salonika, seems entirely fanciful. A main feature of these alleged schemes was that the hereditary Austrian dominions should politically come into the confederated German Empire. Such an idea was never entertained by any sovereign or government during the Hohenzollern epoch. It had been, indeed, the so-called "Great German" policy of the German Liberals in 1848, but it was rejected by Bismarck and by the ruling classes of Prussia. Its realization, apart from other considerations, would have entailed a diminution of the influence of the Prussian Throne and Government, and an immense strengthening of German Catholicism. It again became, of course, the cherished aspiration of republican Germany and republican Austria after the World War. But it never was an old-Prussian or a Hohenzollern policy.

The news of the assassination of the Archduke Francis Ferdinand and his wife at Serajevo on June 28 1914 reached William II. on his yacht at Kiel during the regatta. His first exclamation, "Now I must begin all over again, my work of years is undone," showed that he had reckoned upon the Archduke as an instrument of German policy when he should ascend the thrones of the dual monarchy. William II. returned from Kiel to Potsdam for a week, and the laying of the mines which caused the world-explosion began. On July 5 Count Hoyos arrived at Potsdam with a letter from the Emperor Francis Joseph containing a memorandum, written before the Serajevo assassination, describing the situation in the Balkans, the menace of the Pan-Slavist agitation, particularly in Serbia, and the changed attitude of Rumania. It was only by cultivating friendship with Bulgaria and by isolating and diminishing Serbia as a factor in the Balkans that these dangers could be averted. The crime of Serajevo, it was added, had only confirmed this estimate of the situation. William II. gave Count Hoyos a reply in which he said that any contemplated action against Serbia ought to be taken without delay, that Russia would certainly be hostile, but that he had long reckoned upon this eventuality. If it came to war between Austria and Russia, Germany would loyally take her stand by her ally. A conference (not, as erroneously reported, a Crown Council, which would have meant the presence of the whole Prussian Ministry) afterwards took place, and was attended by the Chancellor (Bethmann Hollweg), the War Minister (Gen. von Falkenhayn), the Under-Secretary for Foreign Affairs (Zimmermann) and the Chief of the Emperor's personal Military Cabinet (von Lyncker). And on the following day, July 6, there was a conference with Adml. von Kapelle, Tirpitz's right hand man at the Admiralty (Tirpitz was on leave), and with representatives of the War Ministry and the General Staff. It was resolved to take measures of preparation for the event of war, and orders in this sense were issued. At the same time it was arranged that all appearance of unusual excitement or activity should be avoided, and that the Emperor should, according to programme, proceed upon his annual cruise in northern waters. He left for Kiel on the same day, and joined the fleet during its summer manœuvres off Norway. He was constantly kept informed by telegraph of the progress of events. And now began the famous series of his marginal notes, afterward published under the German Republican Government, upon the despatches he received. He was at first enthusiastic for the most energetic measures against Serbia. He suggested that Austria should reoccupy the Sandjak, so as to sever the union of Serbia and Montenegro and prevent Serbian access to the sea. Then "there will be a row at once," he wrote. He deprecated war councils and conferences at Vienna, "because," as Frederick the Great had said, "the timid party always gets the upper hand." On July 19 he ordered the German battle-fleet not to disperse, so that it could at a moment's notice be recalled to Kiel. His chief anxiety at this stage was for the safety of the Baltic, and he wrote an angry marginal note because "the civilian Chancellor (Bethmann Hollweg) had not yet grasped his meaning." He (William II.) must "concentrate his forces on land and sea."

The text of the Austrian note to Serbia was communicated officially to the German Foreign Office on July 22, but the German ambassador in Vienna, Tschirschky, had had it on the previous day, and had probably telegraphed it direct to the German Emperor. It was presented at Belgrade on July 23.

The Kaiser at first exulted over a firmness of which he had thought Austria incapable, and expressed the belief that all Slav states were hollow. "Just tread firmly on the feet of this rabble!"—he added. On hearing that Count Berchtold, the Austrian Foreign Minister, did not desire to take any territory from Serbia he wrote, "Donkey! Austria must retake the Sandjak. . . . Austria must become preponderant over the smaller states at the expense of Russia, else there will be no peace." On the report of Serbian mobilization he recalled the German fleet from the North Sea to Kiel. "If Russia mobilizes, our fleet must be ready in the Baltic, and so it is going home." The chancellor had suggested on July 26 that the Emperor should calm European anxiety by remaining in Norwegian waters, but he was now thoroughly aroused, and on the following day he returned to Potsdam. There he received the text of the Serbian reply, and at first thought it "a great moral success." No doubt the Serbians were liars and orientals, and Austria, he said in a letter to his chancellor, might do well to claim a "*satisfaction d'honneur*" and to exercise "*une douce violence*" by a temporary occupation of Serbian territory as a guarantee.

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Anxiety about the attitude of Great Britain was now beginning to influence the Kaiser's mind, and his rage was sudden and great when his ambassador in London reported that Sir Edward Grey regarded the situation as serious and had suggested mediation. He described this as a piece of English pharisaism, and Sir Edward Grey as a "base deceiver, arch-base and Mephistophelian. Great Britain ought to put pressure upon Russia," etc. On July 29 began the rapid interchange of telegrams between the Kaiser and the Tsar, which was to be continued up to and even immediately after the German declaration of war, and in which the object of the Kaiser's frequently rhetorical appeals was to induce Russia to reverse her measures of mobilization against Austria and to refrain from mobilization toward the German frontier. He hoped to score over Russia, by a policy of menace, a diplomatic victory in the Serbian question similar to, but far greater than, that which he had obtained in 1909, when, as he boasted, he had appeared beside his Austrian ally "in shining armour." On July 29 a "Kronrat" with the whole body of the Kaiser's military and political advisers was held at Potsdam, and from Bethmann Hollweg's interview the same evening with the British ambassador (Sir Edward Goschen) and his bid for British neutrality it seems clear that the decision had fallen in favour of war.

After the proclamation of the state of "danger of war" (*drohende Kriegsgefahr*) on July 31, and the delivery of an ultimatum on the same day at St. Petersburg, and after a public mobilization order on the afternoon of August 1, a previously prepared declaration of war against Russia was delivered by the German ambassador at St. Petersburg on the evening of August 1.

Throughout the final episode of the German attempts to secure British neutrality the Kaiser was in a state of violent rage and disappointment, and he gave vent to his feelings in a memorandum to his chancellor on July 30 which may well be the wildest outburst of political passion that a monarch ever committed to paper. He declared that Great Britain had caught Germany in the trap of her loyalty to her Austrian alliance, that this was the crowning success of the policy of King Edward VII., who "though he is dead, is still stronger than I am"; and, finally, he exhorted the chancellor to inflame the Mahommedan world, for "if we are to bleed to death, England shall at least lose India." William II.'s brief exchange of telegrams with King George V., based, as the Emperor's assumptions were, on a false report by his brother, Prince Henry, and on a mistaken account by the German ambassador in London of a telephonic conversation with Sir Edward Grey, may be mentioned in passing. If King George's Government would assure the neutrality of France, the Kaiser was prepared to "employ elsewhere" his troops then moving against her. After Sir Edward Goschen had asked for his passports, a Berlin mob broke the windows of the British embassy. The Kaiser sent an aide-de-camp to the ambassador with an unkingly message, truculently delivered, expressing his regret, but telling Sir E. Goschen that he would "gather from these occurrences an idea of the feelings of the German people respecting the action of Great Britain in joining with other nations against her old allies of Waterloo."

On August 4, William II. opened the session of the last Reichstag of his reign by a war speech, to which he added a personal appeal to the deputies (the Social Democrats alone were absent) to support him "through thick and thin," and individually to shake hands with him in token of their promise to do this. To one of the deputies he said. "Now we will give them (his enemies) a good thrashing."

If during the World War William II. ever attempted to interfere in military dispositions, it is clear that the leaders of the army were successful in preventing his effective intervention. He paid the inevitable visits to the fighting lines at critical moments, especially when a German success was believed to be impending, but there is no reason to believe that he was ever, in accordance with the traditions of his house, under fire. He once or twice narrowly escaped aeroplane attacks, but this was accidental. He lived in his comfortable Imperial train or in a portable asbestos hut, or at Supreme Headquarters at Pless Castle in Silesia, and afterward at Spa. He took no practical military part in the war. His crude rhetoric was from time to time employed in firing the ardour of his troops, as when he exhorted them in Oct. 1914 to destroy French's "contemptible little army," or when in the last year of the war he celebrated the 30th anniversary (June 15 1918) of his accession by describing the struggle as a mortal combat between Anglo-Saxon and Prusso-German ideals. In the eyes of his people his personal prestige did not increase; it distinctly diminished, even before the last phase of open aversion from him. He formally retained the final decision in military as in political affairs. There was a long and bitter struggle between three successive chancellors (Michaelis may be left out of account) and the higher military command on a variety of questions—hypothetical terms of peace, the Brest Litovsk negotiations, the armistice question, and, throughout the war, the best method of maintaining the war-spirit of the population. More than once Hindenburg and Ludendorff threatened to resign, and it was between them and Bethmann Hollweg that William II. had to choose when he parted (July 14 1917) with his first war chancellor. "The Government," as Ludendorff says, "had itself to blame, as it frequently appealed to its agreement with the chief military command, and dismissed proposals and demands on the ground that the military leaders objected."

In naval matters the Kaiser had greater success in resisting the authoritative methods of Grand Adml. von Tirpitz, and carrying out his own policy and Bethmann Hollweg's of holding the High Seas Fleet in reserve, or (as he called it in his order of Aug. 6 1914) "on the defensive." For a long time Bethmann, and perhaps also William II., seem to have hoped that Great Britain might be detached from the Allies, if the struggle for naval ascendency were not too keenly pressed. This hope was chimerical, but Bethmann was not a far-seeing statesman, and the views of the Kaiser, who reckoned upon an intact fleet as a valuable political asset for peace negotiations, were seldom based on sound calculations. Tirpitz found himself compelled to resign on March 16 1916.

William II.'s reputation in peace-time had been largely based upon the spectacular setting which he gave to his policy and upon his rhetorical speeches. All effects of that kind gradually failed him during the World War, and some of them lent themselves to ridicule. In Jan. 1916 he had a meeting with his Balkan ally, King Ferdinand of Bulgaria, at Nisch, when Ferdinand at a banquet addressed him in obsequious terms and exclaimed in unconsciously ambiguous Latin, "*Tu es Caesar et gloriosus!*" The Emperor's part in the attempts to secure a "German Peace" in 1916 and 1917 was singularly unfortunate. The declaration issued on Dec. 12 1916 by Germany and the powers associated with her was manifestly a manœuvre to anticipate President Wilson's peace action, to represent the Allies as blood-thirsty and unconciliatory, and to hearten the German working-classes for the fight. It gave no information as to terms, and it contained no reference to the crucial question of the future of Belgium. What the Kaiser's ideas of peace terms at that date may have been is a matter of inference from what has since become known regarding his attitude some six months later. After the Reichstag's so-called "Peace Resolution" of July 1917, efforts were made to induce the Vatican to interest itself in the question of peace, and ultimately a papal note on the subject was issued. In a document addressed on behalf of William II. to Mgr. Pacelli, the Papal Nuncio at Munich, the Kaiser's peace terms were described as including an indemnity of 30 milliard dollars from the United States and 40 milliard dollars from France. Longwy and Briey, rich mineral districts on the French frontier, were to go to Germany, and Great Britain was to give up Malta. The disclosure of these items in the Imperial document was made in the Reichstag on April 27 1921, by the Independent Socialist, Dr. Breitscheid, Chairman of the Reichstag Committee for investigating responsibility for the origin and prolongation of the World War. In 1917 as in 1916, the only peace which William II. and his military and political backers contemplated was a peace with victory (*Siegfrieden*).

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The events which led up to the collapse of Germany and flight of William II. in Nov. 1918 were political as well as military. Even so stout a Catholic conservative as the Chancellor, Count Hertling, had described the Prussian franchise question, for example, as "a matter of life and death for the dynasty." Internal reforms were long overdue, and this one had been promised in the Kaiser's edicts of April and July 1917, though only as a result of the apprehensions excited by the revolution in Russia. The obstinacy of the Prussian reactionary Chamber of Deputies and the Upper House delayed the reform until the monarchy fell. In the Reichstag the Imperial prerogatives—especially the right in certain circumstances to make war and peace—were being dealt with by a committee on the Constitution. Prince Max of Baden's Coalition Government, which included several Social Democrats, was avowedly installed for the purpose of introducing Parliamentary Government as well as for making peace. Here again reform came too late.

On Aug. 14 1918, the alarm which Ludendorff had communicated to the Kaiser regarding events in the field and the *moral* of the German troops had induced William II. and his political advisers to contemplate applying to Queen Wilhelmina of Holland for mediation, but nothing was done for some weeks. In the middle of Sept. the Kaiser addressed to the workmen at Krupp's an appealing speech which showed that he recognized the military situation and the internal conditions of Germany to be almost desperate. He returned at the beginning of Oct. from headquarters at Spa to Berlin.

Meanwhile an urgent appeal by Hindenburg and Ludendorff to the German Government to open negotiations at once for an armistice had revealed the desperate state of affairs at the front to the members of the Government, including the Social Democrats. Shortly after the Emperor's return, the constitutional changes limiting his prerogatives had been adopted by the Reichstag, and the bill was awaiting his signature. On Oct. 28 he accepted the constitutional law in a letter to Prince Max, in which he avowed sentiments with regard to the rights and duties of the representatives of the people which might have saved his dynasty if he had expressed them years or perhaps even some months earlier. The question of his abdication had now definitely arisen and was being ventilated toward the end of Oct. in the Socialist and the Democratic press. President Wilson's frank declaration that he could not trust the word of the existing rulers of Germany gave a great impetus to the discussion. William II. on the throne, whatever might be his revised sentiments, was regarded in Germany as an obstacle to peace. The Independent Socialists had gone further than the other parties of the Left and, through the mouth of their leader, Haase, had declared in the Reichstag that it was no longer a question of the Kaiser alone, but of the Prussian and other German dynasties. The Majority Socialists, who at that stage would have been satisfied with the abdication of William II. and the renunciation of the Crown Prince's rights to the succession, were forced by the attitude of the Socialist left wing to make at least the Kaiser question most urgent. Scheidemann, in his book *Der Zusammenbruch* (1920), gives an account of the reception of the members of the Imperial Government by the Emperor on Oct. 20 1918 at Bellevue Castle in Berlin. It was the first time (with the exception of a parliamentary soirée at the residence of Dr. Helfferich in July 1917, at the time of the so-called Peace Resolution) that William II. had met the new Social Democratic Secretaries of State, men whom he had formerly described in public speeches as "fellows without a country." Scheidemann says that the Emperor, in uniform, advanced holding in his hand a piece of cardboard, on both sides of which on typewritten sheets the words he was to address to his new ministers were pasted. William II. wore a forced smile and moved the cardboard sheet to and fro as if he meant to say "You know how these things are made up." He read the address with a loud voice, and "it would have made an excellent impression," Scheidemann says, "if it had been delivered some years earlier." It expressed the intention that nowhere in the world should there be freer institutions than in Germany. It concluded, however, with a reference to "the last breath and the last blow"—a phrase which was singularly out of place in view of the desperate efforts to obtain an armistice. The Kaiser afterward affably conversed with the Socialists who were presented to him. After he had departed, it was decided by the Ministry that the speech should not be published, as the situation was so far advanced that it would have made a ridiculous impression.

William II. knew what was in the air, and on Oct. 30 he quietly left Berlin for the western front. The revolution now broke out in the navy at Kiel and on Nov. 7 at Munich. Everything had been prepared by the Independent Socialists for the Berlin outbreak which came on the 9th, although another date had originally been contemplated. The Governmental Socialists, unable to control the movement, felt themselves constrained to address an ultimatum on the abdication question to the Chancellor, Prince Max. Emissaries from the Government had been at Spa from Nov. 3 urging the Emperor to abdicate, but he was stubborn and considered that it was his duty to remain and save Germany from Bolshevism. "Moreover," he said, "I should willingly work with the new order and the new Government; various gentlemen in it whom I have met are very sympathetic to me." On the morning of Nov. 9 Hindenburg was early at the Villa Fraineuse, the Emperor's quarters at Spa. The field-marshal had had a thorough discussion of the situation with representatives of the different army commanders, and at one o'clock he sent a final report to the Villa Fraineuse stating that, in the fairly unanimous opinion of the generals, the troops could still be relied upon to fight against the enemy, but would never fight against their own comrades, *i.e.* in defence of the Kaiser and the Prussian dynasty. Meanwhile, abdication was constantly being urged by telephone from Berlin. About two o'clock a precise answer was sent to Berlin that the Kaiser abdicated as German Emperor but not as King of Prussia. The reply came by telephone: "Too late: we have already published his abdication." To the Crown Prince, who had arrived for luncheon, the Emperor said as he departed about three: "Tell the soldiers that it is not true that I have abdicated as King of Prussia." Later, Hindenburg arrived at the Villa with Gen. Groener and Adml. Scheer. It was then "put in the Kaiser's mouth" to abdicate as King of Prussia also. When he left the conference he said to Count Dohna-Schlodien, his aide-de-camp, "You have no longer any Supreme War Lord."

All the afternoon and evening his suite urged him, in view of the feeling among the troops, to escape to Holland. He at first refused, but consented to go and dine in the Imperial train. On the way he said: "I am so awfully ashamed. I cannot find it in my heart to do this. I cannot go away. If there be but one faithful battalion here, I shall remain at Spa." He thus was contemplating a fratricidal war in defence of his crown. In the train one alarming message after another arrived regarding disorder on the lines of communication and concerning the approach of retreating troops to Spa. To those around him the Kaiser said: "At other times I have always known what to do, now I am at a loss." At 10 P.M. Adml. von Hintze urged him to start, for "in an hour it might be too late." The Kaiser finally said: "To facilitate peace for the nation I shall go to Holland. If I went to Germany, it would be supposed that I wanted to rally a new party to help me to make a *coup d'état*." He now considered himself relieved from any duties toward the army, as it had left him in the lurch; nor did he recognize any duty toward the Government which, on its own responsibility, had announced his abdication.

At 5 o'clock next morning,[1] Nov. 10, the Emperor left his train and, with a small suite, fled in motor-cars across the Dutch frontier to Eysden, where he arrived about 8 A.M. According to one account (Lady Norah Bentinck's *The ex-Kaiser in Exile*), he had walked up to a Dutch soldier at the frontier, saying, "I am the German Emperor," and had offered his sword; but no one knew what to do. At 10 A.M. his railway train arrived at Eysden, and he took refuge in it and there

[1] According to some accounts he departed during the night.

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spent that day and the following night. Arrangements had meanwhile been made, apparently through the Dutch authorities, with Count Godard Bentinck, who with some reluctance consented to receive him as a guest "for a few days" in his castle at Amerongen. The Imperial train left Eysden at 9 A.M. and at 3 P.M. reached Maarn where Count Bentinck and Count Lynden, governor of the province of Utrecht, were awaiting the ex-Kaiser on the platform. There was a considerable suite in the train, who remained to unpack large quantities of food and wine which they had brought with them. Count Bentinck arrived at Amerongen in his motor-car with the Emperor as evening was falling, and, as the guest entered the house, his first words were "now give me a cup of real good English tea." On Nov. 28 William II. signed his formal abdication at Amerongen, renouncing his rights to the Crown of Prussia and his consequential rights to the German Imperial Crown. On the same day the Empress Augusta Victoria arrived from Wilhelmshöhe Castle to join her husband. His personal suite, which had been a burden to his host, was soon reduced to two officials, a master of ceremonies and an aide-de-camp, but he retained a number of his servants. He seldom ventured, save for motor-car drives, beyond the precincts of the castle, which is surrounded by a moat. He spent most of his time in sawing logs of wood, an occupation in which he was so diligent that he provided the castle with firewood for the whole winter. As souvenirs, instead of autographs, he used to give away small blocks of wood on which he had inscribed his monogram. In June 1920 the ex-Kaiser and the ex-Kaiserin left Amerongen for Doorn, a property which the ex-Kaiser had just purchased, and which is situated near the main road between Utrecht and Arnheim. The house and grounds were henceforth watched by Dutch soldiers. Up to March 1920 the Allies' demand for his extradition was an open question, and notes were exchanged on the subject with the Dutch Government, which officially regarded him as a German refugee but undertook to prevent any political activities on his part. He was believed to have ample means, although it was reported toward the close of 1921 that he had been compelled further to reduce his establishment. In the autumn he managed to send a rhetorical message to a royalist demonstration in Berlin at which Ludendorff was present.

The prevailing German verdict upon William II. after the war was that he had been entirely unequal, by temperament, by capacity and by education, to the task of guiding the destinies of the German nation. His training before his accession had been almost entirely in the school of Prussian militarism, and, notwithstanding his subsequent travels and his intercourse with statesmen and men of affairs in his own and other countries, he retained in many matters the narrow outlook and the modes of expression of the average Prussian officer. In his cosmogony sovereigns and dynasties occupied a place entirely apart, and he regarded himself and a certain number of other sovereigns as occupying their positions by the grace of God, and as endowed with something like infallibility in home affairs. In his public speeches he affected the rhetoric of the Prussian officers' mess-room banquets and seemed quite unable to measure the effect of his words upon international relations. He aspired to guide the art, the intellect, the industry and commerce and even the theology of his country. He never realized that the age had moved beyond him in spheres in which he was essentially a dilettante. He had a lax conception of truth and honour in his personal diplomacy, and was accustomed to shift his standpoint in foreign affairs according to the nationality of the person with whom he was conversing. Dr. Hammann,[1] however, testifies that there were almost inexplicable lacunae in the Kaiser's memory. One of the German verdicts upon him, which does not appear to be far from the truth, was that his intellect and character had never matured.

The Empress AUGUSTA VICTORIA (*see* 28.669), who was at the castle of Wilhelmshöhe (the place of Napoleon III.'s internment in 1870–71) at the time of the Emperor's flight, joined him at Amerongen on Nov. 28 1918. She was already suffering from a heart complaint, and anxiety with regard to her husband and the possibility of his extradition weighed upon her more than upon him. She died at Doorn Castle on April 11 1921. Her remains were conveyed to Potsdam and placed in a temporary mausoleum in the park of the New Palace. The funeral furnished an occasion for some royalist demonstrations in Berlin. The Empress, although she accompanied William II. on many of his political journeys, confined her interests mainly to her family duties and to works of charity. She had been active in promoting Christian enterprises, particularly the building of churches in Berlin. She was regarded as the model of a German housewife and of a *Landesmutter*, as the Germans used to call the consorts of their sovereigns.

Interesting sidelights on the ex-Kaiser's character, reign and education may be found in such books as Bismarck's *Reflections and Reminiscences* (English ed. 2 vols., 1898). The third vol. of these *Gedanken und Erinnerungen* appeared in Germany in 1921, though it is dated 1919, having long been held up by an interdict given in favour of the ex-Kaiser on the ground that the volume contained the text of confidential letters written by him. In 1921 he withdrew the interdict, as most of the obnoxious material had found its way into the newspapers. See also Prince Hohenlohe's *Memoirs* (1906). Recently published books bearing on the subject are Dr. Otto Hammann's *Der Neue Kurs* (1918), *Um den Kaiser* (1919), which contains perhaps the best character sketch of William II., and *Der Missverstandene Bismarck* (1921), also Baron von Eckhardstein's *Lebenserinnerungen*, 3 vols. (1919–21). For the last phase Scheidemann's *Der Zusammenbruch* (1921) and *Die Deutsche Revolution* by Ferdinand Runkel (1919) are useful, and there is a remarkable, if rather highly coloured, short character sketch by Walter Rathenau, *Der Kaiser* (1919). Lady Norah Bentinck wrote a book of some interest, *The ex-Kaiser in Exile* (1921). (G. S.)

WILLIAM, German Crown Prince up to 1918 (1882–), eldest child of William II. of Germany, was born at the Marble Palace, Potsdam, on May 6 1882. He was educated at the Military Cadets School at Ploen in Holstein and at the university of Bonn. After visits to the courts of Vienna and St. Petersburg and an unofficial visit to Scotland he went on a tour with his brother Prince Eitel Friedrich to Constantinople and to the Nile. On his return to Germany he began his military career by serving in the 1st Foot Guards, and accompanied the Kaiser to England (Jan. 19–Feb. 5 1901) on the occasion of the funeral of Queen Victoria. On June 6 1903 he married the Duchess Cecilia, sister of the Grand Duke of Mecklenburg-Schwerin. There were five children, four sons and one daughter, of the marriage. His political and personal interventions in public affairs gave some trouble in the years preceding the war. He was credited with pan-German sympathies, and on one occasion (Nov. 9 1911) he appeared in the royal box in the Reichstag during the debate on the Morocco settlement and demonstratively applauded speakers who were attacking Great Britain and the Imperial Chancellor, Bethmann Hollweg. He was afterward compelled by the Emperor to make amends to the Chancellor. Other ill-advised interventions were in connexion with the Brunswick settlement, in regard to which he questioned (1914) the adequacy of his brother-in-law Prince Ernest Augustus of Cumberland's renunciation of all claim to the throne of Hanover, and again, on the occasion of the conflict in Dec. 1913 at Zabern in Alsace between officers of the garrison and the civilian population, when he despatched telegrams encouraging the officers in their truculent attitude. He had, nevertheless, done a public service in 1907 by calling the attention of the Emperor to the disreputable morals of the court *camerilla*, headed by Prince Philip Eulenburg, which was being denounced in the *Zukunft* by Maximilian Harden. In 1910–1 he paid a visit to Ceylon, India and Egypt, and he published some account of his experiences in his *Jagdtagebuch*. On the outbreak of the World War he was promoted to the rank of Lt.-General and appointed to the command of the V. Army in the west, where his troops were successful in the battles of Longwy and Longuyon on Aug. 22 and 24 1914. In Sept. 1915 he received the command of an army group, and he was nominally in charge of the German operations against Verdun. After the Armistice he represented himself in newspaper interviews as having been sceptical, since the battle of the Marne, regarding the possibility of the ultimate success of

[1] *Um den Kaiser* (1921).

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the German arms. His flight to Holland speedily followed that of the Emperor in Nov. 1918, and he went to Wieringen, an island in the Zuider Zee. He formally renounced on Dec. 1 1918 his rights of succession to the crowns of Prussia and the German Empire. The ex-Crown Princess and her children continued to reside at Potsdam, where she enjoyed considerable popularity among all classes of the population.

WILLY, the pen-name adopted by the French novelist HENRI GAUTHIER-VILLARS (1859–), born at Villiers-sur-Orge Aug. 10 1859. He was educated at the Lycée Condorcet and the Collège Stanislas, and afterward adopted a literary career. His early works include a *Recueil des Sonnets* (1878), and various volumes of essays and criticism, including *Essais sur Mark Twain et les Parnassiens* (1882), but he is best known for his novels, many of which were written in collaboration with the actress and authoress Colette Willy. The most famous of these is *Claudine à l'École* (1900), with its sequels *Claudine à Paris* (1901), *Claudine en Ménage* (1902) and *Claudine s'en va* (1903). Willy contributed largely to leading reviews, and also published various plays, including a theatrical version of *Claudine à Paris*, produced in 1902.

WILSON, SIR ARTHUR KNYVET, 3RD BART. (1842–1921), English admiral, was born at Swaffham, Norfolk, March 4 1842, the son of Rear-Adml. George Knyvet Wilson. He entered the navy in 1855, and served in the naval operations of the Crimean War and the Chinese campaign of 1857–8. In 1876 he was appointed to the "Vernon," the torpedo school-ship at Portsmouth. Having reached the rank of captain in 1880, he took part in 1881 in the operations against Alexandria and in 1884 won the Victoria Cross for bravery at El Teb. He became rear-admiral in 1895, was appointed Third Sea Lord and Controller of the Navy in 1897, and in 1901 became Vice-Admiral, receiving the K.C.B. in 1902. From 1901 to 1903 he commanded the Channel Squadron, and from 1903 to 1907 was Commander-in-chief of the Home and Channel Fleets. In 1907 he was promoted by Order in Council to the rank of Admiral of the Fleet, and in 1909 was appointed First Sea Lord in succession to Lord Fisher. He retired in 1912, and received the Order of Merit. He died at Swaffham May 25 1921.

Wilson was from the early 'nineties till practically the end of his life the most universally respected figure in the British navy. Himself the most unassuming man, careless of honours (he refused a peerage) and indeed of his personal appearance, he was a scientific sailor of the highest type, and a recognized master of strategy and tactics, whose advice, in and out of office, carried the greatest weight. He had no party, no favourites, and did not advertise. He was a silent man, whom everyone trusted; and during the World War he was still a power behind the Admiralty, and the ungrudging servant of his country.

WILSON, SIR CHARLES RIVERS (1831–1916), English public official, son of Melvil Wilson, was born in 1831, and educated at Eton and Balliol College, Oxford. He entered the Treasury in 1856, was private secretary to the Chancellor of the Exchequer (Robert Lowe) 1868–73, and was Royal Commissioner for the Paris Exhibition of 1878, having been already appointed Comptroller General of Office for Reduction of National Debt in 1874. Whilst holding this position, he visited Egypt in 1876 and early in 1878 was selected as vice-president of the Commission to enquire into the Egyptian financial situation. Some months later he was nominated Financial Minister in Egypt and, in 1879, he and the Prime Minister, Nubar Pasha, were the victims of a serious outrage by the mob in the streets of Cairo—an incident which was the direct precursor of the Arabi revolt and the British occupation of Egypt in 1882. In April 1880, on the fall of the Khedive Ismail and the inauguration of his son Tewfik as Khedive, Rivers Wilson was appointed president of the Commission for the Liquidation of the Egyptian Debt, with full powers to regulate the financial position of Egypt. On the conclusion of this duty he returned to his post in London, and in March 1885 he became joint British Representative on the Suez Canal Board. On retiring from his post as Comptroller General of the National Debt Office in 1894, he became in 1895 president of the Grand Trunk Railway of Canada. He was created a K.C.M.G. in 1880 and was promoted G.C.M.G. in 1895. He died on Feb. 9 1916.

WILSON, SIR HENRY HUGHES, BART. (1864–), British Field-Marshal, was born in Ireland May 5 1864, and joined the army in 1884. He served in the field in Burma between 1886 and 1888, and was wounded. After some years on the staff at home he went out with the expeditionary force to S. Africa in 1899, and he served there, first with the Natal army, and afterward at headquarters till the end of 1900. The period from 1901 to 1906 he spent at the War Office, and after 1904, in which year he was promoted colonel, he had much to do with working out the organization of the newly created general staff. He then became commandant of the Staff College, a position which he occupied until 1910, when he was appointed Director of Military Operations. In this latter capacity he got into close touch with high French military authorities, and gave special attention to the study of strategical possibilities in the event of war with Germany. He was promoted Major-General in 1913.

On mobilization in Aug. 1914 he was appointed deputy-chief of the general staff to the expeditionary force, and he served in that position for the first five months of the struggle, after which he became principal liaison officer between British and French headquarters in the field. He was given the K.C.B., and at the end of 1915 he took up command of the IV. Army Corps; this he held until the opening of 1917 when he went out as head of a military mission to Russia, returning just before the revolution. He was promoted Lt.-General on his return and was then in charge of the eastern command until Nov., when he was sent to Versailles to act as British Military Representative on the newly established Supreme War Council. In the following Feb. he succeeded Sir W. Robertson as Chief of the Imperial General Staff. The great German offensive of March took place almost immediately after his taking up this high appointment, and he played a prominent part in the steps taken to strengthen Sir D. Haig's forces. The friendly terms on which he stood with the French supreme authorities, no less than with the Home Government, contributed materially to ensure that coöperation between the Allies which so greatly assisted in giving victory to their cause. He had been promoted General soon after taking up the appointment, and on the final distribution of honours for the war he was promoted Field-Marshal, was given a baronetcy, and received a grant of £10,000. In December 1921, however, he resigned his position at the War Office (being succeeded by Lord Cavan); and soon afterwards he ranged himself with the supporters of the Northern Irish Parliament in Ulster of which he was elected a member.

WILSON, JOHN COOK (1849–1915), English philosopher, was born at Nottingham June 6 1849. He was educated at Derby and at Balliol College, Oxford, and in 1874 was elected to a fellowship at Oriel College. After graduating, he studied logic under Hermann Lotze at Göttingen. Returning to Oxford, he became well-known as a lecturer and in 1889 was appointed Wykeham professor of Logic. He died at Oxford Aug. 11 1915. Among his publications were *Aristotelian Studies* (1879, republished 1912); lectures on *Axioms*, on Plato's *Timaeus* (1889) and on the *Traversing of Geometrical Figures* (1905).

WILSON, WOODROW (1856–), twenty-eighth president of the United States, was born in Staunton, Va., Dec. 28 1856. He was baptized with the name of Thomas Woodrow Wilson. The Scotch strain predominated in his ancestry, for his paternal grandfather came from county Down, in Ulster, and his maternal grandfather, Thomas Woodrow, a graduate of Glasgow University, from Scotland. The stern Presbyterianism of his father, a minister of small means but marked capacity as a theologian, early influenced him and left an indelible mark upon his character. His early years were spent in Georgia and South Carolina, where he was deeply affected by the sufferings of the South during the reconstruction period. In 1875 he entered Princeton, graduating four years later. His record for scholarship in college was not remarkable, but he was prominent in debating and literary circles, and became student director of athletic sport.

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His most notable achievement was an article written in his senior year, and published in the *International Review*, which analyzed unfavourably the procedure of Congress and formed the basis of his more mature political principles. After studying law in the University of Virginia and following a brief attempt to practice in Atlanta, he decided to pursue his studies in government and history at Johns Hopkins University, where he received the degree of Ph.D. in 1886. His thesis, entitled *Congressional Government* and published in 1885, was a development of the attack upon Congressional methods, and because of its clear and felicitous expression has been reprinted many times. In that year[1] he began his teaching career at Bryn Mawr College, where he was associate professor of History and Political Economy until 1888; after two years as professor of the same at Wesleyan, he entered the Princeton Faculty in 1890 as professor of Jurisprudence and Political Economy. With slight changes in title he served in this capacity until 1902, when he became president of Princeton. As professor he rapidly achieved distinction. His lectures were remarkable for clarity of presentation and brilliancy of phrasing, and the same qualities characterized both his addresses and his published writings. His gift was for generalization rather than plodding scholarship, and after the publication of his thesis his happiest literary efforts were in essay form. They display keen critical capacity, but are not remarkable either for erudition or for striking creative power. As president of Princeton, Mr. Wilson devoted himself to serious reforms of the educational and social habits of the undergraduates. In the hope of elevating the standards of scholarship and of increasing the efficiency of instruction, he inaugurated in 1905 the "preceptorial system," designed through small classes to bring teachers and students into the most intimate relationship. In his endeavours to democratize the social life of the university he met determined opposition. Further difficulties developed from a disagreement with the dean of the Graduate College. Mr. Wilson's policies aroused warm controversy among alumni, faculty, and undergraduates.

While at Princeton, both as professor and as president, Mr. Wilson displayed great interest in political questions of the day, and through his addresses and articles speedily won a national reputation. In Sept. 1910 he was tendered the Democratic nomination for governor of New Jersey. The offer coming at the moment when the prospects for success of his policy at Princeton seemed most discouraging, secured his ready acceptance. Resigning his academic position he entered upon an active electoral campaign which won him the support of progressive elements throughout the state, despite the fact that his candidacy had been inaugurated largely under the auspices of the conservative Col. George Harvey (afterwards U.S. ambassador to Great Britain) and the Democratic state boss, Senator James Smith. In Nov. he was elected by a plurality of 49,000 votes. He at once made it plain that he intended, regardless of the protests of machine leaders, to fulfil his liberal pledges and would assume the leadership of the party for this purpose. As governor he successfully carried through a series of reform measures. Of these the most significant were: a Direct Primaries Law, which, supplemented by an effective Corrupt Practices Act, did much to purify the political atmosphere of New Jersey; an Employers' Liability Act; the creation of a Public Utilities Commission; reform in municipal administration, making possible the adoption of the commission form of government. Elections to the state Senate and Assembly in 1911 gave the Republicans a majority in both Houses and the legislative output was curtailed. Nevertheless his final activities as governor were characterized by the impetus which he gave to the passage of a series of bills, known as the Seven Sisters, directed to the protection of the public from exploitation by trusts.

When in June 1912 the Democratic National Convention met at Baltimore to choose a candidate for President, Mr. Wilson's reputation as an effective reformer had brought his name prominently before the delegates. The convention was apparently controlled by conservative elements and there seemed little chance of the nomination of an anti-machine progressive. But as the struggle to secure the necessary two-thirds vote proceeded, with the conservative forces divided between Champ Clark, Harmon, and Underwood, Mr. W. J. Bryan, leader of the progressive elements threw his dominating influence in favour of Mr. Wilson. It proved decisive, and on the 46th ballot he was nominated, July 2 1912. In the campaign that followed he voiced popular discontent with the conservatism of the Republican administration, which he believed to have been too closely allied with the interests of "privileged big business." His campaign speeches, characterized by a striking phraseology, won much applause, but were remarkable for their high moral tone rather than for originality of thought or policy. Like Roosevelt he demanded a national renaissance of ideals. In matters of immediate concern, such as the tariff, trust regulation, currency, the interests of labour, he insisted that the "rule of justice and right" must be set up. As regarded the future, in matters of conservation and trade, he asserted that great opportunities had been lost through the interlacing of privilege and private advantage with the framework of existing laws: "we must effect a great readjustment and get the forces of the whole people once more into play." His radicalism was of a mild sort and he insisted that "we need no revolution, we need no excited change; we need only a new point of view and a new method and spirit of counsel." The popular temper was responsive to such a tone, but success in large measure could hardly have come to him except for the division of Republican forces through the campaign of Theodore Roosevelt as Progressive candidate. In the Nov. election Mr. Wilson received 435 electoral votes as against 88 for Roosevelt and 8 for Taft; but his popular vote was a million less than that of his two chief opponents, and in only 14 states (all in the South) did he receive a clear majority.

Despite the fact that he was the choice of a minority of the whole people, Mr. Wilson's political position when he assumed office on March 4 1913 was one of remarkable strength. He was supported by a Democratic majority in both Houses of Congress, the Republicans were at loggerheads, and he might expect support from the Progressives for much of his reforming legislative programme. His Cabinet was not distinguished, but it contained certain elements of political and administrative strength, which proved advantageous for the moment, although later it was to become the mark for bitter criticism. The President soon made it plain that he was determined, as in his governorship of New Jersey, to exercise his personal influence and his position as head of the party to initiate and carry through the legislation he had advocated in his campaign. His ascendancy in Congress was soon established. After convoking both Houses in special session on April 7 1913, he delivered his first message in person, reviving the custom that had lapsed since the administration (1797) of the elder Adams. He intervened constantly during this and later sessions, to further the legislation in which he was especially interested.

The first important piece of legislation that resulted from the special session was the Underwood Tariff Act, which was passed in Sept. and signed by the President Oct. 3 1913. It provided for a notable downward revision and naturally met strong opposition from varied industrial interests. Such opposition was overcome largely through the personal efforts of Mr. Wilson, who appealed constantly to public sentiment, notably in an attack upon the activities of hostile lobbyists. The Tariff Act, in addition to lower duties and important administrative changes, introduced an income tax—long advocated by Democrats—which was destined in later developments to counterbalance the loss of revenue resulting from the lowering of the tariff; it weighed heavily upon the industrial interests of the North and increased the growing unpopularity of the President in that region. The Tariff Act was followed by a broad measure of currency reform, the Federal Reserve Act, signed Dec. 23 1913; it is generally regarded as the administration's second great legislative triumph. Mr. Wilson's purpose was to

[1] In 1885 he married Ellen Louise Axson of Savannah, Ga., who died in 1914, leaving three daughters. On Dec. 18 1915, he married Edith Bolling Galt of Washington, D.C.

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supplant the dictatorship of private banking institutions by a reorganization that should provide funds available to meet extraordinary demands and a currency that would expand and contract automatically. Early in 1914 the President called upon Congress to continue its labours of reform by the regulation of the trusts. After long debate and warm opposition, his appeal was answered by the passing of the Federal Trade Commission Act and the Clayton Anti-trust Act. The latter, besides perfecting anti-trust legislation in several ways, met the demands of labour by declaring that labour was not a commodity, by prohibiting injunctions in labour disputes unless necessary to prevent irreparable injury, and by proclaiming that strikes and boycotts were not violations of Federal law. It further exempted labour associations from the anti-trust laws.

Mr. Wilson's policy of domestic social reform had thus been developed with surprising legislative success during the first year of his administration. His foreign policy was not so clear-cut and aroused little enthusiasm. It was characterized by an evident desire to concede the rights of other nations to the limit and to avoid any stressing of the power of the United States for the material advantage of its citizens. Definite steps were taken to prepare the Filipinos for self-government. Pressure was brought to bear upon the California state Government to mitigate the severity of its anti-Japanese legislation. The "dollar diplomacy" of the preceding administration was repudiated and American bankers effectively discouraged from participating in the international Chinese loans. As a result of the President's personal demand, Congress repealed the law exempting American coastwise shipping from Panama Canal tolls. Mr. Wilson, however, failed to secure the Senate's ratification of a treaty with Colombia, which contained a virtual apology on the part of the United States and an offer to pay $25,000,000 as reparation for the alleged grievances of Colombia in connexion with the establishment of Panama as an independent country. In the Caribbean, Mr. Wilson's policy differed in principle rather than practice from that of his predecessors; in Nicaragua and Haiti the customs were taken over by U.S. officials. By a treaty signed Sept. 16 1915, a virtual protectorate of Haiti was assumed; in Santo Domingo the precautionary visits of American cruisers were followed in the summer of 1916 by the landing of marines, and in Nov. of that year by the proclamation of a military government under American auspices.

Mr. Wilson's Mexican policy aroused heated criticism. Following the accession of Gen. Huerta to power and the President's failure to arrange a settlement-providing for his elimination as dictator, Mr. Wilson resigned himself to what he called a policy of "watchful waiting." Conditions in Mexico were anarchical, and intervention was strongly urged by both American and European commercial interests. To formal intervention the President was definitely opposed, but in April 1914 he was compelled to authorize the occupation of Vera Cruz in retaliation for affronts to American blue-jackets. The proffered mediation of Argentina, Brazil and Chile he gladly accepted, but the resulting protocol of Niagara Falls (June 24 1914) did not provide a basis for peace. Although Huerta fled from Mexico in July, the country continued to be torn by rival factions. American troops were withdrawn from Vera Cruz in Nov. 1914, but it was not until Oct. 1915 that the Government of Carranza was recognized by Mr. Wilson, in company with eight South and Central American Governments. Further complications ensued. The raid into American territory of Gen. Villa, March 9 1916, led Mr. Wilson to authorize a punitive expedition, which soon aroused the protests of Carranza. In May and June the President mobilized the National Guard and sent a force of about 100,000 to patrol the Mexican border. The crisis was tided over by a joint Mexican-American commission sitting at New London, Conn., which brought no definite settlement, but at least postponed hasty action on either side. In Jan. 1917, the last American troops were withdrawn from Mexican soil. The President's policy had not led to stable conditions in Mexico, and the sole advantage secured seemed to be the emphasis laid by the U.S. Government on the principle that it would not take advantage of the misfortunes of a weak neighbour for its own selfish profit.

Foreign affairs after July 1914 were naturally dominated by the World War. President Wilson insisted upon a policy of strict neutrality. This he emphasized not merely by formal proclamation on Aug. 4, but by an address to the American people of Aug. 18, in which he adjured them, in view of the mixture of nationalities in the United States, to be impartial in thought as well as action. His offer of mediation, made on Aug. 5, remained without response, and further attempts at mediation in early autumn proved fruitless. His determination to remain absolutely aloof from European quarrels was underlined in several addresses, in which he insisted that the United States was in no way concerned, and was further emphasized by his opposition to any change in its military policy. America's vital interest in the struggle, however, soon became plain and resulted in diplomatic controversies with the belligerents. Great Britain's attempt to control indirect importation of goods into Germany, by an enlargement of contraband schedules and an extension of the doctrine of "continuous voyage" to conditional contraband, was vigorously opposed by President Wilson, who authorized Mr. Bryan, his Secretary of State, to protest in strong terms. A lengthy interchange of notes followed, which led to no settlement (*see* INTERNATIONAL LAW). The diplomatic controversy with Germany proved more serious. The proclamation of a "war zone" about the British Isles, in which German submarines threatened to destroy enemy merchant vessels with consequent danger to the lives and property of neutrals, was met by a note of Feb. 10 1915, which warned Germany that she would be held to "strict accountability" for the lawless acts of submarine commanders. Mr. Wilson further attempted to find a compromise, based upon a relaxation of the British food blockade and an abandonment of the German submarine campaign. The effort failed and was followed by a series of submarine attacks, which culminated in the sinking of the "Lusitania," May 7 1915, with the loss of over 100 American lives. The President, while he disappointed opinion in the eastern states by a speech in which he reaffirmed his pacific determination, stating that a man might be "too proud to fight," at once set out to win from Germany a disavowal and a promise that merchant ships should not be torpedoed without warning and the saving of the lives of passengers. A lengthy exchange of notes ensued; the pacific Mr. Bryan, Secretary of State, regarding the President's language as too strong, resigned; on the other hand Mr. Wilson's patience with the evasions of the German Government and the continued sinkings by submarines led to bitter attacks upon the President's policy of conciliation, which was stigmatized as anæmic or even cowardly. Mr. Wilson succeeded, however, in securing from Germany a promise not to sink liners without warning (Sept. 1 1915), and continued his efforts to induce Germany to abandon the submarine campaign completely. He was hampered by an attempted revolt of Congressional leaders, who blurred the issue with Germany by introducing resolutions designed to prevent Americans from travelling upon belligerent ships. The President, through his personal influence, secured the defeat of these resolutions in Feb. 1916, insisting that he would not consent "to any abridgment of the rights of American citizens in any respect." Shortly afterwards the issue with Germany was brought to a head by the sinking of the "Sussex," March 24 1916. Mr. Wilson waited three weeks before sending a formal note of protest to Germany (April 19 1916) but couched it in the form of an ultimatum, stating that unless Germany should immediately declare and effect an abandonment of its present methods of submarine warfare, the United States would be compelled to sever diplomatic relations. The German answer, while attempting to make acceptance conditional upon Great Britain's relaxation of the blockade, was in effect a promise not to sink merchant ships without warning and without saving human lives. The submarine issue now seemed less critical.

The diplomatic victory thus apparently secured by Mr. Wilson was utilized in his behalf during the electoral campaign

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of 1916, in which he was inevitably the Democratic candidate. It enabled his supporters to declare that he had vindicated the rights of the United States successfully, and at the same time had "kept us out of war." The slogan made a strong appeal, especially in the districts of the Middle West. The Republicans, on the other hand, who had nominated Charles E. Hughes, criticized the whole foreign policy of the President. They insisted that he had failed to take prompt action for the protection of American lives and honour, alike in his dealings with Germany and in his handling of the Mexican crisis. They characterized his domestic policy as demagogic, instancing the Clayton Act and the Adamson Act; the latter had been urged on Congress by Mr. Wilson to avert a railroad strike in Sept. 1916, and many citizens regarded it as an untimely surrender to labour threats. They also criticized his attitude on "preparedness," to which the President had been opposed until the close of 1915, and ridiculed the cautious expansion of military and naval forces provided for in the National Defense Act of 1916. In the east and in most industrial centres of the middle west, Mr. Wilson was unpopular, but the election showed his strength in the farming districts west of the Mississippi and on the Pacific coast; in spite of Mr. Roosevelt's return to the Republican fold the President drew largely from the Progressives, and on election day received a slight electoral majority over Mr. Hughes (277 to 254) and a popular plurality of 9,129,606 to 8,538,221.

His re-election enabled Mr. Wilson to proceed with plans for peace proposals to the European belligerents. These he had been preparing since the early summer of 1916, and, regardless of the German peace balloon of Dec. 12 1916, he sent on Dec. 18 identical notes to the belligerents, asking them to state the terms upon which they would consider peace. Informed of the undercurrents of German military circles, he evidently feared that if the war continued, the United States would necessarily become involved; he also hoped that a clear definition of war aims would strengthen pacific elements in both belligerent camps. The German reply was evasive; that of the Allies refused to consider peace until Germany should offer "complete restitution, full reparation, and effectual guarantees." The replies gave the President opportunity to expound what he had come to believe was the only sure basis of an enduring peace. This he did in a speech of Jan. 22 1917, in which he insisted that the peace must be organized by the major force of mankind, thus emphasizing the need of a League of Nations; that no nation should extend its policy over another nation; that no one Power should dominate the land or the sea. There must be a limitation of armaments. As a guarantee of future peace and justice, the ending of the existing war must not be the violation of the rights of one side or the other: it must be "a peace without victory." Further efforts to secure a peaceful arrangement were frustrated by the determination of the German militarist clique to renew the submarine warfare, regardless of the effect on the United States. On Jan. 31, the German ambassador, von Bernstorff, delivered a note to this effect, and four days later the President handed him his papers. He still, however, avoided formal war with Germany, and on Feb. 26 asked for a resolution of armed neutrality, which would permit the arming of American merchant ships for entrance into the barred sea zone. The resolution was blocked by a filibuster. Finally, in view of continued sinking of American ships, the President came to Congress on April 2 1917, and asked for a declaration that a state of warfare existed with Germany. The resolution was passed by the Senate on April 4, by the House on April 6.

President Wilson had always abhorred the exercise of force in international relations, and the war which he at last regarded as necessary was, in his mind, a war to ensure peace. Nevertheless he was determined that it should be waged efficiently and that the mistakes of previous wars should not be repeated. Those mistakes, he believed, had resulted chiefly from the intermixture of politics in military affairs, and from the decentralization of the American military machine. He opposed a coalition war cabinet, as leading to divided responsibility. Military policy was handed over to the military experts. He approved the immediate development of the general staff as the centralizing military organ, and it was upon the recommendation of that body that he urged, against the wish of Congressional leaders, the Selective Service Act. On the advice of the general staff he appointed Gen. John J. Pershing commander of the expeditionary force to France, and, also following that advice, he refused to authorize a volunteer force under Mr. Roosevelt. Similarly the plans for the development of a large army in France were inaugurated and translated into fact by the military experts. As regards conduct of operations the President gave to Gen. Pershing complete authority, and permitted no interference by politicians. In the building of the new army, the President took no direct part, but he used his authority consistently to favour centralization under the general staff. He followed a similar policy in the mobilization of the industrial resources of the nation. He encouraged the centralizing efforts of the Council of National Defense and its committees, and sought always to secure for them executive rather than the merely advisory powers which they at first possessed. He urged the Lever Act, which in Aug. 1917 created a Food and a Fuel Administration, and advocated the taking over of the railroads by the Government in Dec. His policy of economic centralization was ultimately assisted by the many protests against his war policies which were made in the winter, and which centred round the demand for a non-partizan war cabinet or ministry of munitions; for his supporters were able to insist that the more effective handling of war problems demanded not new machinery but greater efficiency of the existing mechanism. The President asked for powers to cut through red tape and rearrange bureaus without reference to Congress. His demands were embodied in the Overman Act, which was passed in May 1918, and which enabled him to grant executive powers to the various boards that had been created. The War Industries Board, released from its dependence upon the Council of National Defense, at once became the centralizing organ of the economic activities of the country. In his war appointments Mr. Wilson disregarded party lines, a notable fact since in political appointments he always showed himself strictly a party man. Republicans such as Hoover, Stettinius, Goethals, Schwab, Vanderlip, were chosen because of their administrative qualities and regardless of political affiliations.

During the war President Wilson consistently developed his ideals of a new international system which should perpetuate peace and assure justice and security to every nation regardless of its material strength. He hoped thus not merely to construct a basis for just peace when the war should end, but to hasten the end of the war by appealing to the peoples of the enemy states against their Governments. The most notable of his speeches was that of Jan. 8 1918, in which he stated 14 points necessary to a just and lasting peace. This, with his later addresses, was ultimately accepted as the basis of the final settlement. Their effect in Germany and Austria-Hungary was not apparent until the military defeat of those empires, but his words acted continually as a corroding factor, weakening the enemy's determination to fight. When in the autumn of 1918 they faced military defeat, they turned to Mr. Wilson offering to accept his Fourteen Points as the basis of peace. The President's insistence upon justice as an essential to a lasting settlement had brought him great prestige in Allied countries, but the chiefs of the Allied Governments hesitated to accept the Fourteen Points in the fear that the material advantages of the victory might be thrown away. They yielded, however, to the persuasive diplomacy of Col. House, who represented the President at Paris, and it was on the understanding that the Fourteen Points (reservation made of "Freedom of the Seas" and inclusion of Germany's promise to make full reparation) should be the basis of the peace that the Armistice was granted to Germany.[1] The President realized, however, that it would be difficult to translate his principles into the actual treaty. Aside from the opposition he might expect from selfish nationalistic interests among the

[1] The Fourteen Points are set forth in full in the article WORLD WAR, under the subhead *Political History*.

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Allies, he lacked unified support at home, where his political opponents called for a "strong peace" that would annihilate Germany; there was little enthusiasm for a League of Nations, which the President regarded as essential to a just and lasting settlement. Furthermore he had weakened his political position at home by a series of tactical mistakes. Of these, the most important was an appeal issued immediately before the Congressional election of Nov., in which Mr. Wilson asked the voters to cast their ballots for Democratic candidates, on the ground that a Republican Congress would divide the leadership at the moment of international crisis. Such an appeal would have been comprehensible if it had been made by a prime minister in a parliamentary country, but Wilson had proclaimed himself the leader of the nation and could not logically also play the rôle of party leader. The Republicans seemed to have some ground for complaining that although they had submerged partizan quarrels during the war, President Wilson was now attempting to capitalize the war and foreign affairs in order to win a partizan advantage. Many voters were antagonized by the appeal, and the elections went in favour of the Republicans. The President thus lost command of the Senate in the next Congress and its Foreign Relations Committee was to be controlled by his political and other opponents. Believing that his presence at the Peace Conference was necessary, if it was not to be dominated by old-style diplomatic practices, Mr. Wilson decided himself to go to Paris, and on Dec. 4 1918 sailed with the other members of the American Commission on the "George Washington." He arrived at Brest on Dec. 13, and was received at Paris, in England, and at Rome with tremendous enthusiasm. For the moment he was the popular hero, both in Allied and enemy countries. But his prestige rested on a precarious footing, and must inevitably diminish when he came to oppose the national aspirations of any people. He was anxious, therefore, to strike off a quick general peace, leaving details for later settlement; but this proved impossible, and formal conversations at Paris began only in Jan. 1919. The President succeeded in winning an early victory when he persuaded the conference to accept the principle of the League of Nations as the basis of the peace, and when, on Feb. 14, he won unanimous approval of the preliminary draft of the covenant. On returning to the United States, however, he found Republican opposition to the league strongly manifested in the Senate, although he had the support of Mr. Taft's influence in that party and in the country. Public opinion seemed to be uninstructed and apathetic as to the President's policies. Going back to Paris in March, he was able to secure the insertion in the covenant of certain amendments required by American sentiment, and the approval by the conference of the final draft of the covenant. But he was confronted by the demands of the French, Italians and Japanese for territorial and economic concessions from the enemy, which he regarded as excessive. Long discussions followed, culminating in Mr. Wilson's acceptance of a portion of the Allied demands, notably the granting of Shantung to the Japanese, of much of the frontier line promised by the Treaty of London to Italy, and the exaction from Germany of what amounted to a blank cheque in the matter of reparations. Such concessions aroused the opposition of liberals in England and America, who insisted that the President had surrendered his principles. Mr. Wilson, on the other hand, acknowledging that certain aspects of the settlement were not ideal, believed that he had won his main contention in securing the League of Nations, which provided the mechanism for eradicating the vices contained in the treaties. In this belief he was supported by another liberal protagonist, Gen. Smuts. On June 29 1919, the day following the signing of the Versailles Treaty, the President sailed for America. His international prestige had suffered from his opposition to national claims, especially that of the Italians to Fiume and of the French to the left bank of the Rhine. Nevertheless, as the bitterness of the moment passed, the magnitude of his accomplishments at Paris became more generally recognized. When the veil of secrecy surrounding the negotiations was gradually lifted, it was seen that the belief that he had been outmanœuvred by Lloyd George and Clemenceau was hardly justified by the facts. Lacking the negotiating ability of Lloyd George and the political experience of Clemenceau, he refused to enter the diplomatic lists with them, but by his manifest candour and sincerity early disarmed his opponents in argument. He said exactly what was in his mind, and was careful that his statements should be fortified by the documents and statistics furnished by his expert advisers.

The strain of the conference had told upon Mr. Wilson's physical and nervous strength. He was thus not well equipped to wage the struggle with his Republican opponents in the Senate which developed upon his presentation of the treaty. Had the President been willing to compromise and accept reservations to the covenant of the league, it is possible that the two-thirds necessary to ratification might have been secured. This course he refused to follow, and it soon became clear that the Foreign Relations Committee would not recommend ratification without serious reservations or amendments. In the hope of winning popular support, the President set forth upon a tour of the country and along the Pacific coast aroused enthusiasm in marked contrast to the coldness of the east. The effort, however, overtaxed his strength, and on Sept. 26 at Wichita, Kan., the President was compelled to give over his tour and return to Washington, where he suffered a complete nervous collapse. The exact nature of his illness was not made public and few realized how serious it would prove to be. Many, however, felt that in view of his inevitable abstention from active work, it would have been wiser for him to retire at least temporarily. As it was, his system had provided for no understudy and the administration was left without a leader. Entirely apart from the confusion thus caused in the conduct of the public business, Mr. Wilson's illness led directly to the defeat of the treaty. There was no one else capable either of leading the fight for ratification without reservations, or with sufficient authority to arrange a compromise. On Nov. 14 the Senate adopted reservations which Mr. Wilson declared would "nullify" (etc., etc.) the treaty; for this reason he urged the Democrats to refuse to vote for the ratifying resolution, which was accordingly defeated on Nov. 19 1919. During the succeeding weeks efforts were made to arrange a compromise. The Republican leaders agreed to soften the language of certain reservations, and the President intimated that he would accept a mild reservation on Article X. of the covenant, which had aroused the chief opposition. Neither side would yield enough, and when on March 19 1920, the final vote was taken on the ratifying resolution, which contained a strong reservation on Article X., Mr. Wilson again urged Democratic senators not to accept. The resolution thus failed of the necessary two-thirds by a margin of seven votes, 57–37. The President appealed to the autumn presidential election in 1920 as the decisive plebiscite. Although he had lost his former control of the party, and the Democratic presidential nominee at San Francisco was not his choice, the Wilsonian policies, including approval of the League of Nations, were inevitably the issue of the elections. In the electioneering campaign, however, the President himself could take no active part, for his physical collapse proved so serious as to confine him to the White House. For the overwhelming victory won by the Republicans, *see* UNITED STATES (*History*). After his defeat Mr. Wilson kept close silence on public matters, and his annual message of Dec. 1920, while it sounded the note of national duty, made no reference to that which lay nearest his heart—the League of Nations. This silence, indeed, he preserved until the close of his administration, March 4 1921. In Dec. 1920 he had been awarded the Nobel Peace prize.

The failure of President Wilson to win the approval of the United States for his peace policies presents one of the most interesting problems of American history. He had led the country through the difficult period of a war unsurpassed in magnitude and culminating in complete victory; in the face of serious obstacles he had forced European statesmen to accept the major item in his programme; he returned home only to be repudiated by his own people. Personal and partizan factors

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unquestionably contributed to his defeat. In private intercourse Mr. Wilson displayed a personal magnetism, a breadth of culture, and a genial cordiality that are amply attested by his intimates. But in public life he proved unable to capitalize such advantages, possibly because of natural shyness, possibly because physical delicacy restricted his social activities. Roosevelt's capacity for "mixing" with all political and human types he totally lacked. In the formation of his policies he isolated himself and was unable to establish close relations with Congressional leaders. This gave rise to the impression that the President disliked advice, was an ego-centric autocrat, and immediately dispensed with anyone who disagreed with him. Such criticism, by no means a novelty in the case of strong-willed presidents, was utilized by his political opponents and intensified his unpopularity in the industrial centres, especially of the east, an unpopularity which, except for a few months during the opening months of the war, was an outstanding factor in the political situation. Broadly speaking, the criticism does not seem to be fully justified. In matters of what he regarded as principle he was adamant, and he distrusted the judgment of those whose basic point of view was different from his own; but the evidence of those who worked with him, including that of Republican advisers at Paris, is almost unanimous to the effect that he was anxious to secure advice, was tolerant of opinions, and glad to delegate responsibility. The contrary belief was doubtless fostered by Mr. Wilson's inability to build up an efficient secretarial organization, and his incapacity, rather than unwillingness, to apportion effectively the details of administrative labour. His handling of war problems shows clearly his desire to delegate responsibility; once an appointment was made he refused to interfere and consistently protected his appointee from the importunities of politicians.

Political responsibility in general, he believed, should rest with the President. From conviction, rather than from egotism, he sought to emancipate the presidential office from the control of Congressional committees, a control which he earnestly deplored in his earliest writings. The President, he felt, should be the real leader of the nation, and not a mere executive superintendent. The Cabinet he looked on as an executive and not as a political council, and it was always strictly subordinated to his policies. So long as the Democrats held the majority in Congress he was able to translate such ideas into fact, and effectively disposed of all attempted Congressional revolts. This attitude naturally did not allay the political resentments which were inevitably aroused and which were intensified by Mr. Wilson's tendency to regard political opposition as tantamount to personal hostility; when the Democratic majority disappeared he faced uncompromising hostility. He was intensely impatient of partizan obstruction of his idealistic plans, and there is much of the Calvinist in his refusal to temporize or deviate from the path which he believed himself appointed to tread. While in matters of detail he showed at times some capacity for compromise, in matters of principle he displayed the unswerving determination characteristic of the prophet, a trait that is not always conducive to success in the exigencies of modern party warfare. Indeed it is as a prophet, rather than as a statesman that Mr. Wilson should be regarded. No one has preached more effectively the necessity of introducing a moral standard into international politics.

The following are the most important writings of President Wilson: *Congressional Government, a Study in American Politics* (1885); *The State—Elements of Historical and Practical Politics* (1889); *Division and Reunion, 1829–1889* (1893); *An Old Master and Other Political Essays* (1893); *Mere Literature and Other Essays* (1893); *George Washington* (1896); *A History of the American People* (1902); *Constitutional Government in the United States* (1908); *The New Freedom* (1913); *On Being Human* (1916); *International Ideals* (1919). Personal and political biographies of President Wilson have been written by H. J. Ford, *Woodrow Wilson: The Man and His Work* (1916); by H. W. Harris, *President Wilson: His Problems and His Policy* (1917); by W. E. Dodd, *Woodrow Wilson and His Work* (1920); and by his private secretary, Joseph P. Tumulty, *Woodrow Wilson as I Know Him* (1921). All four are eulogistic, especially the last two named. General surveys of Wilson's foreign policy are to be found in E. E. Robinson and V. J. West's *The Foreign Policy of President Wilson, 1913–1917* (1917); and in Charles Seymour's *Woodrow Wilson and the World War* (1921). Editions of President Wilson's State papers have been made by Albert Shaw, *President Wilson's State Papers and Addresses* (1917); by J. B. Scott, *President Wilson's Foreign Policy;* and *Messages, Addresses, Papers.* (C. SEY.)

WIMBORNE, IVOR BERTIE GUEST, 1ST BARON (1835–1914), British politician, was born at Dowlais Aug. 29 1835, the eldest son of Sir Josiah John Guest, 1st bart., of the firm of Guest, Keen & Nettlefold (the Dowlais Iron Works). He was educated at Harrow and Trinity College, Cambridge, and afterwards devoted himself to the management of his large property. He succeeded his father as 2nd bart. in 1852. He stood for Parliament as a Conservative several times between 1874 and 1880, and in the latter year was raised to the peerage. During the Tariff Reform controversy he seceded from the Conservative party, and afterwards sat in the House of Lords as a Liberal. He died at Canford Manor, Dorset, Feb. 22 1914. Lord Wimborne married in 1868 Lady Cornelia Spencer Churchill, eldest daughter of the 7th Duke of Marlborough.

Lord Wimborne's eldest son, IVOR CHURCHILL GUEST, was born Jan. 16 1873, and was educated at Eton and Trinity College, Cambridge. He unsuccessfully contested Plymouth in the Liberal interest in 1898 and served in S. Africa with the Dorsetshire yeomanry in 1900. In 1900 he was elected for Plymouth, holding the seat until 1906, and from 1906 to 1910 sat for Cardiff. In 1910 he was raised to the peerage as Baron Ashby St. Ledgers and sworn of the privy council, while from 1910 to 1912 he was paymaster-general. He became Lord-in-waiting to King George V. in 1913, and in 1914 succeeded his father as 2nd Baron Wimborne. In 1915 he became lord lieutenant of Ireland, but resigned in May 1916, after the Irish rebellion. He was, however, reappointed in Aug. 1916, and remained in Ireland till May 1918, when he was on his retirement created a viscount. He was well known as an enthusiastic sportsman and polo player, and to him was due the organization of the polo team which defeated the U.S.A. in the international match at Meadowbrook, Long Island, in June 1914.

WINCHESTER, England (*see* 28.704).—The pop. increased from 23,378 in 1911 to 23,791 in 1912. In 1912 the necessary work for preserving the cathedral by underpinning the walls and laying new foundations (undertaken in 1905) was completed, and on July 15 of that year the King and Queen attended a great Thanksgiving Service at the cathedral. The total cost of restoration was £113,000, raised by voluntary subscriptions. As much of the work had to be carried out under water varying in depth from 6 to 20 ft., a diver was employed continuously for 5½ years to lay down cement concrete at the base of the new foundations. The work was carried out by Sir Thomas Jackson and Sir Francis Fox. During 1919–21 a large part of the ancient stained glass in the cathedral was also restored.

In 1918 a find of iron currency bars of the early iron age was made on Worthy Down, near Winchester, and, in excavations near the same spot in 1920, some "pit dwellings" were located, the area appearing to be the site of a settlement of that age. The objects found were placed in the city museum. A number of other objects of archæological interest have been unearthed, including a portion of a stone column with its capital and dedication stone to Carinus (A.D. 283–4), the only inscription to that Emperor as yet found in Great Britain. In 1919 the valuable Dale collection of prehistoric and Roman antiquities was purchased and placed in the museum, and the Rosehill collection of prehistoric remains was transferred to the Tudor House museum at Southampton. A map of ancient Winchester, indicating all existing ancient and historic buildings and the sites of those no longer in existence, was issued by the Ordnance Survey in 1920.

A site of 100 ac. in the St. Cross district of the city has been planned on self-contained garden city lines, on which 560 houses were in course of erection in 1921. New county council offices for the county of Hampshire, on Castle Hill, were opened in 1911. The Guildhall was extended in 1914, and the old Tudor Guildhall restored in 1915. A chamber of commerce was established in 1919. During the World War Winchester was a prominent military centre, and some 50,000 troops, including Canadians and Americans, were continually in training there.

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WINGATE, SIR FRANCIS REGINALD (1861–), British general and administrator in the Sudan (*see* 28.729). In Dec. 1916 he was appointed High Commissioner for Egypt and relinquished the governorship of the Anglo-Egyptian Sudan, after a successful administration during 16 years. At the beginning of 1919 Sir Reginald Wingate was summoned to London to report on the situation which had arisen in Egypt, and he remained there many months at the disposal of the Government until his resignation in Oct. 1919. He had received the G.B.E. in Jan. 1918, and was created a baronet in June 1920.

WINNIPEG (*see* 28.731), the capital of the Canadian province of Manitoba, had a pop. at the close of 1920 estimated at 198,000 (271,958 including suburbs). The Dominion census of 1911 gave a pop. of 136,035. Winnipeg is the great commercial metropolis of western Canada, its importance having been enhanced since 1911 by the completion of the Grand Trunk Pacific Railway (which later became a part of the Canadian National Railways system). The Hudson Bay railway, intended to link Winnipeg with Port Nelson on Hudson Bay and thus to provide an outlet by sea through the summer months for the produce of the west, was still under construction in 1921. Begun as a private enterprise, it had been taken over by the Canadian National Railways system: its completion was expected to improve further Winnipeg's position as the trade outlet of the west. As the wholesale centre for the prairie provinces Winnipeg housed in 1920 5,000 commercial travellers representing an annual wholesale turnover that exceeded $300,000,000. The assessed value of property in the city that year was $259,419,520. After 1911 Winnipeg grew in importance as a manufacturing centre, and in 1920 had 513 factories and industrial plants, including flour mills, packing houses, structural steel works, rolling mills, tanneries, sugar refineries, clothing, harness, soap, jewellery and dye factories, etc. The output of its industries in 1917 amounted to $98,101,632. The almost unlimited power resources of the Winnipeg river, 100 m. away, led to a scheme for an extensive hydro-electric system, to develop 175,000 H.P., which was in course of construction in 1921. The Civic Power Electric Co. had developed 60,000 H.P., and the Winnipeg Electric Railways had developed 30,000 and had 50,000 under construction in 1921. The building of the Grand Trunk Pacific Railway, Canada's third trans-continental railway, in the years following 1911, opened an important phase in Winnipeg's history. The company's extensive railway shops were located at Winnipeg, and the Fort Garry Hotel was erected by the railway in the heart of the city.

WINTER, JOHN STRANGE (MRS. ARTHUR STANNARD) (1856–1911), English writer (*see* 28.734), died in London Dec. 13 1911.

WIRELESS TELEGRAPHY AND TELEPHONY (*see* 26.529).—Wireless telegraphy and telephony (also called radiotelegraphy and radiotelephony) made enormous progress between 1910 and 1921. This was due chiefly to the improvements and advances, effected in three great inventions, viz.: the three-electrode thermionic tube developed out of the Fleming oscillation rectifying valve, the high frequency alternator, and the Poulsen arc generator of continuous waves. The first of these has given a means of detecting electric waves of immense sensitivity, and also a most effective and easily managed generator of continuous electric waves. The second has provided machines for creating high frequency electric currents, and therefore electric waves, of great power, enabling large long-distance radio stations to be equipped which can signal to any part of the world by day or night. The third has also given an alternative method of generating high-power continuous waves. These generating and receiving appliances quite revolutionized wireless telegraphy and made wireless telephony possible not merely as an experimental feat, but as a practically useful art. In addition to these inventions there have been others such as directive radiotelegraphy, and wire-guided high frequency telegraphy and telephony of immense utility. The application of the thermionic valve in ordinary wire telephony as a repeater is also bringing about improvements of very great importance. Contemporaneously with these achievements investigations have been made of a more scientific character arising out of the study of the nature of electric wave propagation round our globe and of the causes of atmospheric disturbances, called "strays," which have always been the great obstacle to practical radiotelegraphy.

We shall consider briefly the nature of these improvements in turn.

High Frequency Alternators.—It had become clear by 1904 or 1905 that the use of continuous waves in radiotelegraphy would have marked advantages over the then employed damped wave trains produced by condenser discharges, and would be essential for the accomplishment of radiotelephony. The most obvious method of producing such continuous waves (C.W.) was by some form of high frequency alternator. At that time, when wave lengths of 300 to 3,000 metres or 1,000 to 10,000 ft. were mostly in use, this meant the design of machines giving alternating currents having a frequency of 1,000,000 to 100,000,000, and such frequencies seemed unattainable by any ordinary alternator construction as long as the revolving part of the alternator had to carry coils of wire. In low frequency alternating current dynamos, generating currents, reversed 50 to 200 times a second, there is an electromagnet which provides a constant magnetic field through which field coils of wire are moved so as to generate in the latter an alternating current. Either the field coils or the armature coils may be the rotating portion. In the case of alternators required to produce high frequency currents (20,000 to 100,000) it is impossible to rotate coil-wound armatures or fields at the necessary speed, and the most usual solution of the problem is to construct inductor alternators in which the moving part consists merely of a disk or drum of steel with teeth or ridges on its edge or surface, which serve to change the magnetic flux through stationary armature coils, the field coil also being fixed. We can then balance such a drum or disk and so fashion its edge that it can be rotated at a high speed safely. With the increase in capacity and wave length of the aerial wires or antennæ requisite for long distance power stations, frequencies between 20,000 and 100,000 came into use, and attention was again directed to the design of alternators giving such frequencies.

M. Latour has classified these machines into: (1) alternators in cascade, (2) internal cascade alternators, (3) homopolar or inductor alternators, (4) variable reluctance alternators, and (5) alternators with partial utilization of periphery. Although Béthenod in France constructed in 1912 a small machine of type (1), the first alternators of type (2) of 100 kilowatt output, or so, were constructed by R. Goldschmidt about 1912.

In machines of types (1) and (2) we start with the production of a single-phase alternating current of some moderate frequency, say 10,000, and multiply it up to much higher frequencies by taking advantage of a well-known principle called Fresnel's theorem. If there be two equal vectors represented by lines of equal length, which are pivoted to one point and revolve with equal angular velocities in opposite directions, their resultant is a line of constant direction but periodically varying magnitude with amplitude twice the size of that of the revolving vectors. Hence an alternating magnetic field of constant direction may be resolved into two fields of constant magnitude but rotating in opposite directions, each of half the maximum amplitude of the alternating field. If then we pass a direct electric current through the field coils of an alternator and induce in the revolving armature an alternating current say of 10,000 frequency the field due to this armature current may be resolved into two oppositely rotating fields, one of which is stationary as regards the field magnets and the other cuts them with twice the angular velocity of the rotor. This gives rise to a current of twice the frequency in the field coils. The field due to this latter current can again be resolved into two oppositely rotating fields and these induce currents of still higher frequency in the rotor coils. We can so build up currents of frequencies in the ratio of 1, 2, 4, etc. The currents of intermediate frequency can be taken up in circuits comprising capacity and inductance tuned to these frequencies respectively. The current of the highest frequency can be put into an aerial wire and employed to radiate long electric waves of corresponding wave length.

High frequency alternators of the above description were built for the radio station established at Tuckerton, N.J., in correspondence with a similarly equipped one at Eilvese, near Hanover in Germany, and used for trans-Atlantic transmission from about 1912 up to the time of the entrance of the United States into the World War.

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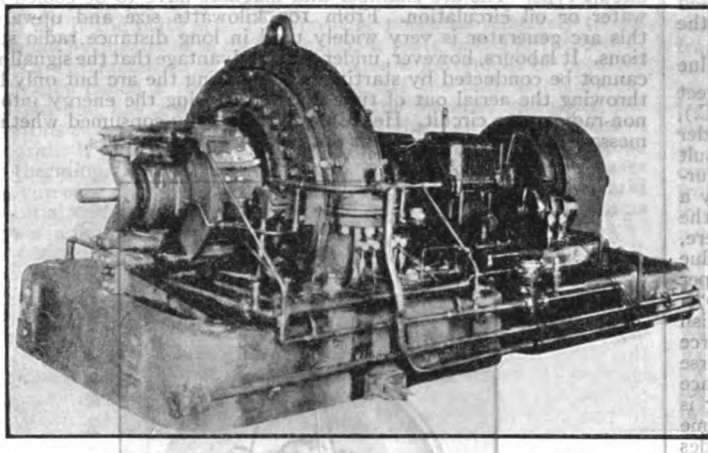
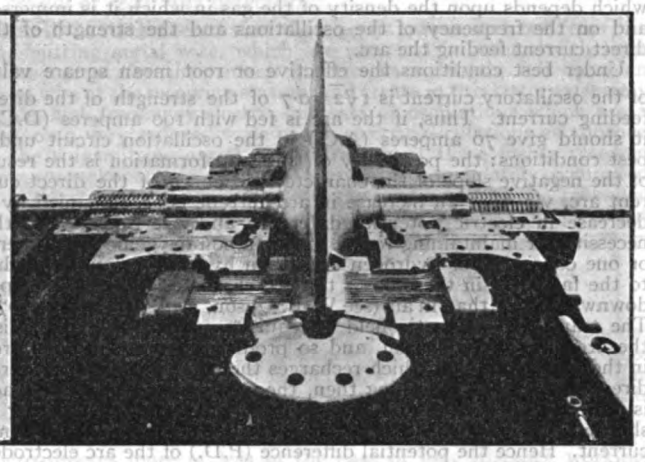
The third type of high frequency (H.F.) alternator, called the homopolar inductor alternator, is represented by the machines of E.F.W. Alexanderson with disk rotor, and Béthenod-Latour and the Société Française Radio-Electrique with drum rotor.

The principle of these alternators is as follows: a fixed ring-shaped frame or stator has inwardly projecting teeth of laminated iron, and a ringshaped magnetizing coil traversed by a direct exciting current causes magnetic flux to spring across from the teeth on one side (N. poles) to the teeth on the other side (S. poles). This flux traverses the air gap. Over these teeth is a zig-zag armature winding. Between the teeth in the Alexanderson machine revolves a steel disk with teeth cut in the periphery (*see* fig. 1 and fig. 1a).





FIGS. 1 (left hand) and 1a (right hand).—FIG. 1, 200 kilowatt Alexanderson high frequency alternator, driven by an electric motor. FIG. 1a.—Half section of the Alexanderson high frequency alternator; showing the inductor disk which revolves between the stator poles. (By permission of *The Wireless Press.*)

The number of teeth in the rotor is half the number of teeth on each side of the stator. These rotor teeth as they pass between the stator teeth decrease the reluctivity of the air gap and increase the magnetic flux passing. Hence as the rotor revolves the magnetic flux linked with the armature circuit is alternately increased and decreased. This creates an electromotive force and a high frequency current in the armature circuit. The only revolving part of the machine is thus a well-balanced rigid steel disk. The field exciting coil and the armature coil are both stationary. Such machines are called in English inductor alternators and in French homopolar alternators.

In the Béthenod-Latour machines the inductor is in the form of a steel drum with exterior of laminated iron in which longitudinal grooves are ploughed out. The stator ring has inward radially pointing laminated iron teeth on both edges, and the magnetic flux, leaving one set of teeth (N. poles), passes down through the drum teeth and up again into the other set of stator teeth (S. poles). The ridges on the drum serve to increase and decrease the flux through the armature wire which is wound zig-zag on both sets of stator teeth.

The peculiarity of the French machine is that the rotor or drum has many more ridges or teeth on it than the stator ring. By this we can obtain the necessary high frequency without dangerous peripheral speed in the rotor, and yet leave plenty of space for the armature winding placed on the stator teeth.

On account of the few turns in the armature such machines give a small electromotive force, but this can be raised by suitable static transformers, one secondary terminal of which is connected to the radiating antennæ and the other to the earth plates. The aerial wire is then tuned to the frequency of the alternator and the necessary wave length. A point of importance is the exact regulation of the speed of the machines which must be kept constant to within 0·1% of the normal. This is achieved by the use of very sensitive governors which control the speed of the direct coupled electric motor which drives the alternator. The signals are made in the case of the Alexanderson machines by varying the inductance of a tertiary coil on the transformer which transfers the energy from the aerial to a non-radiative circuit. By placing condensers in series with the H.F. alternators it has been found possible to run them in parallel, that is two or more together just as in the case of low frequency alternators in electric lighting and power stations.

High frequency homopolar alternators of the Béthenod-Latour type have been built by the Société Française Radio-Electrique up to 220 kilowatts size for the French military radio station at La Doua, near Lyons. To avoid loss of power by air churning these machines are enclosed in an air-tight case in which a partial vacuum is maintained. The speed of the machines is controlled by a Thury governor, and signals are made by short circuiting the armature coils in sections. Two or more machines can be run in parallel, thus giving to the aerial 500 or 600 kilowatts of electric power. Also similar machines are employed in the large French radio station at Croix-d'Hins near Bordeaux, and are installed in the very large French radio station at St. Assise, near Melun, which began to be erected in 1921. Alexanderson alternators of 200 kilowatt power are installed at the American naval radio station at New Brunswick, N.J. This station communicates with Stavanger radio station in Norway (3,554 m.) with Lyons (3,845 m.) and Nauen, near Berlin (3,958 m.) (*see* fig. 1).

The Arc Generator.—We must next mention the improvements made in connexion with the Duddell-Poulsen arc generator. In this appliance an electric arc is formed with a direct current between a water-cooled copper electrode (the positive terminal) and a carbon negative electrode. The arc is inclosed in a chamber filled with coal-gas or kerosene or alcohol vapour, and a powerful transverse magnetic field is made across it (*see* fig. 2). If the arc terminals are shunted by a circuit containing a condenser and an inductance coil, high frequency oscillatory currents will be set up in this latter circuit under certain conditions. Their

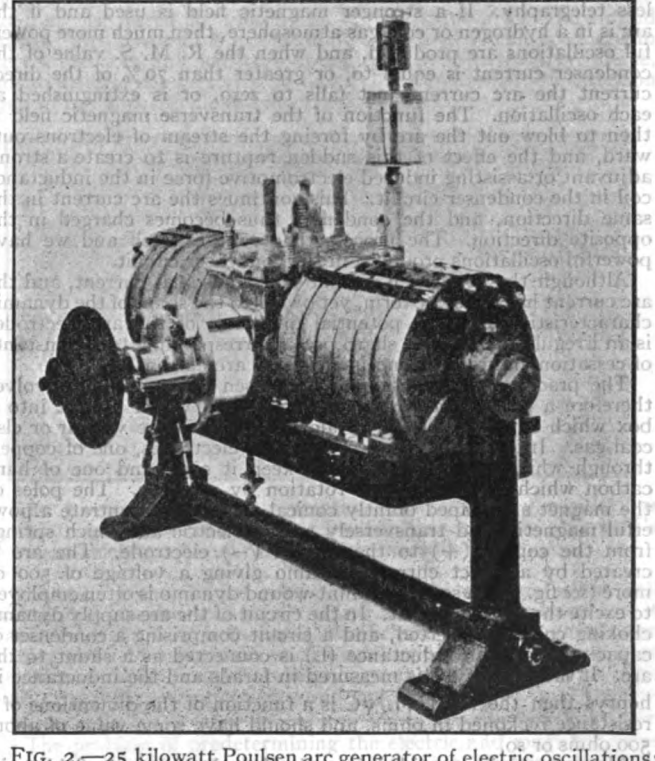


FIG. 2.—25 kilowatt Poulsen arc generator of electric oscillations; showing the electromagnet and arrangement for dropping alcohol into the arc box. (By permission of Marconi's Wireless Telegraph Co., Ltd.)

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energy can be inductively transferred to an aerial wire so as to radiate continuous electric waves from it. The arc must be in a certain *active* condition determined by its length and the strength of the magnetic field in order to produce oscillations. Many investigations have been made to elucidate the working of this oscillation-producing arc.

A fairly complete list of these papers is given by P. O. Pedersen in the *Proceedings of the Institute of Radio Engineers* (United States), vol. v, p. 255, Aug. 1917.

In order that the arc may be active, *i.e.* produce oscillations in the condenser circuit, it must be drawn out to a certain length, and the transverse magnetic field must have a certain optimum value, which depends upon the density of the gas in which it is immersed and on the frequency of the oscillations and the strength of the direct current feeding the arc.

Under best conditions the effective or root mean square value of the oscillatory current is $1\sqrt{2}=0{\cdot}7$ of the strength of the direct feeding current. Thus, if the arc is fed with 100 amperes (D.C.), it should give 70 amperes (A.C.) in the oscillation circuit under best conditions: the possibility of this transformation is the result of the negative slope of the characteristic curve of the direct current arc, viz. that an increase in arc current is accompanied by a decrease in electric potential difference and vice versa. Also the necessity for maintaining round the arc a non-oxygenic atmosphere, or one consisting of hydrogen or carbon hydrides or oxides, is due to the fact that in these gases the arc characteristic has a steeper downward slope than in air (see W. L. Upson, *Phil. Mag.* July 1907). The transverse magnetic field is requisite suddenly to extinguish the arc at each oscillation, and so produce an electromotive force in the inductance coil which recharges the condenser in the reverse direction. Broadly speaking then, the operation which takes place is as follows:—if the arc is burning steadily and the condenser is shunted across the electrodes, the result is to rob the arc of some current. Hence the potential difference (P.D.) of the arc electrodes increases. This, however, continues the charging of the condenser in the same direction. Then the latter discharges back through the arc and this lowers the P.D. of the electrodes.

The study of the oscillatory arc by means of the oscillograph by H. Th. Simon, H. Barkhausen, A. Blondel, and P. O. Pedersen has shown clearly the nature of the operations taking place. If no magnetic field, or a weak one is employed, and if the arc is in air only, feeble oscillations are set up in the condenser circuit, and the current through the arc is a pulsatory unidirectional current. This is the case of the Duddell or musical arc which has no use in wireless telegraphy. If a stronger magnetic field is used and if the arc is in a hydrogen or coal gas atmosphere, then much more powerful oscillations are produced, and when the R. M. S. value of the condenser current is equal to, or greater than 70% of the direct current the arc current just falls to zero, or is extinguished at each oscillation. The function of the transverse magnetic field is then to blow out the arc by forcing the stream of electrons outward, and the effect of this sudden rupture is to create a strong adjuvant or assisting induced electromotive force in the inductance coil in the condenser circuit. This continues the arc current in the same direction, and the condenser thus becomes charged in the opposite direction. The process then repeats itself and we have powerful oscillations produced in the condenser circuit.

Although the condenser current is a sinusoidal current, and the arc current has the same form, yet owing to the shape of the dynamic characteristic curve the potential difference of the arc electrodes is an irregular curve with sharp peaks corresponding to the instants of cessation and recommencement of the arc current.

The practical construction of a Poulsen arc generator involves therefore a large electromagnet having poles which project into a box which can be kept full of alcohol, or kerosene vapour or else coal-gas. Into this box project also two electrodes, one of copper, through which water circulates to keep it cool, and one of hard carbon which is kept in slow rotation by a motor. The poles of the magnet are shaped bluntly conical so as to concentrate a powerful magnetic field transversely to the electric arc which springs from the copper (+) to the carbon (−) electrode. The arc is created by a direct current dynamo giving a voltage of 500 or more (*see* fig. 2). A separate shunt-wound dynamo is often employed to excite the electromagnet. In the circuit of the arc supply dynamo choking coils are inserted, and a circuit comprising a condenser of capacity C and an inductance (L) is connected as a shunt to the arc. If the capacity C is measured in farads and the inductance in henrys then the ratio $\sqrt{L}/\sqrt{C}$ is a function of the dimensions of a resistance reckoned in ohms, and should have some value of about 500 ohms or so.

Means must be provided for adjusting the magnetic field to its optimum value (Ho) which depends on the frequency (n) of the oscillations produced, where n is nearly equal to $1/2\pi\sqrt{LC}$, or upon the radiated wave length λ (in metres) where $n\lambda=300$ million metres.

P. O. Pedersen states that $Ho=a/\lambda-b$ where a and b are certain constants (see "The Poulsen Arc and its theory", *Proc. Institute Radio Engineers*, United States, vol. v, p. 255, Aug. 1917). L. F. Fuller states that $Ho=\frac{K\sqrt{P}}{\lambda}$ where P is the power furnished to the arc and K is a constant depending on the surrounding gas or vapour. For kerosene $K=4{\cdot}23$; for ethylic alcohol $K=8{\cdot}5$. For a power of 50 kilowatts and a wave length of 7,000 metres the arc in alcohol requires a field of 8,300 C.G.S. units and for a wave length of 20,000 metres and a power of 1,000 kilowatts the field must be 13,500 C.G.S. units. Hence as the air gap is large (generally several centimetres) extremely large magnets are required. For the 1,000 kilowatts arc plant the magnets weigh 80 tons and for the 500 kilowatts plant 65 tons. For smaller sizes of plant the magnet is of the open circuit type and for the larger of the closed circuit type. The arc chamber and magnets have to be cooled by water or oil circulation. From 100 kilowatts size and upwards this arc generator is very widely used in long distance radio stations. It labours, however, under the disadvantage that the signalling cannot be conducted by starting and stopping the arc but only by throwing the aerial out of tune or by deflecting the energy into a non-radioactive circuit. Hence power is equally consumed whether message signals are being sent out or only spacing waves.

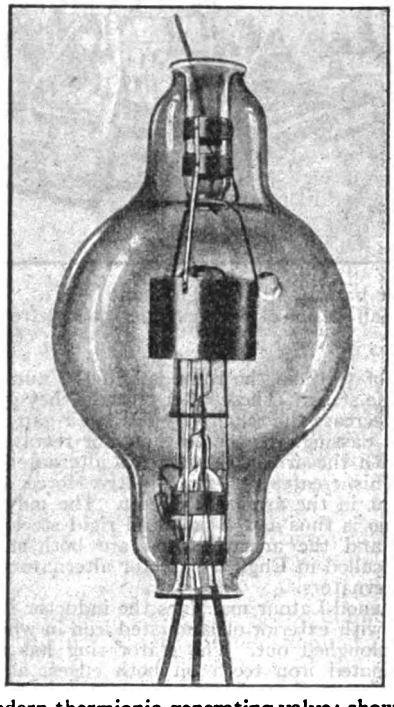

FIG. 3.—Modern thermionic generating valve; showing the cylindrical anode and metal gauze grid, as made by the Marconi-Osram Valve Company. (By permission of Marconi's Wireless Telegraph Co., Ltd.)

The Thermionic Valve.—The third type of high frequency electric oscillation generator which has become of great importance in the last five years is the thermionic valve, which is a development of the Fleming valve (*see* 26.537).

The Fleming valve comprises a glass bulb, highly exhausted of its air, and contains a carbon or metal filament which can be rendered incandescent by an electric current. Around the filament is placed a metal cylinder carried on a wire sealed through the bulb. The peculiar property of it is that, when the filament is incandescent, the space between the filament and cylinder will conduct negative electricity from the filament to the cylinder but not in the opposite direction. Hence the name "valve" given to it. It can, therefore, be used to separate out the two constituents of a high frequency alternating current and "rectify" them into a direct current. This valve was extensively used as a detector of electric waves in wireless telegraphy from 1904 onward as described later. In 1907, Lee de Forest in the United States, after he had become acquainted with Fleming's invention of the valve and its use in wireless telegraphy, added to it an additional element in the form of a grid or zig-zag of wire placed between the cylinder and the filament but carried on a separate terminal. He thus made a so-called three-electrode thermionic valve, a name sometimes shortened into *triode*.

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In its modern form a thermionic valve of the latter type comprises a highly exhausted glass bulb having in it a filament of tungsten, or thoriated tungsten or of platinum wire coated with oxides of barium and strontium (*see* fig. 3). This is rendered incandescent by electric current from a storage battery. Around the filament is a spiral of nickel wire or else a cylinder of nickel wire gauze. This is technically called the grid. Around that again is a cylinder of sheet nickel called the plate. The plate and the grid are carried on separate wire stems sealed through the wall of the bulb. Although the three-electrode valve was originally devised as a detector of electric oscillations as described below yet about 1913, or before, it was found that both the two-electrode valve and also the three-electrode valve can produce electric oscillations as well as rectify or detect them. When the filament is rendered incandescent torrents of electrons or particles of negative electricity are emitted from it. If the plate is given a positive potential relatively to the filament by means of a battery called a plate battery, these electrons are attracted to it, and this creates a movement of negative electricity called a thermionic current. If the bulb is highly exhausted and has a grid in it between the filament and plate, the electrons can only reach the latter by passing through the holes in the grid. If the grid is given a negative potential it reduces or stops the thermionic current. If it is given a positive potential it increases the current. The relation between thermionic current and grid potential can therefore be represented by a characteristic curve as shown in fig. 4.

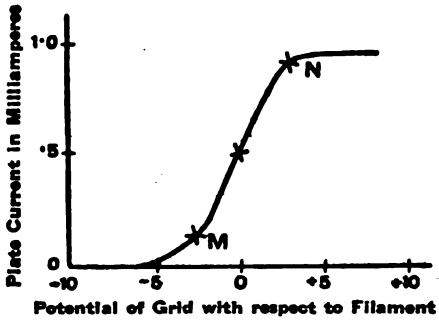

FIG. 4.—Characteristic curve of a three electrode thermionic valve.

The three variables, viz. plate and grid potential (v_p and v_g) and the thermionic current (i_p), may be regarded as three rectangular coördinates which define a characteristic surface, and sections of this, parallel to the $i_p v_g$ axes or $i_p v_p$ axes, delineate the principal characteristic curves. The central portion of this surface, corresponding to zero grid potential, is nearly a plane and has therefore the equation $i_p = av_g + bv_p$ where a and b are certain constants or coefficients.

If we pass a current by means of a high voltage battery from the filament to the plate and send this current also through the primary coil of an oscillation transformer, the secondary circuit of which is connected to the filament and grid, we have an arrangement by which continuous electric oscillations are produced and maintained. For, if properly connected, any variation of the grid potential will increase or decrease the plate current; and this acting through the transformer will in turn create the changes of grid potential which act to sustain the variations of plate current. The action is just like the well-known experiment of the singing telephone. If a magneto-telephone receiver is in series with a carbon transmitter and with a battery, then, when the transmitter is held near the receiver, the latter emits a shrill note. The sound given out by the receiver acts on the transmitter and this in turn actuates the receiver. The energy is drawn in both cases from the battery.

The three-electrode valve so used is called a transmitting valve, and the sustained electric oscillations it can produce, as above described, can be transferred to an aerial wire and cause it to radiate continuous electric waves.

Very large thermionic valves are now made with glass or silica bulbs, a foot or more in diameter, for use as transmitting valves, and numbers of these can be associated together to form a thermionic generator of large power. In this case the high voltage required to pass the plate current through the valve is obtained by the use of a battery of Fleming two-electrode valves which rectify a high tension alternating current of low frequency. A complete valve panel, as it is called, comprises the battery of rectifying valves, and three-electrode valves and also the necessary transformers, induction coils and condensers (*see* fig. 5). Large valve panels are now constructed to transform electric power from 1 kilowatt to 50 kilowatts or more into high frequency electric oscillations of great energy.

Such valve generators are extensively used by Marconi's Wireless Telegraph Co. and others for the production of continuous waves, and are employed at Clifden Station in Ireland for the transmission of wireless messages across the Atlantic Ocean.

Detectors.—We must in the next place notice the improvements which have taken place in means for detecting continuous waves (C.W.) as used in wireless telegraphy. The reader may refer to the earlier article on Wireless Telegraphy (*see* 26.535) for an account of the principal appliances used in connexion with spark or damped wave telegraphy for the detection of electric oscillations, and especially to the section on the oscillation valve or two-electrode thermionic detector, from which other types of improved thermionic detector have been developed. Subsequently to the introduction of the two-electrode, but prior to the advent of the three-electrode thermionic detector, much use was made of *crystal* or *rectifying* detectors.

It will be remembered that the electric waves sent out from the transmitting aerial wire, which are identical in nature with light waves except for their much greater wave length, fall upon an aerial wire at the receiving station, and create in this latter extremely feeble, high frequency electric currents or oscillations which are a copy on a very reduced scale of the electric oscillations established in the transmitting aerial. The strength of these feebly received currents reckoned in amperes (I_r) can be approximately computed from the strength of the currents in the sending aerial (I_s) reckoned in amperes by means of an empirical formula valid up to about 2,000 m. due to L. W. Austin and L. Cohen which is as follows:—

$$I_r = I_s \frac{377\, h_r\, h_s}{\lambda d\, R} \epsilon^{-0{\cdot}0045 d/\sqrt{\lambda}}$$

where h_s and h_r are the heights of the sending and receiving aerial wires in kilometres, d is the distance apart of the stations in kilometres, λ is the wave length in metres, ϵ the base of the Napierian logarithms, and R the total resistance of the receiving circuits in ohms.[1]

The received currents may be something of the order of 5–10 microamperes more or less in the case of long distance working. To detect these feeble oscillations special appliances called detectors are in use. The so-called rectifying detectors do this by converting the received oscillations into feeble unidirectional currents, which in the case of damped waves are equivalent to short gushes of electricity in one direction corresponding in frequency to the condenser discharges in the transmitter. These can then be detected by a telephone, as they create in the latter a musical sound agreeing in pitch with the wave group frequency, and this, by the action of the key in the transmitter, is cut up into *dot* and *dash* audible Morse signals. One of the first rectifying crystal detectors was carborundum discovered in 1906 by H. H. C. Dunwoody in the United States. This material is a crystalline carbide of silicon produced in electric furnaces, and, in certain specimens, as shown by G. W. Pierce, has an electric conductivity 40 or 50 times greater in arc direction than in the opposite along one crystalline axis.

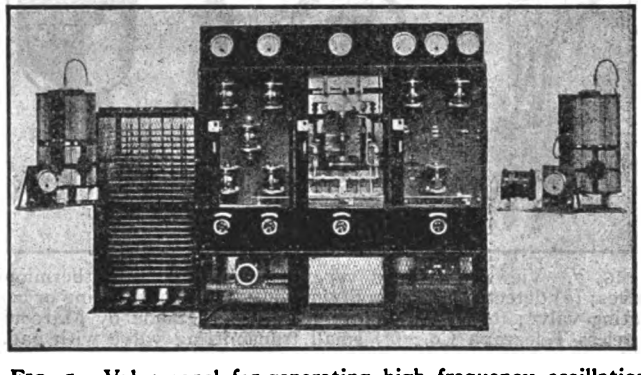

FIG. 5.—Valve panel for generating high frequency oscillations in the transmitters for wireless telegraphy, as made by Marconi's Wireless Telegraph Co., Ltd. (By permission.)

The same properties are exhibited by hessite and anatase as well as by molybdenite and other native sulphides. Furthermore, it was found by L. W. Austin and G. W. Pickard that contacts between certain pairs of substances such as tellurium and aluminium, or zincite and chalcopyrite, also plumbago and galena, have the same kind of unilateral conductivity and can be employed for "rectify-

[1] The problem of predetermining the electric and magnetic force at any point on a conducting sphere due to a Hertzian oscillator at some point on it is a very difficult one. The reader will find references to the work of Macdonald, Nicholson, Love, Rybczynski, and others in *The Principles of Electric Wave Telegraphy*, Fleming, 4th ed. chap. ix., and also in a paper by Balth van der Pol in *Phil. Mag.*, vol. xxxviii. (Sept. 1919). The final result is that diffraction alone will not account for long distance radiotelegraphy.

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ing" high frequency oscillations. These crystal and rectifying detectors came at one time into great use in wireless telegraphy.[1]

The limitation in the power of these crystal or rectifying detectors lay in the fact that the energy used in making the signal is only a portion of that captured by the receiving aerial from the incident waves. An immense improvement was therefore effected by the introduction of the three-electrode thermionic valve, which can act in the manner of a telegraphic relay and employs the received power merely to release a much larger amount of electric power from a local battery, which latter creates the signal in the telephone or other instrument. Moreover, this type of detector is capable of being used in series so as to amplify or magnify enormously the signal-making power.

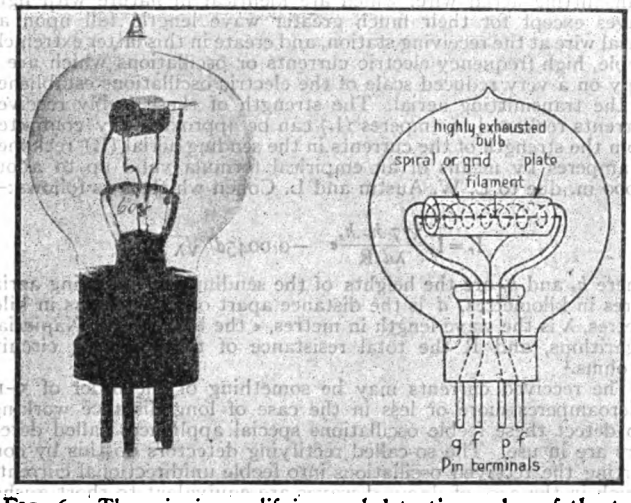

FIG. 6.—Thermionic amplifying and detecting valve of the type usually called the "French" valve with cylinder anode and spiral wire grid surrounding a straight filament.

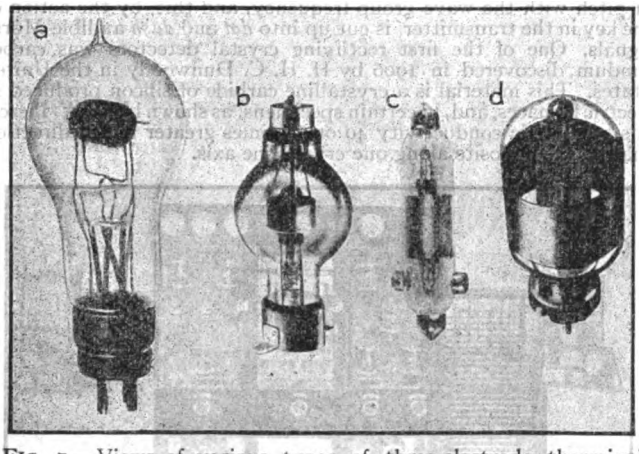

FIG. 7.—Views of various types of three-electrode thermionic valves; (*a*) detecting and amplifying valve; (*b*) transmitting or generating valve; (*c*) amplifying valve of a type made by Marconi's Wireless Telegraph Co.; (*d*) small transmitting valve with gauze grid.

The modern hard or high vacuum thermionic valve as used for reception and amplification is now generally constructed as follows:—a small glass bulb or tube, a few inches in diameter, has sealed into it a filament which can be rendered brightly incandescent by current from a 2-to 3-cell storage battery (4–6 volts). This filament is of drawn tungsten wire, or else platinum coated with oxides of barium and strontium. The bulb is highly exhausted. Around the filament and close to it is coiled a spiral of nickel wire called the grid, and outside that a cylinder of nickel called the plate. The plate and grid are carried on wires sealed through the bulb, and connexions to the grid, plate and filament are brought to four terminal pins at the base fixed to a brass collar (*see* figs. 6 and 7). These pins fit into a suitable socket. A battery of 30 to 200 volts E.M.F. has its negative terminal connected to the filament and positive to the plate, and when the filament is incandescent a stream of electrons (atoms of negative electricity), called the plate current, flows from the filament to the plate through the apertures in the grid wires. This current completes its circuit through a coil of wire in the external plate filament circuit which may be one coil of a transformer. If the grid has a small negative charge given to it the plate current decreases, and, if a positive one, the plate current increases. The relation of plate current to grid potential can be delineated by a characteristic curve (*see* fig. 4). For a certain positive grid potential the plate current becomes saturated and ceases to increase. If the grid and filament are connected to the terminals of the receiving condenser in a wireless telegraph aerial, the incidence of electric waves on the aerial will create alternations of potential in the grid and alternations of plate current, and the amplitude of the plate potential may be five to ten times greater than that of the grid. The thermionic tube is then said to have an amplifying power of five to ten.

If the coil in the plate circuit forms the primary coil of a two-coil transformer the secondary circuit of the latter may be connected to the grid and filament of a second valve, and a second amplification of potential may take place. We can thus employ a series of valves *in cascade* and the total amplification increases as the *n*th power of the number of valves (*n*) in cascade. Thus if one valve amplifies potential ten times, three valves will amplify 1,000 times and so on.

This use of thermionic valves in cascade has given us detectors of enormous sensitivity. In order to detect damped oscillations we can adopt one of two methods. If we place a small condenser with a leak across its terminals in the grid circuit then the side of this condenser next the grid becomes negatively charged, and the plate circuit of the valve is reduced. This charge leaks away almost instantly and the plate current of the valve rises again. Hence if the incident waves are in "damped trains" a telephone receiver inserted in the plate circuit of the valve will give a sound of the pitch of the train frequency, and this can be cut up into signals. In this case the valve is used as a rectifier as in the case of the Fleming valve. The second mode of use depends upon the form of the characteristic curve. If we employ a small battery of cells to give the grid a certain positive potential we can operate the valve at a point on the curve near to the saturation point so that a small reduction in the potential of the grid lowers the plate current, but a small increment of potential does not increase it. Hence if the grid is connected to one terminal of the tuning condenser of a receiving aerial it will oscillate in potential when a train of electric waves falls on the aerial. This, however, will cause a drop in the plate current and hence a sound in a telephone receiver included in that circuit. If the incident waves are damped or intermittent trains the result is to make a steady musical sound in the telephone of the pitch of the train frequency. Accordingly, by interrupting the groups by the sending key, audible Morse signals can be received.

The above described methods of reception are however only applicable in the case of damped or intermittent trains of waves. If the electric waves are continuous as sent out by an alternator, arc, or valve transmitter, then we can only detect signals made with them by converting the continuous waves into the equivalent of a series of damped trains. This is done by generating in the receiving aerial electric oscillations by a local valve generator which have a frequency differing from that of the incident waves by about 300 to 1,000. The result is to create in the receiving aerial resultant electrical oscillations which fluctuate periodically in amplitude just as "beats" in musical sounds are produced when two organ pipes slightly out of tune are sounded together. The number of beats per second is equal to the difference in the frequency of the two separate oscillations. In the aerial wire these electrical beats can then be detected by any of the types of detector and receiver used in spark wireless telegraphy. This method is therefore called "beat reception." The beats disappear when the signal bringing waves are interrupted at the sending station in making the spaces between the Morse code signals.

One great use of the three-electrode valve, or triode, as it is sometimes called, is in amplifying feeble signals. It has been explained already that when the grid of the valve is electrified positively or negatively it increases or decreases the plate current and, therefore, the plate potential. The amplitude of the plate potential variations may however be five or ten times or more that of the grid potential variations. Hence the valve acts as a relay or magnifier of potential. Again we can interconnect a number of such triodes in series by induction coils so that the variations in plate current of one valve are made to vary the grid potential of the next. Hence by using a series of valves in cascade we can multiply potential variations of the grid of the first valve in a geometric progression and enormously magnify them. The remarkable achievements of modern long distance wireless telegraphy are chiefly due to the use of such cascade amplifiers. In fig. 8 is shown a view of such a detector made by Marconi's Wireless Telegraph Co. in which six valves are used as amplifiers and a seventh valve as a detector. So sensitive are these cascade receivers that it is not necessary to employ any long aerial wire to receive wireless signals from distant stations. It suffices to construct a large rectangle of a few dozen turns of insulated wire called a frame aerial and connect this in series with a condenser of suitable variable capacity and tune the arrangement

[1] A fuller description of these rectifying detectors is given in *The Principles of Electric Wave Telegraphy and Telephony* by J. A. Fleming, 4th ed. chapter vi. (1919).

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to the wave length of the wave to be received. This frame is then placed with its plane vertical and in the direction of the sending station. As the incident electric waves sweep over it they set up in the wire very feeble electric oscillations. If a cascade thermionic amplifier is then connected to the terminals of the receiving condenser and appropriate tuning carried out the signals will be heard in the receiving telephone. It is possible to make one small storage battery of three cells provide the electric current for incandescing the filaments, and one battery of 40–50 cells provide the plate currents for all the valves. Very compact and portable multiple valve receivers of this type have been constructed for use in aircraft and for reception of time signals from distant radio stations.

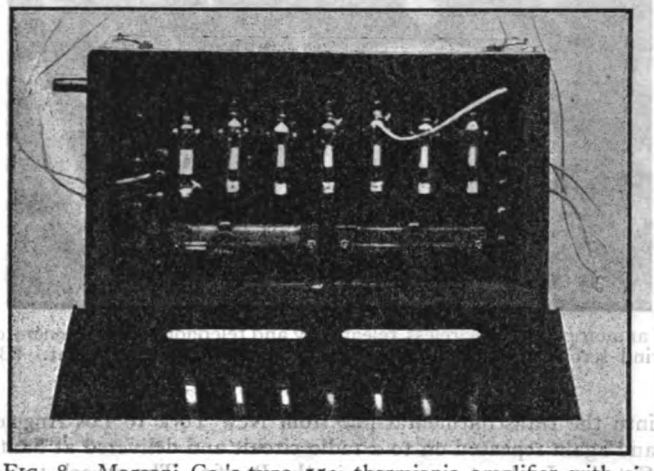

FIG. 8.—Marconi Co.'s type 55; thermionic amplifier with six amplifying valves and one detector as used in wireless telegraphy and telephony. (By permission of Marconi's Wireless Telegraph Co., Ltd.)

Directional Wireless.—The frame aerial has the important quality of being directive; that is, it tells us the direction in which the incident waves are travelling. Hence if two receiving stations at a known distance apart are provided with directive aerials, and if they simultaneously observe the direction of the arriving waves from one transmitting station, which may be on an aircraft or ship, these observations laid down on a chart will enable them to fix the position of the source of the signals. In this manner the position of aeroplanes lost in the clouds or ships in the fog may be found and their exact position communicated to them. There was a considerable development of this directive radiotelephony during the World War of 1914–8.[1] It has been found that there are peculiar difficulties in practising this direction finding at or about the times of sunrise and sunset.

In place of employing a movable frame aerial two fixed nearly closed circuit triangular aerials can be erected with their planes at right angles, and a resonant receiving circuit can be arranged to have a coil which is capable of rotation round a vertical axis but so as to be coupled inductively to both the fixed aerials by coils in the two aerial circuits. If electric waves fall on the aerials and if the movable coil of the receiving circuit is rotated into the azimuth in which it receives signals most loudly the direction of the plane of that coil will determine the line of direction of the transmitting station. It is possible by special arrangements to determine the direction along this line in which the electric waves are travelling. Many coast radio stations are now provided with direction finding aerials, and ships can call up these stations by wireless when in proximity, in case of fog, and have their bearings and exact position given to them. In another method of direction finding the coast station sends out a revolving beam of radiation which has a sharply marked point of zero radiation. The time of revolution of this beam is known, and also the instants when the zero radiation is in the true north and south direction at the sending station. Hence by observing the instants at which the zero radiation is observed at the ship, the ship's bearing with regard to the station can be determined. The station sends out time signals by which to correct the ship's chronometer.

[1] See "Direction and Position Finding," by H. J. Round, *Journal Inst. Elec. Eng.* London 1920, vol. lviii, p. 224; also J. J. Bennett, *Nature*, May 19 1921, vol. cvii, p. 363.

Another ingenious application of radiotelegraphy has been made by Prof. J. Joly to enable ships to find their position in fogs and avoid collisions. For details the reader must be referred to his paper in the *Proceedings of the Royal Society* of London, vol. xcii., A, 1915–6, pp. 170, 176, 252, and also to a paper by H. C. Plumer on p. 377 in the same volume. See also J. Joly, *Proc. Roy. Soc.* Lond., vol. xciv, A, 1918, p. 547.

Wireless Telephony.—The above described improvements in the production and detection of continuous electric waves had by 1921, within a few years, placed wireless telephony on a thoroughly practical basis. It is unnecessary to describe various experimental feats which had been achieved at intervals in this art of radiotelephony, in which the Poulsen arc or some modification was employed to generate the continuous waves (C.W.). All practical radiotelephony now involves the use of the thermionic valve both as a generator of C.W. and as detector.

The general principles of this method are as follows:—one or more three-electrode valves are employed in which the plate and grid circuits are inductively coupled so as to generate continuous oscillations. The plate circuit is also coupled inductively to a radiating aerial wire and continous waves sent off. The amplitude of these waves has then to be modulated in accordance with the wave form of a speech sound. This is done by means of another three-electrode valve called the control valve. The latter has the secondary circuit of an induction coil connected between its grid and filament, and in the primary circuit is a microphone transmitter and a voltaic cell or two. Hence if speech is made to the transmitter the potential of the grid is varied in accordance with the wave form of the speech. The plate current of this control valve is caused to act upon the plate current or grid potential of the oscillating valve so as to modulate the resulting high frequency oscillations also in accordance with the wave form of the speech made. At the receiving end the received oscillations are amplified by a series of valves and then rectified and passed through a Bell magneto-telephone. The speech sounds are then reproduced by the receiving telephone.

The advantage of this method is that only the ordinary standard telephone transmitter and receiver as used in telephony with wires are employed. To obtain the necessary high plate potentials in the oscillating valves we can either use voltaic batteries (dry cells) or else a small high tension direct current dynamo (1,000–2,000 volts), or else we can rectify a low frequency high tension alternating current by one or more Fleming valves. For aeroplane wireless telephony the plate voltage is supplied by a small dynamo driven by a wind screw which is set in action when the aeroplane flies. A large number of schemes for valve circuits for wireless telephone have been devised. During the war a great amount of ingenuity was expended in devising compact light weight sets of radiotelephone transmitters and receivers for use in aircraft and in the field (*see* figs. 9 and 9a). A problem of practical importance is that of two-way radiotelephony enabling two communicators to speak and hear simultaneously or to "cut in" or interrupt each other as can be done in ordinary telephony. If a single aerial wire has to be switched over from transmitter to receiver there is always risk of confusion owing to both operators trying to speak or listen at the same moment.

In the case of ground stations a practical solution is to use two wave lengths differing say by 5%. At each station there is a transmitter and a receiver say 100 yd. apart. One transmitter is tuned to the distant receiver but the wave length of the home receiver, which is tuned to the distant transmitter, differs by 5%. Each operator then speaks and listens on a different wave length and can "cut in" as he likes.

This method is, however, not applicable in the case of aeroplanes or ships for want of space. One suggested solution is that called the "quiescent aerial." The plate voltage of the oscillating valve is not supplied by a high voltage battery but at most by a few cells, and the remainder of the plate voltage is created by the rectification by the valve of the speech currents induced in the secondary circuit of the microphone transformer. In this case continuous waves are not thrown off from the aerial except in the act of speech to the microphone, and the receiver can then

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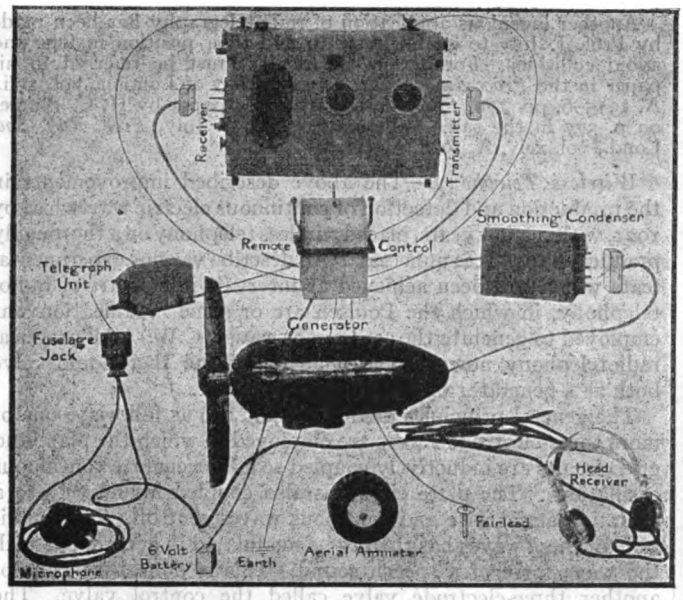

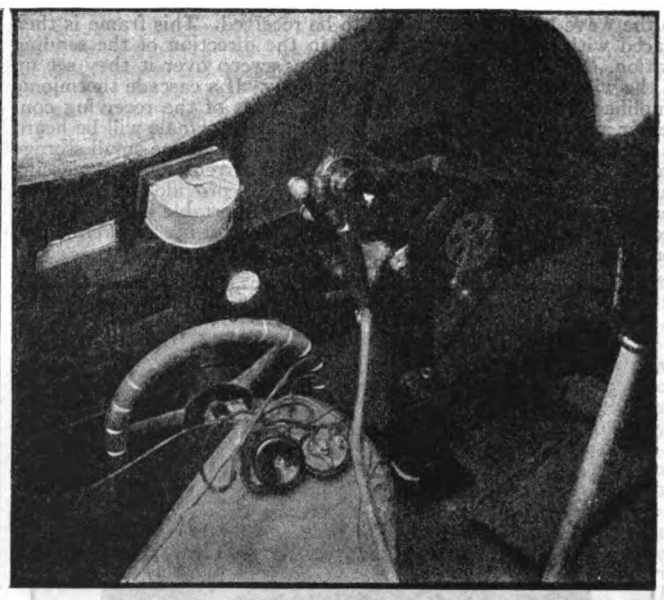

FIGS. 9 (left hand) and 9a (right hand).—The wireless equipment of an aeroplane for wireless telegraphy and telephony. The generator is fixed to the outside of the hull of the aeroplane and driven by a wind screw. Fig. 9a shows the general interior arrangement. (By permission of Marconi's Wireless Telegraph Co., Ltd.)

remain connected with the aerial. The arrangements will be understood from the diagram in fig. 9. The method is, however, not very successful and it cannot be said that two-way radiotelephony with a single aerial wire is a solved problem. On the other hand radio communication to and from aeroplanes up to 150 or 200 m. is now a thoroughly practical matter. The aerial is a wire about 230 ft. in length with a weight at the end which is unwound from a winch when the pilot wishes to communicate. The pilot generally wears a helmet with microphone transmitter opposite his mouth and two receivers over the ears. The transmission of speech from the aeroplane is more easy than reception owing to the great engine and propeller noises; nevertheless it is of immense use in connexion with air traffic as by it aircraft can be guided through the clouds to their destination, and the pilot informed of the conditions as regards fog or cloud at the landing station.

In May 1921 Marconi's Wireless Telegraph Co. carried out very successful demonstrations of practical radiotelephony on the two-wave system between Southwold in England and Zandvoort in Holland—a distance of 125 m. over the North Sea. The wave lengths used were 120 and 125 metres.

A very important use of the three-electrode valve is that of repeating speech currents from ordinary telephone wire circuits to wireless circuits and vice versa. Also this is perhaps the place to point out its extremely valuable qualities as a telephone repeater or relay for long wire circuits. Since the characteristic curve of the triode is nearly flat at the central part it follows that any irregular variations of grid potential are exactly copied by the corresponding variations of plate current. Hence if we connect the secondary terminals of a telephone transformer to the grid and filament of a valve and the primary terminals of another transformer to the plate and filament with plate battery inserted we shall have an arrangement called a *thermionic repeater*, which repeats and amplifies telephonic speech currents. If one or more such repeaters are inserted in a telephone line at intervals they will operate to neutralize the attenuation of the speech currents due to the resistance of the line and enable telephonic speech to be transmitted over larger distances without greater expenditure on the copper line conductor. Thus in the United States the long transcontinental telephone line from New York to San Francisco and Los Angeles has 13 such repeater stations in it, and speech is thus rendered possible over 4,000 m. of line.

In Oct. 1920 a remarkable feat was carried out in telephonic transmission by the aid of thermionic repeaters. A ship four hours out in the Atlantic spoke by wireless telephony to the mainland of the United States. The speech was then repeated into the transcontinental line from New York to Los Angeles and again repeated on to a radio circuit and delivered at Santa Catalina I. about 30 m. out in the Pacific. The speech transmission over this 4,000 m. was as perfect as over any exchange circuit in a large city. It is possible in this manner to speak to flying aeroplanes from the ordinary wire telephone of a town.

Long Distance Stations.—The above improvements in generation and detection of electric waves have not only made radiotelegraphy from ship to ship and ship to shore a certain and indispensable aid to navigation, but have enabled a multitude of long distance radio stations to be established which can maintain communication over distances of several thousand miles. It is now generally agreed that this possibility is due not to true diffraction of these long electric waves round the earth but to the fact that the higher levels of the earth's atmosphere are in a state of permanent ionization due to sunlight or extra-terrestrial causes. This creates a high level reflecting layer which guides the wave round the earth. There are, however, peculiar difficulties and effects at times of sunrise and sunset. In the United Kingdom the Marconi Co. have a large station at Carnarvon, Wales, near Snowdon, which is in correspondence with another at Marion, N.J., United States, for transatlantic working. The British receiving station is at Towyn, about 60 m. from Carnarvon, to enable reception and transmission to be carried out simultaneously. The direct effect of the Carnarvon radiation on the Towyn receiving aerial is neutralized by a balancing aerial (see British Patent Specification No. 13020 of 1911 of G. Marconi). The aerial at Carnarvon is a Marconi directional one, 3,600 ft. in length and 400 ft. vertical height supported on 10 tubular steel masts. The wave length of the radiation is 14,000 metres. The system of wave generation is the so-called timed-spark of Marconi. A direct current high voltage dynamo keeps two sets of condensers charged, and by means of a pair of rotating wheels with studs on their peripheries these condensers are discharged alternately through the primary coil of a transformer, the secondary coil of which is inserted between the aerial and the earth. These two sets of oscillatory discharges are made to follow each other in step and in close sequence by means of a trigger disk discharger which times two discharges so as to constitute in effect a continuous oscillation. The signalling is conducted by switches worked by compressed air which are operated through a relay by electric currents from Towyn. The same company have also a radio station at Clifden in Ireland which corresponds with another at Glace Bay, Nova Scotia. The Clifden station employs large thermionic valves as generators of continuous waves.

The Imperial Wireless Telegraph Committee which reported to Parliament in June 1920 recommended the thermionic valve generator for the imperial stations of the British Empire on the ground that the capital outlay would be less than for arc or alternator stations.

The high power radio stations in the United States comprise one at New Brunswick, N.J. which is equipped with Alexanderson alternators of 200 kilowatts capacity working on a wave length of 13,500 metres. The signals are made by means of a magnetic amplifier which is an independence coil, the impedance of which is varied by means of a small direct current which changes the per-

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meability of the iron core (see *Proc. of the Institute of Radio Engineers*, United States, vol. iv, April 1916, p. 101; a magnetic amplifier for radiotelephony).

The Radio Corporation of America began to build in 1921 a very large wireless station on Long Island which was to have 12 directive aerials, each 1½ m. long, arranged radially around the station. The waves were to be generated by high frequency alternators. The station would cover an area of nearly 10 sq.m. and be the most powerful in the world (see The *Engineering Supplement* of *The Times*, Aug. 1920). Another large U.S. radio station is that at Tuckerton, N.J., containing a Goldschmidt 200 kilowatts high frequency alternator. The radio frequency machine is driven by an electric motor supplied from two direct current generators in Ward Leonard connexion. This station was erected to correspond with one near Hanover, Germany. In France there are four very large radio stations; one at Croix d'Hins near Bordeaux, which was erected by the U.S. army during the war to maintain communications with Washington, contained originally 400–500 kilowatts Poulsen arc generators but is now partly converted to an alternator station. The aerial is carried on 8 lattice towers 800 ft. high (*see* fig. 10).

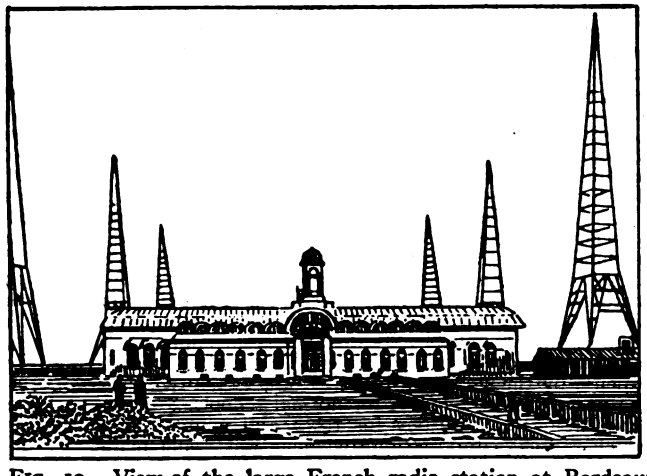

FIG. 10.—View of the large French radio station at Bordeaux erected by the American army during the World War for direct communication with the United States.

Another large French radio station at La Doua, near Lyons, with wave length of 12,000 metres is an arc station; a third exists at Nantes and a fourth is in Paris and employs the Eiffel tower to support its aerial wire.

The French Government began to erect in 1921 two large radio stations at St. Assise, near Paris, for European and world wide radiotelegraphy. These were to be equipped with Béthenod-Latour high frequency alternators and would have 1,500 kilowatts output.

In Germany there is a station at Nauen, near Berlin, which has a range of several thousand miles and wave length of 12,600 metres. This station like that at the Eiffel tower, Paris, sends out time signals at certain hours.

Broadly speaking, we may say that there were in 1921 about a dozen long distance radio stations in the world, which could signal to any part of the world by day or night, making use of wave lengths between 12,000 and 20,000 metres.

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WIRTH, KARL JOSEPH (1879–), German statesman, fourth chancellor of the post-war republican Reich, was born at Freiburg in Baden in 1879. The son of a working engineer, he was educated at the university of Freiburg. In 1908 he was appointed to the chair of Economics at the Technical College of that city; and after his election as a municipal councillor in 1911 he devoted himself to financial questions. In 1913 he obtained a seat as a member of the Catholic Centre party in the diet of Baden, and in 1918 was appointed Minister of Finance. In Jan. 1919 he was elected a member of the Constituent Assembly of the Reich which sat at Weimar. In March 1920, when the Ministry of the Reich was reconstructed after the Kapp *Putsch*, he received the portfolio of Finance, which he continued to hold in subsequent ministries. His task was to carry out the system of increased national taxation which one of his predecessors, Erzberger, had induced the Reichstag to adopt. When in May 1921 the Allied ultimatum on Reparation was presented to Germany and the "Sanctions" enforced on the Rhine, the Fehrenbach–Simons Ministry, which had rejected the London terms, resigned, and Dr. Wirth was called upon to form a new Cabinet. He succeeded in obtaining the coöperation of a number of able Democrats, Catholics and Socialists, including the prominent industrialist and economist, Dr. Walther Rathenau, as Minister of Reconstructions. Wirth himself retained the portfolio of Finance. The new Ministry then accepted the Allies' Reparation terms—132 milliard marks (£6,600,000,000) payable in yearly instalments of £100,000,000 plus the proceeds of a 25% duty on German exports. By Aug. 31 1921 Germany had paid the first half-yearly instalment of £50,000,000; and in the following Oct. Dr. Rathenau succeeded in concluding a comprehensive agreement with France for paying reparations in kind for the reconstruction of the devastated regions.

After the assassination of Erzberger on Aug. 26 1921 the conflict between the Government of the Reich and the reactionary Bavarian Ministry of von Kahr came to a head, von Kahr showing the same recalcitrancy against carrying out the special ordinances of the Reich against reactionary plots as he had previously exhibited in regard to the dissolution of the illegal volunteer force, the *Einwohnerwehr*. Dr. Wirth stood his ground, and ultimately von Kahr was compelled by his own party in Bavaria to resign and make way for a more conciliatory minister-president. The strife which arose out of this acute internal crisis had hardly abated when the announcement in mid-Oct. of the decision of the League of Nations on the partition of Upper Silesia between Germany and Poland aroused wild excitement throughout Germany, and, among other consequences, sent the exchange value of the mark down (Oct. 17) to 750 to the £. Dr. Wirth had not concealed his conviction that the severance from Germany of the rich industrial district of Upper Silesia would fatally affect Germany's capacity to pay further reparation instalments, and the political tension in Berlin again became acute. Eventually Dr. Wirth resigned, but nobody was found able to form a ministry in his place and he resumed office.

WISCONSIN (*see* 28.740).—In 1920 the pop. was 2,632,067, as compared with 2,333,860, in 1910, an increase of 298,207, or 12·8%, the state holding its rank of thirteenth. The density of pop. in 1920 was 47·6 per sq. m.; in 1910 it was 42·2. The proportion of urban pop. increased from 43% in 1910 to 47·3% in 1920. The following table shows the growth of pop. of those cities having 25,000 inhabitants:—

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	1920	1910	Percentage increase
Milwaukee	457,147	373,857	22·3
Racine	58,593	38,002	54·2
Kenosha	40,472	21,371	89·4
Superior	39,671	40,384	−1·8
Madison	38,378	25,531	50·3
Oshkosh	33,162	33,062	0·3
Green Bay	31,017	25,236	22·9
Sheboygan	30,955	26,398	17·3
La Crosse	30,421	30,417	—

Agriculture.—The cultivated acreage was in 1919 8,979,000; in 1909 7,980,000. The number of farms in 1920 was 189,295; in 1900 169,795. These increases were due mostly to frontier advance. In the older part of the state, farms tended to become larger and fewer. Of the farms 84·3% were in 1920 in the hands of their owners. These farms produced in 1909 crops worth $138,000,000 and live-stock products worth $260,922,000; in 1919 $445,000,000 and $371,791,000, respectively. The food product per acre increased since 1885 37% as contrasted with 21% for the United States as a whole. The statistics of special crops year by year are meaningless if taken individually, as there is great yearly fluctuation owing largely to the confidence felt by the farmers in the market forecasts furnished in the *Bulletins* of the University of Wisconsin. For instance, in 1917 the university had advised increased tobacco acreage. When war was declared wheat was advised instead, and an unusual amount planted. This wheat acreage was later returned to other crops. There were in 1920 more silos than in any other state, Wisconsin seed had acquired a reputation and a market, and canning factories, creameries, etc., situated near the point of production, fitted raw products for the market. Relatively the leading feature was dairying, in which Wisconsin stood first among the states. The increase in dairy cows from 1,474,000 in 1910 to 2,180,000 in 1920 was attended by great improvement in quality.

Manufactures.—The total value of manufactured products ($695,172,002 in 1914) was not much below that of farm products, but the value added by manufacture was only $277,756,928. The number of establishments rose from 8,558 in 1904 to 9,104 in 1914. Between the same years the number of workers rose from 173,572 to 230,272. The Lake Michigan region showed the greatest growth, owing to the greater cheapness of coal, which is all brought into the state. The great increase in the use of water-power was chiefly for lighting and transportation. In certain industries closely related to agriculture there was a tendency toward decentralization. The manufacture of farm products took first place, although flour decreased, and beet-sugar remained stationary. This position was due chiefly to the expansion of the dairy interests, butter, cheese, condensed and malted milk, etc. In 1880 the lumber cut was 1,542,021,000 ft., mostly white pine; in 1918 1,275,000,000 ft., largely hard wood. The value of lumber products in 1914 was $55,363,000; 473,840 tons of wood pulp for paper, worth $22,049,498, was produced. In 1914 Wisconsin ranked fifth among the states in the value of furniture produced, its value being $22,586,531. Leather remained in 1914 the fourth industry in the state, with a product of $55,362,511. Foundry and machine-shop products were in 1914 $60,698,000, a 12·1% increase over 1909.

Mines and Quarries.—The output of iron ore grew steadily, reaching 1,167,640 tons in 1918. The production of pig-iron increased rapidly, being in 1900 184,794 tons, and in 1919 605,619 tons.

Forests.—The forests still constituted in 1920 one of the great resources of the state, but of decreasing importance both absolute and relative. Measures for fire protection were increasingly effective. Surveys were in progress to determine what of the cut-over region should be reforested and what turned to farm land. The earliest Wisconsin industry, the fur trade, still produced, in 1918, a value of $669,005.20.

Fisheries.—The development of the fisheries was constant. New hatcheries were established at Spooner for pike, at Sturgeon Bay for white fish, and at Sheboygan for blue fin. In 1918 247,079,876 eggs were distributed. The commercial fishing was mostly in the Great Lakes where the catch in 1918 was valued at $792,040. This was less important than the sport fishing under licence in the rivers and streams.

Transportation and Commerce.—The railway mileage in 1917 was 7,667. It varied from year to year owing to the laying and taking up of logging lines. The main system had been complete for years, the state standing fourteenth in the proportion of mileage to area. About 1900 there began a movement for interurban electric lines, and a system was developed extending from the southern boundary to Janesville and to Milwaukee, and up the Fox river valley. In 1919 the mileage of all electric roads, urban and interurban, was 760. There was no recent extension of the interurban system, and suburban extension was less after 1910 than before, owing to the increased use of automobiles. In 1920 there were 277,093 automobiles, and 16,205 motor-trucks in the state. This development of automobile traffic occasioned a demand for better roads, and extensive plans were in process of completion. In the years 1912–8 $23,086,152 was voted for highway construction by local, county and state authorities. Concrete roads proved successful where the foundation was placed below the frost line.

Government.—A constitutional amendment in 1910 granted the state power to acquire and develop water powers and forests; one in 1912 regulated the borrowing capacity of cities and incorporated villages; another in 1912 gave the state powers for creating a park system; and one in 1920 for the enforcement of the prohibition amendment to the U.S. Constitution. In 1911 the salaries of justices of the Supreme Court were increased to $7,500. A law of 1915 allowed voting by absentee electors under certain circumstances, and one of 1918 arranged for voting by enlisted soldiers. The following state boards and commissions were created in or after 1905; Accountancy (1913), Compensation Insurance (1917), Conservation (1915), Engineering Department (1915), Grain and Warehouse (1905), Health (reconstituted 1913), Highways (1911), Industrial (1911), besides boards of examination for licences for architects, boxers, barbers, plumbers, etc., and *ex-officio* boards.

Miscellaneous Laws.—The cigarette prohibition law was repealed (1915), and the laws directed against out-of-the-state insurance companies were modified. A workmen's compensation law was passed in 1911. A law of 1917 provided for the sterilization of defectives and laws of 1913, 1915, 1917 provided for an antenuptial physical examination for men.

Finance.—In 1918 there was raised for general state purposes $14,281,216, the largest item of income being $5,370,305 from the railway companies; of the total, $5,986,661 was returned to the counties in aid of schools, tuberculosis sanatoriums, highways, etc. The tax levy of 1918 produced $12,142,121 for the use of counties, $22,580,567 for cities, towns and villages, and $16,444,671 were school and school district rates. The state income taxes of 1916, paid in 1917, amounted to $9,482,595, of which $603,762 went to the state and the rest to localities in lieu of the general property tax.

Education.—In 1915 a State Board of Education was provided to correlate the educational undertakings of the state. The most important new departure was with reference to vocational education, for which a Board was provided in 1915. A law of 1917 increased the effectiveness of compulsory education for those between 9 and 14; in 1915 aid in transportation was provided for those attending school at a distance from home; 32 cities in 1920 maintained continuation schools. In 1920 the total educational expense by the state and localities was $25,901,282; $2,779,072 for the university, $1,427,959 for normal schools, $10,024,095 for city schools, and $11,361,692 for town and country schools, toward which a great effort at improvement was being made.

History.—Gov. McGovern, elected in 1911, continued the progressive policy inaugurated by Gov. La Follette. The activities of the state Government were increased, their administration being given to commissions composed in part at least of recognized experts, and similar commissions were given power of supervision and control over private activities. The extension of this policy led to a reaction in 1914 and Emanuel Phillip was elected governor on a somewhat reactionary programme. The break, however, proved to be less violent than many expected, and the main features of the legislation of the preceding 10 years were continued. The outbreak of the World War divided sentiment in the state perhaps more than elsewhere in the country. In the 'fifties some German leaders had hoped to make the state essentially German and a centre in America for the development of German culture, as New England was for English Puritanism, but turned to liberalism. This project had failed, but a large element in the state was German-born or of German parentage, and many communities retained German habits and language, and educated their children in Catholic or Lutheran schools conducted in German. While this element was by no means solid in sentiment, the majority sympathized with Germany as opposed to Great Britain and her Allies. When the question arose of the entrance of the United States into the war, this element was opposed to it, and was reënforced by a powerful sentiment in favour of peace. The national representation of the state was divided. Senator La Follette voiced the peace sentiments, and was one of those characterized by President Wilson as "a little group of wilful men." Senator Husting, a Democrat, supported the Wilson administration. The death of Senator Husting necessitated a senatorial election in the spring of 1918, which attracted wide attention as a test of public opinion in the state which was thought least likely to support the war. An active campaign of education was conducted, by means of pamphlets, speeches and organization. The result was the choice in the Republican primaries of Irvine L. Lenroot, who was pledged to support the Administration in its war policy, and who defeated

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the Democratic candidate in the election which followed. Later Senator Lenroot broke with President Wilson on his peace policy, taking a stand for moderate reservations in the plan for a League of Nations. This stand was endorsed by his reëlection for the regular senatorial term in 1920, when the state gave a large majority also to Harding. In the gubernatorial election of that year, the successful candidate, Mr. Blaine, represented in general the La Follette views, maintaining that the stand taken by that senator was not disloyal, but legitimate opposition. Although many regretted the necessity of fighting Germany, the number who failed to support the United States was negligible.

Gov. Phillip proved an efficient war administrator, working in harmony with the national officials and organizing extremely effective state and local machinery to handle the problems that constantly arose. The state met and exceeded every demand made upon it, for men and for money; the draft was put into operation with success; the administrative effectiveness which had been developed in the preceding 10 years was everywhere in evidence. Wisconsin troops repeated the record they had made in the Civil War. A war history commission planned to put the war record in substantial shape for the future. The Wisconsin National Guard served on the Mexican frontier, 1916–7, and was called into national service for the World War in 1917; its aggregate strength, Aug. 4 1917 was 15,266. The losses of troops from Wisconsin in France were given as 5,735; 71,790 were accepted at camp under the draft laws. To the five Liberty loans $471,194,250 was subscribed. The United War Work Campaign of 1918 produced $4,546,706. Besides this a million had been raised for the Y.M.C.A., nine millions and a quarter for the Red Cross; 8,503 French orphans were adopted, and generous contributions made to all causes of war aid and relief.

The governors of Wisconsin after 1911 were: F. C. McGovern, Republican, 1911–5; Emanuel Phillip, Republican, 1915–21; John J. Blaine, Republican, 1921– .

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WISE, BERNHARD RINGROSE (1858–1916), Australian lawyer, was born at Sydney Feb. 10 1858, the second son of Edward Wise, Judge of the Supreme Court of N.S.W. He was educated in England at Rugby and Queen's College, Oxford, where he won the Cobden prize and was *proxime* for the Lothian Historial Essay, finally graduating 1st-class in law. He was also a prominent athlete, and represented Oxford in the mile race against Cambridge. He was called to the bar at the Middle Temple (1883), then returned to Australia, was elected to the N.S.W. legislature and became Attorney-General of N.S.W. 1887–8, and Q.C. in 1898, being again Attorney-General from 1899 to 1904 and, in addition, Minister of Justice 1901–4. For part of 1903–4 he was Acting-Premier of N.S.W. He did distinguished service to the cause of Federation but was defeated in the elections for the first Commonwealth Parliament, and his abilities therefore were never called upon for Federal service. From 1915 until his death, Sept. 19 1916, he was acting as Agent-General for N.S.W. in London.

WISTER, OWEN (1860–), American writer, was born in Philadelphia July 14 1860. He was a grandson of Frances Anne Kemble (*see* 15.724). On graduating from Harvard in 1882 he intended to devote himself to music. He went abroad for study; but ill-health forced him to return to America, and he spent several years in Arizona and New Mexico. He then entered the Harvard law school, graduating in 1888, was admitted to the bar in 1889 and for two years practised law in Philadelphia. Thereafter he gave his time to literary work. As an undergraduate he had contributed a poem, *Beethoven*, to the *Atlantic Monthly* in 1882. His subsequent publications include the *Modern Swiss Family Robinson* (1883); *The Dragon of Wantley: His Tail* (1892); *Lin McLean* (1898); *The Virginian: a Horseman of the Plains* (1902); *Philosophy 4: a Story of Harvard University* (1903); *Lady Baltimore* (1906); *The Seven Ages of Washington: a Biography* (1907); *Members of the Family* (1911); *The Pentecost of Calamity* (1915, a condemnation of Germany for the World War), and *A Straight Deal: or the Ancient Grudge* (1920). His novels, *The Virginian* and *Lady Baltimore* in particular, established his position as one of the foremost of contemporary American writers. He became a member of the National Institute of Arts and Letters and of the Société des Gens de Lettres de France, and in 1912 was elected a member of the Board of Overseers of Harvard.

WITTE, SERGE JULIEVICH, COUNT (1849–1915), Russian statesman (*see* 28.762), died in Petrograd March 12 1915. His diaries were posthumously published by the Soviet in Pravda in 1918, and a study of his career as Minister of Finance during 1892–1903, by D. A. Lutokhin, appeared in 1915. The *Memoirs of Count Witte*, translated from the original Russian MS. and edited by Abraham Garmolinsky, were also published in New York and in London in 1921.

WOËVRE, BATTLES IN THE, 1914-8.—The military importance of the great plain which separates the Metz ridges from the line of heights along the Meuse was evident as soon as the frontier of 1871 was drawn. On its N. side, a strip of bold undulating country, the axis of which may be taken as Montmédy–Thionville, skirts the Belgian and Luxemburg border, while at the S. it narrows, as the Meuse and Moselle converge toward Toul, to a blunted end facing the Haye Plateau and Toul. Along the Meuse (Verdun–Toul) and along the Moselle (Thionville–Metz) both sides gradually crowned the heights with permanent fortifications. The plain itself, through which the frontier ran along no very well defined line, was not fortified, each side treating it as a sort of foreground or glacis. Generally speaking, this frontier line left the plain to France, but the French ground immediately adjacent to the frontier was practically under the fire of the Metz guns. Hence the war outpost line, which was to protect the concentration of the French main armies, was drawn well back—almost to the verge of the Meuse heights—and no attempt was made to hold the frontier region itself.

This proved, in the sequel, to be of enormous importance. For, from about the end of the 19th century, vast mineral resources had been discovered in the Briey basin or Eastern Woëvre; this lay on both sides of the frontier, and was at the outbreak of war being developed by a Franco-German syndicate. From the military point of view—a short, purely military war being in prospect—no great importance was attached by the French to the evacuation of an untenable stretch of country, but when the war became a prolonged, and largely an economic, struggle, the German occupation and exploitation of the Briey area became a most important asset to the Central Powers.

Nevertheless, after the battle of the Marne and its concomitant fighting on the Meuse died away in Sept 1914, no major offensive took place in this area until the American attack of Sept. 1918. The reasons for this quiescence on the French side were not allowed to appear during the war, and are still rather obscure.

In the following article are described (1) the bitter trench-warfare fighting which—without ever becoming a major offensive—went on continually in 1914–5, around the salient of St. Mihiel—the base of which was the Woëvre plain—and (2) the American operations, which, carried out on a large scale and without reserve, reduced the salient in two days in 1918. (C. F. A.)

(I.) HAUTS DE MEUSE AND WOËVRE, 1914–6

On Sept. 19 1914 the right wing of the French III. Army was carrying out an offensive advance from the Hauts de Meuse in the direction of Mars-la-Tour when the VIII. Corps encountered at Woël an advanced guard of the German army which was being led toward the Hauts de Meuse by Gen. von Strautz. Before the engagement at Woël had assumed any great importance it was suspended by the arrival of an order from Gen. Joffre to the effect that the VIII. Corps was to proceed immediately to Ste. Menehould, where it was to remain in general reserve. Consequently the Germans found themselves confronted only by re-

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serve troops, not yet inured to war, and dispersed over a wide front, when they launched their attacks against the Meuse heights on the 20th and following days.

At Vigneulles Gen. Grand d'Esnon of the 75th Res. Div. was killed and the enemy surmounted the Hauts de Meuse. Before long the German heavy artillery was bombarding the forts of Lionville and Gëronville toward the S. and Camp des Romains in front. On Sept. 24 St. Mihiel was in the hands of the Germans, who tried to gain ground W. of the Meuse but could not get beyond Chauvoncourt. In the N. von Strautz's army was held by Gen. Pol Durand's group of reserve divisions which had come to the assistance of the VI. Corps. Toward the S. it was attacked by the XVI. Army Corps at St. Baussant and by the VII. Cav. Div.

The region of Léronville–Marbotte was without defenders, but the Germans did not advance in the direction of Commercy, as their aim was to encircle Verdun. To this end the German Crown Prince attacked to the S. of Varennes and in Argonne simultaneously and the French III. Army thus found itself threatened both to the N. W. and to the S. of Verdun.

The 15th Div. of the VIII. Corps was brought back to Chaumont-sur-Aire to the III. Army Reserve, ready to hasten either to the aid of the V. Corps in the Argonne or toward Chauvoncourt to help the 75th Res. Div.

The 16th Div. was transported by train from St. Menchould to Léronville–Sampigny and placed under the orders of the I. Army headquarters, for the purpose of covering Commercy, and was reinforced on Sept. 28 by the Belfort Brigade. From this moment von Strautz's army, which was composed of Bavarians, had its III. Army Corps bottled up at St. Mihiel and so the "Hernia," called also the "Wedge," came into being. From Les Eparges to the Meuse S. of St. Mihiel, the III. Army put in line the VI. Corps and part of Gen. Pol Durand's group. The Bislée peninsula and the front Koeur-la-Grande–Brasseitte–St. Agnant were held by the VIII. Corps with the 16th Inf. Div. and the Belfort Bde. To the E., in the region of the Bouconville ponds in Woëvre, was the 7th Cav. Div. Still farther eastward the XVI. Corps was attacking fiercely at St. Baussant, urged on by the determined commander of the I. Army.

The zone S. of the St. Mihiel wedge and Woëvre and N. of Toul was assigned to the I. Army. The point of liaison between the I. and III. Armies was on the Meuse below Bislée. Before long the III. Army was put under the command of the I. Army and it was therefore Gen. Dubail who was matched against Gen. von Strautz.

At first the Germans tried to debouch from Chauvoncourt, but without success. Elsewhere, both in the S. and the N., they made every effort to enlarge the wedge while the French attacks were directed toward diminishing it. Hence there resulted partial engagements at Chauvoncourt, in front of Les Paroches, at Les Eparges near the Hauts de Meuse, in the Bois d'Ailly, in the Bois Brulé, near Apremont, and at St. Baussant.

For the beginning of April 1915, Gen. Dubail ordered an attack on a large scale from the N. and the S. to be delivered by several army corps. A force designated the army detachment Gérard, including the I. and II. Army Corps, the Verdun Provisional Div., and the I. Cav. Corps, opened the attack on April 5 and took possession of Fromezey, Gussaniville and l'Hôpital farm (in the region of Étain), but broke down before the intact German wire—for in the marshy ground the artillery projectiles buried themselves deeply.

In conjunction with the attack by Gérard's force an attack was launched by the XII. Corps and VIII. Corps which, however, had no particular results. The fighting lasted from the 5th to the 22nd without achieving anything but the exhaustion of both attackers and defenders.

From that time forward the struggle resolved itself into a series of partial combats. The names Les Eparges, the Tranchée de Calonne, Chauvoncourt, Bois d'Ailly, Bois Brulé, Seicheprey, Bois le Prêtre recur day by day in the *communiqués* of 1915.

On May 5 1915 the VIII. Corps lost in one morning all the ground which it had taken several months to gain in the Ailly wood. There was even a moment when a gap in the line seemed to be broken through and the way opened to Commercy; but the counter-attacks came in time to regain part of the Bois d'Ailly, and restore the situation. In the course of one of these counter-attacks in the woods, a company of the 172nd, led by Commandant d'André, crossed five lines of German trenches in succession and came within sight of St. Mihiel. But here they were confronted by German reserves and surrounded. For three days these heroes resisted all attacks, having nothing but their rifles and the German grenades picked up in the fifth line of trenches. They finally succumbed to hunger and thirst. Justly indeed was this trench named "the thirst trench." When Gen. von Strautz saw Commandant d'André on the day after the fighting was over, he said, "*Vous avez été deux fois blessé, vous étiez au Bois d'Ailly, vous êtes un brave.*"

At Bois le Prêtre, near the Moselle, the fighting was incessant and for the most part to the advantage of the French.

At Les Eparges it was mine warfare. In this the Germans had generally the upper hand, but, as at the Bois d'Ailly and the Bois le Prêtre, the upper hand did not imply the gain of ground desired. In mine warfare the Germans had a very considerable advantage over their opponents in the matter of equipment and especially of boring tools. At the outset the galleries they made in the Crete des Eparges and the colossal dimensions of their mine chambers astonished even the men of the II. Corps, recruited though many of them were from the mining country of the Nord. But, though astonished, they were not dismayed, and feeble as their implements were, they often took their revenge for the mine attacks to which they were subjected.

The characteristic of the army of 1915 was the poverty of its material in comparison to that at the disposal of the enemy. In it was learned the lesson that a nation poor in coal and iron must shed much blood to save itself from slavery.

When in Sept. 1915 the Champagne offensive was launched, quiet set in on the front Les Eparges–Chauvoncourt–Bois d'Ailly–Bois le Prêtre. On both sides, the forces on this front were milked to obtain quality and quantity on the field of the great battle. When it died down, the battered formations came back to rest and recruit—and also to fight, for activity began again in Nov. and Dec. 1915.

In Feb. 1916 the storm burst at Verdun, and in July the other storm on the Somme. Then the front with which we are concerned became so calm that the commander of the VIII. Corps called the Wedge of St. Mihiel a convalescent home.

Here and there, now and then there was a *coup de main*, but the only result was to show both sides the necessity of not relaxing vigilance. The year 1917 came and went without changing either the positions or the attitude of the two parties. The great British offensive of Arras, the great French offensive on the Aisne, the Franco-British battles of Ypres absorbed all the offensive power of the adversaries on the western front. Not till 1918 did the sector Les Eparges–Chauvoncourt–Bois d'Ailly–Bois le Prêtre become again the scene of victory.

In concluding this survey of operations on the front between Les Eparges and the Moselle, it is necessary to underline again the poverty of material and munitions under which the French army laboured. Not only did it possess little heavy artillery, but even the 75's, excellent for barrages, diminished daily and were replaced by B.L. guns of 90 and 95 mm., obsolete since 1900. Track for light railways could not be had. Boring tools were so short that mine warfare in the Forest of Apremont had to be waged with pick, chisel and crowbar. Ammunition was served out by spoonfuls, and at one moment the commander of the eastern group of armies had only 350 rounds per gun for his 75's—half an hour's battle allowance.

These conditions were, of course, not peculiar to the front under consideration, and are introduced here to enable the reader to see how the Higher Command was obliged to apply the great Napoleonic principle of economy of force; to show how it was possible for the Crown Prince to break in the Verdun front or, for that matter, the whole front from the Meuse to Switzerland, for the defenders were few, their guns few, and their shell very few.

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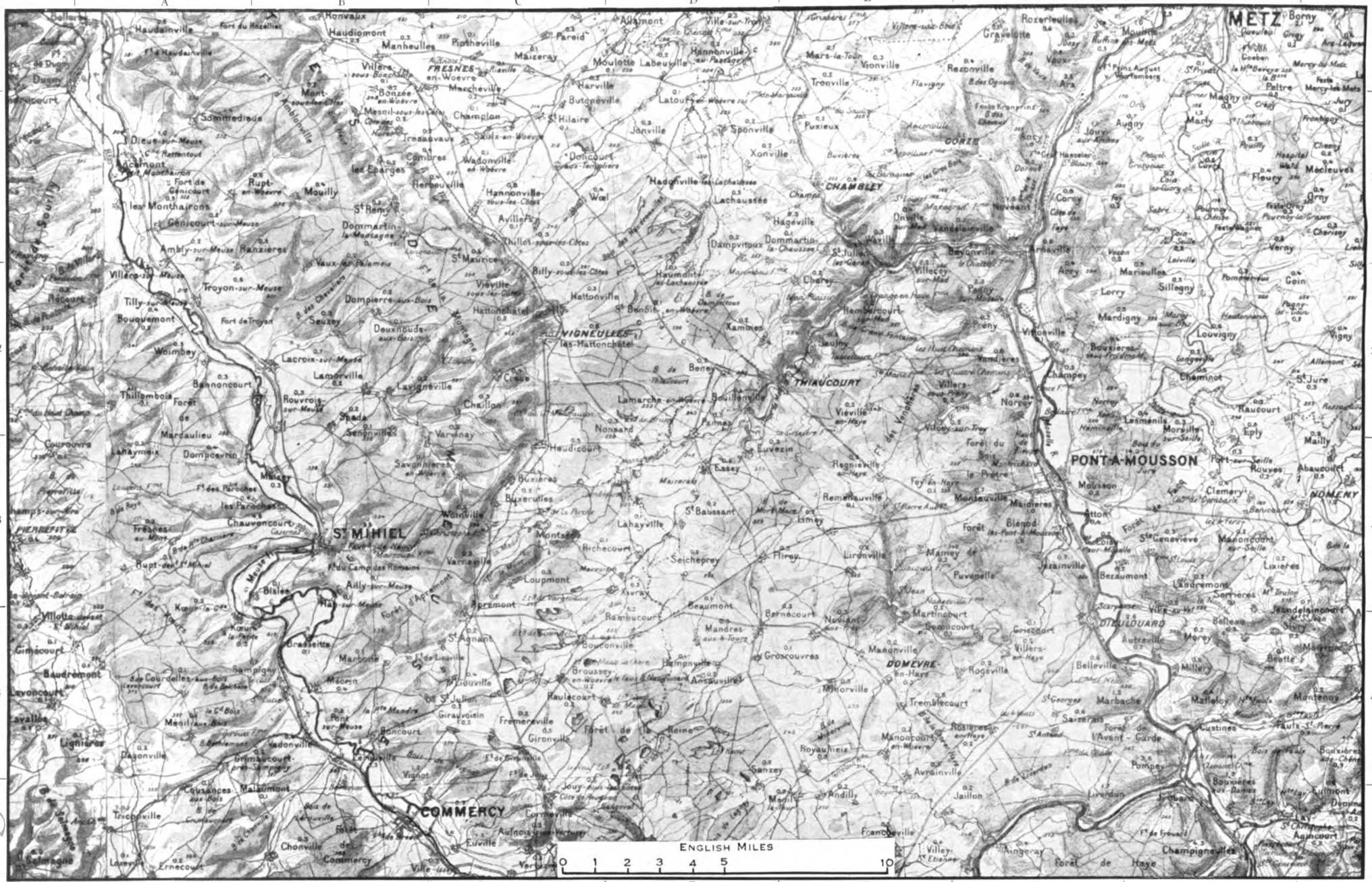
WOEVRE, BATTLES IN (BATTLE OF ST. MIHIEL)



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But it may be seen, too, how a German success was bound always to remain without a sequel, for it was through this conception of the economy of forces that Joffre was able always to keep in hand strong, rested reserves, free guns and unallotted ammunition. (V. L. E. C.)

(II.) BATTLE OF ST. MIHIEL (SEPT. 12 TO 14 1918)

For four years the St. Mihiel salient had projected 28 km. deep into the French line, constituting alike a menace and an invitation to attack. Its original purpose, to serve as one of the jaws of a nutcracker attack on Verdun, having failed, it was used in 1916 as the anvil against which von Falkenhayn sought in vain to drive home his hammer-blows against Verdun from the north. In 1918 Ludendorff again hoped through its possession to gain Verdun and much more by the wider encircling attack in Champagne of July 15, but again the attack failed. During all these years also it had remained not only a threat of further German aggression but a serious interruption of French railway communication with Verdun and also with the Lorraine front. In 1915 the French army had twice attacked to compel evacuation of the salient but both attacks had failed, the first, made in April at Les Eparges, with serious losses.

Tactically, the salient afforded a strong defensive position. The Côte de Meuse, a range of hills rising abruptly 500 metres above the Meuse valley on the W. and the Woëvre plain on the E., afforded strong supporting points on the western face of the salient, while Mont Sec and the lower-lying hills S. of the Rupt de Mad were well adapted to a strong defensive organization.

To the general staff of the American Expeditionary Forces the reduction of the St. Mihiel salient had appealed strongly as a favourable initial or try-out operation for the American army as soon as sufficient forces should have arrived to undertake it. The reason for this selection was not so much the material gain to be reaped from it as the consideration that the fresh and eventually preponderant American force should preferably be employed against a part of the line where it could strike a vital blow to the Germans. Metz, the centre of important railway communications and surrounded by coal and iron fields, obviously presented itself as such a region, and, in addition, while the American forces were being gathered for the later major operations, the same installations and lines of communication needed for them could be utilized by the earlier arriving troops to gain an initial success on a smaller scale, mainly for moral effect though also as a factor in troop training.

General Pershing had discussed this view with General Pétain in June 1917, and, after further study of the front, port facilities and railway lines, this had been adopted as the working plan. However, the slowness of the transportation of troops to France during the first year of American participation in the war, and the exigencies caused by the success of the German offensive operations in the spring of 1918, caused the plan to be temporarily laid aside, and, during both spring and summer of that year, American troops in France and arriving were scattered along the western front to meet needs of the moment.

By the end of July the situation had stabilized sufficiently in favour of the Allies to enable the question of reuniting the troops of the American army to be taken up. On July 24 Marshal Foch confirmed the understanding arrived at the previous year, that the first American operation should be the reduction of the St. Mihiel salient, and, a few weeks later, he authorized the transfer to the I. American Army of that sector of the Allied front facing the salient. This transfer occurred on Aug. 30.

By this time the American army consisted of forces far beyond the number requisite for the mere reduction of the salient and the question of their subsequent employment arose. General Pershing desired to exploit the St. Mihiel attack to the utmost; Foch, however, with other plans and considerations in mind (*see* MEUSE–ARGONNE, BATTLE OF), limited the attack strictly to the forcing of the salient, although Pétain, in a conference on Sept. 2, sided with Pershing in desiring the American army to gain at least the German "Michael" position across the mouth of the salient.

By Marshal Foch's direction, Pétain, on Sept. 2, issued the directive for the operation which called for a main attack on the S., to debouch from the plateau Seicheprey-Limey toward the objective Vigneulles–Thiaucourt, and a secondary attack, to debouch from the vicinity Eparges–Mouilly toward the S.E., and in connexion with the main attack, to effect the cutting off of the German forces in the salient. To the main attack there were assigned eight American divisions; to the secondary, one American and one French; the French troops occupying the intermediate sector were to exercise "pressure" against the enemy forces on their front. The wording and the date of this directive and the disproportionate number of American divisions assigned to the main attack, which alone could hope speedily to reach the *Michel Stellung*, suggest that it was originally drafted to carry out Pétain's conception of at least a partial exploitation of the attack, to include the seizure of the *Michel* position, and that, in a subsequent alteration to conform to Foch's insistence on a more limited scope, only the names of the objectives were changed.

General Pershing's order for the attack assigned the main attack to the I. and IV. Corps with two regular divisions to each corps; the secondary attack, on the Côte de Meuse, to the V. Corps, the attacking troops to consist of one American National Guard Div. and one French division; the French II. Colonial Corps in the centre was to guard the adjacent flanks of the main and secondary attacks, to execute deep raids and to be prepared to follow up a withdrawal. At the disposal of the American I. Army for the operation were 2,971 guns, mostly French artillery. The I. Army also had a marked superiority in aviation, thanks to French coöperation and the assistance of the British Independent Air Force.

On the German side the salient was held by Army Detachment C, under Gen. von Fuchs and comprising, on Sept. 12, the date of the attack, eight divisions on the line, organized as three corps groups, and three in reserve.

As early as Sept. 1 a deserter had given the Germans warning of the impending attack, and Ludendorff had at the time seriously considered ordering a withdrawal from the salient, but was deterred by the representations of the army detachment and army group commanders who were confident of their ability to hold, and also by reports from Duke Albrecht's army group in the Vosges region, of American preparations for attack farther south. These feints which General Pershing had caused to be made in the vicinity of Belfort had led to German uncertainty as to the real intentions of the American commander. By Sept. 8, however, the evidences of a coming attack on the salient had become unmistakable and Army Detachment C was ordered to withdraw to the *Michel Stellung*. No need for haste was felt and the preparations were deliberate and methodical. The night preceding the attack the dismounted batteries were being withdrawn and consequently could not be used in the battle.

Preceded by a four-hour bombardment the main attack was launched at 5 A.M., Sept. 12; the secondary attack at 8:30. Deprived of artillery support the German infantry though ordered to hold, made virtually no resistance. The American I. Corps on the right made its objectives in a few hours, and, in spite of German counter-attacks brought by two divisions against it and against the right of the IV. Corps but beaten off, begged permission to continue its advance; but, because of the precise instructions by which the American staff felt itself bound, this permission was refused. The IV. and V. Corps also made their objectives and halted, awaiting orders.

Army H.Q. in this battle, as also in the earlier part of the Meuse–Argonne battle, appears to have had little conception of the difficulty and time required in the transmission of orders on the battlefield and in consequence to have left but little initiative in the hands of subordinates. The result was that the orders for the troops of the IV. and V. Corps to move forward to Vigneulles and effect the cutting off of the salient did not reach the troops concerned until after dark on the 12th so that the connexion, though unopposed, was not effected until the morning of the 13th. Meanwhile the German commander, realizing his

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hopeless situation, had ordered the evacuation of the tip of the salient, which had not been attacked, and during the night the movement was successfully carried out except for the loss of about 1,000 stragglers.

In the course of Sept. 13 and 14 the troops of the American IV. and V., and French II. Colonial Corps moved forward without serious opposition to the line designated by Marshal Foch facing the German *Michel* position and which the I. Corps had already reached on the 12th.

On the German side the attack showed a complete demoralization in the Higher Command and a lack of initiative in the lower officers. The men showed little will to fight. The advance of the left division of the IV. Corps with one flank uncovered and of the American division of the V. Corps with both flanks uncovered was nowhere taken advantage of.

In regard to the halting of the American offensive the German general staff, in a study of the St. Mihiel attack published for the information of the armies shortly after its occurrence, while giving high praise to the dash and fearlessness of the American soldier, added that the army H.Q., which showed itself so unable to reap the advantages so clearly afforded by its striking initial success, was not to be feared. It is not impossible that Foch, had he himself been in immediate command of the I. Army on the morning of the 12th, or had he been present, might, in view of the manifest military advantages, have felt justified in permitting the Americans to grasp the opportunity offered to complete the destruction of Army Detachment C and to seize and hold the *Michel Stellung*. Indeed Pétain, on the night of the 13th, learning that the German army behind the sector was in great disorder and that the American troops on the right had reached and in some instances gone beyond their objectives, did send an authorization to take the *Michel* position; but by the time this permission was received the opportunity of taking the position cheaply and completing the German rout had passed. Tactically, Foch's avowed purpose would have been better served had Pétain, as long as he was going to prescribe dispositions in detail for the American army, originally called for two main attacks from the two faces of the salient to meet in the centre the first day, advances which the Soissons attack had already shown could be easily made by American regular troops.

Of the troops engaged on the Allied side the Americans aggregated 550,000, the French 110,000. American losses were 7,511, of which considerably more than half were borne by the I. Corps which received the brunt of the counter-attack; French losses were 597. The captures included over 15,000 prisoners and 443 guns. (A. L. C.)

WOLFE-BARRY, SIR JOHN WOLFE (1836–1918), English engineer, was born in London Dec. 7 1836, the youngest son of Sir Charles Barry (*see* 3.443), architect of the Houses of Parliament. He was educated at Trinity College, Glenalmond, and King's College, London, and became a pupil of Sir John Hawkshaw, whom he assisted in the building of Charing Cross and Cannon St. stations and railway bridges. In 1867 he set up for himself, becoming well-known as a railway engineer and traffic expert. Through his initiative and energy the British Engineering Standards Committee was established in 1901, a great step forward in effecting railroad economy. He was made a K.C.B. in 1897. He died in London Jan. 22 1918.

WOLSELEY, GARNET JOSEPH WOLSELEY, Visct. (1833–1913), British field-marshal (*see* 28.777). The closing years of Lord Wolseley's life were spent in virtual retirement. His health gradually failed, and on March 25 1913 he died at Mentone, the title going by special remainder to his only daughter, Frances. His eminent service to the State had not been forgotten, for he was accorded an imposing public funeral and was buried at St. Paul's; an equestrian statue of him on the Horse Guards Parade was unveiled in 1920. It had not been Lord Wolseley's good fortune to hold responsible positions in the conduct of warfare on a great scale, but he was undoubtedly a brilliant commander in the field. His campaign in Ashanti and his overthrow of Arabi Pasha were model operations of their kind, while the failure to save Gordon and Khartum in 1885 was attributable to delays in starting the expedition, for which he was not responsible. His labours in modernizing the organization and developing the efficiency of the British army—often in face of strong opposition—were of incalculable value to the country. He proved himself at the War Office to be an energetic, far-seeing and able administrator. His insistence upon officers fitting themselves for the duties that they would have to perform in war, and upon their taking their profession seriously, was to bear rich fruit in days when he had retired into the background. An excellent judge of men and of character, he was extraordinarily successful in his choice of subordinates. Cultured, possessing varied interests, well read and of wide experience in many lands, he was in private life a man of unusual charm.

WOLVERHAMPTON, HENRY HARTLEY FOWLER, Visct. (1830–1911), English statesman, (*see* 28.781), died at Woodthorne, Wolverhampton, Feb. 25 1911.

WOMAN SUFFRAGE.—In the earlier article (under Women, 28.786), the story of the movement for woman suffrage was brought down to 1910. The narrative may here be continued for the United Kingdom up to the passing of the Representation of the People Act in 1918, with some estimate of its results up to 1920, followed by accounts of the growth of woman suffrage in other countries.

United Kingdom

In the later years of the agitation in Great Britain the constitutional suffragists concentrated their efforts on the formation of public opinion: they sought to form a non-party, non-militant suffrage society in every parliamentary constituency and brought local influence to bear in contested elections to obtain promises of support from candidates of all political parties. They were so far successful as to secure a majority of members pledged to their support in every House of Commons elected since 1886: and in that year, and also in 1897, 1908, 1909, 1910 and 1911, woman suffrage bills passed their second reading, but made no further progress, each successive Government declining to give facilities for the passage of the bills into law. At this period the movement was receiving very valuable support from platform, press and pulpit, besides remarkable help from the theatre in plays by leading dramatists of the day.

In Parliament for several years important support had been given to woman suffrage by leaders of the Conservative party. Among them may be mentioned three successive Conservative Prime Ministers—Lord Beaconsfield, Lord Salisbury and Mr. Arthur Balfour—besides the 7th Duke of Rutland and Lord Iddesleigh, while the younger generation were ably represented by the Earl of Lytton, Lord Robert and Lord Hugh Cecil, and Mr. Alfred Lyttelton. On the Liberal side the leaders, with a few important exceptions (which included Sir H. Campbell-Bannerman, Mr. Lloyd George and Sir Edward Grey), were against it. Among the strongest Liberal opponents during the generation before the World War were to be found Mr. Gladstone, Mr. John Bright, Mr. Joseph Chamberlain, Sir W. Harcourt, Mr. Labouchere, and Mr. Asquith.

In 1908 the death of the suffragist Sir H. Campbell-Bannerman and the succession of the anti-suffragist Mr. Asquith to the Liberal premiership were very disadvantageous to suffrage prospects in the House of Commons. This misfortune was, however, partly counteracted by the emergence of the Labour party, the leading members of which were convinced suffragists; in a short time they induced the party to make woman suffrage a plank in their platform.

The question of "militancy" on the part of a section of the woman suffragists was mishandled from the first by the Liberal Government which came into power in 1906. The Women's Social and Political Union, led by Mrs. Pankhurst and her daughter Christabel, which came into existence about this time, confined its activities to asking inconvenient questions of members of the Government at public meetings. This was in itself a perfectly legitimate method of propaganda. Instead of meeting it by giving reasonable answers, the questions put were in many instances met only by shouts of anger and disapproval or, when written on paper, were contemptuously torn and thrown on the

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ground. Later, if persisted in, those who asked them were treated with shameful violence. A man at Bradford in 1911, brutally thrown out of a meeting by Liberal stewards, had his leg broken. Women were "frogmarched" out of meetings, and while thus absolutely helpless were violently struck on the face with fists or umbrellas by men in the audience. It should always be remembered that between 1905 and 1908 the militants never answered violence by violence; they suffered violence, but used none. In 1908 they definitely abandoned this policy of non-retaliation; to the last, however, they set limits for themselves, and never shed one drop of blood of either man or beast. But they smashed windows, set fire to churches and country mansions when they were empty; burnt down the refreshment pavilion at Kew Gardens when no one was in it, destroyed the contents of letter-boxes and in one instance of a ballot-box at an election; slashed and cut the Rokeby Venus by Velasquez in the National Gallery and the portrait of Henry James by Sargent in the Royal Academy, and destroyed a case of pottery in the British Museum. On June 4 1913 Emily Wilding Davison tried to upset the Derby favourite during the race at Epsom, and died four days later from her injuries. Her funeral on June 14 was made the occasion of an imposing procession through London.

These and similar actions were intensely irritating, and the punishments meted out were correspondingly severe. But long before violence had been attempted groups of women had been sentenced to three months' imprisonment for nothing worse than making speeches in the lobby of the House of Commons, or shouting in the street. The severe sentences passed upon those who had been guilty of real violence were in the later stages rarely carried into effect; for the militants adopted the hunger strike, and after an interval of, in some cases, only a few days were released because public opinion would not have exonerated the Government if these women had died in their hands. Parliament then passed a piece of panic legislation called Prisoners (Temporary Discharge for Ill Health) Act 1912, immediately nicknamed the "Cat-and-Mouse Act," which enabled the Government to rearrest the hunger strikers when they gave signs of restored vitality. The principal result of this Act was the ridicule which it created at the expense of the Government. Public opinion was greatly excited by all these proceedings. Suffrage was a universal subject of conversation. Anti-suffragists had believed that "militancy" would kill the suffrage movement, and therefore the utmost publicity had been given to every act of violence and to every intemperate speech. But so far from killing the suffrage movement the all-pervading discussion stimulated it as nothing else had ever done. Everyone, high and low, was talking about woman suffrage, arguing either for or against it with vehemence and conviction.

It was a difficult time for the law-abiding suffragists. They objected to "militancy" because they believed the use of physical force as political propaganda was invariably mischievous. They were firmly determined to roast their pig, but not to do it by burning down their house. Over and over again the National Union of Women's Suffrage Societies issued strongly-worded protests against "militancy," and they excluded militants from membership of their societies. They deprecated the use of "frightfulness," whether used by the militants or against them, and urged repeatedly that the real cure for violence was the redress of the grievances which had given rise to it. The fact that men under somewhat similar circumstances had been much more violent and destructive did not create the desire to imitate them. Serious differences thus naturally arose between the two branches of the suffrage movement. Each held firmly to its own view of the case. The militants bitterly resented criticism and made organized efforts to prevent its expression by trying to break up the meetings of the law-abiding suffragists. One effect of this situation was that for the first time since 1886 woman suffrage bills were defeated in the House of Commons, once in 1912 and once in 1913. But other circumstances had contributed to these defeats. There were two general elections in 1910—in Jan. and December. Mr. Asquith and his party emerged victorious from each of them, but in the second his majority was greatly reduced, having fallen from 334 to 124. He had promised at a public meeting in Dec. 1909, if returned to power, to bring in a Reform bill and to allow a woman suffrage amendment to the bill to be an open question for the House to decide. At a later date, in answer to a question in the House, he said, just before the second general election of 1910, that, if his Government were still in power, it "would give facilities for proceeding effectively with a woman suffrage bill, if so framed as to admit of free amendment." The *Times* parliamentary correspondent said that this made woman suffrage an issue before the country at the coming election, and that a majority for the Government would mean that Parliament had received a mandate to carry a measure to that effect. Mr. Asquith was again returned to power, and shortly after these two general elections, *i.e.* in July 1910 and in May 1911, the House of Commons carried by immense majorities second readings of the measure known as the Conciliation bill.

This bill was of a very limited character, proposing to enfranchise only about one million women householders, and it was from the outset opposed by Mr. Lloyd George on the ground that it was not sufficiently democratic. The second reading in 1910 was, however, carried in spite of his opposition. After the general election in 1911 suffrage prospects seemed particularly bright; militancy had been suspended in order to give the Conciliation bill a chance; all the suffrage societies were working harmoniously together, and were relying on Mr. Asquith's promise that, if the bill were given a second reading, opportunities should be afforded in the following session for "proceeding effectively" with its further stages. A bombshell from Mr. Asquith shattered these favourable prospects. He announced on Nov. 7 1911, to a deputation from the People's Suffrage Federation, his intention of introducing during the session of 1912 the electoral Reform bill he had foreshadowed in 1908. He said that this bill would sweep away all existing franchises: that the new franchise would be based on citizenship, and votes were to be given to "citizens of full age and competent understanding," but no mention was made of women. Mr. Asquith, on being asked what his bill would do for them, dismissed the inquiry with the curt remark that his opinions on the subject were well known and had suffered no change; but he reiterated his promises of "facilities" for the Conciliation bill in the session of 1912. If he intended to provoke a return to militancy nothing could have been better calculated to do so. A violent outbreak at once took place. Windows were smashed in the principal shopping streets of London, and personal assaults were made on members of the Government. The constitutional suffragists were as angry as the militants, but had a different way of showing it. Many strong suffragists in the Women's Liberal Federation broke away from their party and gave all their energies to the suffrage cause. Some knowledge of this may have reached Mr. Asquith, for before mid-Nov. he took the unusual course of inviting representatives of the whole woman suffrage movement, militant and non-militant, to attend in a deputation to him: this unprecedented invitation was at once accepted for Nov. 18. The N.U.W.S.S. prepared a series of four questions to put before him:—

1. Was it the intention of the Government that the Reform bill should be passed through all its stages in the session of 1912?
2. Will the bill be drafted in such a manner as to admit of amendments introducing women on other terms than men?
3. Will the Government undertake not to oppose them?
4. Will the Government regard any amendment enfranchising women which is carried in the House of Commons as an integral part of the bill, to be defended by the Government in all its stages?

To each of these questions Mr. Asquith gave the answer, absolutely unqualified: "Certainly." He further said, referring to his own position:—

"It is perfectly consistent with the self-respect and the best traditions of our public life that, in relation to a question which divides parties, not only the head of the Government but the Government itself should say that, if the House of Commons on its responsibility is prepared to transform or extend a measure which we are agreed in thinking necessary—a measure for the franchise as regards men—and to confer the franchise on women, we shall not only acquiesce in that proposal, but we shall treat it as the considered judgment of Parliament and shall make ourselves responsible for carrying it out."

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Twenty-six days after this Mr. Asquith received a deputation of anti-suffragists to whom he gave free rein to an expression of his entire sympathy with their position, and to whom he declared that he regarded "the grant of the parliamentary franchise to women as a political mistake of a very disastrous kind." It was never disclosed how he could reconcile his promise to the suffragists to make himself and his Government responsible, if the House so desired, for carrying woman suffrage, with his belief that it would prove a political mistake of a disastrous kind. His words to the second deputation went far to make his promises to the first worthless; many of his followers interpreted his meaning to be that he relied on them to deliver him, as one of them expressed it, from "the humiliation" of having to keep his word. The first step in his deliverance would be the defeat of the Conciliation bill, and the usual parliamentary devices were employed to secure this end. One of these was to detach from the support of the bill the members of the Irish Nationalist party. This was done by making them believe that the success of woman suffrage would break up the Government and thus prevent the third ratification by the Commons of the Home Rule bill necessary to secure (under the Parliament Act) its passage into law notwithstanding its rejection by the House of Lords. These tactics, aided by a coal strike which caused the absence of 13 Labour members in their constituencies, were successful, and the Conciliation bill, which had been carried on second reading on May 5 1911 by 255 to 88, was defeated on March 28 1912 by 222 to 208. It was a heavy blow to the women's cause, and the most perturbing feature to suffragists in this defeat was the conviction that the same unscrupulous tactics which had secured it would be put into operation against the woman suffrage amendments to the Government Reform bill.

When this was produced it was called a Franchise and Registration bill. It came on for second reading on July 12 1912. In his speech Mr. Asquith took full advantage of the recent defeat of the Conciliation bill. He said: "This bill does not propose to confer the franchise on women; whatever extensions of the franchise it makes are to male persons only." He then referred to the defeat of woman suffrage in March as the "considered judgment of the House," and he dismissed as "an altogether improbable hypothesis the possibility that the House would stultify itself by reversing this judgment during the same session." Notwithstanding this ominous warning Mr. Lloyd George and Sir Edward (afterwards Viscount) Grey continued to be confident that amendments to the Government bill gave suffragists the best chance they had ever had of parliamentary victory. The bill itself, however, made no further progress during 1912; the protracted session lasted all through that year and overflowed into 1913; it was officially announced that committee stage would be taken on Jan. 24. All possible plans were elaborated by the real friends of woman suffrage both inside and outside Parliament to ensure the success of one or other of the suffrage amendments. But the parliamentary air was still thick with intrigue, and many and circumstantial were the rumours that the success of any of the woman suffrage amendments would mean the resignation of anti-suffrage ministers and the break-up of the Government. No official contradiction was given to these rumours until the day before the House was expected to go into committee on the bill.

But the defeat of the bill did not proceed from this source. Three days from Jan. 24 had been allotted for the discussion of the woman suffrage amendments. This stage was, however, never reached. On Jan. 23 Mr. Bonar Law asked the Speaker to give a ruling on the point whether the Government's own amendments, regarding the occupation franchise for men, did not so far alter the bill from that which had received a second reading in July as to make it a new measure and necessitate its withdrawal and reintroduction in its new form. In his reply the Speaker intimated that this was his view, and added that there were "other amendments regarding female suffrage which of course would make a huge difference to the bill if they were inserted." The bill was killed by this ruling. Mr. Asquith did not mend the situation by his treatment of the suffragists, from whom he refused to receive a deputation, and they were more incensed against him than ever when, in lieu of what he himself called "the best chance they ever had," he only offered parliamentary time for the discussion of yet another private member's bill. All the suffrage societies repudiated this offer and did nothing to support the bill, which was brought forward in May 1913 and defeated by 266 votes to 219.

These events, the defeat of the Conciliation bill in March 1912 and the fiasco of the Government bill in Jan. 1913, convinced the N.U.W.S.S. that nothing would now be of any use but a Government bill with the whole weight of the party behind it. They accordingly gave a new interpretation to their election policy. This was, and continued to be, to support the best friend of woman suffrage; but events had proved that a suffrage candidate who belonged to a suffrage party was a better friend than a suffrage candidate whose party was either hostile or neutral. The council governing the N.U.W.S.S. therefore resolved "that in judging which of the two pro-suffrage candidates should be supported in an election, the official attitude of the party to which the candidate belongs should be taken into consideration." An analysis of the division when the Conciliation bill had been defeated showed that 42 members who had been supported by the N.U.W.S.S. as "best friends of woman suffrage" (mostly followers of Mr. Asquith) had voted against it. When party pulled one way and voteless women pulled the other, party proved the stronger. As Labour was the only party which had definitely made suffrage part of its programme, this change threw the influence of the N.U.W.S.S. in elections definitely on the side of Labour; and a special fund, called the election fighting fund, was formed for the support of Labour candidates. The N.U.W.S.S. further resolved under no circumstances to support Government candidates, and to endeavour by all legitimate means to strengthen any party which adopted woman suffrage as part of its programme. By the adoption of this policy they succeeded in 16 months in defeating six Government candidates in by-elections, making a difference of 12 in divisions. They had also succeeded in each of the elections concerned in making the whole place ring with the suffrage agitation. Public opinion moved rapidly and strongly in the suffrage direction, the general view being that suffragists had received less than fair play at the hands of Mr. Asquith and his Government.

A "pilgrimage" organized by the N.U.W.S.S. in 1913 received a remarkable degree of support from the towns and villages traversed on the seven routes by which it approached London. But the N.U.W.S.S. were convinced that a free vote of the House of Commons on their question was an impossibility as long as there was a Prime Minister who was ardently opposed to his own principles when applied to women. They were therefore determined to do everything in their power to reduce Mr. Asquith's majority. They believed that their election-fighting policy gave them an effective and constitutional method of doing this, and looked forward to helping to defeat his party in the general election which, but for the World War, must have taken place not later than 1915. They were full of work in preparation for this, when on Aug. 4 1914 the overwhelming catastrophe of the World War broke out, not only destroying all opportunity of suffrage work but jeopardizing the very existence of representative institutions in Europe.

Suffragists shared to the full in the solemn national consciousness that every ounce of strength would be needed in the gigantic effort which the successful prosecution of the war demanded. Indeed, suffragists realized this more quickly than the Government, which for many months seemed to believe that the war could be carried on solely by the efforts of the male half of the nation, without disturbance of the domestic calm which they believed to be the only legitimate role of the female half: for offers of help from women to provide, and staff hospitals to supply, women for work in public offices, thus leaving an additional number of young men free for military service, were plentifully douched with cold water.

Nevertheless suffragists, whether militant or non-militant, quickly faced the facts and clearly saw what their duty was. The

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militants instantly abandoned every sort of violence and organized themselves for public service. They formed a Women's Emergency Corps, ready to undertake all kinds of national work which the exigencies of the time required. Others, both militant and non-militant, in spite of official discouragement undertook the organization of hospital units entirely officered by women (*see* WOMEN'S WAR WORK). The N.U.W.S.S. committee on Aug. 3 resolved to suspend immediately all political propaganda and to use their staff and organizing power in mitigating the distress caused by the war. Their societies, numbering over 500, were consulted by post, and all but two approved this course.

No one claims for suffrage women that they were in any degree singular in the devoted work which they gave to their country during the war. The suffragists were earliest in the field because they were already organized and accustomed to team-work. Women of all classes and all parties threw themselves with zeal and efficiency into every kind of useful patriotic work. Industrial women were beyond all praise, working as they had never worked before, early and late, Sundays and weekdays, to supply the armies with every kind of military equipment. Everyone who came into contact with them bore testimony to their splendid efficiency in departments of skilled work from which before the war they had been rigidly excluded. In March 1915 the Government concluded an Agreement with the trade unions, known as the Treasury agreement, to suspend during the war, in face of the national emergency, the rules excluding women from most of the skilled trades. The Treasury on its part gave a promise not to use the women as a reservoir of cheap labour, and agreed to give women the same wages as men for the same output. This gave an important stimulus to the principle of equal pay for equal work, and went some way also in the direction of establishing industrial freedom for women. The courage of the women in the dangerous trades was as marked as their efficiency. On one occasion 26 women were killed and 30 injured by an explosion; those who remained uninjured displayed the greatest coolness and discipline, and were prompt both in helping the wounded and in continuing the work of the factory. The legend of the innate timidity of women was thus undermined. The tide in this direction rose so high that even Mr. Asquith was floated by it, and in speaking in Oct. 1915 in the House of the heroic death of Edith Cavell, he said: "She has taught the bravest man among us a supreme lesson of courage; yes, and there are thousands of such women, *but a year ago we did not know it.*"

All through 1916 evidence of the conversion of former opponents of women's enfranchisement poured into the suffrage offices. Many of these conversions were of M.P.s, eminent leaders of the press, railway managers, commercial and financial magnates. Liberals very often pleaded militancy as an excuse for their former blindness; Conservatives, in the main, said simply: "I formerly opposed the granting of the vote to women; I thought men by themselves maintained the state; I was wrong; the women have served their country so magnificently that henceforth I shall support their having the vote."

There is no doubt that by 1915–6 the country was by a great majority favourable to the enfranchisement of women. Nevertheless it would have been impossible to induce Parliament to pass a great Reform bill during the war if it had not been that the electoral position of millions of men, caused by their services to their country, was so anomalous as to amount to a public scandal. The parliamentary register, by the direct orders of the Government, had not been revised since 1913. By 1916 it was completely out of date. By-elections had proved its unrepresentative character and it would have been a moral impossibility to take a general election upon it. There were at this time the names of about 8,000,000 men on the register. Of these nearly 7,000,000 qualified as occupiers. The occupation franchise necessitated that the qualifying premises should have been continuously "occupied" by the voter for 12 months since the last 15th July. This meant that a large proportion of the 5,000,000 young men who had voluntarily joined the New Armies since Aug. 4 1914 would, in consequence of their patriotic services, have lost their claim to the parliamentary vote. The men facing death daily, the very men to whom the country was most indebted, would be voteless, whilst those who had evaded similar sacrifices retained their electoral qualification. The position was intolerable, but it was not at first clear how best to amend it. Proposals were made by some M.P.s to create a new franchise based on naval or military service. But this received little general support. The questions: "Why exclude industrial service?" and "What about the services of women?" received no satisfactory answer. Mr. Asquith's Government repeatedly tried to deal with the situation by Special Register bills. These efforts were unsuccessful. Each successive proposal was rejected by the House of Commons with growing symptoms of exasperation. The House wanted a Reform bill; it demanded a new electorate on democratic lines. The Government wanted a Reform bill too, but appeared to believe they could get one to their liking by calling it a Special Register bill. It was long before they abandoned their efforts to get one thing by calling it another. On Aug. 14 1916 Mr. Asquith, on introducing yet another Special Register bill, announced his conversion to woman suffrage; he based it on the ground that when the war was over it would be necessary to revise industrial conditions and that in his view women had a special claim to be heard on the many questions which would directly affect their interests. It was obvious that this was no new condition. Ever since Parliament existed measures had come before it vitally affecting the well-being of women, but on which they had no constitutional means of making their claims heard. But it was not the business of suffragists to point this out. The main difficulty at the moment arose from the plausible plea that, however desirable parliamentary reform might be, it was not the time during the greatest war in history, with the issue still hanging in the balance, to recast the representative system of the country. The reply has just been indicated. The new register and the new qualifications were needed at once unless millions of the most desirable male citizens were to be disfranchised. A good deal of iteration was needed to hammer this into people's heads, and to the end, "This is not the time," continued to be the only effective weapon used against women's enfranchisement.

Mr. Walter (later Lord) Long found a way out of the impasse. He suggested the appointment of a non-party conference, consisting of members of both Houses, selected and presided over by the Speaker, to consider the whole subject of electoral reform including woman suffrage. Mr. Asquith concurred and the House agreed. The conference began its sitting in Oct. 1916 and handed in its report on Jan. 28 1917. In the interval Mr. Lloyd George had succeeded Mr. Asquith as Prime Minister, a change very favourable to immediate action in the direction of woman suffrage. The Speaker's conference unanimously recommended a new franchise for men amounting practically to manhood suffrage; for women it recommended, but not unanimously, household suffrage, including wives of householders, a higher age-limit for women and their admission to the university franchise. This was the scheme subsequently adopted by Parliament. The object of the high age-limit (30) for women was to produce a constituency in which male voters were in a substantial majority. It was believed by suffrage members of the conference that the acceptance of this was essential to success. The anticipated proportion of women to men in the new electorate was as 2 to 3. This expectation proved practically correct. The new register published in 1919 gave the exact numbers: men 12,913,160; women 8,479,156. It may here be mentioned that the United Kingdom is the only country, out of the 28 where women are enfranchised, which created a difference in the qualifications for men and women.

The parliamentary history of the measure based on the recommendations of the Speaker's conference may, as regards woman suffrage, be here sketched. Within a fortnight of his becoming Prime Minister, Mr. Lloyd George intimated to the leaders of the N.U.W.S.S. that he was keen to go forward at once in the direction of women's enfranchisement. This was a month before the Speaker's conference handed in its report. The object was to get an agreed measure supported by every party in the House. This was achieved. On March 28 1917 Mr. Asquith moved a

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resolution in Parliament calling on the Government to introduce a Representation of the People bill based on the recommendations of the Speaker's conference. Woman franchise was the subject of all the speeches, and the leader of every party supported the enfranchisement of women; the opposition was of the feeblest, and the motion was carried by 341 to 62.

When the bill (*see* WOMEN, LEGAL STATUS OF) was debated, the second reading was carried by 329 to 40, and Clause 4 (enfranchising women) was passed by 385 to 55, or 7 to 1, with a majority within each party into which the House was divided; and again in the last trial of strength the anti-suffrage Die-hards were reduced to a mere handful, the numbers being 214 to 17. After this the N.U.W.S.S. felt the ground sufficiently solid beneath their feet to place a new weight upon it, and, in conjunction with many other women's societies, they urged that the local government franchise for women should be amended on the same principle which the House had already accepted for the parliamentary franchise—namely, to include not only householders but wives of householders. This was at first resisted by the Government, but suffragists outside the House and even many anti-suffragists worked vigorously for it and prevailed. The Government gave way, and the amended clause was accepted on Nov. 14 without a division.

The anti-suffragists in the Lords were a more formidable group than in the Commons. Lord Curzon, president of the Anti-Suffrage Society, was the leader of the House and chief representative of the Government. The inclusion of women in the bill was vigorously resisted in the early stages of the bill by Lord Bryce and Lord Balfour of Burleigh; but there was no real fight upon it until the committee stage was reached and the women's clauses came on. After various skirmishes the battle was joined, an anti-suffrage amendment was moved, and there was a full-dress debate on Jan. 8, 9 and 10, 1918. Lord Curzon wound up the discussion. His speech, for the first five-sixths of it, was a tolerably familiar anti-suffrage oration, but the last sixth was cast in a different mould. He reminded the peers that the House of Commons was the sole constitutional representative of the feelings of the country; that in the Commons woman suffrage had been supported by large majorities of every party, "including the one to which most of your lordships belong." He invited them to contemplate what would happen if they came into collision with the other House on such a question as the representation of the people. He elaborated this point with skill, and ended by saying that to reject the clause would be to embark upon a conflict in which the Lords were certain to be worsted. He declined to be responsible for such a catastrophe, and announced his intention of not voting either for or against the amendment. This was the supreme moment for all suffragists present. They felt at once they were safe without disastrous conflict. The division was: for the clause, 134; against, 71. Thus ended the 50-years' struggle of British women for political liberty. The royal assent was given on Feb. 6 1918. The women's task had been a long one, but they were able to look back upon it with satisfaction. They had accomplished it without one scintilla of direct political power and without appeals to party passion. Their appeal had been to common sense and experience. They challenged their opponents to produce one instance of disastrous consequences following upon the women's vote. Moreover, they had not split the country into rival factions, for the bill was carried by the consent and coöperation of all parties.

Those who had worked for woman suffrage quickly perceived the difference it had made in the attitude of Parliament on almost every proposal which came before it. The parliamentary atmosphere completely changed. Measures for which women's societies had been working unsuccessfully for years, such as the Nurses' Registration bill, and an amended Midwives' bill, were taken up as Government measures, and passed through all their stages without difficulty. The grille in front of the ladies' gallery was removed, and women were admitted to the strangers' gallery. By the spontaneous action of the Government a bill was passed in Nov. 1918 to render women eligible to sit in Parliament. It was not in time to be of much use at the general election which followed in about a fortnight, but Viscountess Astor was returned for Plymouth in Nov. 1919 and Mrs. George Wintringham (widow of the previous member) for the Louth division of Lincs. in Sept. 1921. The increased number of women local electors gave a great impulse to the election of women as town and county councillors and the number of women chosen as mayors steadily increased.

The report of the Lambeth Conference 1920 showed that the Anglican communion was breathing the new atmosphere created by the women's vote. It acknowledged that in the past the Church had undervalued women and had too thanklessly used their work. It stated the belief of the Conference that the Church would be strengthened by making freer use of the spiritual gifts of women, and recommended the opening to them of the diaconate, definitely affirming that the diaconate is an "order," though a minor one, and that a woman appointed to it is not merely "set apart" but "ordained."

These changes vary in importance, but they are significant in that they all point in one direction—giving wider scope to the powers and responsibilities of women and recognizing the use of women's work in every well-ordered state.

Before the general election of Dec. 1918 Mr. Lloyd George and Mr. Bonar Law had given a public promise, if returned to power, "to remove all the existing inequalities in the law between men and women"; but when the new Parliament opened there was no indication in the King's speech of proposed legislation in fulfilment of this pledge. The Labour party, therefore, in the session of 1919 introduced a measure called the Women's Emancipation bill, completely removing every legal inequality between men and women and giving women the vote on the same terms as men. This they carried, notwithstanding Government opposition, through all its stages in the House of Commons; the Government, however, defeated it in the Lords, but not without providing a substitute—the Sex Disqualification Removal Act. This did not reopen the franchise question, but it gave women the right to study and practice law in both its branches, to act as magistrates and to sit on juries. It also made it clear to the universities of Oxford and Cambridge that they had the power to admit women to degrees and membership. Oxford availed itself of these powers without delay, but Cambridge in Dec. 1920 declined to take a similar step by 904 votes to 712, and repeated the refusal twice in 1921.

BRITISH DOMINIONS OVERSEAS

The granting of woman suffrage in Canada was almost simultaneous with its victory in England. It was first adopted in the provinces (except Quebec) in 1916, and by the Dominion in 1917. Canada was well in front of the mother country in the matter of the eligibility of women. Miss MacAdams was elected to the Legislature of Alberta entirely by the votes of soldiers on duty in England and France in July 1917. The first Woman Suffrage Act for the Dominion limited the vote to women who had near relatives serving overseas. Full woman suffrage followed very quickly and almost without opposition in March 1918. In Feb. 1921 Mrs. Mary Ellen Smith of Vancouver was chosen as Speaker of the British Columbian legislature. She, however, declined the speakership, but took office as a member of the Cabinet.

New Zealand had enfranchised its women in 1893, and enfranchisement followed in the Commonwealth of Australia in 1902; therefore, with the exception of S. Africa, all the great self-governing overseas dominions of Britain have given political freedom to women. In March 1921 Mrs. Cowan was elected to the Parliament of Western Australia, the first woman M.P. to be elected in Australia.

Jamaica, S. Rhodesia and British East Africa gave votes to women in 1919 and 1920.

A strong effort was made by Indian women, supported by the Aga Khan and the Begum of Bhopal, to induce Parliament to incorporate in the Government of India Act the principle of woman suffrage. This effort was unsuccessful but not fruitless; important support was given in the House of Commons, and the Act, as finally passed, specifically left the question of woman suf-

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frage to be decided, province by province, by the elected Legislatures of India herself. The newly created constituencies therefore have the power, when they choose to use it, of recognizing the full citizenship of women.

United States

American women had been the earliest to make a definite organized struggle for political freedom, having started in 1848, but they were among the last to win. This was in part due to the U.S. Constitution, which can only be amended by a two-thirds majority in both chambers of Congress, and even then the amendment does not become operative until it has been ratified by three-fourths of the 48 states. American suffragists used to say to friends in Europe, "You have to convert one Parliament: we have to convert at least 37 Parliaments." The suffragists worked state by state until there were some 20 suffrage states. The greatest victory thus gained was that in the state of New York in 1917, after America had joined in the war. To win in the "Empire" state was a turning point in the whole struggle. After this, ultimate victory was certain, and the suffragists concentrated on carrying suffrage by constitutional amendment. Theodore Roosevelt in 1912 was the first important presidential candidate who supported woman suffrage. In 1916 and 1920 all the presidential candidates were suffragists. President Wilson during his second term aided the movement by taking the unprecedented course of himself twice urging the Federal amendment upon the attention of Congress. The necessary two-thirds majority was secured in the House of Representatives in Jan. 1918, but there was not a single vote to spare, and the narrow margin weakened the position, especially as the Senate had yet to be won; but in May 1919 the amendment was again brought up in the House and was carried by 304 to 48; and victory in the Senate followed almost immediately. Then came the battle for ratification in 36 states. The first stages were easy and rapid, 11 states giving a unanimous vote in both Houses, and seven more in one or other of their chambers. After this the victories came more slowly until, in May 1920, 35 states had ratified and only one more was needed. The issue was much obscured by the impending presidential election. Both candidates were, as in 1916, suffragists. Both parties probably believed they would gain an advantage if they could plausibly claim that their efforts had given the final victory to women. Tennessee, a Democratic state, voted for the amendment by the necessary majorities in Aug. 1920; legal objections to its validity were, however, raised, but not in time to prevent the proclamation by the Secretary of State in Washington that the 19th Amendment to the U.S. Constitution had been carried. The legal points, however, awaited decision in the High Court. This gave an opportunity for a Republican state, Connecticut, to come to the rescue; a special session was called and the 19th Amendment was ratified on Sept. 21 1920. This made the Tennessee objections negligible for, valid or invalid, the 36th state had now ratified and the following article was added to the Constitution: "The right of citizens of the United States shall not be denied or abridged by the United States or by any state on account of sex." Thus after a struggle of 70 years the women's victory in America was completed.

Other Countries

Before the World War there were only four countries in the world where women exercised the political franchise; by the end of 1920 there were 28—namely, the United Kingdom, Canada, Australia, New Zealand, British East Africa, Rhodesia, Jamaica, Denmark, Norway, Sweden, Finland, Iceland, Holland, Rumania, Serbia, Luxemburg, Germany, Austria, Hungary, the United States; and, among the states newly formed by the peace treaties of 1919, Poland, Esthonia, Lithuania, Latvia, Czechoslovakia, the Ukraine and Palestine.

The charter of the League of Nations contains a clause rendering women eligible for all appointments, including the secretariat. This clause did not remain a dead letter. Besides a large number of women in less responsible positions, Dame Rachel Crowdy was made Director of the Section of National Health, to deal with the white-slave and opium traffic and with the anti-typhus campaign. At the first assembly of the League (Geneva Nov., Dec. 1920) Sweden appointed Mrs. Wicksell and Norway Dr. Kristine Bonnevie as alternate representatives of their respective countries; while Miss Forchhammer of Denmark brought forward in the full assembly the subject of the white-slave traffic and was successful in carrying her proposal to appoint a commission of three persons, one of whom must be a woman, to prosecute a special inquiry on the subject in the Near East. Miss Sophie Sanger was made head of the Legal Section of the International Labour Bureau. In Jan. 1921 Mrs. Wicksell was appointed a member of the Permanent Mandates Commission.

In seeking a cause for so great a development of principles for which comparatively small groups of women, without any direct political power, had worked in some countries for more than half a century, it may probably be found in one circumstance common to them all. In each country a national crisis had arisen on the issue of which the whole fate of the nation depended. National feeling in each had been stirred to its utmost depths. Under its pressure class feeling was minimized; all sorts and conditions of men and women had worked and suffered together for what each felt to be a cause of supreme importance. Men and women acted as friends and comrades when the issue was uncertain, and when the end came the men did not forget the work and the sacrifices of the women. In all countries, whether victors or vanquished, it was universally acknowledged that all through the anguish of the war the women had not been backward either in self-sacrifice, courage or capacity. It was this feeling which broke down the opposition to women's votes in nearly all the warring nations. It was felt also that men by themselves, as a well-known journalist expressed it, had made a mess of the world and needed helpers; men and women together being generally more successful than either men or women by themselves.

Authorities.—M. G. Fawcett, *Women's Suffrage* (1911); M. G. Fawcett, *The Woman's Victory and After* (1920); E. Sylvia Pankhurst, *The Suffragette* (1910); the files of the *Common Cause*, now *Woman's Leader*, and of the *International Suffrage News; Official Reports of Parliamentary Debates* 1911–1919. (M. G. F.)

WOMEN (*see* 28.782).—The decade 1910–20 saw not only an advance in the position of women, unparalleled in any similar period, throughout the civilized world; it saw also an entire reversal of the public attitude towards their claim to equal citizenship. Yet this is true only of the second half of the period. From 1910–4 there was little or no progress; there was indeed retrogression. By 1910 the "Woman Movement" of the later 19th century had very largely resolved itself into a movement for obtaining the parliamentary franchise, a concentration upon a single object deplored by some but defended by others, who contended that the denial to women of the full rights of citizenship constituted an effective check upon their advance in any direction. The rise and progress of "militant" suffragism in England between 1910 and 1914 (*see* Woman Suffrage) did much to alienate public sympathy. It was only the outbreak of the World War which brought about that great and sweeping reform in the position of women which had been accomplished by 1920.

(1) United Kingdom.—After 1914 changes in the United Kingdom were both numerous and rapid. The shortage of manpower during the war opened up a great diversity of fields of employment (*see* Women's War-Work), and broke down barriers in the Civil Service and the learned professions, which had hitherto seemed impregnable. Nothing more was heard in the great war departments of those "structural" and other insuperable obstacles to the coemployment of men and women, which figured so largely in the evidence of practically every male civil servant before the Royal Commission on the Reform of the Civil Service, reporting in April 1914. When the institution of the two new orders of honour, the Companions of Honour and the Order of the British Empire, was announced in June 1917, it was declared that the bestowal of these decorations for war services would be irrespective of sex. In Aug. 1917 a resolution to remove the grille in front of the ladies' gallery of the House of Commons was passed by that House without debate. By the

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Representation of the People Act (1918) women over 30 gained the parliamentary vote, and by a special Act passed in Nov. they were made eligible as members of Parliament, though the only woman elected at the general election of that year, Countess Markiewicz, refused, with the other Sinn Feiners, to take her seat. The Sex Disqualification (Removal) Act (Dec. 1919) gave women the right to hold practically every other public or professional position pertaining to civil life with the exception of membership of the House of Lords. Even this exception was subsequently removed: on March 2 1922 the Committee on Privileges of the House of Lords favourably passed upon a petition by Lady Rhondda holding that she and the 24 other peeresses in their own right were entitled to seats in the House of Lords.

As an immediate result of the Act women could be admitted to the degrees of any university, whatever the terms of its previous charter. The university of Oxford rose to the height of its opportunity; Cambridge, up to the close of 1921, still lagged behind. In the general election of Dec. 1918 women, who had qualified by residence and examination for degrees not yet conferred upon them, exercised the university franchise by reason of that qualification. The absurdity of such a position appealed to the more logical university. In Feb. 1920 Prof. Geldart introduced a statute into Congregation at Oxford, proposing to admit women to full membership of the university. Two amendments were moved on March 9, one to exclude women from university boards, the other from examinerships, but both were rejected by large majorities. On May 11 the statute was carried without alteration, and three subsidiary statutes, admitting women to all university offices, passed unopposed. Since Oct. 7 1920 the women students of Oxford have enjoyed the same advantages, and been subjected to the same university discipline, as the men. They even wear in slightly modified form the same academic dress at lectures and all university ceremonies. Moreover the gift was retrospective; every woman who had passed the examinations for the degree course and resided not less than 9 terms (three years) in Oxford as a member of a recognized Society of Women Students (such societies being the four women's colleges, or the Society of Oxford Home Students) became eligible for a degree, and on Oct. 14 the degree of B.A. was actually conferred upon a large number of qualified women, the principals of the various colleges and halls and the principal of the Oxford Home Students receiving the hon. degree of M.A. On March 11 1921 the hon. degree of D.C.L. was conferred on Queen Mary, on the occasion of a visit to Oxford in support of the appeal of the Oxford women's colleges for funds to meet the anticipated increase in the number of students anxious to matriculate at a university which offered them full privileges of membership. During the academic year 1920–1 the total number of degrees conferred upon women at Oxford was: B.A. 621; M.A. 345; B.Litt. 9; B.Sc. 3; B.C.L. 1; B.Mus. 2; D.Mus. 1; D.C.L. 1.

At Cambridge the position up to the summer of 1921 remained uncertain and, from the women's point of view, unsatisfactory. On Dec. 8 1920 a proposal to admit women to degrees was decisively rejected by the Senate, the figures being 712 for and 904 against. An alternative scheme to set up a separate university for women at Cambridge, conducting its own examinations and conferring its own degrees, met with no favour and was strongly opposed by the women concerned. When it came before the Senate (Feb. 12 1921) it was rejected by 146 votes to 50. A "compromise" scheme, giving membership of the university and full degrees and making women undergraduates eligible for professorships, lectureships, university boards and syndicates but not for the Senate, was again rejected on Oct. 20 when it was defeated by 908 votes to 694. An alternative scheme for conferring by diploma "titular" degrees on women, carrying with them no university membership, was passed by 1,012 votes to 370. This alternative, however, was unacceptable to the women.

Amongst the learned and academic distinctions won by women during the decade may be noted the presidency of the botanical section of the British Association held by Ethel Sargent (d. 1918) in 1913 and by E. R. Saunders in 1920. In Dec. 1920 Eugenie (Mrs. Arthur) Strong was appointed Rhind lecturer in archaeology and the first woman fellow of the Society of Antiquaries. In 1918 the Founder's Gold Medal of the Royal Geographical Society was bestowed upon Gertrude Margaret Lowthian Bell.

By Section 2 of the Sex Disqualification (Removal) Act women were permitted to become solicitors. Three years earlier (Jan. 1917) a proposal to admit women to the bar had been defeated at its annual general meeting by a large majority, though in Feb. 1917 a bill to permit them to qualify as solicitors obtained a second reading in the House of Lords. On Jan. 1 1920 Mrs. Gwyneth Marjory Thomson (Bebb), who died at the early age of 31, was admitted at Lincoln's Inn as the first woman student for the English bar. She had previously (1913) tested the legality of a woman practising as a solicitor by bringing (with others) a case against the Law Society. On May 7 1920 Miss Tata, a Parsi, was admitted, also at Lincoln's Inn, as a student preparing for the Indian bar. A few women presented themselves for the law examinations at the universities and passed with distinction, Mrs. Thomson obtaining a 1st class at Oxford, and Miss L. F. Nettlefold at Cambridge, and in June 1921 Miss K. Snell of Girton College was placed above No. 1 in Class I. of Part II. of the law tripos at Cambridge. In March 1921 five women passed the intermediate examination for the bar and on May 26 Olive Catherine Chapman passed the final examination.

Seven women (the Marchionesses of Crewe and of Londonderry, Mrs. Humphry Ward, Mrs. Lloyd George, Miss Elizabeth Haldane, Mrs. Sidney Webb and Miss Gertrude Tuckwell) were appointed justices of the peace on Jan. 1 1920. On Jan. 9 Mrs. Ada Summers, mayor of Stalybridge, took her seat as first woman chairman of the bench. In March of that year 24 women were appointed for the county of Lancaster, and in July a large number were appointed for the county of London; appointments were subsequently made throughout the United Kingdom.

On Aug. 6 1920 women jurors were for the first time empanelled, at Bristol. In Jan. 1921 women jurors were first summoned to the Central Criminal Court, London, and were also first called as "special jurors" in the Probate and Divorce Court. The first case which they had to try involved details of an unpleasant character, and some controversy subsequently arose as to the suitability of mixed juries in divorce and other cases. It was, however, generally held that the discretion left to the judge to make an order exempting women from service in cases of a certain kind was sufficient safeguard, and a bill, introduced into the House of Commons by Mr. G. Terrell on April 15 to amend the Sex Disqualification Act by providing that no women should be compelled to serve on a jury, failed to secure support, only 19 members being present when he introduced it.

Shortage of candidates for the medical profession during the World War encouraged a very large number of women students to present themselves. War conditions led to the admission of women students to several of the London general hospitals; before the war they were restricted to the Royal Free Hospital and the School of Medicine attached to it, or to the few hospitals for women, staffed by women. A notable advance was also made in placing the Endell Street (London) military hospital, opened Feb. 1915 by the R.A.M.C., under Dr. Louise Garrett Anderson and Dr. Flora Murray, and by the employment of other women surgeons and physicians under the R.A.M.C. in Malta, Salonika and elsewhere.

Progress in the Civil Service was rapid during the war, when women, as temporary civil servants, held many responsible posts, and were paid on a higher scale than had previously obtained. On May 19 1920 the House of Commons passed a resolution declaring that women employed in the service of the State should have equal opportunities and equal pay with men engaged on the same work. But the power to reserve to men certain departments of the service, given to the Treasury by Order in Council, was widely exercised, and the progress made fell short of the desires and expectations of the women affected (*see* WOMEN'S EMPLOYMENT). On Aug. 5 1921 a debate on the subject took place in the House of Commons on a resolution moved by a private member. A Government amendment to it was agreed to,

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whereby for a provisional period of three years special conditions were to obtain both as to method of selection and rates of pay, but subsequent conditions were to be the same for both sexes.

No barriers now exist excluding women from any profession, except the army and navy, and ministry of the Church of England or the Roman Catholic Church. In Feb. 1920 Convocation passed a resolution against giving permission, even to accredited women "to preach and pray in congregations composed of women and children," but in July the Lambeth Conference recommended the admission of women to the diaconate and a wider use of their ministry in non-liturgical services. Permission was, however, refused to Miss Maude Royden to preach in a London church at a special Good Friday service in March 1921. The General Assembly of the English Presbyterian Church resolved in May 1921, by 156 votes to 124, to admit women as elders and deacons.

In practically all other directions the field lies open to women. Their achievements during the war proved that they but needed opportunity. The remaining struggle was not for permission to work but for adequate remuneration. "Equal pay for equal work" became their rallying cry. It was inscribed upon the banners of an imposing procession, demanding equality in the Civil Service, which paraded London on April 28 1920; it formed the basis of the protest of women teachers to the Minister of Education (May 1920) and of their demonstration in Trafalgar Square (Nov. 1920) against the proportion (four-fifths) of male salaries allowed them under the Burnham scale. In the industrial world the women's claim to an equal bonus prompted the successful strike of tramway and omnibus workers in London in Aug. 1918. Not inappropriately the National Union of Women Suffrage Societies renamed itself the National Union of Societies for Equal Citizenship.

The problem was no longer political, or even social; it was economic. The removal of the few remaining disabilities of women, such as their inferior share in the guardianship and control of their children, depends in the last resort upon the securing for them, whether in marriage or out of it, of economic independence. Otherwise freedom to control those whom she cannot maintain, or the right to leave a husband when she is incapable of maintaining herself, are illusory rights of little value to a woman. When the last traces of the legal theory that husband and wife are one person, and that the woman, as such, must be under the tutelage or guardianship of parent or husband, have been obliterated, there will still remain need for legislation securing to a woman freedom to work outside her home, or, as an alternative, wages for work within it going beyond bed and board, as well as a fair share of joint earnings. Not till this is accomplished will the theory of equal citizenship have been translated into fact. (J. E. C.*)

(2) UNITED STATES.—The increase in interest in professional work for women in the United States, during the World War, was evidenced by the number of bureaux and associations for the exchange of information in this field. A book published in 1920 by the director of the Intercollegiate Vocational Guidance Association told the story of over 30 groups of professional occupations where women were already at work. An examination of the many branches under the main groups indicated that there was practically no profession women had not entered. The Bureau of Vocational Information published intensive studies of the leading professions, and the National Social Workers' Exchange was organized to place trained workers in professional positions throughout the country. During the World War increased opportunities came to women, both in the accustomed professions and also in new lines of endeavour. It is probably true, however, that most of the professional work, which was considered "new" to women, was "new" only in the sense that it was unknown to the general public. In the case of employment managers, personnel and welfare workers, for instance, women had been employed for some time, but the war increased the number and brought their work vividly before the public.

Industry.—Many of the women taking executive positions in industry had been forewomen and were promoted in the war emergency. In one investigation of 250 plants, 146 employed women executives other than forewomen. The more important positions included those of designers, office or factory managers, employment managers, welfare directors, nurses and occasionally doctors, matrons, lunchroom managers, production supervisors, department heads, statisticians and saleswomen on the road. Later there developed a tendency to employ college women in these positions, and by 1920 at least three universities and a half-dozen schools had offered special training courses. One school alone graduated over 200 women whose salaries ranged from $2,000 to $5,000 a year.

Medicine.—Perhaps the most important demand among the already recognized professions was for an increased number of nurses and doctors. In 1920 there were registered about 40,000 nurses in private practice and about 10,000 in public health work. It was in the latter field where every effort was being made to increase the number to 50,000. The number of women physicians at the same time was about 6,000, and practically all of the American medical schools were open to women, although not always on quite the same terms as for men. Women were not only practising physicians but they also held important positions in surgery, dentistry, laboratory research, and on the staffs of hospitals and medical schools. In addition to the "regular" physician it was estimated that there were about seven or eight thousand women practising osteopathy.

Law.—Since 1869, when the first woman was admitted to the bar in Illinois, the profession of law has claimed an increasing number of women. By 1921 every state in the Union except Delaware had admitted both sexes, and at least 1,600 women were practising in various branches of both civil and criminal law. Out of 129 law schools only 27 then refused admittance to woman students, but among those refusing were two of the leading schools, Harvard and Columbia. In many cases women who were graduate lawyers specialized in one phase of work such as corporation law, patent law, legal research or court work. Others did not enter the practice of law but engaged in work where their legal training became valuable background. Among the important Government positions held by women lawyers in 1921 were those of the U. S. probate attorney, judge of the juvenile court in the District of Columbia, city magistrate in New York City, deputy collector of customs, and county attorneys, treasurers, clerks, probate judges and justices of the peace in various states. Two states have had women assistant attorneys-general, and probably the most important position held by a legally trained woman was that of assistant attorney-general of the United States.

Education.—One of the few professions given over very largely to women was that of teaching. Women almost completely filled the ranks in the elementary public schools, and very nearly so in the higher grades. Men predominated in the colleges and universities, but women held many important positions as faculty members and occasionally as presidents of women's colleges. Many of the higher educational institutions employed women deans to supervise and advise the women students. Salaries for these positions were seldom above $3,000 or $4,000, but occasionally the dean of women held the rank of full professor and received a corresponding salary. Many smaller cities employed women as superintendents of schools, but in 1921 only one or two of the larger cities had engaged women in this position. An increasing number of women were employed in private schools either as teachers or principals, and often private schools were owned and managed by women. Since 1900 particular problems in education have been emphasized and women specialists developed in such fields as manual training, recreation, kindergarten, physical education, vocational training, and the education of the blind, feeble-minded or subnormal.

Immediately following the World War an acute shortage of teachers occurred, due to the large numbers drawn off into better-paid positions. This exodus amounted almost to an "invisible strike" for higher wages and became so serious that schools in many places either closed entirely or were open for only half-day sessions. A movement was started to establish a minimum salary of $1,500 a year in order again to attract women to the profession, but the wave of economy which spread over the legislative bodies in 1921 greatly impeded the efforts to raise the standard of teaching and to secure better educational facilities.

Social Work.—Since 1900 a remarkable increase occurred in the numbers of women engaged in various forms of social service. Women have of course been the traditional bearers of charity and have long been connected with correctional work. But this was largely in the form of volunteer service. With the greater development of paid service, and the desire to treat causes rather than effects, there developed a wide field of work and a large number of workers. Social service was classified by the National Social Workers' Exchange as follows: (1) Social case work, dealing with individuals, as church visiting, family case work, medical social service, probation, protective and prison work, public health nursing and visiting, school visiting, and employment exchange work, both public and private (2) Social group work, including community-centre work, Americanization boys' and girls' club work, playground and recreation work. (3) Social reform work dealing with people as a mass—as housing reform legislation, anti-tuberculosis work, and the promotion of child hygiene. (4) Social research, comprising special investigations, research and statistical work including surveys and exhibits. No fewer than 14 schools for the training of social workers had been established by 1921 and the demand for women with proper training usually exceeded the supply.

Civil Service.—Extensive opportunities for women are to be found in civil service positions offered by city, state, and Federal

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governments.' In 1920 about 200 cities, 11 states and the Federal Government had adopted the competitive civil service plan. The number of women employed in the civil service throughout the country could not be accurately ascertained but a conservative estimate of those in the Federal service in 1920 placed the number at about 50,000 in the District of Columbia alone. During the first half of the year 1919, examinations were held for 260 different types of service with positions varying from that of charwoman at $240 a year to a Federal Trade Commissioner at $10,000.

The plan of the classified civil service aims, on the whole, to give equal opportunity to both sexes. But in practice women are often discriminated against by the custom of excluding them from certain types of service and also by permitting the heads of departments to determine the sex qualifications both for examinations and for appointments. In the Federal Government service, where women were admitted by statute in 1870 at the discretion of the head of the department, the custom of giving preference to men had been so powerful that in the civil service examinations held between Jan. 1 and July 1 1919 women were excluded from over 64% of the positions in scientific and professional services, from 86% of the positions in the manufacturing and mechanical services and from 75% in the medical services. In the work of collecting information from original sources only 4 out of 16 different kinds of positions were open to women. Even the Federal Bureau of Efficiency and the Federal Board for Vocational Education closed its examinations to women.

This policy of discrimination was deeply affected by the shortage of labour during the World War, and the situation was partly remedied when the Civil Service Commission, after an investigation by the women's bureau of the Department of Labor, opened all examinations to both sexes, but with the reservation that heads of departments may specify which sex was desired. This latter provision will need to be modified before equal opportunity is completely secured. There also exists in the Federal service serious discrimination against women in the matter of salary levels and in the classification of grades. During the first two months of 1919, for instance, over 86% of all women appointed received salaries ranging between $900 and $1,300 a year, while only 36% of the men received these salaries. The number of women receiving probational and temporary appointments, in this same period, was about twice as great as the number of men in the same classes. But efforts to remedy this situation are increasingly successful.

Positions most commonly open to women include those of stenographer, secretary, librarian, statistician, editorial and clerical worker. Many departments, however, require women with expert technical training such as biologists, bacteriologists, chemists, dietitians, linguists, draftsmen, doctors, nurses, directors for playgrounds and recreation centres, and specialists in social welfare such as child hygienists and factory inspectors. Public institutions also offer opportunities for women in such positions as matrons, supervisors, inspectors and in the more technical positions as physicians or psychologists. Tenure of office based upon merit, often with a pension upon retirement, is probably one of the most alluring features in civil service work.

General.—The entrance of women into many other professions was given a special impetus during the war, including journalism, advertising, commercial art and banking, where women were employed both as clerks and as officers and directors. Architecture, interior decoration, landscape gardening and motion-picture work attracted an increasing number of women. In motion-pictures women were not only actresses but also title editors, research workers, readers and occasionally directors or even producers. The exceptionally large salaries of $25,000 and $50,000 were occasionally reported, and a rare motion-picture director or a play broker was said to earn $100,000 a year. It is apparent that women have entered a very large number of professions exclusively held by men in earlier years, and their success indicates that they are certain to remain and to carry important responsibilities. (I. O. A.)

WOMEN, LEGAL STATUS OF (*see* 28.784*).—(1) UNITED KINGDOM.—The position of women in England was almost revolutionized between 1910 and 1921. Very little actual change in the law took place between 1882 and 1918, but beneath the surface inevitable changes were impending, and the World War brought about the outward change as probably nothing else could have done. The parliamentary suffrage (*see* WOMAN SUFFRAGE) was granted in the early summer of 1918 to all women over 30 years of age whether single, married or widows;[1] and in Dec. 1919 they were declared eligible for any office.

It may be taken as a general proposition that from the beginning of the year 1920 onwards there has been no difference in the legal position of men and women on account of their sex throughout the United Kingdom, and since that time no woman has been under any civil disqualification by reason of sex or marriage. As far as property was concerned, even under the old law, the non-married woman, whether spinster or widow, held her property on the same terms as a man. She could buy and sell, go to law and make her will just as a man could. The married woman's position before the year 1882 was far different. It is well stated by one who, though born in the United States, became one of England's greatest lawyers, thus: "A married woman is absolutely incompetent to enter into contracts, and has in the contemplation of law no separate existence. She cannot make a valid purchase on her own account even for necessaries, and when credit is given to her there is no remedy but an appeal to her honor" (*Benjamin on Sales*, 3rd ed., p. 32). All this has completely disappeared. The Married Woman's Property Act 1882 was a great step in advance, and the last remnant of the medieval doctrine that for every purpose husband and wife were one person (and that person the husband) disappeared in 1920 when they were made capable of stealing from one another except when living together. A married woman is now as capable of dealing with her own property as a man is.

Married women (and of course all spinsters and widows) can now make their wills and dispose of their property as they wish. In England neither the husband nor the children have a right to any part of it except in the absence of a will. In Scotland the children have a legal share, on which they can insist on their parent's death. A married woman is not obliged to ask her husband's leave to make a will, nor need she make him executor or leave him any part of her property, unless she wishes to do so. Among wealthy people the married woman's position as to property is often controlled by her marriage settlement. The provisions are almost invariably the same, viz. that the capital of the property is in the hands of trustees and the income goes to the wife, who cannot anticipate it. On the death of the wife the husband sometimes has the income for his life. If there are children the capital is divided among them, generally in equal shares. If there are no children or other descendants of the wife the property goes back to the wife's relations, unless she disposes of it by will as she can generally do.

It is, however, an irony that even in 1921, in respect of her motherhood and the custody of her own children, the woman was still inferior to man (*see* 14.514), and also as to inheritance she was still not in such a good position as her husband or brother. In case she does not make a will all her property except her land goes to her husband, whereas if he dies intestate she only gets a third of his property, or half if he has no children (*see* 14.568 and

[1] By the Representation of the People Act (1918) all the old franchises were swept away. There are now three qualifications for women as parliamentary electors under the Act: residential, university, and as the wife of a local government elector. In her own right a woman may qualify by residence in the electoral area and may in addition have one or more university votes. As the wife of a local government elector she may also have a parliamentary vote, but she may not vote more than once in the same election nor for more than one ordinary constituency in a general election. In addition she has one university vote at a general election. To qualify as a local government elector she must have (*a*) attained the age of 21, be resident in the area on the last day of the qualifying period (Jan. 15 or July 15), have occupied some land or premises in the area for the whole of the qualifying period, or in the alternative (*b*) must have attained the age of 30 and be the wife of a man who is entitled to be registered as a local government elector in respect of the premises in which they both reside. To qualify as a parliamentary elector she must have attained the age of 30 and must be entitled to be registered as a local government elector in respect of the occupation in the electoral area of land or premises of the yearly value of not less than £5, or of a dwelling house, however small the value, or be the wife of a husband entitled to be so registered. This means that the husband must own land or premises in the area of the yearly value of not less than £5. In all the above cases the women must not be under any legal incapacity. A peeress in her own right can be an elector and also a peeress by marriage. There are certain offices, chiefly in Scotland, which if conferred on a woman would incapacitate her as a voter. She must not be a lunatic, an alien or a convict. The wife of a person serving in military or naval forces of the Crown, who would if he were not so serving be entitled to be registered as an elector, is not disqualified. The wife of a "conscientious objector" is not disqualified.

In the case of a university vote the woman elector must be 30 years of age, and fulfil the same local conditions as a man elector, or have passed the final examination and kept the period of residence necessary to qualify a man at the time when the university did not grant degrees to women.

** These figures indicate the volume and page number of the previous article.*

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14.714). A very elaborate bill was in 1921 before Parliament intended to give her an equal share with her brothers in her parents' landed property.

The Sex Disqualification (Removal) Act, 1919, provides that no person (whether man or woman) shall be disqualified by sex or marriage from the exercise of any public function, or from being appointed to or holding any civil or judicial office or post or from entering or assuming or carrying on any civil profession or vocation or for admission to any incorporated society (whether incorporated by Royal Charter or otherwise), and a person shall not be exempted by sex or marriage from liability to serve as a juror. The word "person" in English law includes woman as well as man. The Act further provides (*a*) that His Majesty may by order in Council authorize the admission of women to the Civil Service, and reserve to men any branch of, or posts in, the Civil Service in H.M. possessions overseas or in any foreign country; (*b*) that any judge or other person before whom a case is heard may in his discretion on application (in both civil and criminal cases) by either party or at his own instance make an order that the jury be composed of men or women only, or may on her application exempt a woman from service on a jury by reason of the nature of the evidence or issues to be tried. Rules of Court have been made as to summoning jurors, exempting women who are for medical reasons unfit to attend and as to procedure. Section 2 provides for the admission of women as solicitors. Section 3 enables any university to admit women to membership or any degree notwithstanding any statute or charter of such university. The Act overrides all previous statutes, orders in council, royal charters or other provisions inconsistent with it, and applies to the whole United Kingdom.[1]

It will be observed that the qualification to hold office only applies to civil life. Military and ecclesiastical offices are not open to women. On the passing of the Act Viscountess Astor was almost immediately elected to the House of Commons and took her seat as a member, and women were appointed justices of the peace and began to serve on juries. The contrast between the position of women in 1921 and 50 years earlier is certainly very striking. The unmarried woman, both spinster and widow, was equally disqualified formerly from public functions and offices, but she was in the same legal position as a man for the purposes of contract and wrong-doing. In criminal law the married woman as well as the single one has now the same position as a man with some trifling exceptions. The recent Larceny Act, which codifies the law, finally makes it possible for the wife as well as the husband to steal from one another when they are living apart, or deserting, or intending to desert the other. Up to the last-mentioned date the medieval conception that the husband and wife were one person made it impossible for them to steal from each other, just as it formerly made it impossible for one of them to give or convey property to the other. All this is now abolished and, with the exceptions presently stated, a woman, even when married, must be treated in law as a man. This is not however the case with military or ecclesiastical law. A woman is not liable to serve in the forces of the Crown, and she cannot in the Church of England or the Church of Rome be a priest or hold such ecclesiastical offices as are held by men. She is also subject to her husband in ecclesiastical law, and they are regarded for many purposes as one person. She is also by the law of marriage regarded as under the authority of her husband. Her duty is obedience in all things not sinful. The husband has a right to her custody and control. She must live in the house he appoints and sleep with him if he wishes it. She has no remedy except to leave him, and if she does so for such a reason he is not bound to support her. He cannot however legally prevent her from leaving him (*Jackson v. Jackson 1891*). She cannot get damages from him for imprisonment (*Tinkley v. Tinkley 1908*).

The wife can obtain a maintenance order from a magistrate if she separates from her husband on the ground of his assault on her, or his desertion. Orders made abroad can now be enforced in England, and, if made in England, can be enforced against the husband abroad. Maintenance for the children can also be obtained up to 10s. per child (Married Woman Maintenance Act 1920).

In England until the Act of 1874 (36 and 37 Vict. c. 12) the father was the sole guardian of the children of any marriage and was entitled to the sole custody and control of them. The mother had no legal rights whatever. By an Act of Charles II. (1660) the father was given the sole right to appoint a guardian or guardians of his children to act after the father's death so long as they are under twenty-one. By the Guardianship of Infants Act (1886) the mother, if surviving, is the guardian of each child either alone, when no guardian has been appointed by the father, or jointly with the guardian appointed by him. The mother may also appoint a guardian to act after her own and the father's death. Subject to the confirmation by the Court she may also appoint a guardian to act with the guardians appointed by the father. By Section 5 the Court may make such order as it thinks fit regarding the custody of the child and the right of access thereto by either parent "having regard (*a*) to the welfare of the child, (*b*) the conduct of the parents, and (*c*) *the wishes as well of the father as of the mother.*" This statute however has been interpreted by the judges to mean that where the father's wishes and the mother's were opposed the father's wishes must prevail. By the Guardianship of Infants bill (1921) the above Act would be wholly repealed. The father and mother in future and for all purposes would be joint guardians, and have joint custody, and have "equal authority, rights and responsibility with regard to every legitimate child, any former rule of law or equity to the contrary notwithstanding." The father and mother would be jointly and severally liable for the maintenance and education of the child according to his or her means on the application of either the father or mother or any other person acting as next friend. Their executors would also be liable.

There is an old saying that lawyers are divided into two classes: those who think man is made for the law and those who think the law was made for man. It is the first class that makes the law unpopular; but it should be remembered that when husband and wife quarrel about their children the task of the judge is a very difficult one. The most difficult case is where they differ in religion. It has been laid down (*Agar-Ellis* case 1878) that the child must be brought up in the religion of the father. In this case he was a Roman Catholic and had not been guilty of misbehaviour. It was decided that the children must not be brought up by their mother on the ground that she might make them Protestants; if the father had been a Protestant and the mother a Roman Catholic she would have been deprived of her children on the same grounds. It was further laid down that no promise by the father before marriage as to the education of his children can be enforced after marriage, as he has a right to alter his mind. The last named decision might well be reversed by statute. In the case of property the husband's agreement before marriage can be enforced, and it seems unjust not to enforce his agreement as to the children. But in cases where the father and mother are of different religions and no promise has been given, it makes the judge's task a difficult one. Hard cases make bad law, and the difficulty lies, not with the judges, but in the real tragedy of these disagreements. (R. TH.)

(2) UNITED STATES.—Although the legal emancipation of women was far advanced in the United States at the end of the 19th century, three things were yet incomplete: (1) full recognition and securing of the individual interests of women in the domestic relations, which were often left unsecured legally because of survival of doctrines or institutions coming down from a state of society in which all women were dependents, and were normally under a sort of guardianship; (2) full logical development of the legal capacity of married women and doing away with the remnants of their common-law disabilities, already long abrogated for the most part in the United States, but surviving here and there in curious local anomalies; (3) legal taking account of the facts of women's physical constitution in their relation to wages and hours and conditions of labour in industry, and securing of the social interest in the individual life of women by adequately protecting them in these connexions.

With the progressive breaking down of the legal conception of the household as an entity ruled from within by a head, and as an agency of social control, it becomes necessary to give legal recognition and protection to individual interests of women in the domestic relations, which at common law were supposed to be secured through the internal economy of the household, or were left unsecured in view of a paramount social interest in the household as a social institution. Summarily, these may be put as *parental* interests—interests of women in the relation of parent and child, and *marital* interests—interests of women in the relation of husband and wife.

Parent and Child.—At common law the father was entitled to the custody of his minor child and the mother had a right to custody only after the father's death. In form this still stands in the books as law, but in substance there has been a complete change within a generation. Equity long ago refused to give effect to the father's common-law right of custody as against the interest of the child, and by taking the equitable doctrine of regard for the interest of the child over into the law, the courts have been able to put father and mother upon an equality for practical purposes in almost all jurisdictions. Yet the common-law doctrine remains theoretically in force in the absence of legislation, and legislation halts. One decision as late as 1905 holds that as between father and mother, the former has a legal right to control the religious training of the children. (*Hernandez v. Thomas, 50 Florida Reports, 522, 536.*)

Husband and Wife.—Marital interests of women include claims against the world at large growing out of the relation of husband and

[1] Women who wish to be solicitors should apply to the Incorporated Law Society, Chancery Lane, W. C. 2, or barristers to the Benches of the Temple, E. C., or Gray's Inn or Lincoln's Inn, W. C. Nurses and midwives are under the Ministry of Health. There are penalties for using either title without registration.

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wife, and claims of wives against husbands because of that relation. As interests of personality a wife has claims to the society of her husband, quite apart from any economic advantage; to the affection of her husband, analogous to the legally recognized claim of the husband to the society and affection of the wife; and to the chastity and constancy of the husband as involving her self-respect and honour. These interests, however, are not yet recognized to their full extent and are not fully secured even in legal theory. The first and second are now protected by an action for alienating the husband's affections, which has come to be allowed by the overwhelming weight of American authority. (*Turner v. Heavrin, 182 Kentucky Reports, 65, 1918*). The third is at most but partially recognized and indirectly secured; but it should be said that the obvious inutility of the husband's means of redress, which should be applied by analogy to make the law logically complete, has had much to do with the apparent backwardness of the law on this subject. As an interest of substance the wife may claim to be secured in the marriage relation as an economically advantageous relation, providing her with support and shelter. Where the husband is enticed or induced to abandon his wife or to divert earnings which should be devoted to her support, the courts are coming to recognize this interest directly. (The wife's action was allowed in *Flandermeyer v. Cooper, 85 Ohio State Reports, 327, 1912:* it was denied in *Brown v. Kistleman, 177 Indiana Reports, 692, 1912.*) On the other hand in case of physical injury to, or abduction of, the husband, the wife is still usually denied an action, although the husband may recover in the converse case for "loss of service." No doubt there are practical difficulties here, arising in part from our mode of trial and of assessing damages. Yet the present state of the law, shaped by obsolete conceptions of the position of the wife in the household, is so out of accord with the present-day position of married women that legislative overhauling in the near future is not unlikely. Regarding the claims of the wife against the husband, modern law everywhere has agreed to leave the interest of husband and wife respectively in the society and affection of the other without effective legal sanction as between the two. The claim of the wife to support was recognized fully and secured adequately at common law. Recent legislation setting up domestic relations courts and providing for criminal prosecution in case of non-support has only put more effective administrative machinery behind existing legal duties of the husband. The most serious inequalities in this connexion were in the procedural difficulties encountered in enforcing the wife's legal rights. Domestic relations courts, which have had a considerable development in the U.S. in the last decade, are adapted especially to removing these obstacles (see Smith, *Justice and the Poor*, chap. 11.). It should be noted also that modern legislation, although taking away from the husband all control over the wife's property and earnings and committing it solely to the wife, has left untouched the common-law duty of the husband to support the wife even if she has property and he has none. Some courts go so far as to allow a wife possessed of means who has supported herself out of her separate estate to sue the husband and obtain restitution of the amount thus contributed. (*De Brauwere v. De Brauwere, 203 New York Reports, 460, 1911.*) A few western states, however, now impose upon a wife of means and ability a duty of supporting an indigent and infirm husband, and allow an action by the husband to enforce this duty. (*Hagert v. Hagert, 22 North Dakota Reports, 290, 1911.*)

Disabilities of Married Women.—Unmarried women of sound mind and lawful age were under no common-law disabilities. On the other hand married women were without power to determine their own national character or legal domicile, following their husbands in these respects as a matter of law; were subject to serious disabilities with respect to ownership, use and enjoyment of property; were restricted in their power to sue in the courts; could not convey property; and had no power to contract. Some of these disabilities were rested on a fiction of the legal unity of husband and wife, derived from the position of the husband as guardian of the dependent members of the household in the old Germanic polity and reinforced by certain texts of Scripture, whose authority was decisive in the Middle Ages. Legislation began to abrogate these disabilities early in the 19th century. But it was often far from comprehensive in its scope, and when sweeping provisions were enacted they were often interpreted narrowly because of the doctrine requiring strict construction of statutes in derogation of the common law. There has been a gradual but steady progress in the direction of removing all of these disabilities partly by legislation and partly by judicial decision, and many anomalies which resulted from halfway legislative measures or strict judicial interpretation were in the decade 1910–20 shaken, if not overthrown. With respect to separate domicile of married women and actions by wives against husbands, the social interest in the security of marriage and the family as social institutions of paramount importance has necessarily given the courts pause, since the doctrine that the wife's domicile depended on that of the husband, and that the one might not sue the other, seemed but corollaries of a legal recognition of the family as an entity. Yet when that entity is *de facto* dissolved, these doctrines amount to serious disabilities imposed upon one member. Accordingly in one way or another American courts now recognized the separate domicile of the wife substantially to the full extent of her individual interest in free self-assertion. (*Williamson v. Osenton, 232 U.S. Reports, 619, 1914.*) So also with respect to actions by the wife against the husband. The older Married Women's Acts which in form merely removed disabilities as to property and contract, were long construed as not allowing such actions since they did not do so expressly, and a policy against aggravation of domestic troubles by dragging them into court was taken to be in the way. This sacrifice of the individual interests of the wife to the supposed exigencies of a social interest has now definitely given way, and conservative courts are allowing such actions even under statutes in terms dealing with property rights only. (*Brown v. Brown, 88 Connecticut Reports, 42, 1914.*) The more recent type of statute, providing that a married woman shall have the same legal existence and personality after marriage as before marriage, necessarily permits such litigation. (*Fiedler v. Fiedler, 42 Oklahoma Reports, 124, 1914.*) As to capacity to own, acquire, use and enjoy property, little remains of the old law, and there are but few jurisdictions where legislation might still accomplish anything. In one respect, however, improvement by judicial decision is still going forward. A number of states, by derivation directly or indirectly from Spanish law, have the institution of "community property," in which with respect to certain property, and especially property acquired after marriage, husband and wife are treated legally as a sort of property-owning entity. The older view was that the husband was the administering agent of this collectivity during their joint lives, and hence could dispose of it, alter its form and charge it with his personal debts; and that it could even be taken in execution for his wrongful acts. Recent decisions in some of these jurisdictions, recognizing the individual interest of the wife, hold that the community property is not liable for acts done by the husband outside of the reasonable scope of his authority as agent of the community. (*Schramm v. Steele, 97 Washington Reports, 309, 1917.*) Yet even there a claim for an injury to the wife being an acquisition after marriage and community property, she is not allowed to sue therefore if her husband refuses to join. (*Hynes v. Colman Dock Co., 108 Washington Reports, 642, 1919.*) As to contractual capacity, little remains to be done anywhere in order to give married women full beneficial powers of contracting in their own interest. Yet in more than one jurisdiction privileges which compensated for the older disabilities still remain in force in whole or in part and enable married women to escape from contracts for which as persons of full capacity they ought to be held. This is especially true of contracts of suretyship, by which married women are very generally incapable of binding their separate property.

Protection of Women in Industry.—While American courts have been reluctant to give over, or to construe legislation as abrogating, common-law privileges or disabilities which protected married women when in a condition of legal dependence, they have also been reluctant to uphold legislation restricting freedom of contract on the part of women in industry with respect to hours and conditions of labour and minimum wage. When such statutes were first enacted, they were held unconstitutional as being arbitrary and unreasonable interferences with liberty of contract by a court which had had no hesitation in keeping alive common-law disabilities, that had long ceased to secure any individual or social interest. That decision has been overruled (*Ritchie v. Wayman, 244 Illinois Reports, 509 1910*), and it seems to be settled that legislation may take account of the facts of women's physical make-up and secure the social interest in a healthy womanhood by regulating the hours of labour of adult females. (*Muller v. Oregon, 208 U.S. Reports, 412, 1908; Bunting v. Oregon, 243 U.S. Reports 416, 1917.*) But it is still a matter of controversy whether this may be carried to the extent of fixing a minimum wage for women employees. (*Stettler v. O'Hara, 243 U.S. Reports, 629, 1917.*) Curiously enough, the political and legal emancipation of women is urged as a reason against such legislation, as if the removal of political and legal disabilities had any relation to, or effect upon, the physical handicaps upon women in industry which are the occasion of these statutes.

Women on Juries.—In 1917 California provided for the drawing of women upon juries. (*Laws of 1917, p. 1283.*) Since the adoption of the Nineteenth Amendment of the Federal Constitution providing for women suffrage, 1920, it has been assumed that women are to sit upon juries everywhere. But in some jurisdictions, out of caution, it is felt that the courts should await express legislation, and in others courts have felt compelled to wait until court-houses and jury-rooms could be adjusted to the novel situation presented by juries of men and women. The conditions under which juries are kept while deliberating upon verdicts and the accommodations for jurors in large cities, where many juries are sitting simultaneously for a great part of the year, are not adapted to the woman juror; and in many country court-houses things are even worse. If no other good results from service of women upon juries, the inevitable improvement of the physical conditions surrounding jury service will be a gain. On the other hand, the expense involved in this improvement and in provision for the custody of juries made up of men and women in important cases, where juries must be guarded closely from outside contact, leads many jurisdictions to hesitate.

(R. Po.*)

WOMEN POLICE.—In Sept. 1914 two distinct bodies of women police were formed in England, with the object of maintaining order amongst girls and young women in the new and exciting

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conditions brought about by the formation of military camps and the movement of troops in training (*see* WOMEN'S WAR WORK).

The Women Patrols were organized by a special committee of the N.U.W.W., with Mrs. Carden as hon. sec. and chief organizer; and the Women's Police Volunteers were formed by Miss Nina Boyle and other members of the "militant" Women's Freedom League, and within a few weeks were reorganized by Margaret Damer Dawson (d. May 18 1920) as the Women Police Service. The latter was a paid force, dressed in a uniform closely resembling that of the regular male force; the former was mainly voluntary and wore no distinguishing mark except an armlet. The Women Patrols were, however, from the first recognized by the Chief Commissioner of the Metropolitan Police (Sir Edward Henry), who signed the passes authorizing them to patrol streets and public places, and by the Home Secretary (Mr. McKenna), who circularized the chief constables of borough and county police throughout the United Kingdom, inviting them to do the like in their own districts. The Women Police Service received no direct official recognition; but in 1916 they were requested by Sir Edward Henry to supply policewomen for the munition factories throughout the country. In Jan. 1917 the Women Police Service received a grant from the Ministry of Munitions for the expenses involved, and in the same year the Women Patrols received a subsidy of £400 from the Home Office, reduced the next year to £300. With these exceptions, both forces, which originated in private effort, were for long supported entirely by funds privately collected. They conducted their own training, the Women Police Service entirely at their London centre and the Women Patrols not only in London but also at the three schools which they established in Bristol, Liverpool and Glasgow. These combined in the autumn of 1918 to form the Federated Schools for Policewomen and Patrols and received a grant of £1,000 from the Carnegie U.K. Trust, followed by £250 in 1919–20.

In Oct. 1918 Gen. Sir Nevil Macready, who had become Chief Commissioner of Metropolitan Police when Sir Edward Henry resigned in consequence of the police strike in Aug. of that year, decided to form a force of 100 women police for London, to be drawn from the ranks of the Women Patrols. The force, afterwards known as the Women's Patrol of the Metropolitan Police Force, was organized and placed under Mrs. F. Stanley as superintendent, with one assistant superintendent and 10 sergeants, and its status and duties were defined by the Police Order of Dec. 23 1918. The women were not sworn in as constables and were not given the power of arrest. Similar limitations attached to most of the individual policewomen employed by the chief constables of boroughs or counties throughout the United Kingdom. These, in Sept. 1920, numbered 126 for England and Wales, of whom only 33 were appointed with the same status as men, and 14 for Scotland, none of whom were sworn in as constables. They were for the most part women trained by one or other of the two voluntary organizations. In Dec. 1920 certain members of the Women Police Service were engaged by the military authorities in Ireland to assist in searching women suspected of complicity in conspiracy.

The Committee on the Police Service appointed in March 1919 under the chairmanship of Lord Desborough did not deal with policewomen, and on the request of a deputation, which attended at the Home Office Aug. 8 1919, a Home Office departmental committee was appointed in Feb. 1920 to inquire into "the nature and limits of the assistance which can be given by women in the carrying out of police duties and as to what ought to be the status, pay and conditions of service of women employed on such duties." The committee, which included two women, Viscountess Astor and Dame Helen Gwynne-Vaughan, reported July 24 that "there is not only scope but urgent need for the employment of policewomen." They enumerate as "appropriate" duties: "investigations in cases of assault on women and children; investigations under the Children Act 1908, the Immoral Traffic Acts 1902–1912, and similar statutes; attendance at court when cases of female or juvenile offenders are being dealt with; inspection of common lodging-houses (where this falls on the police); supervision of parks and open spaces; visiting of licensed premises, cinemas, registry offices, etc.; prevention of offences by prostitutes; and, generally speaking, any work in connection with offences committed by and against women and children." They recommended: (1) that all policewomen should be sworn in, given full powers of arrest and ranked with the male police, forming an integral part of the police force and being trained and appointed by the chief constables; (2) that their pay should be standardized and approximated to that of the men (60s. minimum as compared with the men's 70s.), and that their allowances should be the same; (3) that their hours should be seven daily; (4) that marriage should be no bar to service; (5) that pensions should be granted on a scale slightly lower than for men, but that gratuities for dependent children should be the same for both sexes.

Up to Feb. 1921 this report had not been translated into action except as regards the pay and allowances to Metropolitan policewomen, which were standardized from Jan. 1 1921. But on Feb. 28 a deputation from the Federated Schools was assured by the Home Secretary that he would advise chief constables throughout the country that, where policewomen were employed, their employment should be regulated by the terms of the departmental committee's report. He added that it was undesirable that the work should any longer be carried on under voluntary organizations. Under Section 10 of the Police Act 1919 the wearing of police uniform by members of unofficial bodies is an actionable offence, and in March 1921 thirteen summonses were taken out against five executive members of the Women Police Service, which resulted on May 4 in fines of 10s. each and £10 10s. costs against the commandant. The name of the service was subsequently changed to the Women's Auxiliary Service, and changes were made in the uniform differentiating it from that of the official policewomen. Its future function was defined as mainly that of training, in London and in Edinburgh.

See *Report of the Committee on the Employment of Women on Police Duties* (1920, Cmd. 887) and its *Minutes of Evidence* (1921, Cmd. 1,133). See also the annual reports of the Bristol, Liverpool and Scottish Training Schools for Policewomen and Patrols, and the annual reports of H. M. Inspector of Constabulary for England and Wales (1917 *et seq.*). (J. E. C.*)

UNITED STATES.—About 300 cities in the United States employed policewomen in 1921, either as single officers of the law or in connexion with special women's bureaus. In many cases positions were secured through civil-service examinations, and promotions were made on the same basis as for men. Probably the largest number of policewomen was found in the cities of Chicago and New York, where the women's bureaus each employed about 30 women, usually in the capacity of police and patrol officers. Their duties were varied but related largely to the welfare of women and children. In Chicago one woman was assigned to the Morals Court, where she assisted the woman bailiff and the probation officers. In New York the women's bureau had attached to its staff a number of men welfare workers. These were usually former policemen who for some reason became incapacitated for regular work and who were assigned to assist in caring for needy cases, particularly among widows and children of former policemen. One city in 1921 announced the appointment of a coloured woman as police officer.

In some cases this wide field for social service attracted high-class women; their duties included probation work, institutional commitments, supervision of dance-halls and places of amusement, juvenile court work and at times physical and psychopathic examinations. This work frequently merged into expert detective work and required a woman to be on duty almost any time of the day or night. The minimum salary seldom fell below $1,000, while the highest was not often above $2,000 a year, except by special legislation. Policewomen were eligible for the retirement pension, which was usually about 50% of their salary. (I. O. A.)

WOMEN'S EMPLOYMENT.—UNITED KINGDOM.—Women have been employed outside their homes in the industries of Great Britain from at least the days of Edward II., when they appear to have washed ore in the Derbyshire lead mines for 1d. a day. During the following six centuries they found their way into one trade after another, until in 1914, at the outbreak of the World War, in spite of their having been in the 19th century almost driven out from their once considerable occupations of agriculture and coal-mining, the total number of women in commerce and industry in the United Kingdom was 3½ million, while another 2½ million were earning wages as hospital nurses, domestic servants, dress-makers in small workshops and outworkers of similar kinds.

The increase that took place during the war was only a million, and yet it probably attracted more discussion than the whole of the steady industrial development which had made the sudden extension possible. This was due partly to deliberate publicity designed to attract women into the factories, partly to the interesting nature of a small part of the work which they undertook;

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but it also arose from public ignorance of the share that women were already taking in industry before the war. There was no great industrial group which did not at that time already employ thousands of women; in the building trades there were 7,000, and in mines and quarries nearly the same number. The metal trades held 170,000 women; there were even some hundreds in the Admiralty dockyards. The great exceptions were the shipyards, underground work in the mines, iron and steel foundries and rolling-mills, various branches of engineering and whisky distilling. Other important services, like the railways, used them only for clerical work and cleaning, except of course in posts which could only admit of women, such as those of attendants in women's cloakrooms. Others reserved certain processes for men and gave the rest to women: others were women's trades: others again used men and women interchangeably.

The demarcation that existed between men's and women's work was as a rule definite and well recognized in the trades concerned. The very heaviest types of work were done by men, and so in most cases was work that required any high degree of skill. Such work, moreover, was almost certain to be the subject of trade-union restrictions which effectively prevented employers from using women on it. But these criteria, except at the ends of the scale, were not absolute. Women in many occupations—for instance making chains or gramophone records—were accustomed to handle very heavy tools or lift very heavy weights. Many would not trouble to acquire skill, or were denied the opportunity; but the bad organization of women and their low rates of pay tended to conceal the fact that they were often employed on jobs which a man would have considered at least as semi-skilled, while a few women up and down the country were turning out work which required a considerable technical endowment. The Ministry of Munitions, to take an extreme instance, found optical lenses being ground by women in London which they considered equal to the finest German lenses, and this had been going on for a dozen years. Very few women had such an opening, but all along the middle line, where the work was neither too heavy nor took too long to learn, there were trades and sections of trades where the spheres of the two sexes overlapped, so that on certain parts of the work they were either used interchangeably or one or the other according to district custom.

The best known examples of this are probably the cotton, woollen and worsted weavers, and the machinists in the Birmingham brassware trade, clerks and shop-assistants. But in all such border-lands, as has been said, the tendency before the war was for the low-paid and restricted woman to replace the more mobile and unrestricted man. In most of these cases one type of labour or the other—by no means always that actually used—was probably more suited to the work and economically preferable; but even where employers were sensible of this, they found local customs and prejudices too strong to alter, and the problem was little thought about and never squarely faced.

During the World War.—British industry, therefore, when the war came, was not compelled to start afresh with totally untrained women workers. Less than a tenth of the 4,750,000 employed in Nov. 1918 in agricultural, commercial and industrial occupations, had been altogether ignorant when they entered on war work of at least the routine and discipline of an industrial life, and the majority had really useful experience. It is after all more difficult to learn to handle a power loom or a power-driven sewing machine than it is to change from one of these to a semi-automatic lathe. Employers stated that of the 3,000,000 women employed in industry alone 700,500—a number nearly equal to that of the new entrants into the same occupations—were directly replacing men. This did not mean however that they were necessarily engaged on work that before 1914 had always been done by men. In many instances the work itself was new. Gas-masks, depth-charges and anti-aircraft devices, for example, had not been made in the same way, if at all, before 1914. Sometimes the change made was only nominal, as when a shop full of girls who had been machining bicycle parts, was turned over to the manufacture of rifles, and the processes to be performed on the new object remained unaltered. Again the employment of women on a particular job, though new to the factory in question or even to the district, might be customary in other parts of England or Scotland. The Midlands could show thousands of women pressing, stamping, drilling, milling, dressing castings, core-making, assembling, even working on capstan lathes, and some of these were turning out articles for use in war such as fuzes, adaptors and cartridge cases. Any of these processes, if performed in an engineering shop, was entirely forbidden to a woman or a girl. Finally, there were very great numbers of women who merely replaced men on duties which had formerly been undertaken by either men or women. Familiar examples of trades in which this occurred have already been given. It is not too much to say that the majority of the women war workers were employed on work familiar to their sex, and often not widely dissimilar—except in the conditions under which it was done—from their ordinary occupations.

There were, however, exceptions to this, so interesting that they obscured the true state of affairs. Women on buses, policewomen and landgirls, women teaching in boys' public schools, and perched on ladders washing windows, women in gas-works and steel foundries and marine-engineering shops produced a comprehensive effect which was increased by the uniforms and working-dresses they wore, and by the fact that many of the war-workers were drawn from social classes unused to connecting their women-folk with factory life. There were reasons, too, which led to the position being misrepresented. It was in the interest of each employer, anxious to retain the skeleton of his male staff, to emphasize the length to which he had already carried direct substitution, and the returns made by them were found to reflect this anxiety. Moreover, it was in some districts easier to attract women to work which they believed served the purpose of releasing a man for the Forces than to obtain them for uninspiring women's tasks, where the drudgery and hardship to be faced were not even tinted with glamour.

Numerically, the changes in the employment of women and girls took the following course. The outbreak of war produced immediate unemployment. By Sept. 1914 about 250,000 females (8·4% of those employed in Aug.) had already left their jobs. This was the lowest point. By Feb. 1915 only 1·5% of these were still without work; by April the figures showed a surplus of 2%, and by Oct. 1915 the increase already amounted to 150,000. So far, however, it was still almost entirely in trades recognized as women's, or in work performed by both men and women. Of the 429,000 women and girls who entered the metal trades during the war, only 29,000 had entered by July 1915, though the effect of the Government's efforts to achieve dilution, which was made possible by the conferences held that summer, was shown by the fact that another 20,000 joined during the next three months.

By Oct. 1917 the percentage of women and girls to the total number of workpeople employed in industry, commerce, agriculture, transport and Government establishments had risen from 24% to 36% and nearly 1,500,000 women had been drawn into these occupations. By Nov. 1918 there was a 50% increase in the number of females employed in the same callings, representing 1,750,000, though, as has been stated, the addition to the total number of employed women was only 1,000,000. This is accounted for by the fact that over half of the 750,000 which makes the difference were persons who had previously been employed as dressmakers or domestic servants, while the rest had been outworkers of other types who were drawn into munitions work either by patriotism or by the superior interest and rates of pay. At the same time very large transferences of labour were taking place within the framework of industry, for by no means all of the great trade groups shared in the general war expansion. Thus, while industry proper, on a balance of prosperous and declining sections, showed an increase of just under 800,000, the figures for the textile trades fell by over 50,000, for paper and printing by 7,000, and for clothing by 56,000.

After the War.—From Nov. 1918 the fall in numbers naturally begins, but up to July 1920—which is in some ways a better date for the purpose of comparison than Nov. 1920, though figures for that month will be found in the tables accompanying this

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article—there were still 28,000 more women and girls in industry than there were in 1914, and 824,000 more women and girls in industry, commerce, the Civil Service, transport, hotels, theatres, etc., taken together. These figures amount to a loss of women for industry of 512,000, between the Armistice and July 1920, as compared with the 800,000 who entered during the war, and for the larger group of occupations already referred to a corresponding loss of 824,000 as against their gain of 1,648,000. On the other hand the 80,000 women in the women's services had all been demobilized, and so had most of the 60,000 women V.A.D.'s, who, however, being voluntary workers, have not been taken account of in these figures. In July 1918 1,458,000 women were stated to be directly replacing men and 1,874,000 were on Government work, including the Civil Service, the women's services and the land army, but not workers in hospitals. The last figure, however, must be accepted with caution, as many of the contracting firms were not in a position to make accurate returns, and others varied in their views of the basis on which their figures should be compiled. Firms accepting contracts to be filled from stock already in their warehouses could not tell, while the goods were in process of manufacture, which part would be bought by the Government and which by private firms, nor which of their private customers were purchasing the articles against Government orders. In addition to this, many workpeople were engaged for part of a day or week on Government contracts, and for the rest of their time on the firm's normal work. Some firms returned all their munitions work—a far wider and vaguer term, and one made continually more wide and vague by various decisions of the Courts—as Government work, and generally there was a tendency, in view of the privileges it conferred, to bring as much under this head as possible, even when the figures were supplied for statistical use.

These increases in the numbers of women employed in 1920 as compared with 1914 are interesting because they seemed to show that the war might result in a permanent growth in the industrial use of women. The natural growth of the population explains a certain part of them, but it should be noted that whereas the number of males employed had grown during the same period by only 177,000 on a 1914 figure of nearly 10,000,000, women had increased by between four and five times that number on a pre-war figure of 3,250,000. This discrepancy cannot nearly be explained by the casualties. Moreover in commerce and finance, where the rise for women is 344,000, there is an actual decrease for men of 155,000. These figures may alter again to the detriment of women; but, except in so far as bad trade causes general unemployment, there is no obvious reason why they should alter much. The replacement of the temporary women workers has not been left to economic factors which might be thought not yet to have operated to their full extent. On the contrary, non-economic pressure has in many cases prevented employers from keeping women they would have wished to keep. Under the Munitions of War Acts certain trades have been compelled to discharge all women and girls brought in to do work formerly done by men or boys. Trade agreements have had the same wholesale effects in other cases, though in both groups of occupations the natural tendency may be deduced from the fact that new firms, not within the scope of the pledges, are making a large use of women. And in addition to this practically every employer of women has been confronted by a campaign, both sentimental and practical and in some cases bitter, against their continued employment. It has been carried on partly by, or on behalf of, the returning troops, and partly by the men in the industries in which women had been working, and has certainly resulted in the dismissal of large numbers of them who were performing their work to their employer's satisfaction. These causes, though effective, are for the most part temporary in their effect, but those that tend to the increased employment of women are more lasting in character. The war advertised the fact that women are suited for a wider range of occupations than most employers—who as a class tend to be ignorant of what is going on in industry outside their own affairs and those of their immediate friends—had realized. They are also on much work very much cheaper than men. Before the war their average wages were about half those received by men for the same work. In many trades during the war this proportion rose to two-thirds. But even in 1921 in the work which women do well, this discrepancy was a good deal greater than the difference which would be warranted by the difference in their value to their employer; and wherever this is so the employment of men on that work, if women are available, must be regarded as a luxury. It is one of which many employers, for good and bad reasons, are most unwilling to deprive themselves, but falling prices and restricted demand will operate to increase the desirability of the women. Further, they themselves had learned to prefer a life outside the home, to employment within it, while the losses of the war and the diminished prosperity of the nation turned for many of them a matter of choice into one of necessity. It might therefore be thought probable that though the bulk of the work to which women were introduced during the war had by 1921 disappeared or been taken from them, their share of paid work outside private houses would remain considerably larger than it was before the war and also more varied, and it was likely that these new opportunities of employment would be large enough not only to absorb the new workers but also to draw upon the supply of those who would formerly have undertaken domestic service or employment in small workshops.

Number Employed.—The table on next page gives the figures of British women's employment for July 1914, Nov. 1918, and Nov. 1920; the numbers employed on Government work; and the numbers stated to be directly replacing men. It should be noticed that they do not include outworkers, or persons employed on their own account, or employers.

Workers Classified.—The first winter of the war did little more than absorb the workers who had been thrown out of employment during its opening months. They moved from one part of the clothing trades to another, from cottons on to woollens, and from cotton, too, on to metals, from little brass rings and tips and handles and discs and plates on to fuzes, from lace on to leather, and from the food trades into the filling factories. The conditions were more or less familiar, and as far as they could they chose work that was similar to their own, for at this stage no arrangements had been made for training any abnormal proportion of new workers. The supply lasted until the beginning of the next year, as is shown by the fact that of the 79,000 women who enrolled in March 1915 for the Women's War Register under 2,000 had been placed by June, as all vacancies were first offered to suitable applicants on the ordinary register of unemployed persons. When these came to an end industry could still be fed from the immense reserve of fit and experienced workers created by marriage. Former employees in the printing and paper trades, textile trades and boot and shoe trades, returned to the workshops in very large numbers, a few going straight on to munitions in the narrower sense, but most preferring to take up their former employment in order to replace men who had entered the army, or the younger women who were beginning to drift away to more enticing work. It was for the sake of the Lancastrian cotton weavers that the policy was adopted of scattering the new National Factories through the chief provincial towns of the north instead of erecting them in the old armament centres under the eyes of the great armament firms, and it was on their skill and experience that the Ministry of Munitions was able to base its new programme.

These married women perceptibly altered the type of woman munition worker. They increased the average age, and, being tied to their homes and so restricted in their field of possible employment, they reduced the amount of wastage. On the other hand they were in certain respects undisciplined—it was never found possible to apply to them, for instance, the provisions of the Munitions of War Act with regard to Leaving Certificates—and their bad time-keeping, due to the pressure of domestic duties, detracted from the value of their work.

Their movement into industry continued roughly all through the autumn and winter of 1915. They came partly as a result of the feelings that were aroused by their husbands attesting or entering the army, and partly as a result of the appeals that the Government were now making to them. By the spring of 1916, however, the supply was falling short. Congestion was increasing in the munitions areas, and many married women, instead of themselves earning wages in the factories, were taking toll of the wages of others, by letting rooms for sums which were sometimes increased concurrently with every increase in wage rates. Demand for women's labour was rapidly growing, and in March 1916 the Central Committee on Women's War Employment (Industrial) was set up by the Home Office and the Ministry of Labour, and established local committees to superintend on the one hand the recruitment of suitable women and on the other their housing, reception and general well-being outside the factory.

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British Women's Employment, 1914, 1918, 1920.

Nature of Work	Women and Girls Employed				No. on Government work in July 1918	No. stated to be replacing males in July 1918
	July 1914	November 1918	July 1920	November 1920		
Building	7,000	31,000	9,900	9,900	18,000	11,900
Mines and Quarries	7,000	13,000	9,600	9,500	6,000	6,900
Metal Trades	170,000	597,000	305,000	287,000	534,000	194,200
Chemical Trades	40,000	103,000	71,000	68,000	66,000	33,700
Textile Trades	863,000	818,000	883,000	840,000	335,000	65,500
Clothing Trades	612,000	556,000	571,000	530,000	142,000	45,900
Food, Drink and Tobacco Trades	196,000	231,000	241,000	226,000	37,000	62,600
Paper and Printing Trades	148,000	141,000	165,000	162,000	40,000	21,200
Wood Trades	44,000	83,000	65,000	61,000	40,000	25,600
Other Trades (including Gas, Water, and Electricity under local Authorities)	90,000	156,000	138,000	132,000	73,000 (private firms only)	46,000
Government Establishments (Arsenals, National Factories, Dockyards, etc.)	2,200	247,000	6,300	5,100	225,000	187,000
Total in Industries, including Municipal and Government Establishments	2,179,000	2,976,000	2,464,000	2,330,000	1,516,000 (not including municipal)	700,500 (not including municipal)
Municipal Tramways	1,200	19,000	3,100	2,900	..	..
Tramways and Omnibus Services (other than municipal)	400	9,300	2,700	2,500	..	..
Railways	12,000	66,000	29,000	28,000	..	..
Docks and Wharves	Number of females employed insignificant.					
Other Transport	4,600	21,000	11,500	11,300	..	..
Total in Transport Work	18,000	115,000	46,000	45,000	..	79,500 (excluding municipal tramways)
Banking and Finance	9,500	75,000	56,000	55,000	..	59,500
Commerce	496,000	880,000	794,000	792,000	..	352,000
Total, Finance and Commerce	506,000	955,000	850,000	847,000	..	411,500
Hotels, Public Houses, Cinema Theatres, etc.	181,000	222,000	242,000	235,000	..	44,500
Teachers (under local Authorities)	142,000	154,000	140,000	152,000	..	..
Hospitals (Civil and Military)	33,000	80,000	37,000	37,000	..	..
Other Professions (persons employed by Accountants, Architects, Solicitors, etc.)	18,000	40,000	38,000	38,000	..	22,500
Municipal Services, not covered above	54,000	75,000	74,000	75,000	..	..
Civil Service	66,000	228,000	120,000	112,000	230,000	153,000
Women's Services (Naval and Military)	80,000	..	..	..	80,000	80,000
Land Army	30,000	..	..	..	..	30,000
Grand Total	3,307,000	4,845,000	4,051,000	3,871,000	1,826,000	1,521,500

The new efforts tapped new sources of supply. Along with women from the normal industries of Great Britain totally unskilled workers had now to be engaged. They included dress-making hands, domestic servants, girls from school and married women unused to factory life. Of these the domestic servants, with their more adaptable intelligence, comparative readiness to take responsibility, and good physique, were perhaps the most valuable. They are stated by employers to have been much sought in marriage, and to have affected considerably the habits and outlook of the ordinary industrial workers with whom they were brought into contact. They certainly showed no eager desire to return to domestic service.

The married women were said to be less quick to learn, and less disciplined in the sense of observing regulations. On the other hand they were considered very hard workers, and in some cases—as was natural on the part of women, most of whom were soldiers' wives—formed a definitely anti-strike body during serious industrial disputes. The last class of married women to be touched were perhaps the village women, large numbers of whom were recruited by the land army, and taught afresh the agricultural work which had been familiar to their great-grandmothers. They were difficult to persuade, being shy and unwilling to defy village gossip, and further—as is so often the case with poor men's wives—they were chained to their houses by a lack of proper clothing, neither their coats, their skirts, nor their shoes being suitable or adequate for an outdoor life. It was only when outfits were provided, and the idea of women on the land had become commonplace, that it was possible to induce them to come forward.

The girls from school perhaps suffered more than any other class of women engaging in war work. They were particularly sought after by bad employers, for though quicker than any older woman to train, and often able to produce as much as an adult woman, their rates of pay were very much lower and they could be dismissed as soon as they demanded an adult wage. Even so, however, their pay was enormously more than the half-crown or five shillings they would have received as learners in pre-war days, and this, and the independence of spirit and habit which flowed from it, were supposed to exercise a widespread demoralizing effect. By the end of the war the output of the younger workers was said to have fallen, and great anxiety for their moral condition was felt by parents, officials and certain employers. It is, however, difficult to isolate this alleged fall in output from the general fall in output that was taking place in many industries, or to separate out the factors which caused exceptional demoralization, if any existed, in this particular class. It is certain that the end of the war found them in a more helpless position even than other women. Their training on munitions work was of little use to them when they sought to enter regular industry. It had been restricted as a rule to a few standardized operations on a particular garment or article, and employers refused to accept it as entitling the women to ordinary rates of pay on ordinary work. The learners' rates which they were prepared to give were in many cases little more than pocket money, and always quite inadequate to the support of adult women whose parents were as a rule no longer able or willing to maintain them. By lack of knowledge and of suitable clothing—here again a serious factor—by taste, associations and personal habits, they were disinclined to enter domestic service and unfitted for the life it offered, and at the time of the

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Armistice they were acknowledged to constitute a serious problem and a grave responsibility for the Government which had recruited them. Efforts were made to deal with those still juveniles, but the large numbers who had reached the age of 18 during the course of the war were left outside them. At that date they were themselves very generally alarmed as to their industrial prospects, and it was agreed by all those watching the situation, including the trade-union officials, that if immediate training were offered under suitable conditions it would be possible to attract large numbers of them into domestic service, which was not only the one opening available but the direction in which their labours would be socially most beneficial. Schemes agreed to by the trade unions were put forward by the Ministries of Labour and Munitions, but the Treasury, though obliged to permit the payment of unemployment donation to women in idleness, were unwilling to allow the relatively small additional payment which would have coupled it with productive training. A restricted scheme was finally set up which provided training in occupations which had been recognized as women's work prior to the war, and within the limits imposed it was very successful. It was not, however, able to reach the bulk of the women who most needed it or to provide a satisfactory flow of recruits for domestic service.

The other great class which entered wage-earning occupations as a result of the war were the women from secondary schools and universities, who had looked forward to leading idle lives, or to entering the teaching profession. They flowed rather into commerce, finance, the Civil Service and the war services than into industry, but the comparatively small numbers who did enter the munitions factories exercised a disproportionate influence. It was they as a rule who made it possible to set up women foremen, supervisors, and charge hands, and it was generally those better educated women who were first placed on really skilled or technical work. The managing director of the one great marine-engineering shop which trained women to perform the whole of a skilled man's work done in that shop, *i.e.*, to perform any operation of which their machines were capable, accepted only girls from the secondary schools. He stated that in his opinion this degree of intellectual training was essential if they were to learn the work in the time allowed—about six months—and said, too, that his men made far less objection to training them than women of the industrial type whom they regarded as potential black-legs. The Ministry of Munitions Training Department also laid great stress on the importance of general education, going so far as to select only girls with a secondary school education for training in fitting and turning. The educated women had also a good effect upon conditions. Bad employers were restrained by their intelligence and independence from taking advantage of their more helpless companions, and good employers and welfare officers found them a useful channel of communication with the staffs when introducing health services, canteens etc. It is also probably partly due to them that the number of women trade unionists doubled during the war. The figures are said to be 350,000 for 1914 and 660,000 for 1918, but they only pretend to being estimates, and it is probable, owing to the tendency of women to enter their names after a meeting and then to lose all interest and pay no further subscriptions, that they are a good deal too high.

Women of a superior general training were found especially useful in instructing, commanding and supervising other women who had often in the past resented the elevation to authority of one of themselves. In the women's services and the land army this aspect of their work was of the first importance. On the land, particularly, their comparative acquaintance with the country, and their relative indifference to dark and loneliness, persuaded the town recruits to endure the terrors and discomforts of winter, while vestiges of feudal feeling gave them authority with the country women. In fact, wherever the work ceased to be purely physical, and more and more as it took on an intellectual quality the extent of a woman's education was found to determine her aptitude for learning and performing new work. The university women especially, in spite of the fact that those available for war-work were still largely of a uniform type—that which had been preparing itself for the teaching profession—found that their training immensely increased their comparative value in almost every direction, even where their instruction had not led up to, or especially fitted them for, their war duties. It is hardly surprising, however, that the best work of all from a technical point of view was done by those who had been specifically trained for the jobs they undertook, like the women physicians and surgeons and the women employed on scientific research in the National Physical and Chemical Laboratories. It is more to be wondered at that so much could be done by women and girls divorced from familiar surroundings, and set to adapt themselves to entirely novel systems of ideas, and to compress the training time of years allotted to men into a few months or weeks. Not even the atmosphere of the army can have been so foreign to the new soldiers—who as a rule had some notion of its main structure and had often experienced some form of communal existence—as were industrial and even commercial life to the girls who entered them from their day schools and their middle-class homes. And yet they adapted themselves to these new values, not only from duty, but with an enthusiasm and a quickness which seemed to show that the labour, and the variety and the tension, were congenial to their natures.

Quality of Work.—It is not possible here to attempt a final estimate of the qualities their work revealed, but testimony seems to agree on certain points. Above all they were conscientious; they were devoted. As long as they retained interest in their work they endured degrading conditions through monotonous periods of overstrain without apparently accumulating the resentment which from time to time flared out among their male colleagues; instead their health suffered. This tenacity was perhaps due to their stronger imaginative hold on the purpose to which they were giving themselves up. In relation to their environment, on the other hand, they were docile and lacked imagination; as a body they acquiesced in the conditions they found and made no concerted effort to change them. When they felt that the life was intolerable they left it, and the active combative temper of the men roused no response in them. As individuals they were less disciplined than men, less calculable, less impressed by traditions and institutions, giving an effect, for all their high spirits and quickness of tongue, of greater detachment. In the mass they were difficult to organize, elusive, fatalistic, sceptical and inarticulate. If they did combine they were faithful to their leaders, whom they preferred of a sensible and reasoning rather than of an idealistic type. Policy too, to obtain their approval, must be direct, concrete, and likely to produce an immediate effect. They were fortunate in their representatives, and the knowledge, ability and public spirit of the women trade-union officials secured for them an influence to which the numerical proportion of organized women would not have entitled them. Women might well have been proud to support societies to which they owed so much. But they seem as a rule to have left them when they left munitions work. They went back each to her private anxieties and hardships, showing no desire to continue banded together either to protect their interests or to continue their relationship, and seeking no outlet for the sense of injustice which some of them felt. A few of the ex-service women formed clubs and groups under the leadership of their old officers, but not the hundreds of thousands of munition workers, clerks and civil servants whose service took a more democratic form.

Effect on Industry.—It was not without difficulty that trade and industry were adjusted to fit these feminine millions. From the winter of 1914 the Government had been anxious to extend the use of women for the production of munitions, and in the summer of 1915 agreements were signed with the engineering unions which removed in theory the main barrier to their employment on men's work in the metal trades; but it was not until the spring of 1916 that substitution made any real headway. The employers had first to be convinced that they would not cause more trouble than they were worth, the factories had to be prepared for them, the work adjusted to suit their strength and skill, and, hardest of all, the men in each shop persuaded not only to submit to their presence but to coöperate actively in helping them to learn and to carry on their work. The women themselves meanwhile had to be trained. From July 1915 onward the Ministry of Munitions, in conjunction with the Board of Education, was teaching women with great success in technical schools and instructional workshops—for the first year, simple repetition work on shells and fuzes; later, work on aeroplanes and for positions as tool-setters, inspectors or charge hands; and, finally, the really skilled work of fitting and turning.

In all the Government schools trained 45,000 women, and very large numbers were trained by those private firms who preferred to give their own instruction. Under both methods it was found that they were good material, and that the period required before they could be fitted into their niches in the new schemes of mass production was shorter than anyone had thought possible. But the teaching of the women was the least of the trouble. To the last a certain number of employers were hostile to their introduction, and by more or less overt collusion with their staffs could make it impracticable or unsuccessful. Where this was the case the only weapon of the Government was to create a shortage of labour in their works by removing their War Munitions Volunteers and adopting similar coercive measures. This could not always be done in the face of the representations which the firm were nearly always able to secure from the Supply Department with whom their contract was made, that upon its instant fulfilment depended the issue of the war. Employers anxious to support the Government as a rule found the carrying on of their work under war conditions sufficiently harassing with a competent male staff: they could not be expected to welcome a change which meant providing special new accommodation—a much more troublesome matter than might be supposed in town factories where every inch of space was already needed; reconsidering each one of the methods to which they were accustomed, and antagonizing their staffs, in order to bring in labour certain to be relatively inefficient for the time, and of unknown potential efficiency. Their grounds of objection were substantial and their position strong, and it is to the credit of industry that some of the larger firms forestalled the Government in their introduction of women's labour. To effect this it had been necessary to bring the bulk of the work—all of which in some firms had hitherto been carried on entirely by skilled men—within the average capacity of untried and almost unskilled persons. Of the three grades into which it could be roughly divided—skilled, semi-skilled (which included the repetition work), and unskilled and labouring work—the last required the most ad-

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justment and was the least easy to adjust. Every device that was possible was provided, regardless of expense, to minimize the strength required in lifting, hauling, loading, stoking, scraping boilers, and the specially hot and heavy work done in foundries and retort-houses, chemical works and tanneries. At the end of it all, the employment of women on this work was costly and ineffectual. Three women were needed on an average to do the job of two men, and at special points one man's work would occupy two or even three women, while the hardest jobs had now to be performed continuously, instead of as part only of their task, by the remaining men.

On repetition work the sweeping changes that were made were due not so much to the sex of the new operators as to war conditions. The subdivision practised was the natural result of mass production, and has remained where mass production has remained, though men have replaced women at the machines. The fool-proof devices were a protection against the lack of experience of the dilutees, whether men or women, and they too have survived as a means of decreasing worry and improving output.

On neither of these grades, where they already existed as such, did the men make serious opposition to the coming of women. The general unions to which most of them belonged were not before the war the centralized and powerful bodies they are now; they had been able to establish few privileges, and their men were at the mercy of the recruiting officers. They therefore treated the matter as one of individual feeling rather than of labour policy, and were entitled to more gratitude than they received from their country for the unselfish way in which most of them helped the women who were to fill their places and make it possible for them to be spared for the army. It was the splitting up of the skilled work, and the consequent reduction of many of its parts to a semi-skilled rank, which produced the bitter opposition which increased rather than diminished as the war went on. This was due in some degree to mass production but more to the shortness of the training which was all the urgency of the times allowed. The strength of the women was insufficient for labouring work, but by the end of the war it became clear that they did not lack the intelligence and character necessary for the acquirement of an exacting technique. What follows is the official verdict of the Ministry of Munitions:—

"Many women might become skilled mechanics, given the necessary training and experience. But these were precluded by the conditions under which munitions were manufactured. Intensive training sufficed to meet the emergency of the moment, but it was no substitute for a thorough apprenticeship; and the (male) apprentices who were up-graded under schemes of dilution suffered like others from premature specialization. Subject to this limitation, there were few branches of skilled work which some women did not execute with success. They made tools and gauges to the finest limits, they set up complex automatics, they machined and fitted the most delicate mechanisms, they inspected the rifling of guns and mastered the use of the micrometer and vernier, they conducted scientific tests in the laboratory, they acted as charge hands and forewomen."

Had the war continued they would have been used upon this work in increasing numbers. As things were, however, it was more economical, given the large output, to train them and the male dilutees with them, to do one particular part of the complex job which a skilled man had been accustomed to carry out, and whose more difficult portions only were now left for him. Most of the work of a skilled category given to women was actually work which had been treated in this manner. For such subdivided tasks they were found perfectly suitable, and the checks to their more extensive use were, in the first place, the uneconomical rates of wages which the men's unions had imposed as the price of dilution; and secondly, the almost desperate opposition with which their employment was met by the skilled men. It was not only the employers who objected to giving a woman the full rate of a skilled man when all she could do was one among his many different jobs: the men actually working with them, however much they agreed in principle with the system of the rate for the job, could not bear with equanimity the sight of raw, unqualified women receiving wages almost equal to their own.

The obstructive policy pursued by the skilled unions was directed as much against mass production in general as against women in particular. They knew that the women must go after the war; but they feared, not unnaturally, lest the new methods and processes should stay, which meant working toward a state when the skilled man who could not find employment in the tool-room, or as a supervisor, or on experimental work, would find himself degraded to the position of a machine-minder, with his privileges gone, the interest of his life as a craftsman gone, his standard of living in danger, and the prospect before him of becoming gradually merged in the masses of the semi-skilled. Much of this had happened in America, and the utterances of certain employers gave ground for thinking that in England it was at least desired. In small sections of the metal trades they could almost see it coming to pass. On sheet-metal work, for instance, machines and processes were brought in by which women and boys could perform rapidly and cheaply work which had been slowly done by hand by skilled sheet-metal workers. The men were released for the army and left knowing that their work would be gone if ever they came back. It was no wonder that opposition was felt at such a time to this acceleration of the process by which industry develops for the benefit perhaps of future generations but to the hurt of those whose whole equipment for life is their suitability to one of its changing industrial phases.

If this was the origin of the continued disputes that attended the incoming of the women, they were embittered by the fact that nothing was more vague, or varied more from district to district, than workshop practice with regard to demarcation of work. Some shops were entirely staffed by skilled men and apprentices; others did the same work with a few skilled men and a residuum of semi-skilled machinists, unskilled men and boys. Claims were put forward by the unions that work should be treated as skilled and carry the skilled man's rate—which would have covered half the work habitually done by boys; and the employers on their side seemed to consider that the slightest change in a job handed over to women dropped it at once to the minimum labouring rate. These quarrels, at first more or less local, so far from being settled were growing in intensity when the Armistice removed their cause. They did not begin until the autumn of 1915, when the introduction of women on to certain machines in Glasgow opened the troubles on the Clyde.

As will have been gathered, permission to employ women on men's work in the engineering trades had been gained at the price of a wages settlement, intended not so much to benefit the women as to protect the skilled man's rate. It maintained piece-prices and stated that the skilled man's time-rate must be paid to women undertaking a skilled man's work. These compacts, known as the Shells and Fuzes Agreement and the Treasury Agreement, were arrived at in March 1915 between the Government and the engineering unions, and it was hoped that dilution would immediately follow upon them. Unfortunately they did not produce the results expected, and in July it was found necessary to supplement them by statutory powers under the Munitions of War Act. In Sept. the new Ministry, impelled by a pledge given by Mr. Lloyd George in July that there should be no sweated labour in the munitions trades, appointed a committee to settle the wages of the women, who were by this time fast entering the metal trades. The committee, representing the Ministry, the trade and the women, recommended the time-rate of £1 a week for women on men's work other than skilled men's work. This rate, though finally nearly doubled by the awards issued from time to time by the special Arbitration Tribunals to which claims for increases were referred by the Ministry of Munitions, remained the basis of their payment throughout the war, and the standard by which wages were unavoidably fixed for other classes of women. Thus women on munitions work other than men's work came finally to a basis rate of 5½d. per hour. The £1 rate was imposed on the National Factories—already among the largest employers of women—and handed on as a recommendation to private munitions firms, a method which was found inadequate to ensure payment. It was therefore embodied in a Statutory Order, binding upon all controlled establishments under Sec. 5 of the Munitions of War Act. From that moment State regulation of the wages of women on munitions work, under pressure from trade unions representing both the women entering and the men displaced, became more comprehensive every few months, until at the time of the Armistice the Ministry of Munitions' orders covered about 2,000,000 women employed in 27 trades, and a similar number were covered by arrangements made with the Admiralty and the War Office. The work of dealing with women's wages was then taken over by the Ministry of Labour in accordance with the provisions of the Wages (Temporary) Regulation Act, which lapsed only in the autumn of 1920, leaving the general level of women's rates in the trades affected at about three times the very inadequate amounts—11s. to 12s. on an average—that had been usual before the war.

This regulation was the price of dilution, and it was only natural therefore that men anxious to oppose dilution should pick endless quarrels with the interpretation placed upon the wording of the agreements and pledges by the Government departments concerned, and also with their carrying out of their own orders. Into the details of these controversies it is not possible to enter here—the whole subject is covered by the report of the War Cabinet Committee on Industry which sat to consider the question, as well as to deliberate on the theoretical problems of women's wages. On the whole it may be said that the real basis of the men's charges was their objection to dilution and not any important dereliction on the part of the Government. Until the end of 1920 the women in the industries which had been engaged on war work were adequately protected, and they themselves realized this, and showed that they did so by the steadiness and docility with which they continued to work in the face of incitements to unrest. From first to last the time lost by strikes among women on munitions work was negligible, and only one case was brought to light where they were really restricting output.

While this was going on in the munitions trades proper—which included among others shipbuilding, engineering, electrical engineering, ordnance and aircraft work, wire-rope, cables, hemp-rope, tubes, iron and steel manufacture, scientific and optical instrument making, and the manufacture of explosives, chemicals, rubber, asbestos, packing-cases, and tin boxes—the recruiting crisis which took place in the winter of 1915 forced other trades to take steps to denude themselves of men and carry on with women's labour. This was done as a rule under national agreements between the unions in

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a trade and the employers, and it was generally made clear that the work handed over to women would be relinquished by them at the end of the war. They also dealt as a rule with wages, laying down rates which equalled in some cases—though not as a rule in industries where women were expected to be admitted to truly skilled work—the whole man's rate. For instance, women on men's work on the railways or on process work in the seed-crushing mills, started at the man's minimum rate, but most of the agreements provided roughly for equivalent pay for equivalent work. Allusions were also made to the conditions under which the work was to be done and to measures designed to protect the women from injury to their health. These agreements were concluded without much friction and were carried out as a rule in a generous spirit.

Agricultural Work.—The other great industry where the introduction of women caused trouble was agriculture. In spite of the efforts and the efficient organization of the Women's Land Army, and in spite of the satisfactory work acknowledged to be done by the women, the increase in their numbers during the whole war was only 33,000—less than 50% on the 1914 figures of 80,000. To these must be added some of the women entered under the head of casual labour, but it is not a good turnover for a trade employing so large a number of men. The cause was partly the obstinate refusal of the farmers to employ women—which in itself rose in part from their dislike of parting with labour often consisting of their relatives and always more closely tied to them than the town workman can be to his employer—and partly to the fact that work on the land did not prove attractive to women. The country women were not of the temperament which embraces novelties, and the town women disliked being billeted among the hostile farmers, and also the discomforts of a country winter. In the few districts where the custom survives of women working on the land, such as Eversham, a district of small-holdings, there was further discouragement from the country women, who disliked the introduction of "dressed-up" strangers into the fields where they were accustomed to work in their ordinary long clumsy skirts. It was finally found necessary for the land army to cover the country with an organization which would keep in touch with practically all its members, to provide boots and outfits for recruits, to arrange for camps where women could live together, and in short to abandon the view that women could be expected to go on the land as self-sufficing units. As an army—an alien force imported into the countryside—it was found possible to introduce them to all the lighter and much of the more skilled work of agriculture with excellent results, but it is probable that only after two generations of such employment would the industry be prepared to admit that the experiment had been made and had proved successful.

The Civil Service.—In the army, navy and the air force the prolonged resistance with which the idea of employing women was met for so long came entirely from the employing or official side. By their male colleagues they were received not only with acquiescence but with pleasure, and as they had obviously to live in segregated units they were not grudged their inevitable proportion of responsible and well-paid posts. Into the Civil Service, on the other hand, they were early welcomed; but, once there, only a very few individuals from among the 162,000 recruits, who included numbers of women with university degrees, were given any opportunity of earning any salary that any man might have envied, or of rising to any work superior to that of secretaries and clerks. Where they were found in such positions it was almost invariably either as supervisors of the women staffs or because the work of their branch related to women and the appointment had been made as a concession to public opinion, as in the case of the women in the Ministry of National Service, and the Women's Wages Section, and the Welfare Section, and the Dilution Section of the Ministry of Munitions. The most liberal department in employing women on well-paid work which might have gone to men was the Ministry of Food.

It may be said that, even in the establishment divisions, their appointment represented a victory, for so late as the autumn of 1915 one Service department, employing thousands of women and girls, was refusing to pay any of its women university graduates more than 40s. a week, or to provide the staffs with a single woman in authority to whom they could go if in difficulties. Hardly at all, and only by the new type of minister, was the policy pursued of bringing in distinguished women to deal with special women's problems, although men with special experience were brought in by the dozen. Such an experiment would have been of very great value. The demobilization of these enormous bodies of women took longer than had been expected; in fact, it had hardly begun when the passing of the Sex Disqualification (Removal) Act made it necessary for the Civil Service commissioners to consider the terms on which they should be admitted to the higher grades of the permanent service. The task of framing the general principles under which they might enter was entrusted by them to the newly formed National Whitley Council for the clerical and legal departments of the Civil Service, which, as it happened, was preparing to bring forward a scheme of reorganization for the entire service. This scheme, since agreed to by Parliament, provided that, with certain exceptions, women were to be admitted to the general work of the Civil Service with the same status as men. They were not, however, for an experimental period not exceeding three years, to receive the same pay for their work; and they were not to compete for posts with men but were to be appointed to a special proportion of posts which each department was to reserve for them; nor were they to enter by competitive examination but were to be chosen by a selection board. These conditions, especially that dealing with pay, were accepted by the women's representatives under protest, as they considered that the Civil Service together with the teaching profession were fields in which equal pay was not only eminently just but peculiarly desirable, and its opposite calculated not merely to injure the prospects of the women directly affected but to diminish their opportunities of doing valuable work. It was necessary, however, to accept such terms as part of the temporary bargain, and the Treasury proceeded to appoint a Director of Women's Establishments and to persuade, or endeavour to persuade, those branches of the service—such as the National Physical and Chemical Laboratories—where women scientists selected solely for their ability had been receiving the same salaries as men, to reduce the scales of the women on their staffs in accordance with the new arrangements for the clerical class. They took no steps, however, to admit women to the higher grades of the service, preferring to suggest that the Government should remove from the purview of the Whitley Council the question of the employment of ex-service men in the Civil Service—one of the matters definitely referred to it under its constitution—and hand it over to a committee largely composed of members of Parliament. Under shelter of the recommendations of this committee, which were at once adopted by the Treasury, even though they conflicted with the agreement signed by the same officials, the principle of admitting women to the general work of the service was abandoned, and ex-service men were appointed to all posts of which it could not definitely be said that it was impossible to employ anybody but a woman, including a number which had always been filled by women because they were concerned with the health, welfare, wages, or conditions of women. The appointments were made possible by a process of combing-out which took no account of qualifications, knowledge, or experience, and concerned itself solely with financial considerations.

On Aug. 5 1921 a debate took place in the House of Commons on the regulations framed by the Civil Service commissioners for carrying out the Whitley scheme. It was pointed out on behalf of the women that the regulations ran counter to two separate votes of the House in favour of equality of treatment, and a motion was brought forward designed to secure for women the same pay and the same conditions of service as are enjoyed by men doing the same work. Under pressure from the Chancellor of the Exchequer a compromise was finally accepted under which the regulations were confirmed for three years; a promise was given that after that time women should be admitted in the same way as men—except that the Civil Service commissioners should have power not to appoint a woman to any post for which they considered a woman unsuitable—and work under the same conditions as men, except that they might not marry; and that the question of equal pay was for further consideration. It was also promised that women establishment officers should be appointed in departments employing considerable numbers of women, but a motion to the effect that some women should be admitted to every grade was not accepted.

Industries Chiefly Affected.—The most striking transfers of work from men to women naturally took place in the aircraft and metal munitions trades, because it was they which expanded most during the war, and they also were the objects of special pressure from the dilution authorities. What that pressure amounted to may be shown by the fact that in Jan. 1918 firms working for the Admiralty, which controlled its own dilution, employed 458,000 males and 52,000 females, while firms working for the War Office, Ministry of Munitions and Air Force employed 476,000 males and 235,000 females. In Nov. of the same year the Royal Naval Torpedo Factory, Greenock, employed 2,706 males and 372 females—13.7%; while Woolwich Arsenal employed 40,000 males and 24,000 females, or 60% of females.

Next perhaps comes transport, with its uniformed women driving cars, collecting tickets and acting as conductors, guards, goods porters and signal-women. After these and the land, the change was most easily seen in the brewing industry, and in hotels and public-houses, both of which successfully employed large numbers of women on men's work during the war. Possibly 25,000 women came on to aircraft wood-work during the war.

In aircraft work, women in one Government factory by the end of the war were making the entire fuselage, including the really skilled work of propeller-shaping, and all over the country they were making, covering, and doping the wings, and doing all but the heaviest erecting. This is essentially mass-production work, as every smallest stick is cut to its size before the women touch it, and, as such, it is women's and not men's work, and peculiarly suited to them.

Women's Work Characterized.—It may be said that now for the first time the industrial capacity of women has been minutely considered by critics both hostile, impartial, and biased in their favour. The results of this scrutiny, from whatever source, are favourable, and fairly uniform. The women were more adaptable than the mass of observers had supposed them, they possessed more latent intelligence and greater physical strength, and they withstood far better the effects of monotony. On the other hand, as compared with men, they possess certain general defects which may be summed up as follows: insufficient strength; lack of initiative; lack

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of interest in the technical side of their work or desire to improve their position by training or qualifying for work requiring more skill or responsibility; comparatively bad health; lack of care in dealing with machines, materials and tools supplied by the employer; lack of steadiness—shown in the frequency with which they left their situations; their bad time-keeping and irregular attendance. It was also frequently given by employers as a reason against their employment that, where they were working with men, the men's output tended to decrease until it was no more than the women's. Excluding labouring work, they were said as a rule, when on men's work, to be worth two-thirds of a man, but where details were given the discrepancy appeared to be less. On some work—light repetition work or work where skilful fingers were required—they were universally acknowledged to be better than men, turning out more work and more contented. On more skilled work demanding more individual variation they were said to produce from 40% to 60% of a man's output. These complaints were put forward as characteristic of women, but it seems possible that some at any rate were characteristic rather of the conditions under which women work in industry. The first contention—that they lack the strength of men—is of course true, though women are stronger than the pre-war employer with his underfed girls was apt to imagine. The progressive improvement that took place in the health and output of those employed under anything approaching reasonable conditions with regard to hours and lodgings showed the effect that good wages, good food and a certain amount of care will produce in even a few months. Moreover, a great deal of the work that men are now expected to do is not only too heavy for women but too heavy for men as well, and ought not to be imposed on any human being. The result of this is that men employed industrially are more and not less adversely affected by the conditions of their work than women, though their health again is greatly superior to that of married women working in their homes—the most suffering class in the community. But, obviously, women are not so suitable as men for heavy work and cannot be made so by any methods which can be foreseen. The most carefully planned schemes all ended by being prohibitive in cost. Another group of defects, their lack of discipline, their bad time-keeping and bad attendance, were really alleged against the married women hampered by household duties. Single women were as good time-keepers as men. If they changed their situations more often it was often due to preoccupations arising out of the war. They wanted to be near the hospital to which their brother or lover had been sent, or they wished to change from shells to aircraft work because their man had entered the air force. All this population of women was preoccupied: often too they had taken up work for the first time without much considering the wages paid and, as the pinch of the war made itself felt, found themselves obliged to go where they could earn enough to keep themselves.

Their lack of initiative and ambition was put down by the employers as due to their knowledge that the work was temporary, and would be brought to an end either by the end of the war or by marriage. The trade unions frequently added that employers, for the same reason, would not be willing to give women a lengthy training. It is probably true that the majority of wage-earning women are so affected by the expectation of marriage that they are unwilling to expend mental effort on their work. But it should be remembered, on the one hand, that the wages of women before the war were so low as seriously to affect their vitality, and, on the other, that the experiment of offering them training in skilled work had never been made. They are perfectly ready to learn weaving, or the skilled work in the dressmaking and millinery trades. The experience of the war would seem to show that a minority of women would welcome it and benefit by it in other occupations. Another thing shown by the war is that apprenticeship periods for the skilled trades, though convenient both for masters and men as long as the school-leaving age remains where it is, are far longer than is necessary to secure industrial efficiency. A skilled worker cannot be produced in six months, but that does not mean that his apprenticeship must last for five or seven years. If anything were to occur which modified this period the increased employment of women on skilled work would become more feasible.

Lack of initiative, lack of care and lack of attention to detail are more fundamental charges. They are possibly true, though to what extent they are true can hardly be proved by the experiment made under war conditions. Most of the women had been living in circumstances which precluded the development of initiative or a scientific thoroughness. Very few minds show initiative with regard to a totally unfamiliar technique so fenced about with terrors as engineering, so immemorially fixed as work on the land or so trivial as most clerical occupations. Nor, to put it mildly, was women's initiative encouraged during the war, though without it there would have been no women doctors and no women in the fighting services. And as those responsible for the education of naval officers know, this quality, like others, reacts to stimulation. What is certain is that in the strength and skill of its women the war showed that Great Britain possesses a valuable industrial resource, whose wider use under suitable conditions would benefit both the women themselves and the industries they entered. Before such conditions can be established, however, a number of problems must be faced, including the determination of the proper ratio of a woman's wage to that of a man performing similar work. (A. B. W.)

United States

In 1916 there were probably about 10,000,000 women wage earners in the United States, comprising about one-quarter of the total number of persons gainfully employed. In manufacturing there were about 1,500,000, three-fourths of whom were in the food, textiles, tobacco and wearing-apparel industries, but very few in those industries producing implements of war. The first demands for women were met, as in England, by drawing seasoned workers from such industries as the lighter textiles, millinery, corset-making, domestic service, laundries, stores and offices. After the supply of seasoned workers was exhausted, efforts were turned toward securing women outside the wage-earning class. Married women, many of them former industrial workers, were urged to return to industry. Part-time work was offered and occasionally a day nursery was established. In one city an organized publicity campaign for new workers resulted, after the first two weeks, in a 50% increase in employed women and after the first four weeks in a 100% increase. It was estimated that about 4,000,000 women were employed in war trades and that 2,500,000 remained in the newer fields in 1919.

English experience taught the American authorities to keep the most skilled men at home where they could continue in their usual fields of work, but in attempting to supply the increased demand for workers two main problems arose; first, to secure women to fill routine or semi-skilled positions; second, to secure in those industries which were greatly swollen by war demands not only routine workers but also skilled employees. The demand for additional women in war industries was well illustrated by conditions in the iron and steel industry, where, in 1916, less than 4% of the employees were women. During the war in every branch of this industry the number of women employed increased, between the first and second draft, from 18% to over 200%. In the industry as a whole the increase was nearly 70%, while the number of men increased only about 5% and in some branches actually decreased in numbers. In 111 plants making explosives only 73 women were reported in 1914, whereas after the second draft, 25 plants employed nearly 12,000 women. In this industry women constituted about half the total employees. In the manufacture of hand grenades, about 19 out of every 20 were women. In one gas-mask plant with 12,000 employees, 8,500 were women.

Industries showing the largest per cent of increase in the number of women after the second draft were cars, steam and electric railways, automobiles, metal and metal products, lumber and its remanufacture, chemicals and allied products. Industries showing decrease in per cent of women employed were textiles, hat and cap making, tobacco and tobacco products. Industries showing the greatest ratio of substitution were motor-cycles, bicycles and parts, cars, steam and electric railways, automobiles, airplanes, seaplanes and parts, ship and boat building, agricultural implements, lumber and its remanufacture and iron and steel; the latter industry substituted by far the largest number of women. In practically no case did all the different establishments in any industry employ women and an even smaller number substituted them for men. The practice of the employment and substitution of women was largely a matter determined by the individual establishment. In iron and steel, for example, out of 2,140 firms reporting after the second draft, only 1,011 employed women and only 430 substituted women for men.

Before the war women were employed in clerical work in connexion with the railways and as ticket sellers on a few street railways. One of the most striking war innovations was the employment of women in such positions as station agents, ticket sellers, cleaners, section hands, and elevator operators, in connexion with the railways, and as conductors on the street railways. It is estimated that by Oct. 1918 there were over 100,000 women employed on the railways, and many large

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cities had installed women as conductors on the street cars. In N.Y. State alone 2,180 were substituted for men on the steam roads and 1,346 on the electric roads. In this state a law was passed limiting hours of women on street cars to nine a day and prohibiting night work between 10 P.M. and 6 A.M. In Wisconsin hours were limited to eight a day and night work was prohibited between 5 P.M. and 8 A.M., which practically prevented the employment of women on street cars during the rush periods. Other large cities employing women and limiting their hours were Chicago and Boston as ticket agents, and Kansas City, Detroit and Cleveland as conductors. In the latter city a controversy occurred over their continued employment, involving several hearings before Federal authorities. The men's union was strongly opposed to them and finally secured an agreement with the company to dismiss all the women and reinstate the men which was carried out early in 1919. A similar situation arose in Detroit with a similar result, but in Kansas City the union did not oppose the women and the War Labor Board ordered equal pay for equal work. In most cases the women were out of the service by 1921, but on railway work 81,000 were reported as still employed in Jan. 1920. The majority of these were in clerical positions, but there has been also a permanent increase in the number of women employed as station agents, ticket sellers, watchmen, and in the business offices. When the roads were under Federal control, the minimum monthly salary for clerical positions was fixed at $87.50, while executive positions often commanded as much as $225 a month.

Efficiency.—The new fields of work tested, as never before, the abilities of women. Although before the war women were employed in practically every kind of work, they were usually occupied on routine or standardized processes. But the war opened to them a new door. "Instead of 'tending' or 'tripping' or 'feeding work,' measured and marked for her, into a machine especially adjusted or constructed to perform a specialized or standardized process, the emergency created by the war forced the experiment of teaching the woman worker to read blue prints, to understand the characters of different metals, to grasp the purposes and capabilities of various machine tools, to adjust their mechanism, to set up, to measure and to mark her own work and be responsible for its quality as well as for its quantity." In these new fields there were of course failures, due sometimes to personal defects—but more often to ill-advised assignment of tasks, lack of proper instruction and supervision such as was so successfully carried on in English munitions work, and also because of lack of proper equipment and accommodations for women. It must also be pointed out that because of America's shorter war period there was but little time for technical training. Although a few trade schools were utilized, reports indicate that training was usually done by the "foremen," "forelady," "skilled operators," or "the gang boss." On the whole, however, testimony of manufacturers from all parts of the country, as reported by several independent investigations, agreed that the women were unquestionably successful. The output of women, according to 66 firms out of 99 in the important metal trades, "was equal to or greater than that of men in the operations in which both were employed." In another investigation from 50% to 90% of the managers in a variety of industries reported that the production, attendance, and promptness of women was equal to or greater than that of men. Employers stated: "On our 24-in. Fellows gear shapers the women turn out from 20 to 30 more pieces in a 9-hour day than men." "In our filling and burring machines . . . they overrun the men about 250 pieces." "On our drill press work . . . they have increased the production 1,200 pieces in a 9-hour day." The president of a recording and computing machine stated: "In the machine department women became expert and got out much greater production in running turret lathes, punch presses, bench lathes, milling machines, drill presses, grinding machines and engraving machines, and in addition to the operation of these machines we taught them to grind their tools, to act as job setters, and to superintend some of the departments. In the inspection department practically every inspector was a woman. In the assembly departments, as well as in the inspection departments, all were women, and they did better work and got out more production than men whom we tried on the job at various times without success. We found, too, that we could place as much, if not more, dependence on women in coming to their work and remaining on the job, which accounts for our having the lowest turnover in help in any factory ever heard of, which was less than 4% per year. We taught women to inspect tools and check them over according to the drawings after they came from the tool shop, in which department women became expert." Although much of the work done by women was repetitive and semi-skilled, requiring mainly dexterity and lightness of touch, yet testimony shows that they frequently and successfully competed with the highly skilled men.

Standards of Work.—In Oct. 1918 the Women in Industry Service (later the Women's Bureau of the Labor Department) formulated certain standards intended to govern the employment of women. These standards were indorsed by the War Labor Policies Board and after the Armistice were revised to serve as a basis for a programme for reconstruction. The recommendations included the 8-hour day, Saturday half-holiday, one day of rest in seven, and the prohibition of night work between 10 P.M. and 6 A.M. They urged equal pay for equal work and an occupational, rather than sex, determination for wage rates, with a minimum which would cover the cost of living for dependents as well as for the individual. Proper conditions of work were specified, and included the prohibition of employment where poisons which are more injurious to women than to men were used. The standards also urged that joint negotiations between employers and employees be established for enforcement purposes. The War Labor Policies Board ordered all contracts of the Federal Government to require full compliance with the labour laws of the state in which the goods were manufactured.

Hours, Wages and Conditions.—With but few exceptions pressure of work did not reach the high pitch which England experienced, and, on the whole, hours and conditions of employment in the United States did not greatly change as a result of the war; the United States profited also by England's experience in regard to the futility of excessive hours of labour, and although many attempts were made to enact state laws which would abolish or lower the existing standards, public opinion was against this movement and on the whole these attempts failed. Less than a dozen states had laws prohibiting the night work of women and the practice of the Federal Government of referring to the state labour departments for investigation any request for permission to exceed legal hours, resulted in a fairly general conformity to existing legislation. In a few cases where night work was not prohibited by law, women did take their turn in the night shift.

Rates of wages during the war fluctuated greatly and several intensive studies were made. One of the larger studies reported only wage rates and showed that in the majority of cases women's wages were admittedly lower than men's. Probably the most exhaustive study was made in N.Y. State by the Women's Bureau of the Labor Department. This study covered 117 plants and 13,643 women who replaced men. Of these women 56% received only two-thirds to three-fourths of the wages paid the men for the same work. Two-thirds of the women received less than $15 a week, and only 190 received $20–$25 a week. From this study it appeared that wages had practically no relation to production or to efficiency. In 11 plants reporting that women produced more than men not one woman received as much as the men and the majority received about three-fourths of the men's wage. Several states and the Federal Government established minimum wage rates in certain occupations for the war period ranging between $13 and $16 per week. A Federal report indicated that in practice the time-rates of women seldom equalled those of men. Piece-rates were frequently the same for both sexes, but the guaranteed wage for the women was usually lower than for men. Another report stated that women's wages ranked about with those of boys—and often with pre-war standards for boys.

General Results.—An important test of woman's efficiency was her permanence in these newer occupations. On this point one investigation reported that "of all plants employing women in men's places over one-half are going to retain every woman so employed, second that 82% are going to retain all or part of the women so employed." In the leading war agency and implement industries the proportion of women per 1,000 wage earners in 1914 was 65; in Oct.–Nov. 1918, 139; in Aug. 1919 the proportion was 100. The reasons for retaining women were of course varied. In addition to questions of efficiency other factors entered. It has already been pointed out that women's actual wages were almost universally lower than men's. Many employers frankly gave as their reasons for retaining women: "greater production at lower wages"; "better work at lower wages"; "they produce more and demand less"; "to fight the union." One report stated that "women are staying at their new posts primarily because they permit manufacture at less cost per unit of production and with less friction between management and workers."

On the whole, and particularly in comparison with England, there was very little special machinery created during the World War to deal with problems of women in industry. Canteens were set up here and there, an occasional day-nursery was established, employment management and personnel work were stimulated, welfare work and supervision were frequently introduced, but there was no large movement to direct and supervise "dilution," no munitions tribunals with their "leaving certificates" and but few attempts on the part of the Government, either state or Federal, to regulate wages. Except in a few cases there were no serious clashes with men's trade unions, and the post-war problem of women in men's places adjusted itself without state interference.

The principal sources of information are: (1) *The New Position of Women in American Industry*, published in 1920 by the Women's Bureau of the U.S. Department of Labor, Washington, D.C.; (2) *The Industrial Replacement of Men by Women in the State of*

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New York, published in 1919 by the Bureau of Women in Industry of the N.Y. State Industrial Commission, N.Y. City; (3) the publications of several manufacturers' organizations, such as the National Industrial Conference Board, N.Y. City, and the chambers of commerce of various cities. (I. O. A.)

WOMEN'S WAR-WORK.—It would be impossible here to attempt to describe the special war-work done by women of all the belligerent countries in 1914–8; and this article is confined to an outline of women's war-work as organized in the United Kingdom and the United States, beginning with the former.

United Kingdom

The general dislocation which ensued in industry threw numbers of women workers in the United Kingdom out of employment. At the same time women of independent means, moved by patriotism, came forward in large numbers with offers of voluntary service. It soon became apparent that the well-meant action of the non-professional women was likely to press heavily on the position of the unemployed wage-earners; and accordingly on Aug. 20 Queen Mary inaugurated the "Queen's Work for Women Fund," technically a branch of the National Relief Fund, to provide employment for as many as possible of the women thrown out of work by the war. The Queen's collecting committee, with Lady Roxburgh as hon. sec., raised the money, but the administration of the fund was in the hands of the Central Committee on Women's Employment, a Government Committee under the chairmanship of the Marchioness of Crewe, with Mary Macarthur (d. 1921) as hon. secretary. The problem of the Committee was to help to adjust the dislocation of industry, so that unemployed firms and workers in a slack trade might ease the overpressure in other trades. Firms unused to Government work were assisted to undertake War Office contracts, and orders were placed with small establishments employing women, who would otherwise have had to relinquish their businesses. Over 70 special relief workrooms, through which about 9,000 women passed before Feb. 1915, were managed by women's employment sub-committees of the local representative committees set up by the Government Committee on the Prevention and Relief of Distress. Articles made in them were not offered for sale, and were supposed to be educative to the worker. New branches of the toy-making industry, in which there was a possibility of capturing German trade, were started in various private relief workrooms, and became paying business concerns.

The distress among the professional classes caused by the dislocation of work was very great, and the Professional Classes War Relief Council, consisting of representatives from the chief professional institutions and the principal societies organizing relief work, was formed to cope with the trouble in Oct. 1914. The Council dealt chiefly with education, maternity assistance, training, and the organization of concerts for the employment of musicians, who, as a class, were particularly hard hit. The Society for Promoting the Employment of Women opened an educated women's war emergency training fund for a year, which trained out-of-work governesses and journalists to take posts in banks; and hostels were opened by various private committees for ladies in distress owing to the war.

On Aug. 3, before the official declaration of war, the executive committee of the National Union of Women's Suffrage Societies under its president, Mrs. Fawcett, decided to suspend political action (*see* Woman Suffrage) and devote the organizing capacity of the Union to meet the changed conditions. Within a week the London branch, with Miss Philippa Strachey as secretary, had started a free bureau under the name of "Women's Service" to direct the efforts of the thousands of non-professional women eagerly desirous of finding useful work. Over 1,300 volunteers were placed before the end of 1914. Many young women began at once to prepare themselves for nursing, joined Voluntary Aid Detachments, and worked in auxiliary hospitals. The raising of funds and making of comforts for the units of the original Expeditionary Force absorbed others, and the arrival of the Belgian refugees in England before the end of Aug. caused the formation of 2,500 local Belgian relief committees, of whom the members were mostly women. Clubs to help the wives of soldiers and sailors were started by the Tipperary League under Mrs. Juson Kerr, the British Women's Patriotic League, and others. The Women's United Services League under Lady French and Lady Jellicoe coördinated and registered the work done by war clubs throughout the kingdom. A large number of women devoted themselves at once to the work of the Soldiers' and Sailors' Families Associations, and to the work of the Officers' Families Fund founded by the Marchioness of Lansdowne in 1914.

Already in the early months of the war it became evident that the abnormal conditions arising from the quartering of large numbers of soldiers in barracks and camps, and of convalescents in hospitals, would give rise to social dangers, and that steps should be taken to deal with the situation. A militant suffrage society, the Women's Freedom League, formed the Women's Police Volunteers, under Miss Nina Boyle, in Sept. 1914. This Corps was reorganized shortly after as the Women Police Service under Miss Damer Dawson (d. 1920), and Miss Allen. To cope with the same evil the National Union of Women Workers called an emergency meeting of their rescue and preventive subcommittee in Sept. 1914. As a result a corps of "Women Patrols" was formed to work under the official sanction of the Commissioner of Police in the metropolitan district, and of the Chief Constables in the provinces (*see* Women Police).

I. *Voluntary Organizations and Corps.*—The first of the new corps of women called into existence to meet war conditions was the Women's Emergency Corps, originated by Miss Decima Moore, and launched Aug. 6 1914 in coöperation with Miss Lena Ashwell, the Hon. Evelina Haverfield, Miss Eva Moore and Mrs. Kingsley Tarpey. In addition to relief workrooms, and the registration of the innumerable voluntary offers of service characteristic of the first months of the war, schemes were started under its auspices which developed independently, after the parent corps had met the "emergency" conditions of dislocation of labour and refugee relief. The collection of surplus food from the London markets for the unemployed and for Belgian refugees developed into the National Food Fund, which raised £163,615 in gifts of food and money before the end of the war. The Women's Volunteer Reserve, founded in 1914 as a branch of the Women's Emergency Corps by the Hon. Evelina Haverfield, with the Marchioness of Londonderry as hon. colonel-in-chief, "to provide a trained and disciplined body of women ready to assist the State in any capacity," did military drill, wore khaki uniform and saluted their officers. The founders' idea that, as signalers, despatch riders, telegraphists and motorists, they might set men free for the firing line, was premature in 1914, but anticipated the need actually met later by the women of the Army Service Corps and Q.M.A.A.C. In practice the Reserve consisted of working girls who gave their leisure time to organized voluntary work in canteens, hospitals, workrooms and clubs. After Mrs. Haverfield had left the W.V.R. to work in Serbia with the Scottish Women's Hospitals, Mrs. Beatty and Mrs. Kilroy Kenyon formed the Women's Reserve Ambulance (Green Cross Corps) in June 1915, a fresh organization on somewhat similar lines to the W.V.R., but confining its activities mainly to London, whereas the most successful branches of the W.V.R. worked in the provinces till the end of the war. Other somewhat similar corps for the organization of part-time workers were the Women's Auxiliary Force, founded in 1915 by Miss Walthall and Miss Sparshatt, and the Liverpool Home Service Corps. The latter was started in May 1915 by Miss Phyllis Lovell and had branches throughout Lancashire. In Aug. 1915 it formed a Police Aid Detachment which worked in conjunction with the Lancashire police.

Public opinion with regard to the "khaki" women was reflected in a "Punch" cartoon for Dec. 15 1915, showing a gallant Highlander curtseying to take a lady officer's salute. They outlived this ridicule, and in 1918 the salute was officially adopted by the women of the Auxiliary Army Services. Nevertheless by the spring of 1915, when the country began to feel the drain of its man-power, the Marchioness of Londonderry realized that a less military corps of women would attract many of those anxious to come forward to carry on the work of the country. In July she founded the Women's Legion, which from the first was intended to be a corps of paid women replacing paid men. A khaki uniform was worn and the women were subject to regulations and discipline. Ultimately over 40,000 were

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enrolled. This corps was the link between the independent voluntary associations of women, such as the Emergency Corps, formed on the outbreak of war, and the official women's services, two of which (described below) were sections of the Women's Legion.

Throughout 1915 and 1916 efforts were made by voluntary organizations such as the Women's Legion and the Women's Defence Relief Corps, under Mrs. Dawson Scott, as well as by the Government, through the War Agricultural Committees of the Board of Trade, of which 63 had been set up before July 1916, to induce women to offer their services on the land and to persuade farmers to accept them. The Women's Farm and Garden Union was the most important of the bodies which had dealt with women's work on the land before the war, and, realizing that each individual woman was an object lesson for good or ill to the farmers whose favour had to be won, the Union started a system of training farms in the autumn of 1915. Early in 1916 the Government provided a grant, and the Women's National Land Service Corps under Mrs. Roland Wilkins was launched as a war off-shoot of the Farm and Garden Union, to deal with emergency war-work on the land. By the end of the year the demand for women had become greater than could be met by a small voluntary association, and, as the result of a deputation from the Corps to the Minister of Agriculture, the Women's Land Army was instituted early in 1917 as a Women's Branch of the Board of Agriculture. The Corps continued to act as the agent of the Land Army for organizing the supply of educated women as seasonal workers. In all 9,022 workers were sent out, and in 1918 the flax harvest was saved by 3,835 holiday workers from the Corps.

By the spring of 1915 shell-work for women was beginning; in March women tram conductors started work at Glasgow, and girls were employed as telegraph operators in Liverpool. But women were impatient at the slowness of the progress of industrial substitution and at the uselessness of the Women's War Service Register compiled by the Board of Trade in March 1915. The suffrage societies urged the Government to face the need for the recognition of the claim of women to be employed on war production, and in July 1915 a procession and deputation to Mr. Lloyd George was organized by Mrs. Pankhurst to assert this claim. In connexion with the demand for skilled workers, the London Society for Women's Suffrage, which promoted the introduction of women into occupations hitherto reserved for men, started a Munitions and Aircraft Department in July 1915, and arranged the first training classes in oxy-acetylene welding. The pupils were the first women welders to enter the engineering trade, and after two years the Ministry of Munitions assumed financial responsibility for the school.

Messrs. Beardmore in Glasgow and Messrs. Vickers at Barrow-in-Furness and at Erith employed women on shell-making in the spring of 1915. In order to ease the strain due to Sunday work, a band of Women Relief Munition Workers, educated women of the leisured class, were organized by Lady Cowan and Lady Moir and trained in the rough turning and boring of 4·5 shells and 18-lb. shrapnel at Erith; they bound themselves after training to undertake week-end shifts for six months.

In 1915 and 1916 work in canteens, hostels and clubs, formed by voluntary agency in connexion with the welfare of munition workers, absorbed a large number of voluntary women workers. Lady Lawrence obtained permission to enter the almost sacred precincts of Woolwich Arsenal in May 1915 and organized the Munition Workers Canteen Committee, which provided light refreshments at many munition factories and had 1,250 workers. The movement for establishing munition and dock workers canteens, essential for the health of the worker and the consequent output of munitions, dates from this initial effort. About 500 canteens for munition and dock workers were started by 12 voluntary societies:—the Munitions Auxiliary Committee of the Y.M.C.A.; the Y.W.C.A.; the Church Army; the Salvation Army; the Church of England Temperance Society; the National Peoples' Palaces Association; the Y.M.C.A., Scotland; the British Women's Temperance Association, Scotland; the Glasgow Union of Women Workers; the Women's Volunteer Reserve; and the Women's Legion. The latter employed 2,000 paid whole-time canteen workers, but it is estimated that over 10,000 voluntary part-time workers were in attendance at less than 130 out of the 500 canteens.

The Munitions Auxiliary Committee of the Y.M.C.A. under the presidency of Princess Helena Victoria opened 183 of these 500 canteens and had over 10,000 women workers. In all, between 35,000 and 40,000 women gave their services to the Y.M.C.A. in England during the war. The canteen work was undertaken to meet an emergency and to set the canteens going more quickly than would have been possible under any other system. But it was wasteful of voluntary labour, and in 1916 the Central Control Board became the responsible authority for the organization of industrial canteens in munition works throughout the country, and encouraged the employment of paid workers.

The steady withdrawal of men from civilian to military life led in 1916 and 1917 to a remarkable expansion in the scope and volume of women's work (*see* WOMEN'S EMPLOYMENT). The growth of the Women's Services, and the demand for women as substitutes for men in industrial occupations and in the Civil Service, caused a consequent diminution in the number of voluntary workers and in the relative importance of the voluntary corps.

II. *The Women's Services.*—The Women's Services were of two types. First came those composed of "enrolled" women in the legal sense, who were in the direct employment of the War Departments, and whose contracts brought them within the regulations of the Defence of the Realm Act. The women could be enrolled as "mobile" workers for home service only, or for service at home and abroad; or as "immobile" workers, recruited for local employment, who could not be required to move away from the district. Secondly came those composed of "non-enrolled" women in the legal sense, who did not render themselves liable to penalties under the Defence of the Realm Act and might be engaged on an annual or weekly contract. Some services enrolled their women for a year only and others for the duration of the war.

(A.) ENROLLED WOMEN

The Army Nursing Services.—Before the war the only women's auxiliary army services in existence were Queen Alexandra's Imperial Military Nursing Service and Reserve, and the Territorial Force Nursing Service. The V.A.D.s, founded in 1909 under the British Red Cross Society and Order of St. John of Jerusalem, developed a section of 12,000 V.A.D. nursing members, enrolled under the War Office in 1915 for service in military hospitals, and a section of 6,000 General Service members, enrolled for general service in connexion with military hospitals in 1917.

The Q.A.I.M.N.S. expanded from a corps of 800 trained nurses to 10,304; and the T.F.N.S. from 2,738 nurses ready to serve when war broke out to 8,140 (*see* NURSING).

The Military Massage Service.—The Military Massage Service started its career in Aug. 1914 under the name of the Almeric Paget Massage Corps. It was maintained by Mr. Almeric Paget (afterward Lord Queenborough) and Mrs. Almeric Paget (d. 1916), and consisted of 50 fully-trained masseuses who, early in Sept. 1914, were distributed among the principal military hospitals in the United Kingdom, this number being shortly increased to 100. Lady Essex French was hon. secretary.

The next development of the work of the Corps was in Nov. 1914, when a massage and electrical out-patient clinic was opened in London for the treatment of wounded officers and men, financed till Dec. 1920 by Mr. and Mrs. Paget. During the war over 200 patients were treated in the clinic daily. It was inspected by the Director-General Army Medical Service in March 1915 and subsequently became the model for the massage and electrical departments in the convalescent hospitals and command depôts throughout the United Kingdom. Early in 1915 the War Office officially recognized the Corps by making it the body to which all masseuses and masseurs engaged for service in military hospitals must belong. An advisory committee was instituted by the War Office, which laid down the standard of training and qualifications required and formed sub-committees to select the candidates. Thus the admission of untrained or partially trained personnel was prevented, and the interests of the patients and of the massage profession were safeguarded.

In Dec. 1916 the word "Military" was added to the title of the Corps, and in Jan. 1919 it became known as the Military Massage Service by Army Council Instruction.

It was not until Jan. 1917 that military masseuses were required for service overseas, but from that date up to six months after the signing of the Armistice 56 masseuses served in France and Italy; 3,388 masseuses and masseurs had been enrolled in the service and there were over 2,000 actually at work on the day the Armistice was signed. (The Regulations for the Corps are set out in A.C.I. 779, 1,262 and 1,146 of 1917, and 65,308 and 489 of 1919.)

The Women's Legion, Cooks and Motor-drivers.—In July 1915, a scheme was originated by the Marchioness of Londonderry, founder and president of the Women's Legion, which was approved by the Q.M.G., and put into operation at Dartford Camp convalescent hospital, for taking over the whole of the kitchens and installing women cooks. The objects were to release men for the work which women could do; to improve the cooking and cleaning of the camps and to introduce economies and variety in the feeding of the troops. The experiment proved a success; other camps were taken over, and an A.C.I. of Feb. 1916 defined the position of the cooks. The first Commandant was Miss Lilian Barker who, when she became welfare superintendent at Woolwich Arsenal, was succeeded by Dame Florence Leach. Mrs. Long, who lost her life in the torpedoing of the "Warilda," was hon. secretary. Ultimately 4,000 women cooks and waitresses replaced men in camps and convalescent hospitals in Great Britain; they signed a contract for a year, but were not enrolled until the organization became part of the Women's Army Auxiliary Corps in Sept. 1917. Those who transferred retained the right to wear the Women's Legion badge.

Women motor drivers, mechanics and storekeepers were first employed as substitutes for men of the R.A.S.C. in April 1916, and of the R.F.C. in the following September. The women were recruited and put into uniform by the Women's Legion under Miss Christobel Ellis, and were paid by the army. There was no enrolment until the Section was taken over by the W.A.A.C. in 1917,

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This arrangement lasted only a few months, and in Nov., at the instigation of Lady Londonderry, the army abandoned the scheme for centralizing the administration of women working in the army in one corps, and it was decided that overseas drivers should enrol in the W.A.A.C., but that drivers for home service should again belong to the Motor Transport Section of the Women's Legion. They were enrolled for a year only, instead of for the duration of the war, as in the W.A.A.C., and came under the Q.M.G.'s Department; 647 Flying Corps drivers were transferred to the W.R.A.F. in 1918. Ultimately about 2,000 women were attached to areas and battalions throughout Great Britain, and after the Armistice several hundred drivers were sent to France to replace the demobilized mechanical transport men.

Women's Forage Corps, R.A.S.C.—In July 1915, women supervisors were enrolled under the War Office for the duration of the war to arrange for the transit of hay from the farm to the station and to forward it to its ultimate destination. The urgent need for increased substitution caused a special women's branch of the Forage Department, known as the Women's Forage Corps, to be inaugurated in March 1917 under Brig.-Gen. Morgan. Mrs. Athole Stewart was appointed superintendent and 4,200 women were enrolled as 1st. and 2nd.-grade officers and industrial members, for a year or the duration of the war. They were distributed throughout Great Britain and Ireland and wore khaki uniform. The industrial members took the place of privates in the R.A.S.C. and worked as hay balers, sack makers and menders, sheet repairers, thatchers, chaffing hands, transport drivers and clerks. The substitution of women did not depreciate the quality of the work.

Queen Mary's Army Auxiliary Corps.—In Dec. 1916 the War Office ordered Gen. Lawson to enquire into the number and physical categories of men employed out of the fighting area in France. On Jan. 16 he reported that in his opinion 12,100 men might be replaced by women to begin with. He added:—"In the last year or more in England the employment of women has developed to an immense extent through lack of men, and has been attended with remarkable success. Women have taken up various forms of male employment, which, by many, had been deemed impossible for the sex. They have found their way into work in all branches of life and have proved their capacity for it. In the army at home the success has been conspicuous and women are to be found working in numerous offices and cooking in many of the home military establishments. Results have shown that the sex difficulty has not been anything like what some have predicted. The women have been hard at work and felt they were out for the job and the men have respected them, and their experience at home has been, I understand, almost unanimous in this respect."

On Jan. 24 1917 the suggestion was put forward by Sir Nevil Macready, adjutant-general, that women employed in the army should be part of the army, entirely distinct from any outside organization and established in the War Office under his Department. This scheme materialized under the name of the Women's Army Auxiliary Corps, known popularly as "W.A.A.C.'s." Mrs. Chalmers Watson took up her duties as Chief Controller at Headquarters on Feb. 18 and Dame Helen Gwynne Vaughan as Chief Controller in France. Below the Chief Controllers were a staff of controllers and administrators, all women. A special branch of the War Office, known as A.G. 11, was formed to assist in getting the Corps into working order so that it could fit into the army machinery. A Women's Auxiliary Corps of the R.A.M.C. organized the medical boards in England and France, of which Dr. Jane Turnbull was president at home, and Dr. Laura Sandeman in France. At the end of a year Mrs. Chalmers Watson resigned for urgent family reasons, having accomplished the pioneer work of the Corps and won a recognized position in the army for her women in the face of many difficulties. She was succeeded by Dame Florence Leach, then known as "Controller in Chief." When Dame Helen Gwynne Vaughan was made Commandant of the W.R.A.F. in Sept. 1918, Miss L. Davy became Chief Controller in France. The full charter for the organization of the Corps was finally completed at the end of June 1917.

The women were enrolled as mobiles for home service only, or for home or foreign service, and for the duration of the war; they received a special rate of pay, not civilian or military, and were not enlisted under the Army Act. At first substitution overseas only had been contemplated, but by March the number of women recruited by the Department of National Service was so great that Home Commands were included in the scheme. Recruiting was afterwards carried on through the Employment Department of the Ministry of Labour. In Dec. 1917, owing to the shrinkage of available woman-power, an immobile branch was formed. Women employed in the Ordnance Army Pay Department and Record offices at home were not made to join the Corps. A khaki uniform with distinguishing badges was worn. In all there were 1,200 officials and 56,000 women, of whom 9,500 were the outside number employed in France at any one time. This figure was made up of women working in the Calais, Boulogne, Etaples, St. Omer, Abbeville, Dieppe, Rouen and Havre areas and on the lines of communication, chiefly at army schools, and in certain offices at G.H.Q. A number were employed with the Expeditionary Force canteens, mostly at officers' clubs. They were drafted to every type of office and domestic employment, and to bakeries, ordnance and motor transport depôts. In the spring of 1918, when the R.A.F. was formed, 7,000 women, including nearly the whole of the immobile branch of 1,800, transferred to the W.R.A.F.

When the American Expeditionary Force arrived in France and was prevented by shortage of transport from bringing over American women clerks, 500 members of the Corps under a Chief Controller, Miss Horniblow, who was succeeded by Miss Gordon and finally by Mrs. Vernon Lloyd as Deputy Controller, were transferred to the American camps at Bourges and Tours. Mrs. Vernon Lloyd was subsequently made Deputy Controller in Cologne, where over 100 Q.M.A.A.C. officials were employed with the army of the Rhine in the Censor's Department, under the provost marshal, and in ordnance. A small contingent was attached to the British military mission in Berlin for over a year. Queen Mary assumed the title of Commandant-in-Chief of the Corps in the spring of 1918.

A Q.M.A.A.C. unit attached to the Director-General of Graves Registration at St. Pol was in being in 1921.

Women's Royal Naval Service.—The W.R.N.S. was instituted as part of the navy at the end of Nov. 1917 when Sir Eric Geddes, the First Lord of the Admiralty, outlined what was required. The Director, Dame Katharine Furse, was asked to put up a scheme for the organization of the service, which was accepted with small amendments giving her more powers than she had set out. She had the opportunity of starting with a staff of women of considerable experience in organization and asked for Miss Edith Crowdy to be appointed as her deputy. The Director was the executive head, responsible only to the Second Sea Lord. No naval officer was available to assist her, and from the first the navy encouraged the greatest possible independence in the organization of the service. The formation of another service of women under the Air Board was already in contemplation, so that the W.R.N.S. (or Wrens) was from the first organized with a view to handing over all the members working in Royal Naval Air stations; 2,033 ratings were transferred to the administration of the W.R.A.F.

For the purpose of calculating allowances the following relative ranks were agreed to:—

W.R.N.S.	R.N.
Director	Rear Admiral
Deputy Director	Commodore (2nd class)
Assistant Director / Medical Assistant Director	Captain
Deputy Assistant Director / Divisional Director	Commander
Deputy Divisional Director / Principal	Lt.-Commander
Deputy Principal	Lieutenant
Assistant Principal / Quarters Supervisor	Sub-Lieutenant
Superintending Section Leader / Chief Section Leader	Chief Petty Officer
Section Leader	Petty Officer
Leader	Leading Hand
Woman	Seaman

There were 12 Divisions: Devonport, Portsmouth, The Nore, Harwich, London, Humber, Tyneside, Scotland, Ireland, Liverpool, Cardiff and the Mediterranean. After the Armistice, stations were set up at Ostend and Zeebrugge under the Nore Division.

The ratings were enrolled for the duration of the war and paid on a civilian basis. Coöperation with the Employment Department of the Ministry of Labour on similar lines to that already set up in connexion with the Q.M.A.A.C. was arranged for the purpose of recruitment. As it is estimated that at the time when the W.R.N.S. was being formed over a million and a half additional women had already been drawn into industrial and commercial occupations, as munition workers and substitutes for men in the Forces, the recruiting up to the high standard required was made more difficult; but in spite of this excellent results were obtained. The service consisted of women living in hostels (mobiles) and of women living in their own homes (immobiles) in almost equal proportions. The women were largely recruited from naval families, and this contributed to the keen service spirit shown.

A total of 608 officers were appointed; 6,880 women were enrolled and 785 absorbed from women already employed in naval establishments, before the formation of the Wrens. On Nov. 21 1918, the date of maximum strength, there were 6,392 ranks and ratings.

The officers, other than those engaged in the organization, welfare and discipline of the women, replaced naval officers for the following work:—coding and decoding, intelligence work, confidential books, secretaries, telephone exchange, paymasters, accountants, gas mask work, and observation station. The ratings were employed as ledger clerks, clerks, shorthand typists, victualling store assistants, telephone operators, postal sorters, stewards, cooks, general domestic workers, orderlies and messengers, porters and storewomen, bakers, tailoresses, gas mask workers, gardeners, fitters, turners, boiler cleaners, boot cleaners and painters, wiring hands, net mine workers,

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depth charge workers, armourers, sailmakers, tracers and draughtswomen, photographic workers, technical storekeepers, valve testers and wireless telegraph operators.

Blue uniform with distinguishing badges was worn by all ranks and ratings. The service was demobilized in Dec. 1919.

The Women's Royal Air Force.—On April 1 1918 the R.A.F. was formed by the amalgamation of the R.F.C. and the R.N.A.S. Seven thousand women in Q.M.A.A.C. and 2,033 in the W.R.N.S. had been attached to R.F.C. units and to R.M.A.S. stations before the amalgamation. These were transferred to the W.R.A.F. and formed the nucleus of the service. The chief superintendent was Lady Gertrude Crawford, who was succeeded in May 1918 by Miss Violet Douglas Pennant as Commandant. Dame Helen Gwynne Vaughan, hitherto Chief Controller Q.M.A.A.C., France, was appointed Commandant in Sept. 1918. Mrs. Pratt Barlow was Deputy Commandant, and Miss K. Curlett Assistant Commandant over-seas.

Five hundred and sixty-six officers and 31,764 other ranks passed through the Service, the strength at the time of the Armistice being rather over 25,000. (The constitution and regulations were similar in outline to those of the Q.M.A.A.C. and the W.R.N.S.) The Service consisted of mobiles and immobiles in approximately equal proportions. In addition to the administrative, clerical and domestic work common to all the Services, the women were employed on meteorological work and as despatch riders, dopers, painters, acetylene welders, carpenters, magneto repairers, photographers and drivers. Fabric workers did duties of all kinds from the covering of aeroplane wings to the mending of the finest balloon silk. The uniform was first khaki, then blue, with the badges of the R.A.F.

The corresponding rank of officers and other ranks is shown below:

W.R.A.F.	R.A.F.
Commandant	Air Commodore
Deputy Commandant	Group Captain
Assistant Commandant Class 1	Wing Commander
" " " 2	Squadron Leader
Administrator	Flight Lieutenant
Deputy Administrator	Flying Officer
Assistant Administrator	Pilot Officer / Observer Officer
Senior Leader	Warrant Officer 2
Chief Section Leader	Sergeant
Section Leader	Corporal
Member	Aircraft man

The medical arrangements for the W.R.A.F. were in the hands of Director of Medical Services R.A.F. under whom Dr. Laetitia Fairfield served as Woman Medical Director. A woman medical officer was on the medical staff of each of the R.A.F. Areas, and a medical woman was detailed for duty at each of the W.R.A.F. depôts and larger camps. They had hon. rank corresponding to that of the R.A.F. medical officers and by means of regular inspections and efficient care, preserved a high standard of health.

In March 1919 the first overseas draft embarked for service in France and 500 officers and other ranks formed part of the Air Force of Occupation on the Rhine. Demobilization took place March 31 1920.

In relation to the W.R.A.F. the experiment was tried of running a women's service as nearly as possible (having regard to the fact that the women were enrolled and not enlisted) as a part of the force to which it was attached. Thus correspondence was carried out through the usual Air Force channels; officers and other ranks of the W.R.A.F. were under the orders of senior R.A.F. officers; women officers were attached to the staff of the Air Officers commanding areas and were allowed to sign for them letters dealing with the W.R.A.F.; the officer in charge of W.R.A.F. inspection was a member of the staff of the Inspector General R.A.F. and the Commandant was stated in Air Ministry weekly orders to be on the staff of the Master General of Personnel and instructed to sign letters dealing with W.R.A.F. in the same way as directors and heads of independent branches; so that her correspondence, like theirs, carried the authority of the Air Council. The same principles were followed in the medical arrangements. By these means the need of a special section of R.A.F. officers dealing with the W.R.A.F. was obviated; economy was effected, and the administration of the W.R.A.F. was carried out on Air Force lines. The result was indicated by the terms of Air Ministry Weekly Order No. 1110 (promulgated Oct. 7 1920):

" In issuing orders for the final disbandment of the W.R.A.F. the Air Council desire at the same time to express their appreciation of the good work done by the Force both during and after the period of hostilities. In spite of much difficulty and in the face of hostile and unjust criticism, the W.R.A.F. has left a record of which it can well feel proud. During hostilities the good work it accomplished went far towards enabling the R.A.F. to reach that dominating position in the air which had such a direct influence in the achievement of the final Victory. Subsequent to the Armistice, when it was necessary to disperse a large number of airmen to civil life, it was the W.R.A.F. which made it possible for the R.A.F. to meet the demands made upon it, and maintained the services at the Aerodromes until new male personnel could be enrolled. The necessity for the demobilization of the W.R.A.F. is now imperative, but in returning to civil life, Commandant Dame Helen Gwynne Vaughan, D.B.E., Officers and Members may feel assured that they carry with them a debt of gratitude from the Nation."

(B.) Non-Enrolled Women

Anti-Gas Department.—On April 22 1915, at the battle of Ypres, the Germans first made use of poison-gas, and within 36 hours some sort of improvised mouth pad had been issued to every man in the line. Anti-gas work was begun at once, and men worked night and day to devise a really sound method of protection. Early in June 1915 Miss Beaver was appointed superintendent of the Camden Laundry Smoke Helmet Impregnating Station, where the work of drying and packing gas helmets had been largely carried on by members of the Women's Emergency Corps. When it was decided that gas helmets could be repaired for re-issue after use at the front, Miss Beaver and Miss Carey Morgan were sent out by the War Office to organize depôts for repair work with French labour at Abbeville and Calais. They were at once given the status of officers of the Army Ordnance Department, but were not actually gazetted till June 1916. They wore a nigger brown uniform with the badges and buttons of officers of the Army Ordnance Department. Six V.A.D.s were attached to the Abbeville depôt and four to Calais; they afterwards transferred to the W.A.A.C. as Administrators. The French depôts closed down when the " box respirators " had superseded the helmet types and the repair as well as the manufacture was carried out in England.

Practically the whole of the work on gas-mask manufacture was performed by women. There were 34 factories employing 12,000 under the immediate control of the Anti-Gas Department and 160 contractors employed a further 90,000 on work for the Department. In Aug. 1917 a number of educated women were trained for inspection work on the mask of the respirator and drafted out to the factories. They wore an indoor uniform of scarlet and were called " red-coats." Ultimately 800 to 1,000 of these were appointed, and 100 were promoted to the duties of check inspecting, formerly performed by sergeants of the Anti-Gas Department. They were known as sergeants also, and were interchangeable with the men. A few lady superintendents were appointed over " sergeants " and " red-coats," and Miss Carey Morgan was made officer in charge of the principal repair factory. In all about 50,000 respirators were issued.

Army Pay Corps.—The Army Pay Department was one of the earliest in the army to substitute female clerks. In July 1915, 479 were working and by Jan. 1 1916 there were 4,556 female clerks and 13 lady superintendents. The engagement was a weekly one and there was no form of contract till Aug. 1917. By that time the demands made for women by the W.A.A.C. and other organizations were so insistent that a form of agreement to serve for the duration of the war and three months afterwards was signed by the superintendents and a portion of the women doing skilled and semi-skilled work. These wore a badge but no uniform, and by March 1918 there were 5,171 of them out of a total of 17,500. Miss Constance Holmes, lady inspector, was responsible for the welfare of the women under Sir J. T. Carter, " Accounts 2 " War Office, who was " at a loss to find words to adequately express his appreciation of the valuable work performed by the Women Clerks for the Army Pay Department during the war."

Army Remount Department.—Owing to the withdrawal of male personnel from Remount Depôts, women accustomed to hunting and to the superintendence of considerable stables of horses, were employed on remount work early in 1915. The first women's establishments were organized near Pangbourne by Mr. Cecil Alden, who worked on a contract basis for the War Office, employing what labour he chose. In 1915 he had 10 depôts for the stabling of 520 convalescent horses from veterinary hospitals in the vicinity of Aldershot, and half the depôts were staffed by women. They did the entire work from beginning to end, and horses were issued fit to units direct from their stables.

The next women's depôt was organized near Chester by Mrs. Rigby, and from these beginnings the employment of women spread until nearly 200 were working as grooms in 15 depôts directly under the Remount Department. The Charger depôt at Russley Park under Lady Birkbeck was the largest staffed entirely by women, and at Dr. Rimington's depôt near Chester women schooled horses rejected by their units as incurably vicious.

Navy and Army Canteen Board.—When the Navy and Army Canteen Board (then called the " Army Canteen Committee ") started operations in April 1916, only 20 women clerks were employed. During 1917 the Board's activities were enormously expanded to include catering for the Imperial Overseas Forces and for the American and Allied Troops. It was decided in March 1917 to institute a N.A.C.B. Women's Corps in mobile and immobile sections, and by the date of the Armistice the women employed in connexion with canteen organization in the mobile corps numbered 10,000 and the clerical staff in the immobile corps 2,000. After the Armistice 500 members of the Q.M.A.A.C. and 8 officers were transferred to the N.A.C.B. Women's Corps to carry on the work in France during the dispersal of British troops, and 120 went with the army of occupation to Cologne. Although the women wore uniform and were under the orders of the chief superintendent working under the Department of the Controller of the N.A.C.B., they were

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not enrolled. The written agreement signed had no binding force and they could leave when they liked.

In addition to these groups of non-enrolled women in the direct employ of the War Departments, there were at the time of the Armistice 5,000 civil service clerks working on Army Records, 10,000 clerks employed by the War Office, and 17,500 miscellaneous industrial workers belonging to the Hospital Labour Staff, and the A.S.C.

Women's Land Army.—In Jan. 1917, a Women's Branch of the Food Production Department of the Board of Agriculture was set up under Dame Meriel Talbot as Director and Mrs. Alfred (Dame Edith) Lyttelton as Deputy Director. Two appeals were issued for the Branch by the Women's Section of the Department of National Service in March 1917; the first appeal to women to join a mobile Land Army on a year's enrolment ultimately secured 45,000 recruits, of whom half had to be rejected on medical and other grounds; the second appeal to village women for their part-time services, under the organization of group leaders and forewomen in the Land Army, gradually trebled the number of part-time workers already on the land.

Arrangements for recruitment were subsequently revised, and a scheme of coöperation between the three Departments concerned (viz. Board of Agriculture, Women's Branch, Ministry of National Service and the Employment Department, Ministry of Labour) was adopted early in 1918. Under this scheme women were given a choice of enrolling for a year or for six months, and arrangements were made with the Women's Forage Corps, R.A.S.C. and the Forestry Corps, Timber Supply Department, Board of Trade, for their recruits to be dealt with by the same machinery. With regard to Scotland a Scottish Women's Land Army was formed on somewhat parallel lines in which 1,816 women were enrolled. In addition 6,860 unenrolled women were placed in agricultural work. The employment of women as part-time workers was also stimulated and organized, and it is estimated that there were in Sept. 1918 300,000 women part-time workers and 16,000 whole-time workers actually engaged in agricultural work in England and Wales. This triumph, in the face of innumerable difficulties and at the cost of an elaborate and expensive organization, was due to the combined efforts of the Women's Branch at Headquarters, and the Women's War Agricultural Committees. These Committees set up in each county by the Board of Trade in 1915 and 1916 acted as its agents and conducted the local administration of the Land Army by means of the 13,000 women who served on them in a voluntary capacity. Between March 1917 and May 1919, 23,000 women passed through the training centres. Returns relating to 12,657 women made in Aug. 1918 show the distribution of the types of work done: 5,734 milkers, 293 tractor drivers, 3,971 field workers, 635 carters, 260 ploughmen, 84 thatchers, 21 shepherds.

The workmanlike and becoming uniform of overall, breeches and leggings contributed largely to the success of the Corps.

Special steps were taken to supply workers for seasonal work in connexion with the fruit crops, flax weeding and pulling and potato picking; coöperation was established by the Employment Department of the Ministry of Labour with the National Land Service Corps, who by arrangement with the Board of Agriculture undertook the supply of educated women for holiday work.

The work being done for food economy in the villages by the Women's Institutes (which had been founded in England in 1915 by the Agricultural Organization Society on the model of those in Canada) was so important that a special section of the Women's Branch of the Food Production Department was formed in 1917 to undertake their propaganda. These Institutes bid fair to become a permanent feature of country life, and owe much to the increased interest in rural matters due to the widespread employment of women on the land during the war.

Women's Forestry Service.—The Women's Forestry Service under Miss Rosamond Crowdy was instituted under the Timber Supply Department of the Board of Trade in 1917. In 1916 a considerable number of women had been employed by contractors in the cutting and measuring of timber, but it was not till early in 1917 that the first two Government camps for training women in the felling and preparation of timber for sleepers and pitprops were opened by the Women's Section of the Department of National Service, acting as agents for the Timber Supply Department of the Board of Trade. The first Government training camp for timber measurers was started in Aug. 1917 at Wendover under Mrs. Donald, through which 370 educated women passed. They learned to measure and mark off where a tree should be sawn and find the cubic contents of the logs, and were afterwards put in charge of timber gangs consisting of 20 to 30 cutters. In some cases women had the entire charge of a saw-mill with men working under them. The two camps for cutters were given up, as it was found that training was unnecessary when the women were put out to work in gangs under skilled forewomen. Private employers were supplied with 144 such gangs for felling, cross cutting, marking and measuring of timber between 1917 and 1919. About 3,000 women were engaged on the work, and wore an appropriate uniform with distinctive badges.

The King's Thanks.—On June 29 1918, an address of homage was presented to the King and Queen on the occasion of their silver wedding by the Chief Woman Inspector, Employment Department, Ministry of Labour acting on behalf of the organizations of full-time women workers engaged on work of national importance under the control of state departments, and of whole-time women workers engaged in public utility services under local authorities. A procession of 2,540 women in uniform led by the V.A.D.s as the senior service, formed into six companies, eight abreast, facing the dais in the quadrangle of Buckingham Palace. Princess Mary stood by the King and Queen wearing her V.A.D. uniform. The King's reply to the address of homage contained the following words:—

"When the history of our Country's share in the war is written no chapter will be more remarkable than that relating to the range and extent of women's participation. This service has been rendered only at the cost of much self-sacrifice and endurance. Women have readily worked for long hours and under trying conditions in our factories and elsewhere, to produce the supplies of munitions which were urgently needed at the front and to maintain the essential services of the country. As nurses and V.A.D. workers they have laboured in hospital for the care of the sick and wounded with even more than the accustomed devotion which has characterized our Red Cross Service since the days of the Crimean War. They have often faced cheerfully and courageously great risks both at home and overseas in carrying on their work, and the Women's Army has its own Roll of Honour of those who have lost their lives in the service of their country. Some even have fallen under the fire of the enemy. Of all these we think to-day with reverent pride."

Only the women actually belonging to the Army, Navy and Air Force took part in the Peace Procession. The W.R.N.S. marched with the Navy and Q.M.A.A.C. with the Army. The Army Nursing Services, the V.A.D.s, the F.A.N.Y., and the Military Massage Service formed part of the R.A.M.C. contingent; the Women's Legion and the Forage Corps marched with the R.A.S.C.; and the W.R.A.F., incorporated with the R.A.F., brought up the rear.

III. *Voluntary Organizations.*—When war broke out there was an eager desire on the part of professional and non-professional women to work in France and Belgium. The passport restrictions were less stringent at first than they afterwards became, but it was never easy for women to obtain permission to work in France in connexion with the British armies. The French and Belgians, who had fewer trained women workers of their own, and were in greater need of help at the beginning of the war, accepted offers from organizations which the British authorities had rejected. Thus the privilege of undertaking the considerable amount of work actually performed by women in connexion with the British armies, even before the formation of the Q.M.A.A.C., had been won with difficulty and was highly valued.

In 1914 Rachel, Countess of Dudley (d. 1920), Lady Sarah Wilson, the Duchess of Westminster, Lady Norman and Lady Hadfield established hospitals for the British at the bases in France in which every bed was of value in the early days of stress. After a few months the army took over Lady Dudley's hospital as No. 32 Stationary; the Duchess of Westminster's became No. 1 Red Cross and Lady Hadfield's No. 5 Red Cross. In 1916, the units of Millicent Duchess of Sutherland and of Lady Murray, which had previously been open for the French, were accepted for the British as No. 9 Red Cross and No. 10 Red Cross. These voluntary units were staffed with Red Cross and St. John's nurses, who were encouraged to enrol in the Army Nursing Services when they had obtained a knowledge of active service conditions. Nursing V.A.D.s were employed from the beginning in addition to hospital orderlies. Princess Louise's convalescent home for nursing sisters was opened at Hardelot in 1914 by Sophie Lady Gifford under the British Red Cross Society, and transferred to Cannes in 1917 as a winter home for the sisters.

On Aug. 12 1914 Dr. Garrett Anderson and Dr. Flora Murray offered the services of a hospital unit staffed by women doctors and nurses to the French wounded. Within a week the offer was accepted, and within a month the unit, which was the first formation to be entirely officered by medical women, had collected sufficient funds and started for Paris, under the name of the Women's Hospital Corps. Owing to the pressure of work in the north at the end of Oct. Dr. Garrett Anderson and Dr. Flora Murray decided to divide their staff and establish a branch of the unit at Wimereux. This new hospital was accepted by the British Army Medical Service. In Feb. 1915 Sir Alfred Keogh offered the Women's Hospital Corps the charge of a military hospital in London which opened at Endell Street in May.

In 1916 85 women doctors were attached as civil military practitioners to the R.A.M.C. at Malta to help care for the 27,000 wounded in the hospitals. As this experiment proved a great success, 39 others were sent with R.A.M.C. units to Salonika, and in Jan. 1918, the first medical women, of whom there were ultimately 36, went to Egypt. Four women doctors were attached to British military hospitals in France. They did not wear a distinctive uniform, and none of the 331 medical women who served under the War Office at home and abroad held military rank.

Women belonging to the Red Cross organization worked at the British Red Cross Society headquarters in France, recruiting Red

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Cross nurses and tracing the wounded and missing. On Oct. 21 1914 the first V.A.D. unit, composed of 16 members and 2 trained nurses, under Dame Katharine Furse as officer in charge, arrived at Boulogne. On Oct. 26 they founded No. 1 V.A.D. rest station, Gare Centrale, Boulogne, in three French wagons and two passenger carriages and within 24 hours had given hot drinks to a thousand wounded from the first battle of Ypres. Under the Principal Commandant, Dame Rachel Crowdy, who succeeded Dame Katharine Furse in France, this work expanded in all directions until there were five rest stations for the feeding of patients on ambulance trains; two detention stations for the care of the personnel of veterinary hospitals and remount camps; six convalescent homes for nurses and W.A.A.C.s, and six motor convoys—all run and staffed by V.A.D.s. In Holland and Switzerland they were able to work for prisoners of war. In Salonika, Malta, Egypt and Italy they started kitchens attached to hospitals for the supply of invalid diets, and organized and staffed canteens for ambulance trains and convalescent homes for army nurses. In Italy they staffed motor convoys. At the beginning of the Gallipoli campaign two military hospitals went to Egypt without female personnel, on the assumption that they were destined for the peninsula, and had to depend on voluntary women helpers of all nationalities till trained nurses and V.A.D.s. could arrive.

Early in 1918 the British Section of the First Aid Nursing Yeomanry affiliated to the British Red Cross Society. This earliest women's military corps had been founded in 1909, and reorganized by Mrs. McDougall, in 1910, to assist the R.A.M.C. in time of war by providing mounted detachments with horse ambulance wagons, to take over wounded at clearing stations and convey them to base hospitals. When war broke out the services of the corps were offered to the British authorities without success, but were accepted by the Belgian army in Oct. 1914. With the ideal of working for the British always before her, Mrs. McDougall asked the War Office in July 1915 to reconsider the employment of women drivers of the F.A.N.Y. for driving motor ambulances at any British base. Although this was at first refused, renewed applications resulted in a F.A.N.Y. motor convoy starting work at Calais under Miss Franklin on Jan. 1 1916, for the transport of all British sick and wounded in the district. The F.A.N.Y. drivers were voluntary workers and supplied their own uniforms and traveling expenses; the Army gave rations; the British Red Cross Society kept up the ambulances, and in Aug. undertook complete financial responsibility in connexion with the cars. As a result of the success of this experiment, V.A.D. motor convoys were instituted in six other bases, and on Jan. 1 1918 the St. Omer convoy started work with 22 F.A.N.Y. drivers and 12 V.A.D. drivers under F.A.N.Y. officers. On May 18 1918 they worked through a particularly severe air raid and won 16 Military Medals in one night.

The great need for clubs where the army nurses and women workers could obtain rest and relaxation from hospital work was recognized by Princess Victoria early in 1915, when she formed a committee in London to finance such clubs at all hospital centres. The first was opened at Wimereux in Feb. 1915, and 10 others followed at Étaples, Camiers, Rouen, Le Tréport, Trouville, Calais, St. Omer, Abbeville and Paris. These clubs were a recognized unit under the administration of the Director-General Medical Services. In 1919 a club was also opened at Cologne. Lady Algernon Gordon-Lennox acted as Director in France and Germany.

The British army in France employed French labour for necessary industrial work such as the making of camouflage, repair of gas-masks and the salvage of clothing and war material. But in Jan. 1917 Messrs. Tarrants, who had a contract for building army huts, were allowed to send 100 trained women carpenters to Calais, where in collaboration with French female labour they made 37,000 huts. The women lived in a camp for two years under quasi-military discipline and were to a certain extent the prototype of the W.A.A.C.

On Nov. 4 1914 Lady Angela Forbes, who had a house at Étaples, started a free buffet for the wounded in the waiting-room of the Gare Maritime, Boulogne; this was the earliest of all the voluntary canteens provided for the British troops in France. In the following month Lady Mabelle Egerton opened her "Coffee Shop" at Rouen Station. From these individual efforts huts and canteens, maintained by authorized organizations, spread to every British camp in France. As time went on the authorities compelled the few privately conducted enterprises to affiliate to larger organizations. Lady Angela Forbes' original buffet became an Expeditionary Force canteen and her hut at Étaples was taken over by the Salvation Army; the Rouen Coffee Shop was affiliated to the Church Army in 1917; and in March 1918, by order of the Adjutant-General, only 10 voluntary organizations were authorized to work in the zone of the armies. These were the British Red Cross Society, the Y.M.C.A. and Y.W.C.A., the Salvation Army, the Church Army, the Scottish Churches Huts, the United Army and Navy Board, the Soldiers' Christian Association, the British Soldiers' Institute and the Wesleyan Soldiers' Institute. All these organizations had huts for men at the bases very largely staffed by women; but these were few in number compared to the huts and tents close behind the firing-line to which women could not go.

In Dec. 1914 Princess Helena Victoria formed the Ladies' Auxiliary Committee of the Y.M.C.A., to assist in providing recreation huts and reading-rooms for the troops in France and to send out concert parties. The Committee, under the chairmanship of Princess Helena Victoria, with the Countess of Bessborough (d. 1919) as hon. sec., selected the ladies to take charge of these huts, voluntary workers living at their own expense and signing on for four months' service. The work grew rapidly, until there were Y.M.C.A. huts, largely staffed by women, in all the bases in France, providing for the spiritual, material and educational needs of the men. Women workers were sent to Italy and Malta, and huts in Egypt and in Palestine as far north as Aleppo were also partly staffed by women. In 1918 the War Office gave permission for Y.M.C.A. huts to be opened in Holland for interned officers and men, and these were entirely staffed by the female relatives of the prisoners of war, a special fund being raised by the Association to pay the expenses of those who could not afford to travel and live at their own cost. Sixteen hostels for relatives of wounded in France were also staffed by women workers, of whom more than 1,860 passed through the Committee's hands for service abroad as canteen helpers, secretaries, librarians, motor-drivers, storekeepers, lecturers and teachers. In 1918–9 a certain number had their expenses paid, and the secretaries and motor-drivers received salaries.

The provision of entertainments was under the direction of Miss Lena Ashwell, the first concert being given at Harfleur on Feb. 8 1915; at one time there were 25 parties in France, giving concerts at the rate of 14,000 a year. In addition permanent concert parties worked continuously at 12 bases, and 6 theatrical parties were stationed at Paris, Havre, Abbeville, Dieppe and Étaples. Two concert parties went to Malta and a third to Egypt. £108,000 was raised for the work.

Although the hardships of camp conditions were ameliorated as much as possible for the W.A.A.C., the unaccustomed military discipline in a foreign country was trying in many ways, and the women badly needed the friendly help of an outside organization. In May 1917 Miss Ethel Knight of the Y.W.C.A. went to France under the auspices of the Y.M.C.A. to establish huts for them on the same lines as those which had proved so great a boon to the men. By the middle of 1918 there were 23 Blue Triangle huts in all the chief Q.M.A.A.C. camps, where the women could behave as though they were at home, and forget the discipline of army and camp life. Adjoining each there was a chapel or quiet room, but in the hut itself everything possible was done for the entertainment and recreation of the girls. Central clubs were also established in seven towns, and there was a rest-house at Le Tréport, a tea-garden at Havre and the Lady Carisbrooke marquee in the Q.M.A.A.C. rest camp.

Within 24 hours of the declaration of war Lady Bagot propounded her scheme that a hospital should be sent to the front manned and equipped by the Church Army. It was established at Caen under the French Red Cross. In Feb. 1915 the first of the Church Army recreation huts in France was opened at Rouen; these were staffed by voluntary workers, mostly women, who also paid their own expenses. About 500 altogether worked in Church Army huts in France and Germany.

A recreation hut for convalescent soldiers at the Colomn Camp, Boulogne, was opened by the Catholic Women's League under Mrs. Baynes in March 1915 and remained open until after the Armistice. Other huts in France followed. This was the only society which undertook concerted Catholic work on an organized plan during the war, though the Catholic Club, which had no organization or society behind it, maintained eight huts in the war zone staffed by 100 women and 18 men.

The Church of Scotland and the United Free Church of Scotland acted jointly, under the name of the Scottish Churches Huts, to carry on work similar to that of the Y.M.C.A. at the bases in France, up the line, in Malta and Egypt and in the Army of Occupation. The Salvation Army had a large organization to work among the troops, and women Salvationists laboured among Australian and American troops in huts in France, besides carrying on extensive hospital visitation and work amongst the homes of the bereaved in the United Kingdom.

The Women's Emergency Canteens, formed early in 1915 under Mrs. Wilkie with the idea of working for the French only, catered for the British also in the canteen opened at the Gare du Nord, Paris, in April 1915, which was a rendezvous for all Allied nationalities on leave. Early in 1917, when the Australians and Canadians visited Paris on leave in very large numbers, Miss Lily Butler opened a "Corner of Blighty," the pioneer leave club in Paris, to help them to spend their time as pleasantly and profitably as possible. Everything was given free of charge, and a staff of 45 voluntary women workers entertained 44,000 men in the first 10 months of the 2½ years for which the club was open.

Six months later the British Army and Navy Leave Club was opened and was the pioneer residential club in Paris for soldiers and sailors on leave. Baron D'Erlanger lent the house, and Miss Decima Moore and the Rev. A. S. V. Blunt were hon. secretaries. In the two years that it was open 59,102 men were registered and 701,546 meals were served. A body of uniformed Women Guides looked after the comfort of the men, and free entertainments on a large scale were organized.

As a result of the success of this club, the British Empire Leave Club at Cologne was originated and organized on the same lines by Miss Decima Moore, Hon. Director-General, who raised the funds

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with a London Committee under Baron D'Erlanger as chairman. Each department was conducted by a voluntary woman worker drawn from one of the proved women's war organizations, who wore the uniform of her society, and did her last piece of war-work for the British in an officially recognized institution opened at the invitation of the army.

IV. *Voluntary Work For Allies.—Scottish Women's Hospitals.*—On Aug. 12 1914 Dr. Elsie Inglis, president of the Scottish Federation of Women's Suffrage Societies, proposed that the Federation should equip a hospital "staffed entirely by women, if not required at home to be sent abroad." Within a week the War Office had declined the offer of a unit, and on Aug. 20 overtures were made to the embassies of Belgium, France and Russia. Mrs. Fawcett agreed that the N.U.W.S.S. should join in the appeal for funds, and by the end of the war £449,000 had been collected. In all, 14 different hospitals staffed entirely by women were mobilized and worked for the Belgian, French, Serbian and Russian armies. The first opportunity of service came when typhoid broke out in the Belgian army; on Dec. 5 1914 Dr. Alice Hutchison and Dr. Phillips, with 10 trained nurses, were put in charge of the typhoid annexe of Dr. de Page's hospital at Calais, where they worked for three months, until the epidemic had been overcome. On the same day the first complete unit under Dr. Ivens, consisting of 3 surgeons, 2 physicians, a radiologist, 10 trained nurses and as many dressers and orderlies, arrived in Paris on their way to the Abbaye de Royaumont, which had been allotted them by the French Red Cross. In this ancient edifice, founded by St. Louis, French wounded were tended by the Scottish women till Feb. 1919. An offshoot of the hospital, established at Villers-Cotterêts in huts in the spring of 1917, was evacuated before the German push on May 30 1918, being the last hospital in the district to remain at work. In both hospitals 10,861 patients were treated.

The Girton and Newnham unit worked uninterruptedly under the French War Office for four years. It went to Troyes in May 1915 with Dr. Louise McIlroy as C.M.O. and with Mrs. Harley (d. 1917) as administrator. As the hospital was entirely under canvas, it was ordered to accompany the French Expeditionary Force to Salonika in Oct. 1915, and went for a short time to Ghevgeli. The unit then settled down in Salonika for three years and opened an orthopædic department for disabled Serbian soldiers.

The remaining S.W.H. units worked for the Serbian army. The first went to Kragujevatz under Dr. Eleanor Soltau in Dec. 1914, and was the second British unit to arrive in Serbia in time for the typhus epidemic. With an equipment of 100 beds, Dr. Soltau had to take 250 patients immediately on arrival, and in March took charge of two fever hospitals as well. Three of the staff died of typhus. The next unit went out in May under Dr. Alice Hutchison to Valjevo, and was detained at Malta for a fortnight to look after British wounded from the Dardanelles, the one occasion on which a S.W.H. unit worked officially for the British army. By this time the typhus epidemic was over and a long peaceful summer intervened before the autumn invasion. The staffs of the two fever hospitals formed a camp hospital at Mladanovatz under Dr. McGregor, and Dr. Hollway with some sisters took over a Serbian hospital of 200 beds at Lazorovatz. Both these were evacuated at once when the storm of invasion broke out in Nov.; Dr. McGregor's party joined the great retreat through Albania; and Dr. Hutchison's party, with Dr. Inglis, who had come out to Serbia in May, remained working for the Serbs at Krushevatz, as prisoners of the enemy, from Nov. to Feb. 1916. The Austrians then sent them home.

In Aug. 1915 a party of Scottish women under Dr. Mary Blair had been sent to Serbia to reinforce Dr. Alice Hutchison's unit at Valjevo. As the invasion was pending they went to Salonika instead, to wait for work, and when it was decided that the Serbian civilian refugees were to accept the hospitality of the French Government at Corsica, this unit was invited to be in charge of the medical affairs of the colony. The hospital remained open at Ajaccio till April 1919 and treated 1,704 in-patients and 15,515 out-patients.

Among these were many of the Serbian soldiers who had accomplished the retreat through Albania, and after two months' rest were re-equipped to form a second Serbian army. A new S.W.H. unit, called the "America" unit, under Dr. Agnes Bennett, with a transport column under Mrs. Harley, was formed to accompany this army to Salonika. In Sept. 1916 they went to Ostrovo, to act as a casualty clearing station for the push to Monastir, and after the fall of the town a dressing station was opened at Dobreveni. The unit worked at Ostrovo till Nov. 1918, and then went to Vranja in Serbia, under Dr. Elmslie, till Oct. 1919, and coped with another typhus epidemic. Mrs. Harley, Gen. French's sister, left to do relief work in Jan. 1917, and was killed by a stray shell.

On her return from Serbia in Feb. 1916 Dr. Inglis spent six months in England trying in vain to obtain authority to take a unit to Mesopotamia for the British. Then the Serbian Government asked her to equip and maintain a field hospital, with a motor transport column attached, for service with the newly formed Serbian division, consisting of ex-Austrian subjects, who had allowed themselves to be made prisoners by the Russians and were attached to their army. The unit started in Aug. 1916 in charge of Dr. Inglis herself, with Mrs. Haverfield commanding the transport column, and went to the Dobrudja. They only had 19 days of work for the Serbs before becoming involved in the retreat of the Russian army, and while the Serb division was resting the unit worked for the Russian Red Cross. Once again they had to retire to Galatz, and then were helped by the British Armoured-Car Corps to get to Reni, where they were able to settle down for eight months and work for the Russians. An offshoot of the hospital under Dr. Chesney went to the Rumanian front. The Russian Revolution had meanwhile broken out, and the demoralization of the Russian army was so complete that Dr. Inglis was determined to prevent the Serb division from being sacrificed on that front in order to stiffen up the Russian *moral*. She sent two members of the unit to England to deliver a memorized message of 2,500 words to the Foreign Office, and, after pressure from the British Government, the Russians permitted the Serb division to go to Archangel, and the Admiralty sent transports to bring them to England. Although by that time Dr. Inglis was very ill, she insisted on waiting to return home with the Serb division, and as the first Admiralty transport was filled by the Russians with refugees, she had to wait for the second. They landed at Newcastle-on-Tyne on Sunday, and on Monday Nov. 27 1917 she died. The "Elsie Inglis" unit, equipped immediately after her death, left for Serbia in Feb. 1918, under Dr. Annette Benson, and worked at the first dressing station behind the lines during the Serbian offensive that preceded the Armistice. The transport column followed on the heels of the victorious army into Serbia.

Work for French and Belgian Armies.—At the beginning of the war the regulations affecting the entry of British subjects into France and Belgium were not strict, and as the British authorities discouraged voluntary offers, British organizations, individuals and groups of friends gave lavishly of funds, stores and the service of trained nurses to the French, Belgian and Serbian allies. Millicent Duchess of Sutherland had installed an ambulance of 8 trained nurses and a surgeon at Namur by Aug. 17, and by Aug. 24 they were all prisoners of the Germans. The British Red Cross Society sent out 12 parties of nurses to Belgium before the end of Sept., and 25 parties to different voluntary units in France before the end of the year, besides two parties to Serbia and one to Montenegro.

The second hospital unit to be officered by medical women only was organized by Mrs. St. Clair Stobart as administrator, under the name of the Women's Imperial Service Hospital, and left for Antwerp to work under the Belgian Red Cross Sept. 20 1914. It consisted of 6 doctors, 10 nurses and 10 orderlies under Miss Sally McNaughtan (d. 1916), who described the 14-days' work in *An Englishwoman's Diary of the War*. The wounded were evacuated just before the entry of the Germans. Within three weeks of their return the unit was re-formed and worked at Cherbourg until March 1915 under the French Red Cross.

Miss Sally McNaughtan had stayed behind at Ostend and joined the Hector Munro Ambulance Corps, a mixed body to which Miss May Sinclair, Lady Dorothie Feilding (the first woman to win the Military Medal), Mrs. Knocker and Miss Chisholm belonged. During this time of greatest hardship for the Belgian army the corps established a hospital at Furnes, to which ambulance drivers brought in wounded under fire. Early in 1915 Mrs. Knocker and Miss Chisholm left the corps and started a dressing station of their own at Pervyse, close to the Belgian lines, where they served the soldiers till both were badly gassed in their dug-out in April 1918. Miss Sally McNaughtan ran a portable soup kitchen for the Belgians in Furnes during the winter of 1914–5 and laid the seeds of the illness to which she succumbed in 1916. During this first winter of the war the Belgian army was in deplorable need of help, and Lady Bagot, who worked at Dunkirk in Nov. and Dec. 1914, dressing wounded at the station, raised funds to establish a transportable "Hospital of Friendship" at Adinkerke, which became the surgical section of the Hôpital d'Évacuation for the Belgian army. It was too close to the front for nurses to be allowed to work there, but Lady Bagot herself remained there for two years, before handing it over to the Belgian authorities. To meet the dearth of hospital requisites and clothing, Mrs. Bernard Allen started the Belgian Hospital Fund in Jan. 1915, which collected £25,000 in money and £25,000 in kind and aided 137 Belgian military hospitals and convalescent depôts in France and Belgium, and 30 colonies for refugee children, besides providing a club for soldiers, a recreation hut for the front, a hospice for refugees and 450 surgical outfits for regimental doctors.

During the battle of the Yser in Oct. 1914 the Belgian wounded poured into Calais, and Mrs. McDougall, of the First Aid Nursing Yeomanry, who had offered the services of the corps to the Belgian army, was asked to take over two old schools full of wounded as a hospital. There was no equipment, and the unit worked incredibly hard to produce a good military hospital out of nothing. The workers, with the exception of the trained nurses, paid all their expenses and subscribed to the hospital as well. From Nov. to Jan. 1915 they established a regimental aid post for the Belgians at Oostkerk, and during the height of the typhoid epidemic ran a convalescent home as an offshoot of the Lamarck hospital. The convalescent soldiers were drafted off in large numbers to the Camp de Ruchard near Tours, and there the F.A.N.Y. maintained a hut for them, with a canteen and cinema, and paid a trained nurse to look after the consumptives.

The motor-drivers originally belonging to the Lamarck hospital, who also conveyed the Belgian wounded from the clearing hospital

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to all the other hospitals in Calais, were officially attached to the Belgian Corps de Transport when the Lamarck hospital closed in Oct. 1916. This unit continued to drive for the Belgian army till after the Armistice and went with it to Bruges and Brussels. Belgian civilians who remained in the little strip of land not occupied by the enemy were in desperate plight too. King Albert's Civilian Hospital Fund was founded, by Mrs. Oliphant Murray and the Duchess of Buckingham and Chandos, to help Belgian state civilian hospitals abroad; the Belgian Canal Boat Fund, with Mrs. Agar Adamson as founder and Mrs. Innes Taylor as organizer in Belgium, fed and clothed 300 families in and about Furnes till June 1919; and the Belgian Front Relief Fund, under Miss Georgie Fyfe, evacuated 1,341 Belgian children from the war area into France and Switzerland, and repatriated them all at the end of the war, besides maintaining a maternity hospital at Vinckem for four years.

The work for the French was more extensive still. There were three Red Cross societies in France; the Société de Secours aux Blessés Militaires, the Association des Dames Françaises, and the Union des Femmes de France. As only the last named had a committee in London, a British Committee of the French Red Cross was called into being by the French ambassador towards the end of 1914, in order to allocate the services offered by British volunteers to the best advantage of all three societies. At the end of 1917 the Anglo-French Committee of the Joint War Committee, which had been formed in Jan. 1915 tc sift the credentials of British applicants for Red Cross work with the French, united with the British Committee. By this date 8,537 certificates had been granted to British volunteers for work in France. As the French army bore the brunt of the fighting for the first two years of the war their hospital problem was acute, especially as the nuns had left France before a sufficient number of nurses had been trained to replace them. To help fill the need, Miss Grace Ellison founded the French Flag Nursing Corps, which organized the supply of 250 British trained nurses, paid by the French Government, to help in the improvisation of the enormous number of French hospitals needed to cope with the rush of wounded. The Urgency Cases Hospital, a unit of first-class surgeons and 20 fully trained nurses, raised on the initiative of Miss Eden, hon. sec. of the National Union of Trained Nurses, went to Revigny in March 1915 to receive the worst cases on that section of the front. In July 1917 it was taken over by the British Committee of the French Red Cross. About 30 other units for the French were equipped by voluntary effort and staffed by British nurses and V.A.D.s, including Miss Bromley Martin's hospital at Arc-en-Barrois, the Johnston-Reckett unit at Ris-Orangis, Lady Sykes' hospital at Malo-les-Bains, the Michelham Foundation in Paris, the Ulster unit supported for two years by the Ulster Women's Unionist Council, the Martouret hospital and Ceret convalescent home of Mrs. Allhusen, the Sanatorium Beausoleil of Miss Lind-af-Hageby, Lady Eva Wemyss' hospital at Compiègne, Lady Guernsey's at Fécamp, Mrs. Symons' at Rimberlieu, Lady Tangye's at Paris Plage and others. In addition a large number of V.A.D.s worked in French hospitals and held positions of considerable responsibility.

The French Wounded Emergency Fund, which had branches throughout Great Britain for the making of comforts, was founded in Nov. 1914, with Miss Evelyn Wild as hon. sec., in order to give assistance to the French military and *bénévole* hospitals, as distinguished from the auxiliary hospitals run under the three French Red Cross societies. In May 1916, 2,755 French hospitals were classed as military, 1,552 as *bénévole* and 1,225 as auxiliary. By March 1918 the Fund had helped military hospitals in 1,200 different French towns, and £163,000 had been raised in money, and £75,000 in kind. Canteens were also established in many of the military hospitals. The French authorities placed a devastated sector on the Somme under the care of the Fund, and after the Armistice much work was done in the devastated areas.

On the closing of the Lamarck hospital at Calais the F.A.N.Y. transferred their personnel to staff a hospital for the French at Port à Binson, Marne, which opened in Jan. 1917. In the summer of 1917 the Corps began supplying ambulance units for the French army. There were finally three: S.S.Y.2, S.S.Y.4, and S.S.Y.5. The F.A.N.Y. officer commanding each unit held official rank in the French army as an officer. After the Armistice the S.S.Y.2 drivers were the first women to go into Germany with their ambulances to bring back prisoners of war. The Hackett-Lowther ambulance unit of women drivers under Miss Toupie-Lowther was attached to the second Army Corps of the 3rd French army in 1918 as S.S.Y.3. This was the only women's unit allowed to do front-line work; the cars were sent to the advanced " postes de secours," and the entire section was mentioned in despatches, which carried with it the right to have the Croix de Guerre painted on their ambulances. During 1919 the women's convoys did civilian relief work in the devastated areas.

The Women's Emergency Canteens, an independent Society under Mrs. Wilkie, and an offshoot of the Women's Emergency Corps, started a canteen at Compiègne in Feb. 1915 with a recreation room, which was the first of its kind. Another canteen was opened for four years at the Gare du Nord, Paris, with 60 beds attached, which was used by British and Allied soldiers, and all Belgians were fed free there for two years. Other smaller canteens were run for a time as offshoots of the one at Compiègne.

Canteen work under the " Oeuvre de la Goutte de Café " started by M. Duquesnoy early in the war, absorbed a very large number of British women workers, who were selected and sent out to France by the British Committee of the French Red Cross. The canteens were of four types, those at railway stations; those at *foyers de cantonnement* or recreation rooms attached to rest camps; those for the provision of invalid diets at *depôts d'écloppés*, and those at *depôts d'isolés* for men rejoining their regiments. The earliest railway canteen was opened at Hazebrouck in Feb. 1915, and moved to Doullens, where the work was very heavy during the Somme offensive; thousands of wounded from Gommecourt came through in a few days, and the helpers were sometimes working for 19 hours at a stretch. Many of the canteen workers had narrow escapes during the German push of 1918, when they had to evacuate suddenly with the Germans on their heels. A large number of the helpers were elderly women who worked extraordinarily hard, paid all their own expenses and faced all the hazards of war.

Work for the Serbian Army.—The first British women who worked for Serbia during the war left London with Madame Grouitch, the American wife of the Serbian minister at Nish, on Aug. 12 1914, and went to the Serbian 1st reserve hospital at Kragujevatz; the hospital material was exhausted in a few months, and it was as a result of the pitiful stories that reached home from this band of women that the Serbian Relief Fund was formed. Miss Flora Sandes and Miss Emily Simmonds, who belonged to the original party, raised a private fund, took out 108 tons of hospital material to Valievo in Jan. 1915, and nursed typhus in a Serbian hospital, doing operations and dressings for 12 hours a day, till both caught the disease.

The plight of Serbia during the first winter of the war, harried first by the Austrian invasion and then by the typhus epidemic, was so terrible that hospital after hospital was sent out from Great Britain by the Serbian Relief Fund, the British Red Cross Society, the Wounded Allies Relief Committee and the Scottish Women's Hospitals. All these took out trained nurses and many had women doctors, but, with the exception of the Scottish Women's Hospitals, the only two units under women administrators were financed by the Serbian Relief Fund. The first Serbian Relief Fund surgical unit under Lady Paget, the wife of Sir Ralph Paget, who became the British Commissioner for Serbia in 1915, reached the country in Nov. 1914 before any of the others, and did heroic service at Skoplje under appalling conditions. From Nov. to Jan. there was an unending stream of Austrian and Serbian wounded and in the second half of the month the typhus epidemic assumed serious proportions. Lady Paget, who had previously worked in Serbian hospitals in Belgrade during the Balkan wars of 1911 and 1912-3, organized a typhus colony in collaboration with the British Red Cross Society unit, for the isolation of the cases, which opened on March 1. Very few nurses could be spared from the surgical hospital, as over 90% of the staff were off duty for sickness between Nov. and February. Lady Paget herself, two sisters, two doctors, some Serbian voluntary assistants and Austrian prisoner orderlies coped with beds at the colony for 300 typhus patients. Between March 6 and 24 sixteen workers went down with the disease, including Lady Paget, and for a week one sister remained in charge of 300 patients. Then she was relieved by four nurses from the second Serbian Relief Fund unit (Lady Wimborne's). By May the epidemic was overcome and not a case left in the town.

Plenty of hospitals had arrived in the country by this time and, as there had been no fighting since Dec., the surgical units found themselves with little to do. Mrs. St. Clair Stobart, who commanded the 3rd Serbian Relief Fund unit, which was entirely staffed by women, landed in Serbia in April 1915, and at once began to utilize her medical personnel for the far greater needs of the civil population. She put up a wayside dispensary by the hospital camp, where 12,000 people were treated in a few weeks, and established six others in country districts during the summer. At the end of Sept. the Austrians, Germans and Bulgarians began massing on the frontiers and Mrs. Stobart was invited to accompany the Serbian army to the front with a part of her unit as a flying field hospital. They moved forward for a few days, but on Oct. 17 the great retreat of the Serbian nation began, and thousands of people trekked for three months over the Albanian mountains down to the sea at Scutari. Mrs. Stobart rode at the head of her column all the way, for 800 m., and brought it through intact.

Lady Paget with all her staff decided to remain with the hospital at Skoplje and allow themselves to be taken prisoners by the Bulgarians, in order to continue to care for the Serbian wounded of their own hospital and of the other hospitals abandoned by their staffs. She was allowed by the Bulgarians to distribute the hospital stores of food and clothing to all destitute refugees irrespective of nationality. Early in Dec. the Germans arrived, and in Feb. permission was given for the unit to leave the country. Lady Paget had accomplished the purpose for which she had stayed, having been able to superintend the distribution of all the stores and money.

Miss Flora Sandes, who was in England when the Bulgarians declared war, went back at once, and was officially attached to the ambulance of the 2nd Infantry Regiment. When the retreat began, the Commandant of the Division told her that her presence would encourage the soldiers; so, as the ambulance could not travel, she enlisted in the 2nd Infantry Regiment as a private and retreated through Albania with the Serbian army. When the army was

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re-formed she was promoted corporal, sergeant, and lieutenant; and went through every engagement with her regiment till she was wounded; she returned again to the front and was not demobilized till 1919. Whilst on active service, in coöperation with Mrs. Haverfield, she organized a Comforts Fund for the Serbian soldiers in the trenches, and raised money for the Sandes-Haverfield canteens, which worked directly under the Serbian army.

Work for the Russian Army.—In Sept. 1915 a British Committee, with Lady Muriel Paget as hon. sec., raised funds to equip an Anglo-Russian hospital for work under the Russian Red Cross Society. The hospital of 200 beds was formally opened in the palace of the Grand Duke Dmitri at Petrograd in Feb. 1916 in the presence of the Empress and a brilliant company. At the beginning of May, during the offensive of Gen. Brussilov a field hospital of 100 beds was attached to the Russian Guards, with a motor ambulance column of 22 ambulances: the Anglo-Russian hospital also took charge of 120 beds in a Russian hospital at Lutsk, providing the nurses and doctors. Over £100,000 was raised. Mrs. Wynne, an original member of the Hector Munro Ambulance Corps in Belgium, took a unit of motor ambulances to Russia in 1915, and was attached to the First Caucasian ambulance unit on the Persian front. The conditions proving too rough for her 50 H. P. cars, she transferred them to the column of the Anglo-Russian hospital. The Revolution put an end to the work, and Lady Muriel Paget and her staff had to travel home *via* Siberia and Japan, taking a month to cross Siberia in a third-class carriage.

The N.U.W.S.S. raised the Millicent Garrett Fawcett Maternity unit for work among the Russian refugees at a cost of over £12,000, and the Great Britain to Poland Fund, and the Polish War Victims Relief Committee worked as long as political circumstances permitted for the Polish refugees.

Work for the Italian Army.—Soon after Italy joined the Allies in May 1915, the British Committee in aid of the Italian wounded raised funds to finance the first unit of the British Red Cross Society in Italy, which arrived on the Isonzo front in Sept. 1915. A field hospital at Villa Trento, staffed by British sisters and V.A.D.s under the Joint War Committee, broke down the Italian rule against employing women nurses at the front.

In Dec. 1915 Lady Helena Gleichen and Mrs. Hollings, who had been trained as X-ray operators and had raised private funds to purchase motor-cars fitted with X-ray apparatus, were attached as a radiographic unit to the 6th Army Corps of the 3rd Army. The British Red Cross Society provided additional staff and cars. After six months they were attached to the headquarters staff of the 2nd Army and were present at both battles of Gorizia. Between Dec. 1915 and Oct. 1917, 12,600 X-ray examinations were made.

Mrs. Watkins, who raised her own funds for two years, and was helped by the British Red Cross Society, went to Italy in Sept. 1915 with a staff to set up station canteens for the hospital trains at Cervignano and San Giovanni Manzano, the railroads on the Isonzo front. In July 1917 she undertook the feeding of the wounded in the clearing station of Dolegna, and during Aug. an average of 1,600 wounded were dealt with in 24 hours. It was due to her initiative that the first recreation hut for soldiers of the 2nd and 3rd armies was opened by the Italian army in the spring of 1916. Mrs. Watkins and her helpers undertook the organization of 14 others, which proved so successful that the Supreme Command took up the idea and were building 100 huts just before the retreat of Oct. 1917. Mrs. Wynne, on her return from Russia, worked with her motor ambulances for the Italian Red Cross.

V. *Voluntary Effort in Supplies, Etc.*—The outbreak of war found voluntary effort for the fighting forces entirely unorganized, apart from the Regimental Associations in connexion with the regular battalions of the regiments comprising the pre-war army. The British Red Cross Society and Order of St. John were the only organizations that supplied hospital requisites for the sick and wounded. These could obviously not expand sufficiently fast to meet the new needs, and Queen Mary's Needlework Guild, with Lady Lawley as hon. sec., came into being on Aug. 10 1914, with the more general object of "organizing a collection of garments for those who will suffer on account of the war." The King and Queen and Princess Mary gave the lead in promoting funds to send a present for Christmas 1914 to every person wearing the King's uniform and to every nurse at the front, and Queen Alexandra presented each nurse in the regular army nursing services in France with a fur-lined cape, hood and muff.

It is estimated that the value of goods in kind presented to soldiers and sailors by voluntary effort in the first year of the war was £5,000,000, and funds were formed to collect in bulk such articles as air pillows, Christmas puddings, gloves, handkerchiefs, hot-water bottles, Bovril, letter cases, razors, respirators, "tubs for Tommies," periscopes, field glasses, wire cutters, sandbags, matches, cigarettes, tobacco, mouth organs, hospital bags, walking sticks and eggs. Some of these funds continued till the end of the war. The National Egg Society provided over 44,000,000 eggs for hospitals in four years. Lady Smith-Dorrien's Hospital Bag Fund distributed over 2,500,000 bags before Jan. 1 1918; Lady Roberts' Field Glass Fund produced on an average 300 field glasses a month; Miss Gladys Storey's Bovril Fund sent Bovril to all the fronts throughout the war; the Glove Waistcoat Society made 55,000 windproof waistcoats out of old gloves, and John Penoyre collected over 100,000 sweaters. By the sale of worn-out silver thimbles and oddments of silver and gold, the Silver Thimble Fund under Miss Hope Clarke raised over £60,000 and provided 15 motor ambulances, 5 motor hospital launches 2 motor dental surgery cars, besides large donations to the Red Cross and other funds for soldiers and sailors. The Vegetable Products Committee for naval supply under E. Jerome Dyer despatched 50,000,000 lb. of vegetables to the fleet, estimated in cash value at £1,250,000. Every town had its own fund to send parcels to prisoners of war, and the packing was done by voluntary women workers.

Outstanding private comforts funds were those started by Lady French and Lady Jellicoe, which closed down at the end of the first winter campaign, when the needs of the army and navy were for the moment satisfied. The one comforts fund inherited from the Boer war was Queen Alexandra's Field Force Fund, which opened in Oct. 1914, with Mrs. William Sclater, who had organized it in S. Africa, as hon. secretary. Gifts were sent out in response to definite requests from commanding officers, and by the Armistice over £80,000 had been raised.

The universal desire to make something for the man on active service caused a multitude of uncorrelated work parties to spring up all over the country, and it was clear that before the second winter campaign some general scheme of coördination was essential if the best use was to be made of the energy and enthusiasm of a vast band of voluntary needle workers. In Sept. 1915 the department of the Director-General of Voluntary Organizations, with Sir Edward Ward as Director General, was formed as a branch of the War Office, without funds, to establish county, city, borough, and district associations throughout Great Britain under which it was proposed to affiliate existing voluntary bodies. The organization dealt with supplies to combatants and to men in military hospitals. Regimental organizations were recommended to continue and extend their work, and the Joint War Committee and Queen Mary's Needlework Guild were recognized as separate and independent organizations.

From Aug. 10 1914 till Feb. 1919 St. James' Palace was the collecting centre for the 15,500,000 articles that were sent in by the members of Queen Mary's Needlework Guild all over the world. Six hundred and thirty branches with a membership of 1,078,839 persons were formed in Great Britain alone. The need for hospital dressings had been realized early and the first Surgical Branch Depôt was started by Miss McCaul in 1914, with Mrs. Gibson as general manager; this became the Central Surgical Depôt of the Guild, which sent 11,000,000 articles direct to Allied hospitals and hospital ships. The first orthopædic branch was the Surgical Requisites Association started at Mulberry Walk, Chelsea, which became the central orthopædic branch of Q.M.N.G. with 1,000 members and 44 branches. This depot was a centre of instruction for all the institutions engaged in orthopædic work, owing to the inventions made by the workers. Elinor Hallé first utilized papier-mâché as a material for arm cradles, and then devised a light boot, with a papier-mâché back, for drop foot, which was in such great demand that centres were opened for making them throughout France and Italy as well as in Great Britain and India. A Papier-Mâché Surgical Appliances Department at Simla had 11 branches.

A process of making the papier-mâché waterproof for baths by using a cuprammonium solution of cotton wool instead of paste for the final layers of the papier-mâché, was invented by Miss Acheson. This medium was adapted for splints, and permission was obtained for voluntary workers to visit the military hospitals and take plaster casts from the limbs of the patients, on to which the splints were moulded, so that the utmost amount of pressure could be brought to bear without causing pain. This method of making splints for special cases became generally adopted by other depôts. Many elaborations of the splints were invented by Mrs. Sanyer Adkin; in the words of Sir Robert Jones, the department was an "inspiration."

The Red Cross and St. John's working parties were recognized as a distinct body under the Joint War Committee. They continued as before primarily to supply the auxiliary and voluntary hospitals, and sent their surplus to the military hospitals when asked to do so by the D.G.V.O. During the war 2,823 workparties were registered at the Central Workrooms at Burlington House, which were established in Oct. 1915 to coördinate the work. Over 30,000,000 articles were produced by the branches; 540,000 gifts were contributed by the 1,617 registered home workers, and 800,000 things were made by the 1,202 members of the Central Workrooms. The independent bodies of workers not belonging to Queen Mary's Needlework Guild or to the Joint War Committee were dealt with by the D.G.V.O., who invited the workparties to assemble their workers into groups covering certain areas under the Army Council's scheme. The comforts were issued to combatants through a "Comforts Pool" in each theatre of war, and to military hospitals according to the demands of the officers commanding hospital units. A total of 88,000,000 articles of clothing and surgical comforts estimated at a

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value of £5,000,000 were supplied to combatants, patients in military hospitals, allies and prisoners of war, by the 267 recognized head associations, composed of approximately 400,000 workers, grouped into 2,983 branches, all financially independent. These ranged from bodies of village women and shop girls to factories like the Belgravia War Hospital Supply Depôt and the Kensington War Hospital Supply Depôt; the latter with an average daily attendance of 1,200 workers turned out 6,000,000 articles, making a speciality of elaborate orthopædic appliances. A number of men did valuable work in the woodwork annexes of the depôts.

In addition to comforts made by hand the D.G.V.O. sent out 232,599,191 cigarettes, 256,487 lb. of tobacco and 62,193 games. The supply of books to the troops was in the hands of Dame Eva Anstruther, who had established the Camps Library in Oct. 1914 (afterwards affiliated to the D.G.V.O.) and despatched 16,000,000 books and magazines to fighting men. The War Library, run by Mrs. Gaskell and Dr. Hagbert Wright under the British Red Cross Society, furnished 6,000,000 books to the hospitals.

The provision of artificial teeth and dental treatment for soldiers and sailors was undertaken by the Soldiers and Sailors Dental Aid Fund under Miss Banister Fletcher. When it was founded in Dec. 1914 there was no arrangement for the supply of dentures to soldiers; but from March 1915 onwards the War Office gave a grant to meet the cost of treatment for their own men, and in Nov. took over the work. The Fund was reconstituted later under the name of the Ivory Cross, to provide treatment for discharged service men, for Home Army men and for the mercantile marine.

Ten thousand people, mostly women, worked in 1918 for the welfare of soldiers on leave in the London area alone, under the control of the General Officer Commanding the London District. In that year 3,068,135 men, 232,495 officers and 28,450 cadets were accommodated in rest houses in London. The Maple Leaf Club, the Victoria League Club and Peel House (started by Mrs. Moncrieffe and Mrs. Graham Murray) had been opened as residential clubs for the Overseas forces in the autumn of 1915, on the same lines as the Union Jack Club, founded as a memorial to the men who had lost their lives in the Boer War. Motor volunteer corps, such as the Motor Transport Volunteers, the Y.M.C.A. Baltic Night Transport, and the Women's Reserve Ambulance (Green Cross Corps) drove nearly a million men from station to station in 1918, and 8,000,000 men were fed at the free buffets at Victoria, Paddington, London Bridge, Liverpool Street, Euston, Waterloo and Charing Cross the same year. These buffets were maintained and staffed in night and day shifts entirely by women voluntary workers, and 12,000,000 men were fed during the war at Victoria station at a cost of £60,000. Similar buffets were organized at the big junctions in the provinces, such as Preston. It is impossible to estimate the additional number of women who worked throughout the country in canteens for soldiers in training and on home service.

Parallel with the supply of tangible comforts such as food and clothing went the provision of entertainment for men in camp and patients in hospital. The "Music in War Time" committees, subsidized in part as relief work for musicians by the Professional Classes War Relief Council, gave 15,000 concerts in hospitals and camps at home, 2,000,000 wounded soldiers being entertained in the Manchester area alone. Individuals and organizations such as the Y.M.C.A. at home, the Lena Ashwell concert parties at the front, the Three Arts Club and the Soldiers Entertainment Fund, did the same work.

The labour of the nursing staff in hospitals was lessened by the organizations which provided drives for the wounded, free bus rides and river trips, and arranged for the visitation of patients and the teaching of handicrafts. The friendships formed in hospital led to voluntary after-care work for the disabled. (For a list of funds, associations and societies for the assistance of service and ex-service officers, men, women, and their dependents, see 114/Gen. No. 6198, compiled by the secretary C.3 department, War Office.)

The Auctioneers and Estate Agents Institute of the United Kingdom bought the Star and Garter Hotel, Richmond Hill, as a home for the totally disabled in 1915 and presented it to Queen Mary; a sum of £224,000 for the building was raised by the British Women's Hospital Committee under the chairmanship of Dame May Whitty as a tribute from the women of the Empire.

VI. *Work for Belgian Refugees in Great Britain.*—In Aug. 1914 the gaze of the Allies was focussed upon Belgium, where one of the greatest tragedies of history was being enacted. After the first accounts of the German atrocities perpetrated at Visé and Liége, but before the extent of the German invasion of Belgium was foreseen, it occurred to Lady Lugard that a large number of Belgian women and children might be brought to the protection of English hospitality, by means of the organization recently improvised in Ulster for the removal of Irish women and children from the area which in July 1914 threatened to become a theatre of war. Preparations on these lines proceeded, with the coöperation of Ulster, the Catholic Church, the Foreign Office, the Local Government Board and the Belgian Government. Meanwhile the situation in Belgium was becoming more acute, and on Aug. 22 an official of the Exhibitions Branch of the Board of Trade, who was in Belgium on business, announced to Lady Lugard that he hoped to arrive from Ostend on the 24th with a transport carrying from 100 to 1,000 Belgians. Within two days the War Refugees Committee was formed to provide for them, mainly by the exertions of Lady Lugard and Mrs. Alfred Lyttelton. Lord Hugh Cecil became chairman and Viscount Gladstone treasurer. The response of the first appeal in the press brought offers of private hospitality for 100,000 persons, and not one of the refugees who poured into the country in an increasing stream was left without food, lodging and a warm welcome from the 500 volunteers who at first did the work. But the Committee was not rich in funds. A large proportion of the money, subscribed in England for the Belgians, went to the Belgian minister's fund for Belgian relief, which was earmarked to be spent upon the Continent. £106,500 was subscribed to the War Refugees Committee, and this had to be conserved for the expenses of organization, and for emergency relief. It was soon obvious that a national exodus could not be dealt with by private effort alone. In the House of Commons, on Sept. 9, Mr. (afterwards Sir) Herbert Samuel, then President of the Local Government Board, offered the hospitality of the British nation to Belgium, and from that day a department of the Local Government Board, under Sir Frederick Willis, worked in close relation with the War Refugees Committee. At first the Belgians had been received in refuges improvised by the War Refugees Committee; but it was then arranged that the Local Government Board should provide accommodation for the refugees in London and should superintend their reception at the ports and bear the cost of their transport. The War Refugees Committee was to allocate the refugees to private hospitality and organize the transport.

The Women's Emergency Corps had provided a body of interpreters to meet trains early in Aug. and did valuable work for the Belgians of the middle and upper classes who were able to pay their way temporarily. The greatest rush occurred during the week after the fall of Antwerp, when 26,000 refugees arrived at Folkestone and were welcomed by the local committee; 2,000 a day were dealt with in London by the allocation department of the War Refugees Committee under Dame Victoria Samuel (Mrs. Gilbert Samuel), and 6,000 a day by the transport department under Mr. H. Campbell. The occupation of Ostend by the Germans on Oct. 17 closed the Belgian coast, and all refugees arriving in England after that date came by way of Holland, and in far smaller numbers.

The early refugees had borne the first onslaught of German fury, and families arrived separated from each other and with no material possessions whatsoever. British women, protected from the same fate by the sea, and with few opportunities at that time of helping actively with other war work, poured out money and sympathy lavishly on the Belgians. By Jan. 1915, it was estimated that private hosts had spent £2,000,000 on hospitality. The central register of refugees compiled under the Registrar General's Department showed that 265,000 refugees arrived in England; they cost the Government approximately £3,500,000; but the total spent on them by private hosts and local committees was estimated in 1917 as at least £6,000,000. Over 6,000 Jews were cared for at the cost of the Jewish community in London. 2,500 local Belgian relief committees, of which about 1,500 were really effective, were formed in Great Britain, to which the refugees, after spending a few days at the Government refuges, were allocated by the 100 voluntary allocators of the War Refugees Committee; by the allocators at the office of the Belgian consulate, working in the same building; as well as by the Catholic Women's League and the Women's Emergency Corps. Four large refuges holding 8,000 persons, at Alexandra Palace, Earl's Court, Edmonton and Millfield House, were managed for the Local Government Board by the Metropolitan Asylums Board, and during the period of the greatest rush several boards of guardians lent other buildings. Edmonton and Earl's Court through which 100,000 refugees passed, remained open till the end of the war.

When the local relief committees, originally organized by the Earl of Lytton, had received their refugees from headquarters, they worked in complete independence. The Glasgow Corporation Belgian Refugee Committee under Mr. Alexander Walker acted as a central authority for receiving and distributing refugees all over Scotland. The Scotch committees raised £360,000. Liverpool, Manchester, Birmingham and Exeter, to mention only a few, looked after many thousands of refugees each. The university of Cambridge invited professors and students from the four Belgian universities to come into residence and organized lectures for them and hospitality for their families. The Chelsea Committee, with Mrs. Erskine Childers as hon. sec., started industries for the refugees on a large scale, and spent £72,000 of English and American money. The National Food Fund and the Belgian Refugee Food Fund, with the substantial assistance of the Smithfield Markets Belgian Relief Fund (which divided gifts of meat between the two funds), supplied an allowance of free food to hostels and Belgian households in London; this made it possible for a large number to do without other financial assistance.

In Jan. 1915, owing to the natural drying up of the sources of private hospitality, the Government undertook to make grants in aid to refugees when private offers were not available, and in this way wholly or partially maintained an average of 6,500 persons till May 1919. In Nov. 1915 it took over the cost of the staff of the War Refugees Committee. When this organization took definite shape, it consisted of a staff of 400 paid workers, who by degrees assumed the places of the original volunteers, though some of these

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continued to give their services till the end of the war. Lord Gladstone was chairman of the managing committee and Mr. Algernon Maudsley, who had assisted the committee from the earliest days of the war, hon. secretary. The health department, which made provision for chronic, maternity, convalescent and dental cases all over the country, was organized by the Countess of Sandwich in Oct. 1914 and afterwards by Dame Victoria Samuel. Viscountess Gladstone was at first in charge of the education department, and Mrs. Alfred Lyttelton of hostels and flats for the use of refugees passing through London. Mrs. Henn Collins and Mrs. A. S. Webbe looked after undesirables and organized rescue work.

In the first months of the war, owing to unemployment at home and to the feeling that the Belgians might soon be able to return to their own country, the refugees were discouraged from seeking paid work. But when this policy was reversed, it became the chief duty of the relief committees to help their guests to find employment. During 1915 factories for the manufacture of war material, established by the initiative of the Belgians themselves, were staffed with Belgian labour, and 65,000 refugees obtained work through the labour exchanges. Ultimately, nearly all the refugees, except those of the professional classes, were absorbed into the economic life of the country. This did not mean that they were all entirely self-supporting, owing to the high rent of furnished rooms and to the difficulties besetting exiles in a foreign country. Lady Lugard's hospitality committee and the Duchess of Somerset's housing committee established hostels for the propertied and professional classes, where the Government allowance was supplemented by a private fund. A scheme for assistance with the rent of furnished flats in London on a large scale, devised by Mrs. Alfred Lyttelton, proved an immense boon to all classes of refugees.

In the first week of Oct. 1914, the Wounded Allies Relief Committee organized the transportation of the first wounded soldiers from Belgian hospitals to England. Auxiliary V.A.D. hospitals, mobilized, but not at the time needed for the British, opened with enthusiasm to receive the Belgians. 40,000 wounded soldiers came to England, many to return shortly to the front. The first of the five King Albert military hospitals, established in England by the Belgian Government, opened at Highgate in Dec. 1914. By degrees the seriously wounded were concentrated in this hospital, which remained open till 1919, and the discharged drafted to a Belgian reëducation camp in France.

Owing to the large number of refugees in England, the Belgian soldier at the front had to be helped to spend his leave with his relatives. The Local Government Board, from Jan. 1916 onwards, bore the expenses of his journey; a special channel service transporting 300 men a day was organized; the transport department of the War Refugees Committee under Mr. H. Campbell arranged the distribution of 185,000 men to their families, and the British Club for Belgian Soldiers was opened from voluntary sources as a residential club for men without friends or relatives.

Gradually much help was organized for their compatriots by the refugees themselves. A "Union de Comités" under M. Émile Vandervelde, Ministre de l'Intendance de l'Armée Belge, which had its headquarters in London, coördinated the work of approximately 20 Belgian funds chiefly for Belgian soldiers. Mme. Edmond Carton de Wiart, Mme. Maton, wife of the Belgian military attaché in London, and Mme. Pollet, wife of the consul-general for Belgium, took a prominent part in the charitable activities of the Belgian community.

During four and a half years of exile the Belgians grew to feel at home in a strange land, and when the time for repatriation came, many were loth to go. The expenses of repatriation were borne by the British Government at a cost of £243,000 and in Oct. 1920 a monument was erected on the Thames Embankment from a fund raised by the ex-refugees themselves, in memory of their exile in Great Britain during the war. (A. E. C.)

United States

When the United States entered the World War in April 1917, but one organization depending mainly on the efforts of women was officially recognized by the Government: the Red Cross. On May 6 1917 the Red Cross had 562 chapters with a membership of 486,194. At the signing of the Armistice, it had more than 3,500 chapters and upwards of 8,000,000 regular volunteer women workers. These women produced in 20 months over 371,000,000 relief articles, including surgical dressings, garments for the wounded and the refugees, and a variety of comforts and conveniences for soldiers and sailors. The value of their output was about $94,000,000. The Red Cross enrolled during the war 23,822 women as nurses. They served in the military and naval hospitals in the United States, Europe, and the Near East, as well as in convalescent homes for soldiers and sailors and in relief work for adults and children both in the United States and overseas. They worked in 700 Red Cross canteens in the United States and 130 in France, serving refreshments to moving troops, giving them medical care, transferring them when sick, and in other ways aiding and cheering them.

When war was declared many large national organizations of women applied to the Government for instructions. The Council of National Defense appointed at the end of April 1917 a committee of nine women (afterwards increased to eleven) with Dr. Anna Howard Shaw as chairman, to form a plan by which the women of the country could be utilized. This committee selected a woman in each state as a temporary chairman, requesting her to call together the heads of all national organizations of women in her territory to elect permanent officers for a state division. This state division was in turn to organize county committees and each county was to form a division in each city and town. This work of organization was carried on so rapidly that by Dec. 1917 the county organization was complete in 23 states, and a year later there were county chairmen in more than 80% of all the counties in the country. Seventy-three different national organizations of women coöperated. Through these divisions it was possible to convey at once to practically all of the women of the nation the requests of the Government.

The plan of work which the women's committee laid out included the following departments: (1) registration for service, (2) food production and home economics, (3) food administration, (4) women in industry, (5) child welfare, (6) maintenance of existing social service agencies, (7) health and recreation, (8) educational propaganda, (9) Liberty Loan work, (10) home and foreign relief. The specific tasks for these departments originated either in requests or suggestions of the Government or in plans made by the committee itself and approved by the Government. Two months after the women's committee was created it was requested by the Government to enrol the women of the country in a league to support such plans for food conservation as the food administration might present. In a few weeks 5,223,850 pledge cards were signed. The signers were the nucleus of a women's food army which, throughout the war, responded to every request for the conservation, substitution or production of foods made by the food administration. Throughout the war, the women's committee continued to serve the Government in similar drives. For some months the committee gave active assistance to the national women's Liberty Loan Committee created by the Secretary of the Treasury, and in 1918, at the request of the agencies responsible for furnishing nurses to the army, including the Red Cross, and the surgeon-general's office undertook a campaign to enrol students for the U.S. student nurses' reserve. While 5,000 student nurses had been asked for, 13,880 were enrolled, and by the end of Dec. of that year 7,730 of these had been placed for training.

The National League for Women's Service, an organization formed after a study of the activities of Englishwomen, some weeks before the United States went into the war, developed an extensive motor corps, carried on a variety of services to soldiers and sailors, and effectively supported all drives. The Y.W.C.A. organized in June 1917 a war council, under which it developed a variety of service clubs, both in the United States and overseas, particularly France. The hostess houses of the association at the home camps of both white and coloured soldiers looked after women visitors, a service which proved of such value that the War Department at the close of the war took the work under its educational and recreational branch. Some 50 buildings were turned over to the Government by the war works council of the Y.W.C.A. Overseas the association conducted service clubs which served Red Cross nurses and other women workers. Both in France and in the United States this organization carried on industrial service clubs near large manufacturing centres.

The employment of women in war industries began in the United States in the winter of 1914–5 with the manufacture of supplies for the Allies. The percentage of women to men in the 19 leading war industries increased from 6·5% in 1914 to 7·7% in the latter part of 1916. In the next two years, to the close of 1918, the proportion rose in these industries to 13·9 per cent. A conservative estimate places the number of women employed in factories (food, textile and war supplies) by the end of 1918 at 2,139,100—an increase of between five and six hundred thousand over the number employed in

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these industries in 1914, the date of the last official census. These women were trained to perform a variety of skilled and semi-skilled tasks in the metal trades, in electrical and chemical occupations, in the making of fine instruments, in wood, rubber and leather work, all trades which had been considered beyond their capacity. The substitution of women for men on street railways and subways, in railway yards, banks, offices, shops and hotels and in agricultural pursuits, increased steadily until the signing of the Armistice.

This invasion of industry and commerce by women was accompanied by an effort to preserve existing legal safeguards and to ensure suitable living and working conditions. In 1918 Congress established a women's bureau in the Department of Labor, the aim of which was to develop the most effective use of women's service in production for the war, and at the same time to prevent their employment under injurious conditions. The bureau adopted a set of standards governing women's employment. Although created for the war emergency, the woman's bureau in June 1920 was made a permanent section of the Department of Labor.

No official nation-wide registration of women for war service was ever made; plans for such registration were completed by the women's committee of the Council of National Defense and approved by the Government, and it was left to each state to decide whether or not there was a need for registration in its territory. But it is a fact that practically all the women of the United States were doing volunteer war service at the time of the Armistice. They served in the food army, in the farm army, in the chapters of the Red Cross, in the many drives for funds, and in many other less conspicuous but essential activities backed by the Government.

(I. M. T.)

WOOD, SIR HENRY EVELYN (1838–1919), British field-marshal (*see* 28.789). The field-marshal, who retained his mental and bodily vigour almost to the end, died at his Essex home Dec. 2 1919 and was buried at Aldershot. His record in Zululand indicated unmistakable capacity for command in presence of the enemy, and he was perhaps unfortunate in that his presence during the hostilities with the Boers in 1881 and at Alexandria in 1882 afforded him no further opportunities of a similar kind. From the period when he was chief at Aldershot dates the introduction of military training on practical lines into the British army, and during a prolonged and distinguished career as a soldier he proved himself a keen reformer and an untiring worker, wrapped up in the profession which he adorned.

WOOD, SIR HENRY JOSEPH (1869–), English conductor and musician, was born in London March 3 1869. His musical education was largely received at the Royal Academy of Music and when only ten years old he became deputy organist at St. Mary's, Aldermanbury. As a conductor, he first appeared in 1889, when he joined the Rousbey opera company, and for some years he toured with various companies, including the Carl Rosa (1891). In 1895 the Queen's Hall concerts were started under a system of guarantees, with Henry Wood as conductor and Robert Newman as manager. Under his conductorship the standard of English orchestral playing was notably raised, and his work for music in London was deservedly honoured by a knighthood in 1911. He married, first, in 1898, a Russian lady, Princess Olga Ourousoff (d. 1909); second, in 1911, Muriel, daughter of Major Greatrex.

WOOD, MRS. JOHN [Matilda Charlotte] (1833–1915), English actress, was born at Liverpool Nov. 6 1833, the daughter of Henry Vining, and first appeared on the stage at Brighton at the age of eight. As a young girl she played leading parts in comedy at the Theatre Royal, Manchester, and in 1852 appeared there as Ophelia. After her marriage she acted for some years in America, beginning in 1854 with *The Loan of a Lover*, followed by many other parts. She opened a theatre of her own in New York in 1863 but returned to England in 1866. From that time until her retirement from the stage in 1905, she was in the first rank of robust comedy actresses. Her management of the Court theatre between 1883 and 1891 saw the production of many of Pinero's best comedies. Later she appeared in elderly rôles in most of the Drury Lane melodramas, her last appearance being in Hall Caine's *The Prodigal Son* in 1905. She died at Birchington-on-Sea Jan. 11 1915.

WOOD, LEONARD (1860–), American soldier, was born at Winchester, N.H., Oct. 9 1860. He graduated from the Harvard Medical School in 1884, was appointed assistant surgeon with the rank of first-lieutenant in the U.S. army in 1886, and at once joined Capt. Lawton's expedition against the Apaches in the southwest, resulting in the capture of Geronimo. For distinguished services he was awarded the Congressional Medal of Honor. In 1891 he was promoted captain and full surgeon, and later, while stationed in Washington, D.C., was President McKinley's personal physician. Here he became the close friend of Theodore Roosevelt, then Assistant-Secretary of the Navy. On the outbreak of the Spanish American War in 1898 Wood was commissioned colonel of volunteers, and together with Roosevelt, as lieutenant-colonel, raised the famous regiment of "Rough Riders," composed of western ranchmen and cowboys as well as members of prominent eastern families eager to serve under these two strenuous leaders. For conduct at Las Guasimas and San Juan Hill, Wood was promoted brigadier-general July 1898 and in Dec. major-general of volunteers. He was military governor of Cuba from 1899 to 1902 when the Cuban Republic was established. Under his guidance great improvements were made in schools and sanitation. Meanwhile he had been honourably discharged from voluntary service and appointed brigadier-general in the regular army Feb. 1901. In March 1903 he was sent to the Philippines and in Aug. promoted major-general. For three years he was governor of the Moro Province and during 1906–8 was commander of the Philippines Division. In 1908 he returned to America as commander of the Eastern Department for a year. In 1910 he was special American ambassador to the centenary celebration of Argentine independence. On his return he was appointed chief of staff, serving until 1914, when he was again given command of the Eastern Department. General Wood often had disapproved the policies of the War Department, and as early as 1908 had urged preparedness. To him was largely due the establishment of a summer camp at Plattsburg for training civilian officers, which was taken as a model for other camps of the kind after America's entrance into the World War. In 1915, when he gave unofficial indorsement to the proposed formation of the American Legion whose purpose was to establish a body of some 300,000 men ready for immediate service, he was rebuked by the Secretary of War. Just before America's entrance into the World War in 1917 it was announced that the Eastern Division, then under Gen. Wood's command, had been divided into three divisions, and Gen. Wood was assigned to the Southeastern Division, with the alternative of choosing either Hawaii or the Philippines. As a soldier desiring active service he naturally chose the American post; but the apparent motive of the War Department to humiliate him aroused criticism. He was later transferred to Camp Funston, where he trained the 89th Div., N.A. In Jan. 1918, while in France, presumably preparatory to bringing his troops there, he was painfully wounded by the explosion of a French mortar. After his return to America he was on the point of embarking with the 89th Div., when he was suddenly assigned to the Western Department, no reason being given. It was generally understood that his name was not on the list of officers submitted by Gen. Pershing as acceptable for duty overseas. By change of orders he was returned to Camp Funston, where he trained the 10th Div. of the regular army and other troops. In 1919 he was put in command of the Central Department, with headquarters at Chicago. In 1920 he was a prominent candidate for the presidential nomination at the Republican National Convention. He led on the first four ballots and never fell below second place. When the supporters of Governor Lowden, his chief competitor, were released after the eighth ballot, they swung to Senator Harding, a "dark horse," who was nominated on the tenth ballot, with 692½ votes to 156 for Gen. Wood. In 1921 Gen. Wood was sent on a special Federal mission to the Philippine Is. to report on conditions there. During his absence he was appointed head of the university of Pennsylvania. In Oct. 1921 he retired from active service in the army and was appointed governor-general of the Philippines. He was granted a year's leave of absence from the university of Pennsylvania, but it was thought that he might be able to assume his academic duties in Oct. 1922. He was the author of *The Military Obligation of Citizenship* (1915, lectures at Prince-

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ton and elsewhere); *Our Military History, Its Facts and Fallacies* (1916); and *Universal Military Training* (1917).

See I. F. Marcosson, *Leonard Wood, Prophet of Preparedness* (1917); Joseph H. Sears, *The Career of Leonard Wood* (1919); and *Leonard Wood on National Issues* (1920), compiled by Evan J. David.

WOODGATE, WALTER BRADFORD (1841–1920), British oarsman and barrister, was born at Belbroughton, Worc., Sept. 20 1841. He was the eldest son of Canon Henry Arthur Woodgate, who was a fellow of St. John's College, Oxford, and Bampton lecturer in 1838. He was educated at Radley College, and Brasenose College, Oxford, and during his undergraduate course he founded Vincents' Club. In 1872 he was called to the bar; but it is as a first-class oarsman and journalistic critic of rowing that he is remembered. He rowed for his own college, and in 1862 and 1863 in the winning eight for Oxford. In 1864 he won the Diamond sculls after a dead heat two years previously (*see* 23.784), and in 1865 he was in the winning eight for the Grand Challenge Cup at Henley. He contributed the volume on *Boating* to the Badminton Library, and also wrote *Oars and Sculls, and how to use them* (1889) and the *Reminiscences of an Old Sportsman* (1909). He was also the author of *A Modern Layman's Faith* (1893) and of one or two novels. He died at Southampton Nov. 1 1920.

WOODS, HENRY GEORGE (1842–1915), English divine, was born at Woodend, Northants., June 16 1842. He was educated at Lancing and at Corpus Christi College, Oxford, where he had a distinguished career. In 1865 he became a fellow of Trinity, and in 1866 was ordained. He was a tutor at Trinity from 1866 to 1880, and bursar from 1867 to 1887, in which year he was elected president of Trinity. He resigned the presidency of Trinity in 1897, and from 1900 to 1904 was rector of Little Gaddesden, Herts, and chaplain and librarian to Lord Brownlow at Ashridge Park. In 1905 he succeeded Ainger as Master of the Temple. He died at the Master's House, Temple, July 19 1915.

His wife, MARGARET LOUISA WOODS (b. Nov. 20 1856), poet and novelist, was married to him in 1879. Her first novel, *A Village Tragedy*, appeared in 1887, and her first volume of verse, *Lyrics and Ballads*, in 1889. Later novels included *Esther Vanhomrigh* (1891); *The Vagabonds* (1894); *Sons of the Sword* (1901), and *The Invader* (1907). In *The Princess of Hanover* (1902) she essayed historical drama. In 1913 her *Collected Poems* were published.

WOODWARD, HENRY (1832–1921), English geologist (*see* 28.804), died at Bushey, Herts, Sept. 6 1921.

WOODWARD, HORACE BOLINGBROKE (1848–1914), English geologist (*see* 28.804), died Feb. 5 1914.

WOOL (*see* 28.805).—The functions of "supply" and "demand," of "free-trade" and "controlled trade" in the wool industry, during the decade 1910–20, form a very interesting study for the economist. The situations before, during, and after the war are best shown separately:—

I. BEFORE THE WAR (1911 to 1914)

(*a*) *Wool Production.*—The best available statement of the world's sheep and wool production is given in Table 1; it includes figures of the pre-war and post-war periods.

TABLE 1. *The World's Sheep and Wool.*[1]

	Sheep		Wool in lb.	
	Pre-war	Post-war	Pre-war	Post-war
Europe	177,981,207	171,026,261	803,400,043	751,104,667
Australasia	96,189,727	107,467,005	645,132,880	852,122,484
S. America	118,638,046	72,342,762	482,640,707	487,180,000
N. America	54,053,409	49,549,458	303,473,000	327,829,531
Asia	92,318,419	96,735,546	273,146,000	326,505,000
Africa	63,432,755	69,114,685	219,919,000	219,919,000
Central America and W. Indies	710,380		750,000	750,000
Total	603,323,943	566,235,717	2,728,461,630	2,965,410,682

[1] Chiefly from the *Wool Review* of the National Association of Wool Manufacturers, United States.

From these statistics the following interesting deductions are to be drawn. It is somewhat surprising to find Europe heading the list of wool-growing continents. This is largely due to the flocks of European Russia: 320,000,000 lb. of wool (pre-war) are credited under this head, and this probably explains the source of German wool clothing during the latter days of the war. What had become of this huge quantity latterly was not on record in 1921. Incidentally it would certainly appear that the continent of Europe as a wool-growing continent had not claimed the attention merited. In most respects Europe compared more than favourably with other continents, and it was only owing to the diversity of interests, languages, etc., that this was not more in evidence. If the nations of Europe would all pull together, that continent would probably have more to give to the world than to receive.

Europe and North America, being by far the greatest manufacturing centres in the world, have practically consumed the whole of the very large surplus stocks from the other wool-growing countries, apparently in the proportions of 80% for Europe and 20% for North America. The marked difference in the weights of the fleeces produced as indirectly shown by this table is obviously worthy of careful consideration.

(*b*) *Wool Distribution.*—The detailed figures respecting local supplies, importations and reëxportations are very confusing. The figures in Table 2 may be taken—with exceptions to be presently noted—as an indication of the wool each important manufacturing country received. One or two questions here arise. The United Kingdom is credited with manufacturing 90,000,000 lb. approximately of a 120,000,000 lb. clip. It must not be forgotten, however, that a very considerable amount of the world's wool supply passes through the London or Liverpool wool sales, as is shown by Table 3:—

TABLE 2. *Wool-manufacturing Countries.*

Country	Imported for Manufacturing	Local Supplies	Total
1. France (1909)	623,000,000	75,000,000	698,000,000
2. United Kingdom (1911)	490,307,000	90,000,000	580,307,000
3. United States	251,000,000	304,000,000	555,000,000
4. Germany	517,000,000	25,600,000	542,600,000
5. Russia	94,000,000	320,000,000[1]	414,000,000[1]
6. Belgium	355,000,000	1,000,000	356,000,000

Austria, Hungary, Italy and the Netherlands follow in the order named.

[1] These figures require careful consideration. Probably a large proportion of this wool is usually manufactured in other countries—notably Germany and Britain.

TABLE 3. *United Kingdom Imports and Exports* (1911).

	Imports	Exports	Retained
Colonial	659,511,000		
Foreign	135,004,000		
Totals	794,515,000	304,208,000	490,307,000

The colonial (and foreign) wool not accounted for by Table 3 is no doubt sold direct to the manufacturing countries. This is indicated by the sales of South African wools for the year 1913 (Table 4).

TABLE 4. *Distribution of South African Wools.*

	1913	1919
United Kingdom	96,028,737	96,462,203
Germany	61,123,713	—
Belgium	20,695,225	12,662,059
France	4,898,212	9,588,452
Italy	924,852	43,002
United States	221,522	71,502,522
Japan	—	39,800,648

An analysis of S. American exports would, no doubt, show by far the larger porportion of S. American wools passing directly to Belgium, France, Germany and the United States, a large quantity, of course, passing through the Antwerp sale-rooms.

(*c*) *Tendencies in Production and Distribution.*—In wool production from 1910 to 1914 there is little to note. S. Africa

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made a valiant attempt to improve both the quality and quantity of her wool, and succeeded in both objects to a certain extent. In Australia certain developments of sheep-growing districts are to be noted, but these, with the increase in the weights of the individual fleeces, probably only just served to balance losses through drought and in other directions. Falkland Island wool (fine crossbred) made a name for itself as a good hosiery wool, but unfortunately the increase up to 1914 was not great. S. America generally proved disappointing, in view of the demand for its wools, not only from the European continent but also from Great Britain, following the decline in the prejudice against them.

Undoubtedly the greatest wool problem prior to the war was the provision of a sufficient quantity of fine merino wool. This is illustrated in Table 5. S. Africa partly met this deficiency, but Australia pinned her faith on mutton rather than on wool, so that the tendency to eliminate the pure-bred merino is still in evidence.

TABLE 5. *New Zealand Wool.*

	Total Sheep	Merinos
1910	23,480,707	1,868,805
1917	25,270,386	1,063,491
1920	23,914,506	803,589

So far as the distribution of the wool manufacturing industry was concerned there was an undoubted tendency in Britain to relinquish wool manufacture owing to severe competition. The continental European competition took the form of efficiency in manipulation and excellence in the goods produced. How Yorkshire was going to face the importation of certain continental goods was a problem—and one that had still to be faced after the war. The competition with the United States was apparently controlled by the tariff charges, but it is more than probable that the excellence of American manufactured goods was already beginning to tell against European importations; although America still had to start her export trade. Yorkshire, however, appeared to be falling between two stools—she was not producing goods of the excellence of the continental styles and thereby forcing a way into neutral markets; nor was she organized on such a scale that she could face the United States' markets—indeed the American manufacturers were surpassing her in scale of organization. It would not be overstating the case to say that the year 1914 opened with many misgivings so far as the British wool manufacturing industry was concerned. The war came, and temporarily dominated everything. But the conditions of 1914 were likely to reappear afterwards, and would have to be faced sooner or later.

II. The War Period (1914 to 1918)

The Slump in Trade.—Fear of the unknown naturally created the trade slump observable during the early months of the World War. Britain, a country whose very life depended upon the importation of the raw material and exportation of the semi-manufactured or fully manufactured article, naturally had most to fear. This fear was further aggravated by the fact that British manufacturers had huge financial interests involved with Germany; and, conversely, Germany had financial interests with Britain. With trade universally in a state of suspended animation, and the sequence of delivery of goods and payment of accounts seriously interfered with, many British firms—and especially those in the wool, top and yarn trade—were at once in serious financial difficulties. The Government, however, tided over the difficulty by the "moratorium," which, by the "time easement" given, enabled the greater proportion of firms eventually to meet their liabilities.

A period of suspense followed, during which the exact trend of many matters was being worked out. By the middle of 1915, however, the idea that, when the British and French armies got going, they would sweep the Germans back into the Fatherland, had practically gone. In the meantime Germany had been swept from the seas. It was now evident that Germany, from the wool point of view, would have to be self-contained, neither importing raw wool[1] nor exporting manufactured goods; that France was seriously incapacitated as a manufacturing country owing to the invasion of much of her manufacturing territory; that Russia would seriously have to draw upon British stocks of manufactured goods; in fact, that Britain must be the mainstay of the Allies—and of the world, with the exception of the United States and Japan—so far as wool manufactured goods were concerned. The extent to which Germany deliberately crippled France both during the war period and subsequently will be realized from the following quotation from the *Yorkshire Observer* in March 1921:—

"The Fourmies District remained practically the whole time away from actual fighting range and did not suffer from gunfire, but, this notwithstanding, the destruction by hammer, pick, dynamite and fire was complete, the Fourmies woollen plants having always proved most serious competitors of those of Germany. The enemy reached the district on Aug. 26 1914, and left it on Nov. 9 1918. When they arrived there were 75 textile works in full activity; they destroyed all except five worsted spinning plants, one woollen spinning plant and one combing plant. The steam engines were broken or otherwise damaged; the boilers removed and rendered unserviceable, the safes were broken into and all records of manufacture, samples, reference data, representing 30 years of activity, removed to Germany. . . . Immediately the Germans occupied the northern departments of France, not a single wool-combing machine was left throughout the country; there remained in activity throughout the land only 160,000 worsted spindles out of 2,400,000; only half the total of 700,000 woollen spindles; only about 11,000 weaving looms out of 56,000."

By 1916, two other factors had come into play. The drain on the man-power of Great Britain was becoming serious. But it was now fully revealed that in the wool industry there was a vast surplus of labour ready to maintain output, at least at a very high rate. By April, scarcity of shipping was threatened. Thus early in 1916, if the serious limitation of the supply of raw materials was not actually felt, it was in sight.

The Difficulties Leading to Wool Control.—The British War Office, having in the very early days of the war experienced the difficulty of clothing in khaki the large army in course of formation, organized itself to overcome this difficulty, and by the inevitable restrictions indirectly placed on the manufacture of civilian clothing had so far succeeded fairly well in its direct object. But by the early days of 1916 the War Office was seriously alarmed at the future prospects of supplies of raw materials and sought outside advice. As illustrating the method of working the following may be taken as typical. On Feb. 2 1916 a War Office official (who, incidentally, knew nothing of wool) visited the university of Leeds and asked for certain estimates respecting British combs and spindles, to be supplied to him four days later when the Army Council would meet to discuss supplies. In Table 6 the figures then supplied are given, and alongside the estimates are given also the actual figures, kindly supplied some years later by the same official. The estimate for 1916 was 337,500,000 lb., as against an actual production of 309,443,185 lb., based on the first half of 1917.

The following figures were also supplied on the same date:—

Wool available for use in the United Kingdom .	800,000,000 lb.
Less clothing wools used in the woollen trade .	200,000,000 lb.
Available for combing	600,000,000 lb.
Less shrinkage and tearage in scouring and combing (40%)	240,000,000 lb.
Wool available for "tops"	360,000,000 lb.

The estimated shrinkage and tearage of 40% would have been much too low—as average Australian merino gives a shrinkage of about 50% and a tearage of from 5 to 1 to 8 to 1—but for the endeavour made to save shipping space by shipping in the scoured state only, and by reason of the large quantities of washed home-grown wools and low-yielding colonial crossbreds included. The effect of this is clearly shown (Table 7) in Mr. Norman Rae's figures published in the *Yorkshire Observer* of Friday, Aug. 10 1917. From these figures it is evident—(*a*) that the Government by 1917 had fears of being unable to

[1] With the exception noted with reference to Russian wools.

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TABLE 6. *Estimates (Feb. 1916) and Figures.*

(Output of combs per annum.)

Combs			1,500 combs long wool and crossbred each combing 600 lb. per 10 hours		1,500 combs Botany each combing 300 lb. per 10 hours	
Actual 1914	Estd. 1916	Actual 1915	Estimated 1916	Actual (1917)[1]	Estimated 1916	Actual (1917)[1]
2,823	3,000	2,956	225,000,000	206,655,428	112,500,000	92,869,516

(Output of worsted spinning spindles per annum.)

Spindles			2 lb. per week per spindle estimated	
Actual 1904	Estd. 1916	Actual 1916	1916	Actual (1916)[1]
3,000,000	3,000,000	3,241,714	300,000,000 lb.	300,241,712 lb. (The 1915 actual was 253,879,664 lb.)

[1] Large quantities of scoured colonial wools were being imported. Certain worsted wools were also being drawn and spun without being combed, thus eliminating "less tearage."

TABLE 7. *Stock Dec. 31.*

Schwartze % Type	%	Greasy lb.	Clean lb.
72 N.Z. greasy crossbred	70	50,656,000	35,459,000
45 Aust. greasy merino	45	49,438,000	21,258,000
85 " scoured crossbred	85	33,704,000	28,648,000
" mtg. gsy. crossbred	72	17,901,000	12,888,000
" mtg. gsy. merino	43	4,638,000	1,994,000
73 " low wools	75	40,223,000	30,167,000
60 " mohair, etc.	80	17,807,000	14,245,000
	68·69%	237,213,000	162,935,000
Private British	78	21,701,000	16,926,000
Government British	78	51,053,000	39,821,000
Total	70·87%	309,967,000	219,682,000

Yield as above . . . . . 219,682,000 lb. (clean)
Leaving out skins, yield at 50% (instead of 70·87%) . . . . . 154,983,000 lb. (clean)

Increase (wool under-estimated) . . 64,698,500 lb. (clean)
Skins, 7,238,000 lb., not included.

keep the Allies' wool industries supplied with wool, and much under-estimated the yields—although they had the Leeds University suggestion of 40% for yield and tearage before them; (*b*) that the industry was feeling the shortage of wool and was regarding the future with misgivings; (*c*) that leading wool men thought it actually expedient to question the Government figures, and, if possible, to obtain at once a greater wool distribution; (*d*) that as subsequent figures seem to show, the university figures of 40% average loss between raw wool and finished top and the other figures supplied were most nearly correct, and would have served well as a basis to work upon. All these figures, however, are chiefly useful as illustrating the difficulties involved not only in estimating the workable supplies of wool during the war period but in estimating the yields and in averaging up the quantities of clean wool which the actual deliveries might be expected to give.

How serious was the problem of supplying wool to the home trade, and to such of the Allies as could manufacture it, is shown in Tables 8 and 9. To the quantities shown in these tables should be added something over 300,000,000 lb. of remanufactured materials, probably derived as follows (in 1914 figures):—Of the wool manufactured in Great Britain, 500,000,000 lb., about ⅓ (166,000,000 lb.) is retained at home, and about half this (or 84,000,000 lb.) is torn up each year; rags imported amount to 100,000,000 lb.; so that the total remanufactured materials (excluding noil) amount to 184,000,000 lb. But this is probably an under-statement, as the figures collected by the Board of Trade during the war period show an average approximating to 200,000,000 lb. Thus it would appear that the woollen industry of Great Britain roughly consumes per annum:—200,000,000 lb. greasy wool[1], 200,000,000 lb. remanufactured materials, and 60,000,000 lb. of noil, or a total of 460,000,000 lb.

These figures reveal—(1) the continuous reduction in the quantity of British wool grown and, excepting during the war period, manufactured in Britain; (2) an increase in supplies of colonial and foreign wools, if we take into account the fact that there is possibly still some of the 1919 period wool to be accounted for; (3) the increase in the quantity of colonial and foreign wool manufactured in Britain; (4) the large increase in the foreign and colonial importation in 1915; (5) the effects of the German submarine campaign on the 1918 importation, and the making up of lost ground in 1919; (6) the fact that the average importation of colonial and foreign wool for the five years ending 1919 is much below the five years ending 1914. Had wool gone elsewhere, or had it not been grown? It may be noted (7) that Turkey mohair (sent to Britain by parcel post during the first year of the war) would disappear until 1919, the large increase shown on 1919 being no doubt partly Turkey mohair and partly Cape mohair; and (8) that alpaca, being free, was largely employed to take the place of merino wool during 1917 and 1918,—the clipping of immature fibre led to the marked increase in 1918 and the consequent reduction in 1919.

[1] This figure is questionable as large quantities of so-called clothing wools may be employed for combing purposes.

TABLE 8. *Pre-war Supplies of Raw Materials.*

(In millions of lb.)

Average for five years finishing	1899	1904	1909	1914	1919
British wool: Grown	137	136	133	131	120
Manufac. Britain	114	104	94	95	105
Colonial and foreign wool Imported	715	607	707	782	724[2]
Manufac. Britain	376	342	388	463	647
Skin wool	34	30	35	35	30
Pulled wool	132	145	193	206	163
Mohair, Alpaca, etc.	28	37	41	42	21

[2] This figure is explained in Table 9.

TABLE 9. *War Period and Post-war Period Supplies of Raw Materials.*

(In millions of lb.)

For years	1915	1916	1917	1918	1919
Imported—					
Foreign wool	87	54	44	17	..
Colonial wool	838	564	578	396	..
Totals	926[3]	618[3]	623[3]	413[3]	1,042[3]
Imported—					
Mohair	..	..	3·5	5·6	29·4
Alpaca	..	..	5·5	7·0	3·8
Camels' hair	..	..	2·7	2·3	4·8

[3] Average for five years = 724 (*see* Table 8).

These facts and figures, although somewhat prematurely placed here, may be usefully borne in mind in studying all phases of the subject.

In April 1916 the Army Contracts Department of the War Office began to commandeer hosiery yarns on the financial basis of a fixed margin to cover the processes of manufacture. A little later restrictions were imposed upon the export of raw wool—possibly owing to rumours of it reaching enemy countries and certainly because wool supplies for home purposes were becoming very restricted. By June 1916 the War Office knew that further control was almost certainly inevitable, and circulated compulsory requests for particulars of stocks of wool, tops and yarn, which requests, of course, were very disquieting to the trade. Later in the same month, so serious was the position judged to be that the War Office prohibited the opening of the British wool fair of Kettering, and, eventually, after some debate,

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purchased the whole of the British clip at 35% above July 1914 prices. The British clips of 1917 and 1918 were also bought.

Anxiety with reference to the possibility of supplying the army with the wool goods it really needed continually increased. In April 1917 the open market for wool was closed and the sales by auction abolished. In May, in anticipation of the lack of wool to keep the factories going and of labour disturbances, an army council order was issued which resulted in the reduction of working hours in the factories from 55½ per week to 45 per week, unless permission was obtained from the director of army contracts to work full time. This order was not withdrawn until May 18 1918, following the enormous demand for flannel goods.

Following the revolt, already referred to, of Yorkshire manufacturers in Aug. 1917, due to War Office restrictions of supplies and of estimates of future supplies, and following the failure of the trade itself to supply reliable data, came the formation of a "Board of Control."

Wool Control.—The Board of Control was organized with Sir Arthur Goldfinch as director of raw material supplies, Col. F. V. Willey as controller of wool supplies, and Sir Charles Sykes as director of wool textile production. The department was housed in the Great Northern Hotel, Bradford, and was given complete control of both supplies of raw material and output of finished clothing. The activities of the department followed briefly the following lines:—(1) A reasonably exact basis of "yields" was ascertained and all wools dealt with on the "clean wool" basis. (2) Reliable statistics were obtained and made the basis of the distribution of supplies of raw materials. (3) A method of "rationing" the margin of wool supplies (about 20% of the available supplies) available for the civilian trade was worked out. (4) Difficulties of a minor nature, such as the supply of oils for oiling wool, soaps for scouring, etc., were faced and usually satisfactorily surmounted. (5) A standard clothing scheme was introduced, the intention of which was, no doubt, good, and its failure only to be attributed to the failure to employ the technical skill actually available in the industry in the designing and displaying of the goods manufactured. Exhibitions were held up and down the country and attracted much attention, but little demand for the fabrics was exhibited. Last, but perhaps not least, the department had to face the problem of relinquishing control on the termination of the war. Those who know the anxiety caused, years before the war was over, by the clearly foreseen difficulties of disbanding an enormous army, will know something of the anxieties of the Wool Control Board to close down with credit to itself and no less to either the wool grower or the wool manufacturer.

Provision for After the War.—The Armistice brought with it the determination of those whose trade had been taken from them by the Wool Control Board to oust the Board and regain their own back again. The Board's function, on realizing the inevitable, was to dissolve (1) with credit to itself, and (2) with due regard to the interests of the wool growers and wool merchants, of the wool manufacturers, and of the consuming public. With the huge demand for goods following the Armistice prices soared up and up, and it was only human that the Board should tend to retain command to its own financial advantage, and also to attempt to prevent undue inflation of values to the detriment of the consuming public. So far as British wools were concerned the removal of control was so simple that no preliminary action was considered necessary, and the restrictions were actually removed in time for the wool fairs in 1919.

To meet the difficulty with reference to Australian wools the Imperial Government had decided to purchase the Australian clip for one year after the war. To further facilitate matters, a Wool Council, which included imperial representatives, was formed by the War Office.

With reference to the interests of the manufacturers and consumers the Government again asked for advice from the university of Leeds through one of its representatives. In a personal interview with the official in question the probable trend of trade after the war was outlined and the suggestion given that, in view of the almost certain shortage of immediately available supplies and the huge demand for fine merino wools, certain manufacturing restrictions—such as spinning only to fine counts of yarn—should be imposed. Unfortunately this suggestion was not sufficiently acted upon, with the result that the army's revolt from rough khaki to fine blue serge sent merino wools soaring up to unthought of heights, all other qualities following suit. The intention of the Wool Council was undoubtedly good, but again the direction of the matter was primarily in the hands of those who knew little or nothing about the wool industry, who could not even judge who were giving them sound advice and who were giving them questionable advice. It may be conceded that to control speculation under the conditions prevailing from 1918 to 1921 was apparently impossible. Apparently the only thing to be done was to unload stocks as rapidly as possible—although one authority did suggest that the way to reduce prices was to keep large stocks of wool and not to sell.

During this period there was much unrest in the labour world and a great deal of talk about "profiteering." As an indirect result of this the Whitley Act was passed by Parliament, and note should here be made of the endeavours made by the British woollen and worsted industries to take advantage of this Act and form "Industrial Councils" composed of employers and employees, also of the formation of the "National Wool Textile Industrial Council," the final draft-constitution of which—prepared by Mr. Ernest Marsh (chairman) and Mr. G. H. Wood (secretary)—as adopted on Dec. 10 1918, was as follows (*Yorkshire Observer*, Nov. 27 1918):—

"The title selected is the National Wool (and Allied) Textile Industrial Council, and its objects are defined as follows:—

To promote the development of the industry and to secure that wages, methods of production, and conditions of employment shall be systematically reviewed and decisions agreed upon which shall have as their object the improvement of the relations between employers and employees.

In furtherance of these objects the Council shall:—

(*a*) Consider wages, hours, and working conditions in the industry as a whole, and the fixing of standard rates of wages for similar occupations in the industry. It shall also consider the employment of scientific and agreed methods of fixing wages, and of adjusting wages to new conditions, and the securing to the employees of a share in any increased prosperity of the industry;

(*b*) Consider the best means of securing the highest efficiency of the industry, including any improvement in machinery, invention, or method by which the prosperity of the industry is to be increased; secure that such invention or improvement in method shall give to each party a fair distribution of the benefits derived from the increased efficiency; utilize to the fullest extent the practical knowledge and experience of the workpeople, and secure that such knowledge may receive consideration;

(*c*) Consider the existing machinery for the settlement of differences between different parts and sections in the industry, and the establishment of regular methods of negotiation on anticipated issues between employers and employees, and upon differences which may be reported with a view to the prevention of differences and their equitable adjustment;

(*d*) Consider the supervision of the entry into and training of employees for the industry, and coöperation with the educational authorities in arranging educational facilities for the industry in all its branches;

(*e*) Make comparative studies of the workings and methods of the industry in this and other countries, and when desirable publish reports;

(*f*) Secure to the workman a greater share in and responsibility for the determination and observance of the conditions under which he works, in so far as it relates to his material comfort and well-being; make efforts for the decasualisation and permanent security of employment, having regard to the conditions surrounding changes of occupation between one employer and another; consider means toward the improvement of conditions with a view to removing the danger to health in the industry, and toward providing special treatment where necessary for employees in the industry;

(*g*) Make reports to Government departments and local authorities of the needs and opinions of the industry; consider any questions bearing on such matters which may be referred to the Industrial Council by the Government or by a Government department; consider jointly all proposed legislation affecting the industry and take joint action where such legislation is likely to interfere with its prosperity;

(*h*) Consider the best means of insuring the observance of the decisions of the Council and of agreements made between organizations of employers and employees;

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(i) Consider means whereby the employers and employees shall be brought within their respective associations."

This Council steadily extended its activities, and may ultimately be the deciding factor in helping Great Britain to maintain and possibly to extend her manufacturing position.

Another indirect result of the war was the development of industrial and scientific research. The university of Leeds (so far as the wool industry was concerned) here took the lead, and, in conjunction with the West Riding County Council and with the help of many prominent manufacturers in the various manufacturing districts, raised approximately £5,000 per annum for a period of five years. With the development of the Government Department of Scientific and Industrial Research, however, came the question of overlapping, and the university, while naturally retaining its own research status, not only gave way to the new department but strenuously helped in the development of "The Research Association for the Woollen and Worsted Industries" now housed in Leeds. This Research Department is designed to cover the requirements of Great Britain and Ireland.

III. After the War (1918 to 1921)

Withdrawal of Control from British Wools.—Under political pressure the Government freed the wool fairs of 1919 from State control. But a curious tendency now made itself felt. Owing to the limitation of supplies of colonial crossbreds and other

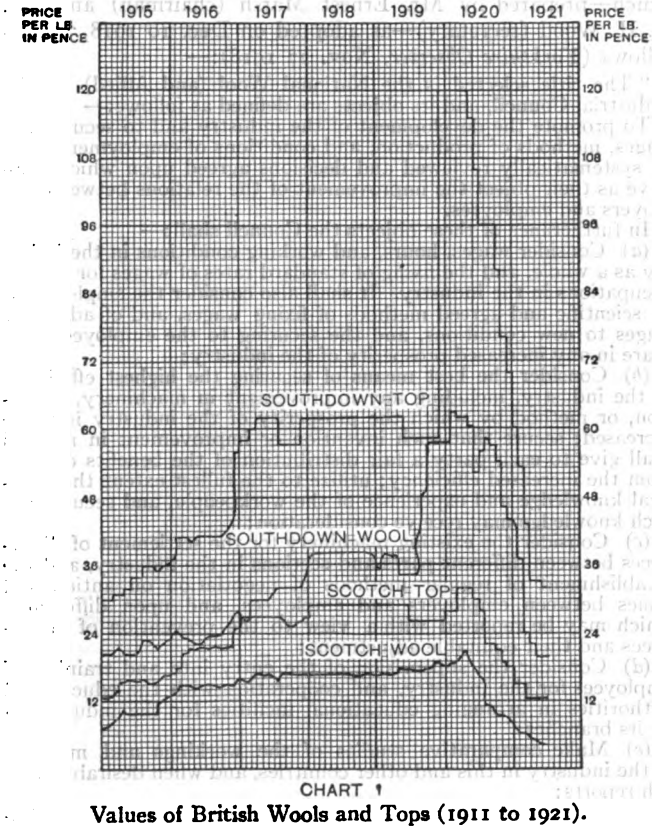

CHART 1

Values of British Wools and Tops (1911 to 1921).

crossbred wools, woollen manufacturers had been constrained to use British Down wools and Down crosses. These were discovered to possess just the characteristics sought for in certain woollen goods. They were also the wools sought for by the hosiery manufacturer; and as hosiery now took a wonderful development the Down wools went soaring away in price, at last almost rivalling colonial merinos. When the slump came, Down wools stood out against it even longer than merinos, and it seemed probable that when trade should revive Down wools would again come into their own. In view of the great future before Down wools it was regrettable that more British farmers did not follow the suggestion to grow Down crosses, as strenuously advocated by qualified representatives of the universities of Edinburgh and Leeds.

The changes in values of British wools and tops are shown for the decade in Chart 1.

Of course the high values shown in this chart are fictitious in more senses than one, but it would seem that if the 1921 prices of these wools had been brought to the 1914 basis they must be so cheap that demand for goods manufactured from them would have been immediate. Probably the large stocks of manufactured goods still held in 1921 by the middleman kept the prices of these goods at an artificial height and thus lamentably interfered with trade.

Withdrawal of Control from Colonial Wools.—The Wool Council of the War Office on the cessation of hostilities found itself in great difficulties with reference to colonial wools. Just as on the outbreak of war no one knew what would happen, so in this case it was impossible to foresee whether the enhanced values of the war period would be maintained or prices rapidly fall. If prices had rapidly fallen it is possible that the wool grower would have held the Wool Council to its bargain, and

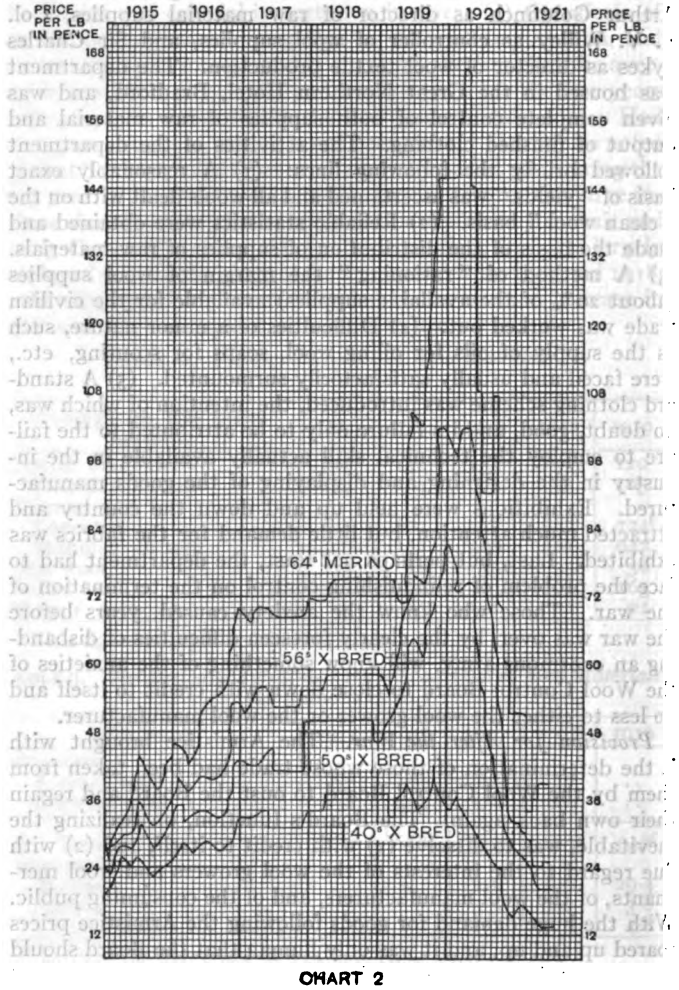

CHART 2

Values of Colonial Wools and Tops.

no one could well have found fault with their attitude. But prices rapidly rose, and so it came about that the colonial wool grower felt aggrieved that he was not going to profit by the enhanced wool values like the home wool grower. Thus it came about that the Imperial War Council agreed to share the very substantial prospective profits with the colonial wool grower. Unfortunately much of the 1919 wool had not been brought under the hammer before the slump started (May 1920), but it was stated that, after the British Treasury had been reimbursed for the expenditure it had incurred, there was at the end of 1920 a clear profit of £14,000,000, half of which belonged to the growers, bringing their total receipts up to £180,896,059. In addition to this there remained unsold (Dec. 1920) 1,800,000 bales, half of which belonged to the growers.

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The change in the values of colonial wools and tops during the decade are shown in Chart 2.

Up to May 1920 the endeavour of the Wool Council was rather to maintain than to inflate values, and much fault was found with the Council for not making greater progress with the disposal of the wool to hand—the manufacturers were crying out for it. To meet this demand the Antwerp sales were reopened on Oct. 25 1919 and extensive sales in the United States of America were also promoted, one of the first being held in Philadelphia in Sept. 1919. Apparently the fall in the prices of wool was almost coincident with the release of ships for transport. Unfortunately few realized the large stocks of wool on hand—or rather they estimated their consumption at the 1919 rate and consequently minimized their stocks. Thus it came about that, following a period when every conceivable bale of wool was called for and (from the sellers' point of view) ought to have been placed on the market, came a period when with bated breath one heard the word "unloading," and all too soon new wool and old wool were on the market together.

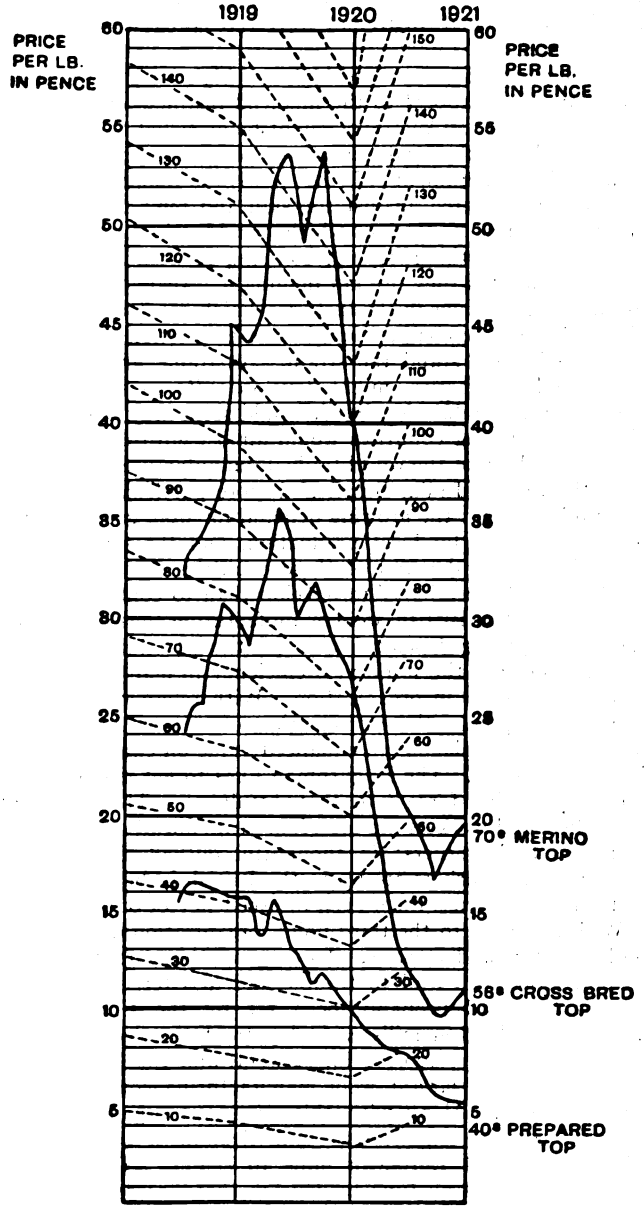

CHART 3
Wool Values Adjusted to 1914 Values.

Adjustment of Sale of Old and New Wool.—In the early days of 1920 those starting new works in the colonies, India and elsewhere, were asking—can we obtain sufficient wool to run our factories? And there was every inducement to wool growers—particularly growers of the finer sorts—to extend operations. Toward the end of 1920 almost all factory building the world over was suspended or carried on very leisurely; and with the fall in wool values many sheep breeders were already looking on wool as an almost valueless by-product. Probably both extremes were wrong. Table 10 gives a fair idea of the world's wool stocks about the end of 1920 or early in 1921.

TABLE 10. *World's Wool Stocks (Approximate)* [1]

Wool in England (held by the B.A.W.R.A.)	1,600,000 bales
" " Australia " " " "	800,000 bales
Cape wool (held by B.A.W.R.A.)	100,000 bales
U.S.A. surplus stock (Oct. 1 1920)[2]	1,000,000 bales
S. American wool	5,000 bales
Total	3,505,000 bales

[1] No doubt small stocks were held elsewhere.
[2] Two years' stocks said to be accumulated.

Prior to the war the world's yield of wool was about 2,728,461,630 lb., and it might be taken that about this amount was yearly absorbed. It would thus appear that the surplus wool on hand was equivalent to about 14 or 15 months' normal world's consumption.[1] Now if there were serious depletion of stocks of manufactured goods, and if there were likely to be a greater demand from the better paid workers of the world, and from countries likely to demand wool goods which previously had not consumed such goods in great quantities (India for example), then the stock of wool would appear hardly sufficient to meet the probable demand. Possibly these brighter conditions might have been realized, but for over speculation in the wool industry and the general slump in prices. Actually, however, what did happen was that the countries which could purchase were inundated with the goods which, under normal conditions, would have been spread over a broader field and the slump followed storage of goods and lack of sales. The reaction probably went much too far—for the home market in Britain was good in the middle of 1921. But the Wool Council had not only to face this surplus of wool but the new wool (1920 clip and in prospect the 1921 clip) coming on to the market at the reopened sales in Australia. The adjustment of this prospective difficulty was exemplified as shown in table 11 in the quantities of old and new wools—offered, sold and withdrawn—in both London and Australia in June 1921. Of these quantities, about 79,500 bales,

TABLE 11. *London Colonial Wool Sales* (Feb. 22 to March 5 1921).

	On Government Account	On Importers' Account
	Bales	Bales
Sydney	24,567	9,889
Queensland	4,991	6,435
Port Philip	12,862	3,274
Adelaide	5,286	1,542
Tasmania	2,648	279
Western Australia	3,599	10,507
New Zealand	20,264	10,213
Cape	..	3,134
Punta Arenas	..	3,487
Falkland Islands	..	577
River Plate	..	165
Sundries	..	724
Total	74,217	50,226

of which approximately 76,000 bales were colonial, were sold; 44,000 bales were taken for export, including 2,000 bales Punta Arenas and Falkland Islands; 8,000 bales went to America. At the April 1921 London sales the reserve prices of the old wool were so high that no bids were forthcoming and all of this wool was withdrawn. Owing to the formation of the British Australian Wool Realization Association not being completed, or rather its policy not being decided upon, all the Australian old wool sales for April 1921 were also cancelled.

The difficulties of adjustment, actually realized later, were foreseen and deemed so great that when Mr. Hughes (Prime Minister of the Commonwealth and a stalwart fighter for the

[1] The U.S.A. normally holds 400,000,000 lb. of wool in stock.

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development of Australian wool industries) proposed to form an association of Australian wool growers and British Government representatives, with the object of realizing at reasonable values the large stocks of wool held in Australia and England, the Wool Council accepted the proposed control. Indirectly the Wool Council was apparently sacrificing the possibility of cheap wool for the manufacturers of this country: but it regarded the pocket of the whole country as coming first and the manufacturers' demand for cheap wool as coming second. The Australian Board was thinking chiefly of the interest of the Australian grower. The association was registered in April 1921, as follows:—

"British Australian Wool Realization Association, Ltd., Caxton House, West Tothill Street, Westminster, London, S.W.1. Incorporated in the State of Victoria, Australia. Registered April 14, to acquire and take over (*a*) one-half share of, or interest in, all Australian wool bought by the British Government through the Government of the Commonwealth of Australia and still undisposed of, and in all real and personal property acquired in connexion therewith and still undisposed of; (*b*) one-half share of, or interest in, any surplus profit on resale of Australian wool so bought still undistributed. Also to take over and assume one-half of all or any liabilities and obligations connected with and chargeable to such wool, property and surplus profits not yet liquidated. Nominal capital £25,000,000 in 25,000,000 shares of £1 each. Names of persons authorized to accept service; Sir Arthur Horne Goldfinch, K.B.E., 8 Rosecroft Avenue, Hampstead, London, N.W. (Governing Director British Australian Wool Realization Association, Ltd., Delegate General Chilean Nitrate Producers Association); James Alexander Cooper, C.B.E., F.S.A.A., Mentmore House, Uxbridge Road, Kingston on Thames, Surrey (Assistant Governing Director, British Australian Wool Realization Association)."

With the lack of demand for goods and consequent lack of consumption of wool the world over, even the best merino continued to fall in value up to May 1921, and the poorer sorts in some cases were below 1914 values (*see* Chart 3). Whether the enhanced values realized in May by both merinos and crossbreds would be maintained was questionable. Table 11, from the *Yorkshire Observer* of May 16, showed a turn of the tide—if there were no set-backs. Demand from the United States in anticipation of the new tariff might be, at least in part, the explanation. Germany had already commenced to buy wool.

TABLE 12

1914 July d. per lb.	Description	1921 May 7 d. per lb.	1921 May 12 d. per lb.
	Combing		
32	70's super fleeces	40/42	40/44
30½	64/67's good medium fleeces	35	36
30	60/64's good medium fleeces	27	30
28	64's good pieces	30	33/36
27	60's good pieces	30	33/36
27	60's good pieces	23	26/28
29	58/60's good medium fleeces	30	30
26	56's fine crossbred fleeces	24	24
23½	50/56's fine crossbred fleeces	17	18
18	46/50's crossbred fleeces	14	15
17	46's crossbred fleeces	12	13
16	44's crossbred fleeces	10	11
15½	36/40's crossbred fleeces	9	9
	Capes		
27	10/12 months' combing Capes	28/30	None
24	6/7 months' good clothing Capes	None	None
	Carbonizing		
26	60/64's good carbonizing pieces	23	26
25	60/64's carbonizing pieces and bellies	20	24
20	64's average locks	16	18
—	64's average lambs	20	20

IV. PROSPECTS IN 1921

Wool Manufacturing.—Australian combed tops were on the Bradford market, on the American market, and were also being worked up in Japan in 1921. Did this presage a re-distribution of the world's wool manufacturing industry, and if so what was the line of distribution likely to be followed?

The astounding prosperity of the British wool-manufacturing industry following the Armistice attracted world-wide attention, and it was but natural that every one with any connexion with the industry the world over should wish to share in the prosperity. There were two types of country in which the development of manufacturing would undoubtedly be attempted, and in which the attempt is undoubtedly justified, (1) the wool-producing continents or countries, Australasia, S. Africa, and S. America, and (2) new wool-consuming countries such as India, Japan, Brazil. In Australia some few mills were developing before the war, and after the war, under private enterprise, stimulated by the energy of Mr. Hughes and others, and, in some cases, further encouraged by the mother-country financiers. Australia made strenuous endeavours to develop a huge wool-manufacturing industry. Her ideal was to manufacture one-tenth of her wool production per annum—say, 50 to 60,000,000 lb., and in 1921 nearly 40 wool manufacturing mills were already in existence. Similarly South Africa, stimulated by Gen. Enslin, was also making a bid for wool manufacturing.

In the case of Australia no forethought or skill was being spared. The mills were being equipped with the finest machinery—French-made combs, for example, had so far been given preference over the speedier but less exact British (Noble) combs—and the best skilled workers were engaged in many of the mills. Excellently combed Australian tops were already on the Bradford market.

So long as profits remained high and high rates of wages were maintained, the appeal to the financial instincts of the worker, even in the case of Australia, might be expected to hold him in the mill. But if the conditions of 1914 came round again and the skill and temperament of the newly developed Australian industry were pitted against the skill and temperament of the older industrial countries, which would win out? Broadly speaking, in anything beyond combing it would be the older countries' fault if they did not dominate. Again, with the need for harder conditions in the factories which must almost inevitably follow severe competition, it was a question which operatives would best stand the strain. Australia, and possibly S. Africa and S. America, might develop quite considerable wool manufacturing industries, but it would seem inevitable that the old manufacturing countries would almost entirely retain their hold on the bulk of the world trade in manufactured wool goods.

In the case of India, Brazil and more particularly Japan, it was probable that the growing demand for wool goods would be only partly met by local production, and for some years to come the outside demand of these countries for manufactured goods seemed more likely to develop than to contract.

So far as the British wool manufacturing industry is concerned everything depended upon (1) the introduction of scientific method into the works; (2) efficiency in manipulative skill, and (3) efficiency in organization. With reference to the first and second points the introduction of automatic machinery was day by day placing an enhanced value on careful, thoughtful workmanship. The Englishman likes to get a job done, he prefers "driving force" to thoughtfulness. The continental controllers and workers are too often years ahead of the British managers and workers; in thoughtful outlook the American managers and workers are up to the British in bulk production and threaten to pass them even in excellency of output.

With reference to the third point, organization depends upon both directors and workers. An unsympathetic attitude on the part of either will lead to trouble and disaster. The scale of organization had probably been set by the United States. There the Arlington mills each day treat the fleeces of about 35,000 sheep—say, 200,000 lb. of wool: and this is said by no means to be the largest wool manufacturing company in the United States. Along with this enormous organization goes an efficiency in organization and cleanliness in installation which puts most European mills to shame. The American manufacturer has no time to develop that "secrecy" which is far too much in evidence in European concerns; he relies upon progressive efficiency.

To sum up, it would seem that while wool-growing countries may develop quite considerable wool-manufacturing industries, these will not be to the exclusion of the older manufacturing countries. On the other hand, American enterprise (and possi-

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bly Japanese enterprise) will severely test the resources of the older industrial countries, and success will rest in the future with the country developing the most thoughtful captains and rank and file of industry.

(*b*) *Wool Production.*—During the high prices period of 1918 to 1921 the demand for wool was so great, and future prospects for the wool-grower seemed so rosy, that likely and unlikely fields for the development of sheep-breeding were considered.

With the slump in prices the future prospects of the wool-grower suffered an apparent eclipse. No doubt in 1920 prospects were considered too rosy, but equally in 1921 prospects were regarded in altogether too sombre a light. A few broad glances at the situation will clear the way.

If we take the United States as practically a self-contained country, and allow the approximately ten million negro population (wearing little or no wool) to balance the extra wool required for garments in the northern states, where cold winters have to be faced, we get this interesting result:—Wool consumed, 600,000,000 lb.; population, 100,000,000; or 6 lb. of wool per head per annum. Even if we allow for a considerable quantity of re-manufactured material and also for the negro population, this can only be regarded as a "miserable statement," for the 6 lb. is greasy wool yielding about 3 lb. of clean wool, or half a suit or half a dress length per annum for each male and female in the United States. In this allowance are included the imports of wool materials (other than raw wool) amounting to an average of over 30,000,000 lb. per annum. Neither Great Britain, France nor Germany shows any advance on this.

The world's wool statistics and population only serve to emphasize the lack of supplies; for taking the pre-war figure (given in Table 1) of 2,728,461,630 lb., and allowing an average yield of 60% clean wool, this leaves about 1,400,000,000 lb. of clean wool to serve for a world's population of 1,606,542,000 or ·9 lb. of wool per male or female. To make this discrepancy even clearer, however, take only the population of Britain, Canada, Australia, the United States, France, Germany, Austria, European Russia and the Netherlands—these total up to approximately 282,000,000 souls, consuming hardly 6 lb. per head per annum. The problem of the future would seem to be:—How to develop such conditions of livelihood the world over that the greatest possible number become substantial purchasing (or exchanging) units?

What possibilities of increased supplies are there? These may be grouped under two heads: (1) an increased yield from the present flocks, and (2) the opening up of new tracts of sheep-rearing land. The first point is admirably illustrated by particulars taken from Table 1, the weights of fleeces for the several continents working out as follows:—

Europe $\frac{8034}{1780}$	5 lb. per fleece.
Oceania $\frac{645}{96}$	7 " " "
S. America $\frac{4826}{1186}$	4 " " "
N. and Central America $\frac{3042}{547}$	6 " " "
Asia $\frac{2731}{923}$	3 " " "
Africa $\frac{2199}{634}$	3 " " "

In some cases the sheep-lands are too poor to be expected to do better, but it will probably be found that this is very rarely the case. It is stated, for example, that Herdwick sheep, living on Cumberland hills which will hardly support rabbits, will produce fleeces from 5 lb. to 10 lb. weight. But what may be effected through careful selection is best illustrated by the following record of New South Wales flocks:—

Period	Sheep	Average Weight of Fleece	Total Weight
1890–3	60,000,000	3 lb. 9 oz.	213,700,000
1900–3	36,000,000	6 lb. 3 oz.	222,750,000
1916–9	35,000,000	8 lb. 7 oz.	295,310,000

Thus with 25 million fewer sheep in 1916 as against 1890 some 80,000,000 lb. more wool was produced. Great Britain has seriously taken these figures to heart, and under the auspices of the Research Association for the Woollen and Worsted Industries strenuous endeavours are being made, (*a*) to increase the quality and yield of the well-established breeds of sheep, and (*b*) to improve the quality of the wool in certain mountain types by crossing with better quality sheep, especially Down sheep.

With reference to the second point, although nothing like the development of a second Australia is to be expected, it is already obvious that marked developments of sheep-growing tracts of land may be expected. In the spring of 1921, for example, Col. Robert Stordy, on behalf of the Peruvian Government, sailed from Britain with cargoes of Southdown, Suffolk Down, Shropshire, Rambouillet (merino) and Soay rams, with the object of developing wool growing in Peru. Wool analysis of the Peruvian wools grown in 1921 on the degenerate sheep of the country, as analyzed by the university of Leeds, revealed remarkable qualities specially acceptable to the hosiery manufacturer. The development of Peru as a wool-growing country is one of the most fascinating possibilities.

The Duke of Devonshire, Governor-General of Canada until 1921, was specially interested and concerned in the development of the prairie lands of the Dominion on the four years' rotation basis, and one of the years will mean sheep. Thus it is quite possible that in the near future Canada will produce more wool of the Down type and possibly of the merino type: for if Russia can raise merinos amid the snows of winter, why not Canada? The Indians and Japanese are both making inquiries with the idea, not only of improving the breed of such sheep as they have but also of developing large tracts of land which probably could well carry sheep.

(*c*) *Wool Distribution.*—The question as to where the wool of the world will be distributed for manufacture and re-distributed for wear, is largely a matter of surmise, and, after the extraordinary change from the conditions prevailing in the early months of 1920 to the conditions prevailing in the early months of 1921, even the most reliable authorities hesitated to commit themselves. If the world becomes more stabilized, and the suppressive effects of vested interests on the one hand and of "ca'canny" on the other are brought within reasonable limits, then it may be that conditions as rosy as 1918 to 1921 will return with accompanying similar conditions in other industries. To meet such conditions, should they arise, will necessitate the employment of every possible type of automatic machine, and a developed skill depending on the quality of "thoughtfulness" on the part of the individual worker in using such automatic machinery. It will thus be evident that forethought, efficiency and skill will play a greater part than ever in deciding the peoples to whom the bulk of the world's wool shall pass to be manufactured. Australia will undoubtedly manufacture an increasing quantity of wool—but she may possibly grow an even greater quantity than that demanded to balance for the manufacturing in her own mills. S. Africa, S. America, India and Japan will no doubt all claim their quota for manufacturing purposes. But the great bulk of the wool will be manufactured elsewhere: and it is safe to say that will be where scientific method and scientific management and a broad, humane outlook dominate. And the manufactured material of course will go to those peoples who have something to offer in exchange.

It is true that the immediate outlook in 1921 was dark. But the reason why was becoming apparent. And when this was fully realized the world would be well on the way to adjust its economic condition to facilitate production and exchange to the advantage of all its peoples. (A. F. B.)

WOOLDRIDGE, HARRY ELLIS (1845–1917), English musical antiquary, was born in 1845. He studied art, and became a student of the Royal Academy in 1865, about the same time commencing his researches into early music. He received various commissions for artistic works, the most important being a reredos for St. Martin's church, Brighton, and the frescoes in St. John's church, Hampstead. At the same time his reputation as

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an authority on music was steadily rising, and in 1895 he was elected Slade professor of Fine Arts at Oxford, a post which he held until 1904. His chief works on music are a new edition of Chappell's *Popular Music of the Olden Time*, which appeared under the title *Old English Popular Music* (1893) and *The Polyphonic Period*, parts I. and II. (vols. i. and ii. of the *Oxford History of Music*, 1901–5). He died in London on Feb. 13 1917.

WOOLWORTH, FRANK WINFIELD (1852–1919), American merchant, was born near Rodman, N.Y., April 13 1852. He was reared on a farm, studied in the public schools, and graduated from a business college at Watertown, N.Y., in 1872. He began his career as a clerk in Watertown, and it is said that a bargain counter in his employer's store first suggested to him the idea that resulted in the establishment of the long chain of "five and ten cent" stores that bear his name. Early in 1879 he opened at Utica, N.Y., his first "five cent" store which, however, was a failure. Later in the same year he established a similar store at Lancaster, Pa., followed by another at Harrisburg. The chain in 1920 was composed of about 987 "five and ten cent" stores in the United States, 94 in Canada, and 81 in England. When the F. W. Woolworth Co. was incorporated in New York in Dec. 1911 he became president. In 1912 the Woolworth building in New York City, costing $13,000,000, was completed from the designs of Cass Gilbert. It is 760 ft. high, has 57 storeys, and, excepting the Eiffel Tower in Paris, is the tallest building in the world. The gross sales of the company in 1920 amounted to $140,918,981 and the net profits $9,775,251, as compared with $119,496,107 and $10,361,557 respectively in 1919. Woolworth died at Glen Cove, L.I., April 8 1919, leaving an estate appraised at $27,000,000.

WORDSWORTH, ELIZABETH (1840–), English educationalist, was born at Harrow June 22 1840, the eldest daughter of Christopher Wordsworth, afterwards Bishop of Lincoln, and hence a great-niece of the poet. She was educated at home and lived a home life until in 1879 Lady Margaret Hall was founded at Oxford, largely owing to Miss Wordsworth's energy and organizing capacity, and she became its first principal. Her social gifts and powers of clever conversation made her a prominent figure in Oxford life. She retired from her post at Lady Margaret Hall in 1909, but continued to live in Oxford and to be an active member of its council. In Oct. 1921 the university of Oxford conferred upon her an hon. M.A. degree. Miss Wordsworth contributed many charming tales to *Aunt Judy's Magazine*, edited by Mrs. Gatty (*see* 11.530), and also published various devotional books and volumes of verse and essays. In collaboration with J. Overton, she published in 1888 the *Life of Christopher Wordsworth*.

WORDSWORTH, JOHN (1843–1911), English divine and scholar, was born at Harrow Sept. 21 1843, the son of Christopher Wordsworth, afterwards Bishop of Lincoln, and grand-nephew of the poet. He was educated at Winchester and New College, Oxford, where he had a distinguished career, and after a short period as a master at Wellington College was elected a fellow of Brasenose and took orders (1867). He became widely known both as a Latin scholar and as a theologian, being elected Bampton lecturer in 1881 and Ireland professor of exegesis in 1883. In 1883 he became a canon of Rochester and in 1885 Bishop of Salisbury. His works include *Fragments and Specimens of Early Latin* (1874); *Old Latin Biblical Texts* (1883 and 1886), vol. ii., in conjunction with Dr. Sanday and Rev. H. J. White; *The Episcopate of Charles Wordsworth* (1898); *Teaching of the Church of England for Information of Eastern Christians* (1900); *The Invocation of Saints and the 22nd Article* (2nd ed. 1910). He died at Salisbury Aug. 16 1911.

WORLD WAR, THE.—The military history of the World War is told in these New Volumes in separate articles dealing with campaigns and battles; and a general account of the war at sea is given in the article NAVAL OPERATIONS (supplemented by separate articles on the battles of JUTLAND, DOGGER BANK, CORONEL, HELIGOLAND BIGHT, FALKLAND ISLANDS, ZEEBRUGGE, and on the GOEBEN AND BRESLAU affair, together with those under the headings of SUBMARINE CAMPAIGNS, BLOCKADE, MINESWEEPING AND MINELAYING and CONVOY). As regards the land operations, reference to the separate headings under which the military history is narrated may best be made here by a brief *résumé* of the course of the war.

The war opened simultaneously on three fronts in Aug. 1914. These fronts were the western, the eastern and the Serbian, and the continuous story of the major operations on these fronts will be found under the respective headings: WESTERN EUROPEAN FRONT CAMPAIGNS, EASTERN EUROPEAN FRONT CAMPAIGNS and SERBIAN CAMPAIGNS, together with SALONIKA CAMPAIGNS. In the west the German invasion of Belgium and France was marked by the five-fold battle of the FRONTIERS (*q.v.*)—in Alsace, Lorraine, Ardennes, at Charleroi and at Mons—by the sieges of LIÉGE, NAMUR and MAUBEUGE (*q.q.v.*), and by the battle of GUISE (*q.v.*). Its culmination in the battles of Sept. 4–20 is told in detail under the heading MARNE; and the development of the northern flanks of the opposed armies towards the sea, at the same time as ANTWERP (*q.v.*) fell to the Germans, is dealt with under the headings ARTOIS (part I.), and YPRES AND THE YSER (part I.).

On the eastern front the Russian invasion of East Prussia, with its battles of Tannenberg and the Masurian Lakes, is dealt with in detail under the heading MASURIA, BATTLES IN (parts I., II.), while the main conflict between the Russian and Austrian offensive efforts in Galicia and Poland during August and early September is described under LEMBERG (part I.). The subsequent united efforts of the Austrian and German armies in Poland and Galicia to stem the onset of the "steam-roller" may be divided into periods characterized by the battle names VISTULA-SAN (*q.v.*), and LODZ-CRACOW (*q.v.*). The first siege of PRZEMYSL will be found under that heading. The three Austrian invasions of Serbia are described in the general article for that front, mentioned above.

The year 1915, a year of stabilization on the western front, was one of open warfare on the eastern. Beginning with the battle of the CARPATHIANS (*q.v.*) and the second siege of PRZEMYSL (*q.v.*) on the one flank, and the "Winter Battle" of Masuria (*see* MASURIA, BATTLES IN, part III.) on the other, the operations, after a pause, took shape as a general Austro-German offensive from May 1. The right half of this offensive preceded the left by two months, and its successive episodes are marked by the battles of Gorlice-Tarnov and the San (*see* DUNAJEC-SAN and PRZEMYSL), the battles of Grodek, Lemberg and Stryi (*see* LEMBERG, part II.), and by the later episode of ROVNO (*q.v.*). At a certain stage in the development of these operations, their left wing becomes one branch of a double-envelopment aimed at the rear of the Russian centre in West Poland; this branch is the campaign from the Tanev river against BREST LITOVSK (*q.v.*), while the other is the offensive of the "Gallwitz army" from Przasnysz, across the Narew into the interior of the corridor followed by the Russians in their retreat (*see* NAREW, BATTLES OF THE). The final efforts of the Germans to isolate the retreating Russians, which ended in ill-success and in the formation of a stable trench-line, as in the W., are dealt with in the general military narrative of operations on the eastern front, named above.

In the E. the entry of Turkey into the war led to the expedition against the DARDANELLES (*q.v.*), and to the renewal of the offensive of the Central Powers against Serbia in the autumn of 1915 (*see* SERBIAN CAMPAIGNS), which closed with the conquest of Serbia on the one side, and the creation of a new minor front at Salonika on the other (*see* SALONIKA CAMPAIGNS). The campaigns in Asia Minor are dealt with under the general heading TURKISH CAMPAIGNS, of which the several sections describe the operations which took place in the Caucasus, in Mesopotamia and in Sinai and Syria.

In the W. the years 1915, 1916, 1917 are essentially the "trench-warfare" period. The battles of Ypres in 1915 (*see* YPRES AND THE YSER, part II.), of Neuve Chapelle, Carency, Souchez and Loos (*see* ARTOIS, BATTLES IN, part II.) respectively, the minor offensive of Crouy, the winter battle in Champagne (*see* CHAMPAGNE, parts I., II.), and the trench-warfare fighting in ARGONNE (*q.v.*) and WOËVRE (*q.v.*), culminated in the great French

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offensive of Sept. 25 1915 in Champagne (*see* CHAMPAGNE, part III.), but without materially affecting the stability of the trench-warfare conditions. The year 1916 opened with the great German blow at VERDUN (*q.v.*), which forestalled the Allied offensive of the SOMME (*q.v.* part I.): these two great names fill the history of the 1916 campaign in the west. In 1917 a first essay in operating under a united command was made by the Allies in the spring campaign, and produced the Arras battles described under ARTOIS (part III.), and the Aisne offensive of April (*see* CHAMPAGNE, part IV.); the results were disappointing, and the parts of the inter-allied machine fell asunder, the British taking up the weight of the task in the battles around Messines, Ypres, Passchendael, etc. (*see* YPRES AND THE YSER, part III.), and in the "tank-battle" of CAMBRAI (*see* ARTOIS, section I.), while the French carried through two battles of limited objective, described under CHAMPAGNE (part IV.) and VERDUN.

Meantime, the entry of Italy into the war in 1915 had created new military relations in the Mediterranean basin. Austria had established a new defensive front on the Isonzo, and, shortly after the Verdun offensive of her ally, had struck a similar blow on the Tirol front at Asiago. The unity of operations in the Italian theatre of war makes it possible to refer the reader to a single heading, ITALIAN FRONT CAMPAIGNS, with the subordinate articles therein referred to, for the story of the war in this region from first to last.

On the Russian front, the year 1916 saw a final effort of Russia, in spite of losses, to regain lost ground and to help her Allies. The battles, after an isolated winter battle known as the "New Year's fight," described under the heading STRYPA-CZERNOWITZ, fall into two main groups, those of the spring and those of the summer and autumn, in which the battles of NAROCH LAKE (*q.v.*) and LUCK (*q.v.*) are the central episodes.

The spring of the final year, 1918, finds the focus of military events in Europe placed on that section of the front in France which lies north of the Oise. Here, on March 21, the great German offensive broke through the lines of the British V. Army (*see* SOMME, part III.); here also, on April 9, a second effort was made at the LYS (*q.v.*). In summer, the German attacks of May 27 on the Chemin des Dames (*see* CHAMPAGNE, part V.), of June 9 on NOYON (*q.v.*), and of July 15 on both sides of Reims (*see* CHAMPAGNE, part VI.), culminate, and the period of Allied counter-attacks under united command begins with July 18 (*see* CHAMPAGNE, part VII.), Aug. 8 (*see* SOMME, part IV.), Aug. 21 (*see* SOMME, part V.) and St. Mihiel (*see* WOËVRE), to assume at last a coherent and decisive form in the three simultaneous offensives of the Americans in the MEUSE-ARGONNE (*q.v.*) battle, of the British in the battle of CAMBRAI-ST. QUENTIN (*q.v.*) and the Belgians, British and French in the last battle of YPRES (*q.v.*).

As regards the origin of the World War, its history is told in the article EUROPE, in the final section of which its results on the national reshaping of Europe after the war are analyzed. Reference on both these aspects may also be made to the historical and geographical sections of the articles dealing with each country involved in the war. But during the war itself the political aspects ceased to be merely European: it became a World War. The general international politics throughout its course are therefore dealt with under the present heading, in the article below, as distinctively world-history, by way of continuation of the historical article under EUROPE which deals with the international politics of Europe up to August 1914. (H. CH.)

POLITICAL HISTORY OF THE WAR[1]

From the moment hostilities began in 1914, it became the absorbing aim of all the combatant countries to win the war; but each of them placed a different interpretation upon the meaning of victory, and that meaning also varied with their fortunes, the eclipse of this or that belligerent, and the entrance of fresh forces into the arena. The war aims of Great Britain were tersely stated in general terms by Mr. Asquith at the Guildhall on Nov. 9 1914, when he declared: "We shall never sheathe the sword, which we have not lightly drawn, until Belgium recovers in full measure all and more than all that she has sacrificed, until France is adequately secured against the menace of aggression, until the rights of the smaller nationalities of Europe are placed upon an unassailable foundation, and until the military domination of Prussia is wholly and finally destroyed." France and Russia, while agreeing with these objects, mentally put a more concrete interpretation on victory: to France the symbol of victory was the restoration of Alsace-Lorraine with further guarantees against a repetition of 1870-1; while Russia desired to exorcise Prussian apparitions "in shining armour" at Petrograd and to secure control of Constantinople and the Straits.

The Original Combatants.—Germany was less single-minded in her ideas. The mass of her people had been persuaded that the war was one of defence against a Pan-Slav peril and hostile encirclement by other Powers; but the bourgeois classes looked for *Weltmacht* in the shape of commercial and colonial expansion, while Bernhardi expressed the mind of Prussian militarists, when he demanded three years before the war that "France must be so completely crushed that she can never cross our path again." Behind such ebullitions was a growing conviction in the Prussian mind that the Prussian system of government could not long maintain itself against social democracy without fresh tributes to the efficacy of the sword. "This danger," wrote Prince von Bülow, "must be faced and met with a great and comprehensive national policy under the strong guidance of clear-sighted and courageous governments, which whether amicably or by fighting can make the parties bow to the might of the national idea." "Nor," concluded Bernhardi, "must we think merely of external foes who compel us to fight. A war may seem to be forced upon a statesman by the condition of home affairs." To Austria the compulsion came from the attitude of Yugoslavs within her borders; and her original war aims probably did not extend beyond the reduction of Serbia to dependence and the consequent eclipse of Russian prestige in the Balkans. For Belgium and for Serbia the object of the war was primarily self-defence, although in Serbia's case successful self-defence would inevitably bring with it the prospect of increased influence in the domestic affairs of the Habsburg Empire. Japan was bound to intervene by her alliance with Great Britain, but a positive inducement to fulfil its terms was held out by the opportunity of conquering Kiaochow and excluding Germany from Far Eastern waters.

Not much choice had in fact been left to these original combatants by the circumstance of past policy which had driven them into the war. Other Powers had freer hands and a market in which they could sell their alliance to buyers who would bid high. They could intervene or hold aloof, and the nature and extent of the price they set on their services would modify the war aims of those whose cause they espoused. The course, the objects, and the end of the war were profoundly affected by the gradual expansion of the hostile groups.

The leading part played by Germany in the movements which precipitated the outbreak is emphasized by the fact that Austria, having declared war on Serbia on July 28, remained at peace with all other States for several days after Germany had drawn the sword. It was not until Aug. 6 that Austria declared war on Russia, nor until the 10th and 12th that France and Great Britain declared war upon her, nor until the 27th that she declared war on Belgium, the German invasion of which had dragged in Great Britain three weeks before. So far as Austria was concerned, the Triple Alliance had been purely defensive, and it had not even bound her to defend Germany against France, unless Russia also intervened. Italy, on the other hand, had been bound to assist Germany against a French attack; and the legends about French aggression, which Germany

[1] For side-lights on conflicting national viewpoints in connexion with particular episodes, and for greater detail in regard to them—the accounts being still sometimes irreconcilable as between representatives of the different countries concerned,—see the separate historical articles under country headings: especially ENGLISH HISTORY, UNITED STATES (*History*), AUSTRIAN EMPIRE (*Foreign Policy*), GERMANY (*History*), FRANCE (*History*), ITALY (*History*), JAPAN (*Foreign Relations*), SERBIA (*History*), YUGOSLAVIA (*History*), CZECHOSLOVAKIA (*History*), GREECE (*History*).

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propagated in the early days of Aug., were meant for Italian as much as for British consumption. Italy had, however, under wise guidance, refused to believe in French aggressiveness, and had declared her neutrality on Aug. 1 on the ground that her intervention was not required by the terms of the Triple Alliance. Her abstention on this occasion was probably the greatest service she rendered to the Entente during the war, for it released from the Franco-Italian frontier some hundreds of thousands of troops without whose assistance the battle of the Marne could hardly have been won. Her example may also have been the last straw in the balance which determined Rumania, despite its Hohenzollern King and its Austrian alliance, to stand aloof from the struggle.

The Neutral States.—Neutrality was expected from the other European States, whatever their sympathies might be. Holland's traditions were more friendly to Germany than to Belgium, but they were obliterated by the wanton invasion of Belgium's neutrality, and Bethmann Hollweg's argument that a German annexation of Belgium would be useless without the acquisition of Dutch territory was not calculated to assuage alarm. But more immediate perils dictated Dutch neutrality. There was no reason to suppose that Entente forces, which protected only a tiny corner of Belgium, could have saved a single acre of Dutch territory. Holland, with its wealth of capital and agricultural produce and its harbours, would have fallen an easy prey to Germany, while the remnants of its colonial empire might have gone the way the Cape of Good Hope and Ceylon had gone during the last occupation of Holland by an enemy of Great Britain. Holland was wise in its neutrality, and even the Entente probably benefited more by it than it would have done by Dutch intervention. It was certainly well for Great Britain that in 1917–8 German submarines had no Dutch ports for bases which could not be blocked as the exits from Bruges were in April 1918.

Denmark was in the like case, albeit with an ancient grievance against Germany in the wrongful detention of Danish Slesvig. But again, Denmark could not have been defended against German invasion, and Danish coasts and ports would have been invaluable to German submarines. Denmark, too, was wise to eschew belligerency and seek to develop its influence in conjunction with its Scandinavian colleagues. Of these, Norway sympathized with the Entente, and might, but for the fear of Sweden, have been driven by German piracy into war. Sweden's affections were more divided. The Labour party, led by Branting, was, if not pro-Entente, at least averse from intervention on Germany's side. But the upper and bourgeois classes were strongly German in sympathy and inclined to *activism* in that direction. This affection was partly due to cultural development, but more to a greater fear of Russia which had been aggravated by the fate of Finland and Russian designs in the Åland Islands. The Baltic was, like the Adriatic, the scene of a triangular duel; but the Russian menace in the Baltic was greater than the Teutonic menace in the Adriatic. Sweden's fears of Russia counterbalanced Danish and Norwegian grievances against Germany, and the Scandinavian States found a basis for neutrality in an equilibrium of antipathies.

Spanish neutrality was the resultant of similarly antagonistic domestic feelings. The King, with his English wife, was pro-Entente, but the Catholic and conservative upper classes were pro-German, while the democratic factions, hankering after revolution, took the opposite side. Portugal was, as it had been since its war of liberation and the marriage of Catherine of Braganza, an ally if not a pawn of England; and the prospective agreements which England and Germany had just made for the division of its colonies had not sufficed to transfer its allegiance from the one to the other beneficiary. No one expected Switzerland to abandon its neutrality; and the Balkans were left as the principal sphere of diplomatic competition. Greece had a Prussian Queen and a King who was a Prussian field-marshal, but a prime minister whose sympathies and confidence were whole-heartedly on the Entente side. Bulgaria, as a result of the Treaty of Bucharest in 1913, had no sympathies at all, but a comprehensive grievance against all her neighbours who had robbed her of the fruits of victory over Turkey, and against the Great Powers which had acquiesced in that spoliation. Her object was simply to discover the probable winner, and back it with all her resources in the hope of getting back all she could from the losers. For the moment she would wait and see.

Turkey was nearer to a decision. She had long been wooed by the Kaiser. In 1898 he had declared himself the friend of all Mahommedans, whose-soever subjects they might be; and the circumstance that, outside Turkey, they were mostly the subjects of Great Britain, Russia, or France gave point to his policy. The Turkish revolution of 1908 and the machinations of a so-called party of progress, led by Enver and Tal'at, made no difference to the growth of Turco-Teutonic affection. England had afforded but a half-hearted support against the Russian advance toward Constantinople; she had assisted in the liberation of Greece and the Balkans, and had helped herself to Cyprus and Egypt and other fragments of the dismembered Turkish Empire; and her friendship seemed but the nether millstone to the upper millstone of Russian aggression. Moreover, by August 1914 the antagonism between England and Russia, on which 'Abdul Hamid relied, had disappeared in an alliance in which, so far as the Near East was concerned, Russia would be the predominant partner; and the interpretation which Russia put on that entente was illustrated by a crown council held in St. Petersburg on Feb. 6 1914 to discuss the means for securing the Straits and Constantinople. The appointment of the German Gen. Liman von Sanders to reorganize Turkish forces was the retort which naturally commended itself both to the Turk and the Teuton.

The Turkish mind was, however, slow to move; it was no light matter to reverse the traditional policy of centuries and embark on war with a Power which had long regarded the maintenance of the Turkish Empire as one of the first of British interests. The Kaiser believed that he had Turkey in his pocket, but no one knew what her attitude would be. When the German admiral made for the Dardanelles with the "Goeben" and the "Breslau" on Aug. 8–9 his course was dictated by necessity and not by plan, and he was even prepared to force his way up the Straits if peaceful admission were refused. As late as the 5th the German embassy at Constantinople had reported that it was undesirable for him to arrive there yet. He was, however, received with open arms. Turkish opinion had been profoundly irritated by the commandeering of two Turkish dreadnoughts which had been built in British dockyards out of the proceeds of a patriotic Turkish loan; officers of the British Naval Mission in Turkey were superseded, and, in spite of the Grand Vizier's opposition, Enver, the Minister of War, was mobilizing Turkish forces for an attack on the Suez Canal. Plans for Anglo-French naval co-operation in the Mediterranean had to be abandoned and British ships detached to blockade the Dardanelles and safeguard the Red Sea, while troops were hurried from India to Egypt. Twice before the end of Aug. Sir Louis Mallet, H.M.'s ambassador at Constantinople, mooted the possibility of forcing the Dardanelles, but expressed the opinion that success was doubtful without military coöperation and that failure would be disastrous. He succeeded, however, in prolonging the resistance of the Grand Vizier to Enver's designs and in delaying the breach until toward the end of Oct.

Turkey's Entry.—By that time the German Government had determined to cut the Gordian knot of Turkish indecision. The western campaign was coming to a deadlock before Ypres, the first German attack on Warsaw had failed, and a great Austrian effort was being planned to punish Serbia for her success in resisting attacks in the Balkans. On Oct. 28 Souchon sallied out of the Bosporus into the Black Sea with the combined German and Turkish squadrons, and on the 29–30th he mined Sevastopol harbour, sank a transport, and bombarded Odessa, Theodosia, and Novorossisk. Souchon alleged that the transport was a minelayer laying mines in Turkish territorial waters; and while the rival parties were still discussing the rival versions, Russia, having in Sept. secured a neutrality engagement from Rumania which was not communicated to her allies, declared

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war on the 31st without their connivance. The British and French ambassadors had already been instructed to follow their Russian colleague; on Nov. 1 they left Constantinople, and on the 3rd Adml. Carden bombarded the forts of the Dardanelles. Russian precipitation had, however, only hastened the end. Enver's troops had long been on the march toward the Suez Canal, and on Oct. 27 British outposts at El 'Arish and Nekhl had been withdrawn.

The entrance of Turkey into the war as Germany's ally was the first great diplomatic success achieved by either of the belligerent groups, and it did more than anything else to extend the sphere of the war and to increase in particular Great Britain's anxieties and obligations. Britain had little contact with Austria, and not much more with Bulgaria. Even Germany, apart from her naval ambitions, presented few points of direct conflict; they arose indirectly, either through the menace to Britain's allies in France and Belgium, or through the doors which Turkey now opened to German penetration. These led so far and in so many directions threatening British interests that, as they were gradually revealed in 1914–5, it seemed to many that they represented the original motive of Germany's aggression. Through Turkish dominions lay the overland route not merely to India but to Egypt and E. Africa; and both paths were strewn with inflammable material. Britain ruled over something like half the Mahommedans of the world, and for many of them the Sultan of Turkey as Caliph was their head. Even more dangerous might Germany's propaganda, backed by German military success, become in the midst of other discontented elements in India and in Egypt. With these under German and Turkish influence, the ferment might spread throughout the greater part of Asia and of Africa. Even the sea routes, on which the life of the Empire depended, would become unsafe when threatened on their flanks; for the problem has not yet been solved of how to command the sea in distant waters against an enemy holding the neighbouring lands and using the submarine. More immediately the entrance of Turkey into the war imposed upon Great Britain the task of defending the naval position in the eastern Mediterranean, the route through the Suez Canal, Egyptian territory, the Persian Gulf and the overland route to India against Turkish and Arab attacks. Incidentally it cut off Russia from her least indirect and irregular communication with her allies. Fortunately, the action of Japan limited these anxieties and relieved the Entente of the greater part of the burden of eradicating German power in the Far East. A Japanese ultimatum, which had been expected a little earlier, was delivered to Germany on Aug. 15 demanding the unconditional surrender of Kiaochow; it expired on the 22nd, and next day Japan entered the war.

Turkey's intervention had an immediate effect upon the status of her former provinces held by Great Britain. Cyprus was annexed at once; a British protectorate was proclaimed over Egypt on Dec. 17 with the connivance of France, whose protectorate over Morocco was recognized by Great Britain on the 24th, and on the 18th the Khedive 'Abbas II., who had thrown in his lot with his Turkish suzerain, was deposed in favour of his uncle Husein, who further received the title of Sultan. Egyptian opinion accepted the change, and Turkey's efforts to reconquer her lost dominions were frustrated by the necessities of self-defence in the Dardanelles and on all her Asiatic frontiers. Before the Russians could move across the Caucasus, divisions of the Indian army had sailed up the Shatt al 'Arab and begun that chequered advance which led them from Basra to Mosul. Not the least of the political effects of Turkey's action was to bring India into the war to a far greater extent than would have been possible had British participation been restricted to European fronts. Over a million native Indian troops were eventually engaged, and they assisted materially in the conquest of Mesopotamia, Palestine, and Syria. Before long Arabia, too, turned against the Turks, and found in Turkey's participation in the war the opportunity to emancipate itself from Turkish rule.

Russia's Claims.—For the moment, however, these were unforeseen developments, and the more immediate effect of Turkey's intervention was to bring within the sphere of apparently practical politics ambitions which belonged to an older world. The breach which Russia had helped to precipitate opened up the prospect of giving effect to the deliberations of the Russian crown council of Feb. 6 1914. The subject was not apparently broached by Russia to her allies until they, for reasons of their own, had committed themselves to an enterprise which would render it possible for Russia to reap its fruits—unless, indeed, it was really with an eye to securing Constantinople and the Straits by means of allied efforts that Russia despatched on Jan. 2 1915 an urgent request for some diversion to relieve Turkish pressure in the Caucasus. This is not the place to trace the growth of the Dardanelles expedition, which after the premature bombardment of Nov. 3, was keenly taken up by Mr. Churchill. The political and strategical motives for it seemed adequate. There remained no flank to turn on the western front; an unbroken line of trenches stretched from the North Sea to the Alps; and neither side could break the deadlock. On the other hand, the flank might be turned by sea power operating in the Dardanelles, an enemy knocked out by the capture of Constantinople, communications restored with Russia, the Teutonic path barred to the East and to Egypt, and two if not three new allies found in Greece, Rumania, and Bulgaria, who uniting with Serbia and linking up Russia with a fourth potential recruit in Italy, might sweep upon Austria-Hungary and threaten an attack on Germany's southern frontiers which would destroy the bastions she had made on her eastern and western fronts.

Such was the prospect which Allied vision discerned and Russia proposed to convert into territorial substance. On March 4, when England and France had been committed to the enterprise, Russia handed in a memorandum to the British and French ambassadors at Petrograd, in which she explained her ideas. Most of what was left of Turkey in Europe, including Constantinople, the western shores of the Bosporus, of the Sea of Marmora, and of the Dardanelles, and Thrace as far as the Enos-Midia line, was to become Russian territory. So, too, were the islands in the Sea of Marmora, Imbros and Tenedos outside the Dardanelles, and the coast of Asia Minor from the Bosporus to the mouth of the Sakaria and across to the gulf of Ismid. On the other hand, the middle zone of Persia, declared neutral by the agreement of 1907, was to be assigned to the British sphere of influence, while Arabia was to become independent. By March 20 both the British and French governments had signified their assent to these proposals. Russia was still the predominant partner in the military alliance, her armies were overrunning the Carpathians and the Bukovina, and the anticipated collapse of Austria discounted the need to respect Balkan susceptibilities.

The agreement was secret, but Russian secrets had a habit of leaking out to her enemies during the war. Nor, indeed, did British or French politicians conceal their conversion to the justice of Russia's demands, while they ignored in their comments the impression it would produce upon wavering minds in the Balkans. The effect was to give Turkey the unaccustomed part of champion of Balkan independence; for with Russian ambitions fulfilled, no other Balkan power could have been more than a client State. Greece saw her aspirations—more legitimate at least than those of Russia—thwarted for ever by Allied complaisance; Bulgaria seemed to have struggled in vain under Stambolov to free herself from Russian tutelage, and to be doomed to perpetual servitude; Rumania lost hope of righting the wrong of 1878 and redeeming the Rumanians of Bessarabia; and only Serbia, which looked to the Adriatic, was content with this prospective Russian monopoly of the Black Sea and the Straits and dominance of the Aegean. The intervention of Turkey had given a predatory turn to the thoughts of the Entente; and, so far, the diplomacy of the war had tended to show an increasing disrespect for the liberties of little nations.

The war was not, however, making much progress on those lines. In the Near East Russia's difficulty lay not in securing her Allies' assent to her aspirations but in providing for their realization. This she was totally unable to do, and her contribution to the Dardanelles campaign, which was to have taken

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the form of a hundred thousand men landed on the N. coast of Thrace and a naval attack on the Bosporus, came to nothing. Great Britain and France were not merely to assent to Russia's schemes but to give them effect; and they were not such as would enlist support in the Balkans. Venizelos was apparently prepared to land two Greek divisions, but they would almost certainly have been inadequate, and it was more than Hohenzollern interests that prevented the embarkation. Bulgaria would have bowed to the accomplished fact, but no sane politician could have expected her to help Russia into Constantinople. The western Allies themselves were deeply committed to an offensive with their maximum force on the western front, and reluctantly doled out belated troops for the Dardanelles. So the ill-starred enterprise dragged on to its inevitable end. Success may sometimes redeem the worst of policies and plans, but the failure of the Dardanelles expedition precipitated the evils it had sought to prevent, drove Bulgaria into the enemies' camp, and handed the Balkans over to the Teutonic alliance.

Italy's Entry.—The next diplomatic move was more successful. The better mind of Italy had been shown by her refusal to acquiesce in an Austrian attack on Serbia in 1913 and to back up her Allies in Aug. 1914; and the tradition of Garibaldi and Mazzini had already inspired Italians to enlist under Ricci Garibaldi for service in France. The gibe of the French diplomatist that Italy would rush to the rescue of the conqueror was disproved by her quiescence when the Germans were at the gates of Paris; and popular Italian sympathies were undoubtedly stirred by the wrongs of Belgium and of Serbia. But in Italy, as in other countries, there was at first a hiatus between the soul of the people and the diplomacy of her government. It was Baron Sidney Sonnino who was mainly instrumental in negotiating the secret Treaty of London on April 26 1915. He had been convinced that Italy's interests required her intervention on the side of the Entente. He believed in a balance of power which Italy might turn to her own advantage. The seizure of Tunis by France in 1881, and fear lest the Mediterranean might become a French lake, had driven Italy into the Triple Alliance and the bosom of her hereditary Austrian enemy; and fear lest the Adriatic should fall under Teutonic domination if the Entente were defeated, and under Yugoslav influence if it won, drove Sonnino in 1915 out of the refuge of neutrality. In either event it was only by Italian belligerency that the situation could be redressed in Italy's favour; and Sonnino's calculations were that, if the war did not end in a decisive victory, Italy would probably get more out of a semi-victorious Entente than out of a semi-victorious Germany. Germany might, indeed, throw the Habsburg dominions into the melting pot as part of a general liquidation, and recognize Yugoslav independence; but she would keep Trieste for herself and Fiume for Hungary, which would be worse for Italy than the *status quo*.

Better terms could be obtained from the Entente, and Sonnino sought a fulcrum for his bargain in the concessions he demanded from Austria. Both Austria and Italy were pledged to the principle of reciprocal compensation in case either was forced to disturb the *status quo* in the Balkans. Austria argued that the invasion of Serbia involved no permanent territorial change; but Sonnino retorted that during the Turkish-Italian War Austria had declared that an Italian bombardment of the Dardanelles or even the use of searchlights against the Turkish coasts would constitute a claim for Austrian compensation. In March 1915 Burian admitted the principle of the Italian claim, and under pressure from Germany conceded the Trentino to avoid a breach. But there was no guarantee that the concession would be regarded as binding in the hour of victory, nor would Burian budge an inch with regard to Gorizia, Trieste, the Dalmatian islands, or Valona. Sonnino had naturally less compunction in demanding from the Entente Powers their recognition of acquisitions to be made at the expense of their enemy than he had in requiring the surrender of territory from his ally; and in the Treaty of London, signed on April 26 1915, he made full use of this opportunity. To the Entente it seemed that victory was all that mattered, and victory appeared to be doubtful without Italian assistance. It was useless to talk about placing the rights of the smaller nationalities upon an unassailable foundation if insistence upon all those rights prevented any foundation at all. Nor apparently did any of the Entente governments appreciate at that time the view which the smaller nationalities involved in the bargain took of their rights.

The complete dissolution of the Austro-Hungarian Monarchy was not then, declared Salandra four years later, considered as a possible war-aim; and it was under the impression that peace would still leave the Habsburg Empire a formidable foe to Italy that the Entente agreed to the terms which ultimately threatened to break up the Peace Conference in 1919 and provoke a fresh war between Italians and Yugoslavs. Thus Italy was to receive the Trentino up to the Brenner Pass; this would give her all the advantages of a strategic offensive against Austria which Italy complained that Austria had possessed against her, and would subject to Italian rule a quarter of a million Germans. She was to acquire Istria, including Gorizia, Trieste, and Pola, but not Fiume, and western Dalmatia including the harbours of Zara and Sebenico, a protectorate over central Albania and the sovereignty of Valona. The Adriatic would thus become an Italian lake. In the E. Mediterranean she was to have entire sovereignty over the Dodecanese which she had occupied since the Turco-Italian War, and in the event of a complete or partial partition of Turkey was to receive the province of Adalia and its adjacent littoral. She was to be compensated for any British and French colonial expansion in Africa by similar extension of territory in Eritrea, Somaliland, and Libya, and to be paid a share in the war indemnity corresponding to her sacrifices. The signatories were pledged to secrecy and to support Italy in opposing papal participation in the negotiations and settlement of peace. Italy in return undertook to wage war with all her resources against all the enemies of the Entente, to commence hostilities within a month, and to sign the declaration of Sept. 5 1914 by which the Allies engaged to make no separate peace. But while she denounced the Triple Alliance on May 3 1915 and declared war on Austria on the 23rd, she did not announce her adhesion to the pact of Sept. until Nov. 30 and remained at peace with Germany until Aug. 27 1916. Salandra subsequently claimed this delay as an important service rendered to his country, and Tittoni justified it on the ground that no date had been specified in the treaty, although her Allies in giving their consent to it noted her declaration that she would "actively intervene at the earliest possible date, and at any rate not later than one month after their signature."

The secrecy of the treaty exonerates the Italian people from the charge of being actuated by its materialistic motives when they enthusiastically supported intervention in May 1915 and defeated Giolotti's attempt to drive Salandra from power. But the treaty was soon revealed to the Yugoslavs with results which materially helped the Austrian cause. Great indignation was expressed during the Peace Conference of 1919 at the admission of Yugoslavs to plead their cause, and the Italian premier Orlando exclaimed that it would be as proper to call in the Germans, since Slovenes and Croats had fought throughout the war on Austria's side. But some at least of their persistence was due to the Treaty of London, which proposed to transfer hundreds of thousands of them merely from a familiar to an unfamiliar alien domination. The upshot was largely to reinforce the small pro-Austrian party among the Yugoslavs, and to place obstacles in the way of Italy's march to Trieste. Similarly deterrent was the effect of the Italian claim to the purely Greek Dodecanese and her Albanian pretensions upon the popular mind in Greece. Italy was not, however, alone to blame. On the eve of her decision a Pan-Slav society in Petrograd adopted and published abroad a resolution to the effect that in view of Russia's victorious progress across the Carpathians the projected Italian intervention was belated and undesirable; and the first use which Serbia made of the promised accession of strength was, as soon as Italy was at war, to dash across to the Albanian coast where Serb and Italian ambitions conflicted. It was not the imperialism of Italy which delayed

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the intervention of Rumania, to whom an Entente loan had been guaranteed three months before; nor was it the ineffectiveness of Italy's attacks across the Isonzo. It was the military defeat of Russia in Galicia and Poland, and Great Britain's failure in the Dardanelles, that provoked the next accession of strength to the enemies' cause.

Bulgaria's Entry.—Bulgarian neutrality had always been precarious, and the Government itself had difficulty in restraining its irregulars and *komitajis* from raiding the Serbian frontier. A serious affray of this sort occurred on April 1. at Valandova while King Ferdinand was still waiting upon events, but by July the Russian *débâcle* in Galicia and the British failure to make much advance in the Dardanelles convinced him that Germany would win, and on the 17th a treaty was concluded which offered Bulgaria, in return for her intervention, the whole of Serbian Macedonia and Albanian Epirus; she was also allowed to extort from Turkey a strip of territory along the Maritsa controlling that river and Adrianople. Belated efforts had been made to buy off this new enemy, but it was not until Aug. 23 that the Serbian *Skuptshina* was brought to recognize "the sacrifices indispensable for the preservation of the vital interests of her people." They would have preferred more heroic measures, and in vain begged the Entente to authorize a Serbian attack on Bulgaria before the latter got her blow in first. The normal correctitude of the Entente was reinforced by the fact that Serbian aggression would release Greece from her treaty obligations to assist Serbia if attacked by Bulgaria. It did not foresee the autocratic dismissal of Venizelos by Constantine on Oct. 6, the acquiesence of the Greek parliamentary majority, and Constantine's repudiation of his treaty obligations when Bulgaria took the offensive. It was carefully synchronized with Mackensen's invasion from the N.; and, taken on two fronts, Serbia was in a desperate position. The British and French troops hastily transferred from Gallipoli to Salonika were too late even to assure the Serbs a retreat down the Vardar; and they had to make their perilous way across the trackless and snow-clad mountains of Albania to the inhospitable shores of the Adriatic. The outposts followed the centre of the Entente position in the Balkans; Montenegro was overrun by Austria; and the British evacuated Gallipoli, keeping Salonika as a thorn in the enemy's side and a bridle on Greek vagaries.

Christmas, 1915, marked the climax of German success in the war. She had easily held her western front with inferior forces against wasteful and premature Allied attacks, while she conquered Galicia and Poland, and with Bulgarian help overran Serbia and made a corridor to Turkey and the East. Von der Goltz was already in Mesopotamia organizing the Turkish forces which saved Bagdad from Townshend in Nov. 1915 and then captured his army in Kut in the following April; while Egypt had to withstand Arab attacks on the W. and Turkish attempts in the Suez Canal. But it needed a longer and stronger arm than even Germany possessed to strike with much effect across the torpid body of the Turkish Empire and the sands of Syrian and Arab deserts. Russia more than atoned for the British failure before Bagdad by the rapid and brilliant seizure of Erzerum in Feb. 1916, and then pushed on S. to Mush, Bitlis, and Van, and W. to Trebizond. On June 7 the Grand Sherif of Mecca threw off his allegiance to Turkey, occupied Jidda and Yambo', laid siege to Medina, cut the Hejaz railway and was joined by tribes farther S. who captured Aunfuda; on Dec. 16 he was recognized as King of the Hejaz by Great Britain. Between March and Sept. Smuts conquered nine-tenths of German E. Africa, while Portugal threw in her lot with Great Britain to assist in the campaign; and, although the week after the fall of Kut did not seem a happy moment for the conclusion of the Sykes-Picot Agreement of May 9 1916, its arrangements for British, French, and neutral zones in Mesopotamia, Syria, and Palestine were intelligent anticipations of the future. Germany's oriental visions were unsubstantial, and her Balkan allies would not be much help toward a decision on the western front. She had merely secured immunity for her eastern frontiers and relief from fear lest Austria should collapse, while she turned her forces once more to the W. for a blow at the heart of France before the first serious Allied offensive matured. The Marne had taught her the risks of the far-flung line, and she now selected the shortest route to a vital spot at Verdun.

Rumania's Entry.—France saved herself in the titanic conflict which followed; but Germany, too, was hardly less successful in her resistance to the Franco-British attack on the Somme, while with her left hand, so to speak, she bolstered up Austria's stand against the unexpected and vigorous assaults which Brusilov launched in July, and then crushed Rumania when on Aug. 27 the fifth Balkan state ventured into the turmoil of war. Rumania, long shivering on the brink, chose an unfortunate moment to plunge. Her case was a replica of Italy's; there was a *Romania irridenta* (as the Rumanians spell it) across the Carpathians, subject to worse treatment from Magyars than unredeemed Italy suffered at Austria's hands. There were also strategic frontiers to be rectified, and a semi-circular state to be rounded off. By the secret treaty with Rumania which was signed by Italy, France, Great Britain, and Russia, Rumania was to receive the Banat, the whole of Transylvania, a large slice of Hungary up to a line from Szeged on the Theiss through Debreczen to half-way between Csap and Szatmar-Negeti, as well as the Bukovina up to the Pruth, "the most ethnically unjust of all the secret agreements made during the war,"[1] which only the subsequent and separate peace of Bucharest in May 1918 released the Allies from their obligations to enforce. Nothing was naturally said about the Rumanes under Russian rule in Bessarabia or Bulgarians under Rumanian sway in the Dobruja. The treaty had been drafted on Aug. 8, but Stuermer objected that the Great Powers must not be bound to continue the war until all Rumania's territorial aims had been achieved, and Briand agreed to waive the point. Bratiano, however, threatened to resign, and on Aug. 12 the Tsar apparently yielded. The Allies were to advance from Salonika on the 20th and Rumania to declare war on the 27th.

Sarrail's plans had, however, been betrayed by two of his officers, and it was not until Sept. 7 that he could move. Rumania kept to her bond, and attacked Transylvania on Aug. 28. Her subsequent disasters were attributed to her neglect of Entente counsels and wishes in attacking Transylvania instead of Bulgaria; but the criticism was unjust. There was apparently no stipulation about the direction of Rumania's action, and she had hopes that Bulgaria might not intervene. Justification for aggressive war must always be found in a political and not a strategical motive. Rumania had a legitimate grievance against Austria-Hungary in the treatment of *Romania irridenta;* she had none against Bulgaria whom she had robbed in 1913. Even on strategical grounds her conduct might be defended; her ruin was wrought, not by Bulgaria, but by Falkenhayn's Austro-German attack through the passes, and their progress would have been even more rapid had Rumania launched her armies against Bulgaria. She might have withstood Falkenhayn, had Russia done her duty and sent adequate forces into the Dobruja to oppose Mackensen and carry out the threats she had uttered against Bulgaria in 1915, while Rumanian neutrality barred their execution. The Entente Powers had, in fact, simply looked to Rumania to pull their chestnuts out of the Balkan fire; they had no idea that the battle of the Somme had left Germany in a condition to make an effort elsewhere like Falkenhayn's; while the creeping paralysis which had overcome Russia suggested the tale of a secret understanding between her ambiguous Premier Stuermer and the Habsburgs to partition Rumania, Wallachia to go to the Habsburgs and Moldavia to Russia. Before the end of the year Bucharest had been captured and the Rumanian armies driven behind the Sereth, while Sarrail's offensive in the S.W. barely reached Monastir. From the Aegean to the Carpathians, and from the Adriatic to the Black Sea, the Balkans had become a solid Teutonic block.

Peace Moves, 1916–7.—The moment appeared favourable for Germany to make overtures of peace. The Kaiser had discussed the idea in a letter to his Chancellor, Bethmann Hollweg, at the

[1] *History of the Peace Conference*, i. 184.

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end of Oct.; on Dec. 12 a note was addressed to President Wilson and the Pope, and the matter was made public in the Reichstag. The note was based on Germany's success; she and her allies, it declared, "have given proof of their indestructible strength. . . Their unshakeable lines resist ceaseless attacks. . . . The latest events have demonstrated that a continuation of the war cannot break their resisting power. The general situation much rather justifies their hope of fresh successes." These they would forego for the sake of peace. "They do not seek to crush or annihilate their adversaries" and "they feel sure that the propositions which they would bring forward . . . would be such as to serve as a basis for the restoration of a lasting peace." These they did not specify; nor, indeed, had they made up their minds on the point. Eighteen months earlier the "Six Associations" representing German industry and commerce had demanded as conditions of peace "a colonial empire adequate to satisfy Germany's manifold economic interests," the military and economic control of Belgium, the annexation of the French coast and its hinterland from the Belgian frontier to the Somme, of Briey, Longwy, Verdun and Belfort, of "at least parts of the Baltic provinces," and had declared that the surrender of any occupied territory "in which so much German blood has been spilt and so many of our best and noblest have found a grave, would do violence to the sentiments of our people and to their conception of an honourable peace." Bethmann Hollweg would not have countenanced such preposterous demands; but Ludendorff was more influential, and in vaguely describing the terms which alone reached the enemy with his approval, he uses phrases which might be made to cover them all except the annexation of the Channel ports and their hinterland.

Whatever their official conceptions of peace, the Teutonic allies dared not avow them in public, and the absence of substantial proposals convinced their opponents that the note about peace was a mere manœuvre of war, a continuation of the German offensive designed to complete the disintegrating work of German arms and to break up the Entente by playing off one Power against another. Consciousness of the real perils of such a conference gave an angry tone to the note in which the Entente replied on Dec. 29, and it consisted of a comprehensive indictment of Germany's conduct during the war, with particular reference to Belgium, and of a categorical refusal "to entertain a proposal which was devoid alike of sincerity and of substance."

Almost simultaneously but quite independently President Wilson addressed an inquiry to both belligerent groups on Dec. 18. He admitted that he was embarrassed by the coincidence because his note "may now seem to have been prompted by the recent overtures of the Central Powers," and the popular voice in Entente countries was convinced that he was "playing Germany's game." Clearer sighted observers discerned in it the President's first step toward intervention on the Entente side. It was, in effect, a request for information about the intentions of the belligerents, and resembled the inquiry which Great Britain addressed to France and to Germany with respect to Belgium's neutrality. The answers then determined British intervention, and the answers to Wilson's note helped him to make up his mind, or rather that of his people. "What," he asked, "did the two sides mean by the general terms they used of the war? The concrete objects for which it is being waged have never been definitely stated. The leaders of the several belligerents have . . . stated those objects in general terms. But, stated in general terms, they seem the same on both sides. Never yet have the authoritative spokesmen of either side avowed the precise objects which would, if attained, satisfy them and their people that the war had been fought out. The world has been left to conjecture what definitive results, what actual exchange of guarantees, what political or territorial changes or readjustments, what stage of military success even would bring the war to an end." Germany brushed aside the request on Dec. 26 by reaffirming her contention that a direct exchange of views between the belligerents was "the most suitable way of arriving at the desired result," and proposing "the speedy assembly, on neutral ground, of delegates of the warring States."

The Entente reply was more considered and was not completed until Jan. 10 1917. Demurring to the President's "assimilation" of the two belligerent groups, the Allies expressed their disbelief in the possibility at the moment of attaining "a peace which will assure them reparation, restitution, and the guarantees to which they are entitled by the aggression for which the responsibility rests with the Central Powers." They proceeded to indicate as their objects the restoration of Belgium, Serbia, and Montenegro with indemnities; the evacuation of the invaded territories of France, of Russia, and of Rumania with just reparation; the "reorganization of Europe"; the "restitution of provinces and territories wrested in the past from the Allies by force or against the will of their populations; the liberation of Italians, of Slavs, of Rumanians, and of Czechoslavs from foreign domination; the enfranchisement of populations subject to the bloody tyranny of the Turks; the expulsion from Europe of the Ottoman Empire." In a covering despatch dated Jan. 13, which was one of the most important and effective State papers of the war, Mr. Balfour demonstrated that "a durable peace can hardly be expected unless three conditions are fulfilled. The first is that existing causes of international unrest should be, as far as possible, removed or weakened. The second is that the aggressive aims and the unscrupulous methods of the Central Powers should fall into disrepute among their own peoples. The third is that behind international law and behind all treaty arrangements for preventing or limiting hostilities some form of international sanction should be devised which would give pause to the hardiest aggressor." It would, perhaps, be hyperbole to call Mr. Balfour the author of Mr. Wilson's policy, but its future outlines could hardly have been more accurately indicated.

Germany's first "peace offensive" had failed, to the deep disappointment of her people and her Government. Her situation was, indeed, imposing rather than substantial. Apart from a corner of German E. Africa, her colonies had all been lost; the battle of Jutland had terrified her high seas fleet into ignominious inaction; and on the western front Hindenburg had prepared a comprehensive retreat. In Oct. the *Vorwärts* had been suppressed as a minority Socialist organ and subjected to official inspiration. Ominous creaking began to be heard in the joints of her Austrian ally. Francis Joseph had died on Nov. 21, giving place to the more pacific Charles, and the murder of Count Stürgkh on Oct. 27 was followed by a rapid succession of three prime ministers in Dec. and by the substitution of Czernin for Tisza's henchman Burian as Foreign Minister. Peace had become a popular aspiration, and when the Allies rejected the offer, astonishment mingled with consternation. "*Jetzt ist alles verloren*," exclaimed a German officer interned in the Engadine. Nor did the opening months of 1917 belie this gloomy German forecast. The German retreat to the Hindenburg lines, sound enough in itself, depressed a public accustomed to judge by the map. Sir Stanley Maude's spectacular conquest of Bagdad gave a sinister turn to the Berlin-Bagdad vision. Sir Archibald Murray was at the gates of Gaza, and, if Maude's campaign were a precedent, would soon be in Damascus. Above all there loomed the threatened breach with the United States, which would make the ultimate defeat of Germany inevitable save by a miracle. Corresponding elation appeared on the Entente side; even sober critics thought that the war would soon be won with the substitution of Mr. Lloyd George for Mr. Asquith in Dec., and in Jan. 1917 a highly successful "Victory" loan was launched in England on the basis of triumph within eight months.

Allied War Aims.—Prospective victors made haste to divide the contingent spoil. France demanded, and Russia agreed, on Feb. 14 1917 to the Rhine as "a permanent strategical frontier against a Germanic invasion." Besides the restoration of Alsace-Lorraine, the new boundaries were "to be drawn up at the discretion of the French Government so as to provide for . . . the inclusion in French territory of the entire iron district of Lorraine and of the entire coal district of the Saar valley." The rest of the territories on the left bank of the Rhine were to be separated from Germany, constituted an autonomous and neutral state, and garrisoned by French troops until all the condi-

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tions of peace had been completely satisfied. Mr. Balfour on Dec. 19 1917 affirmed that the British Government had never desired, encouraged, or approved of this idea; but it was publicly advocated by one of his colleagues in the Cabinet. In return Russia insisted upon, and France recognized, Russia's "complete liberty in establishing her western frontiers." The meaning of this had been specifically explained by Sazonov a year earlier, on March 9 1916: "It is particularly necessary to insist on the exclusion of the Polish question from the subjects of international discussion and on the elimination of all attempts to place the future of Poland under the guarantee and the control of the Powers." Since that date, the Central Powers had, on Nov. 5 1916, proclaimed the independence of Russian Poland, and on the 15th the Tsar issued an ambiguous statement to which Mr. Asquith and M. Briand endeavoured to give a precise interpretation. In his general order for Christmas Day, the Tsar did, indeed, refer to a "free Poland," and the Allied note of Jan. 10 1917 averred that his intentions had thereby "been clearly indicated." But an imperial commission, appointed to determine what was meant by the phrase, narrowed it down in Feb. 1917, as Gourko relates, on the ground that "a free Poland would fall under Germany's influence." Others of Russia's imperialistic aims had been recognized in the spring of 1916, at the time of the Sykes-Picot Agreement about Syria and Mesopotamia, and she had secured Erzerum, Trebizond, and Turkish territory as far as a line running through Mush, Sert, Ibn 'Omar, and Amajia to the Persian frontier. On July 3 1916 by a treaty which was to be "kept in complete secrecy from everybody except the two high contracting parties," Russia and Japan had bound themselves to safeguard China "against the political domination of any third Power entertaining hostile designs toward Russia or Japan"; and in Jan.–Feb. 1917 the Entente Powers, by another secret treaty, recognized the concessions which Japan had extorted from China on May 7 1915 by means of an ultimatum. Japan thus became the territorial if not the spiritual heir of Germany in the Shantung peninsula and acquired a lien on China's economic development.

The opening of the campaign of 1917 proved, however, delusive, and its later stages postponed to an indefinite future the realization of these secret agreements. The Hindenburg lines justified the hopes the Germans had placed upon them; and while the British won a considerable success at Vimy, the French effort in Champagne and along the Chemin des Dames was a costly and disastrous failure. The German submarine campaign was hardly less disastrous to the shipping upon which Great Britain and her Allies relied for their ability to continue the war; the British offensive in Flanders was a depressing disappointment, and Murray failed to force the gates of Palestine. The doubtful success of Entente arms corresponded to the dubious methods and aims of its diplomacy; and a candid survey of the secret agreements, to which the Entente Powers had committed themselves, suggests a serious doubt whether, if victory had been won early in 1917, it would have been worth the winning or would have resulted in a happier world than that which had existed before the war broke out. Not all of the Powers were, indeed, committed to all of the agreements; but each of them had staked out claims for new conquests and fresh subject-peoples, and not one had proposed to sacrifice a single acre on the altar of self-determination. Nor, in the hour of imperialistic victory, would it have been British or American statesmanship which would have interpreted the "freedom" of Poland, the "autonomy" of Germans on the Rhine, the rights to self-government claimed by Czechoslovaks, Dalmatians, or Armenians, or the liberties of little nations in the Balkans or the Baltic. There would, in the event of victory early in 1917, have been no League of Nations, no "minorities clauses," no mandates, no guarantees for better domestic rule by states or better regulation of their external affairs. Russia might even have remained an autocracy fortified by success, and the Tsar have supported the cause of autocracy in Germany and in Austria. Cruel as were the sacrifices exacted from the western Powers by the deferment of hope and by Russia's collapse, criminal as were the means by which the Bolsheviks imposed their new tyranny upon the Russian people, the destruction of Tsardom may seem to have been in the long run the greatest service Russia rendered in the war. No one would claim perfection for the work of the Peace Conference of 1919, but what sanity it showed was mainly due to the fact that the one autocracy in the Entente had disappeared and its place in council had been more than filled by the great republic of the West. The diplomatic atmosphere was purified by the change, and power shifted towards an idealistic left. Great Britain, instead of representing as hitherto the extreme of moderation, presently found herself holding the balance between France, which, with the elimination of Russia, came to represent the right of annexation, and the United States, which ultimately put two million men in the field and did not ask for an acre in return. Gradually a programme was evolved which did not require the veil of secret diplomacy; a reformed band of Allied and Associated Powers gathered behind its banner of freedom most of the democracies of the world; and the war entered on a course which made a fight to a finish a rational policy.

The Russian Revolution.—The Russian revolution and American intervention together form the turning point of the war even more from the diplomatic than from the military point of view. But the one was needed to complete the other: without the revolution American intervention would still have left the Entente with a dubious face and a divided mind; without American intervention the Russian revolution would have robbed the Entente of its victory. Nevertheless, the coincidence of the two events appears to have been accidental. The revolution came first by some three weeks, and the Ides of March were fatal to the Russian Caesar. Its effects upon the war developed step by step with the progress of internal change, but from March 1917 fighting almost ceased upon the Russian fronts. The Cadet party, which was led by Miliukov and controlled the Provisional Government, would have continued the war for the sake of the Straits and Constantinople; it was straightforward on Poland, and on March 30 frankly recognized its independence. But power passed more and more into the hands of the Soviets, who wanted a general peace which would give each nation what it possessed before the war and each proletariat a good deal more. There were to be "no annexations and no indemnities," save such as each proletariat was entitled to levy upon its own capitalists and bourgeoisie. For this purpose the Soviets on May 12 proposed an International Labour Congress at Stockholm and on the 30th invited the Allies to restate their war aims. But even the Soviets did not yet demand a separate peace, and while on April 10 Russia renounced her imperialistic aims, on the 15th Czernin's offer to that effect was declined.

On May 13, however, the Russian Provisional Government fell, and Kerensky became the leading spirit in a new and more socialistic administration. He believed that only the success of Russian arms could guarantee the orderly progress of the revolution, and did his best to withstand the propaganda of the Bolsheviks, who were destroying discipline, urging peasant soldiers to go home and garner the fruits of the revolution in the shape of the land, and denouncing the wickedness of Russians killing their brother German socialists. Lenin's Bolshevik insurrection on July 16 was suppressed, but the miasma of his doctrine proved fatal to Kornilov's spirited offensive in Galicia; and as soon as the Germans counter-attacked, Russian troops threw down their arms and fled, massacring the officers who sought to stop them. By the end of July Russia had lost all her gains in Galicia; in Aug. a similar riot in the Russian contingent in Rumania nearly ruined the latter's gallant resistance which defeated the Germans at Marasheshti; in Sept. the Germans forced the Dvina and captured Riga, and in Oct. occupied Oesel, getting into touch with Finland. Kerensky now became a convert to the necessity of a dictatorship, but repudiated Kornilov when on Sept. 7 he moved troops on Petrograd to effect it; and on Nov. 7 another Bolshevik insurrection transferred the dictatorship to Lenin and Trotsky, who began *pourparlers* for peace.

Russia had gone effectively out of the war faster than the United States came in; but she left a blazing trail behind her, and

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sparks from the conflagration started a smouldering fire on German soil which was never extinguished. Bolshevik pacifism seemed a ridiculous gesture in face of Prussian arms, but its moral effect was by no means contemptible. "Looking back," writes the archmilitarist Ludendorff, "I can see that our decline obviously began with the outbreak of the Revolution in Russia." After all, the original ground or pretence upon which the war had enlisted democratic support in Germany was its appearance as a war of defence against autocratic Pan-Slavism. When Russia had destroyed the Tsardom, repudiated its aims, and laid down its arms, Germans who were not militarists or capitalists might well ask for what they were fighting; and on June 27 Hindenburg pointed out to the Kaiser the decline in German *moral*. So, while the elimination of Tsarism gave greater reality to the moral claims of the Entente, it deprived those of the Central Powers of their substance; and the war became more nakedly a struggle between militarist imperialism and democratic idealism. A practical illustration was afforded by the formation of a Polish army in Russia and a Polish legion in France at the moment when the Polish legion in Austria had to be disbanded.

Czernin seems to have been the first among Teutonic statesmen to realize the change in the position and to seek to capitalize a situation in which the Habsburg Empire had nothing more to gain and everything to lose. Her soil was now rid of the Russian invader; Italy had made no serious impression, and Trieste was in no danger; Serbia only existed in exile, and Rumania trembled on its brink. On the other hand, the prolongation of war and Russian contagion might stir a series of domestic revolutions. Hence his conference with Bethmann Hollweg on March 27, his offer of peace to Russia in April, and his suggestion that Germany should cede Alsace-Lorraine to France while Austria handed over Galicia to Poland with a view to the subjection of both to German control; hence, too, the meeting of the Austrian Reichsrat on May 30 for the first time since the war began.

Ludendorff placed his heel on these proposals, and Czernin then turned his attention to the German Reichstag, where a complicated struggle was waged between Ludendorff's militarists and Bethmann Hollweg's politicians, who were beginning to react to popular discontent and the effect of Russian developments. "Bethmann Hollweg and Czernin," writes Ludendorff, "were both completely obsessed by the Russian Revolution. Both feared similar events in their own countries." On July 6 Erzberger, who was perhaps in Czernin's confidence, opened the attack with revelations about the non-fulfilment of official hopes from the submarine campaign and demanded a "peace of understanding." On the 11th the Kaiser was constrained to sign a rescript promising universal, direct, and secret suffrage for Prussia after the war; as a set-off to this Bethmann Hollweg was forced to resign on the 13th, being succeeded by Michaelis, a mere official who said what he was told and contradicted himself when occasion or his superiors required it. Then on the 19th the Reichstag passed by 214 to 116 votes a resolution in favour of peace "without indemnities or annexations," which Michaelis accepted only "as he understood it." It was timed and tuned for the Stockholm conference, which German and Russian Socialists were allowed to attend, while British and French were not, and probably also for the Peace Note which the Pope launched on Aug. 1, and which France and England, being estopped by their secret agreement with Italy, left President Wilson to answer.

President Wilson's Policy.—From that time onward for two years President Wilson became the principal spokesman of the Allied and Associated Powers; but it appears that the Russian revolution had exercised so far a more potent influence on the Central Empires than the intervention of the United States. Russia was their immediate neighbour on a frontier of a thousand miles. America was four thousand miles away, and it was long a German delusion that American troops would be kept out of Europe by the same submarines on which Germany relied to bring Great Britain to terms; and to arguments not backed by mailed fists Germany was indifferent. She had made up her mind to take what risk there was when in Feb. 1917 she resumed her unrestricted submarine campaign; and that approaching resolve had helped to determine her simultaneous refusal to state her war-aims in response to the President's invitation.

The coincidence seems to have been largely a matter of accident. Originally elected President in 1912 by a minority vote owing to the split in the Republican party between Roosevelt and Taft, Mr. Wilson was reëlected in 1916 after a close contest in which neither of the opposing American parties had made war with Germany a plank in its platform; and without the prospect of an unprecedented third presidential term, Mr. Wilson enjoyed in his second a freer hand than any other democratic statesman. But he was obviously tied by the traditions and public opinion of a community diverse in origin, in interests, and in outlook, spread over vast areas, separated by thousands of miles from the European conflict, and inured to the idea of splendid isolation. "We are," said President Wilson on March 5 1917, "a composite and cosmopolitan people. We are of the blood of all the nations that are at war." Action was impossible until there was some common measure of agreement in a heterogeneous people, and it was not easy to unite on a basis of intervention a Federal democracy whose one common principle in foreign policy was abstention from European quarrels. The Monroe Doctrine, as understood by modern interpreters, implied that the United States would resent and resist European intervention in a S. American war, however gross might have been the aggression, and however much it might have shocked the European conscience. So far as the Western Hemisphere was concerned, the United States claimed to be the keeper of the conscience of the world, and it thought that claim was only tenable so long as it washed its hands of conscience so far as Europe was concerned. Intervention on behalf of Belgian neutrality or even protest against its violation might open the door to retorts in kind and break down the quarantine which the democratic republic had sought to impose upon Old World infection.

But the war put the finishing touch to the obsolescence of the schismatic doctrine of two worlds and two human consciences. It was only a practicable dogma provided either that the United States kept not merely its conscience but its people, its capital, its commerce, and its shipping on its side of the Atlantic; or that the Old World observed those rules of international law and conscience which had commended themselves to the American people. In other words, so far from there being two worlds, the Old must accommodate itself to the New; and the most hardened believers in the Monroe Doctrine rebelled against the idea that Germany could indefinitely sink American ships and kill American citizens without provoking a war, which America could not wage without giving its conscience a passport to Europe. "As far as the United States is concerned," writes Dr. J. B. Scott, "the cause of its war with the Imperial German Government is the submarine . . . for the law could not be changed to suit the submarine." Nor was the Monroe Doctrine compatible with the enforcement of the American conception of the freedom of the seas or with the maintenance of neutral rights; and a long series of incidents convinced the American public that its cause could not be isolated. "The challenge," said President Wilson, "is to all mankind"; and when he intervened, it was not merely in defence of American rights but of a common humanity.

The outstanding episode in the slow and painful process by which the American people were brought to realize the dilemma between war and the surrender of their principles must be briefly indicated. A series of events, which, in the despatch of Secretary Bryan, the Government of the United States had observed "with growing concern, distress, and amazement," culminated on May 7 1915 when the "Lusitania" was torpedoed without warning, and 114 American and nearly a thousand other lives were lost; and on the 13th he intimated that his Government would not "omit any word or act necessary to the performance of its sacred duty of maintaining the rights of the United States and its citizens and of safeguarding their free exercise and enjoyment." But he resigned when acts seemed likely to follow words, and the President's second "Lusitania" note was signed on June 9 by Mr. Lansing. Bryan's resignation was not, however, without its effects; and the words continued

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while more American lives were lost in each succeeding month.[1] The most definite action was taken in Sept. against Germany's less powerful and less pernicious ally, when Dr. Dumba, the Austrian ambassador, was required to leave on account of his complicity in the intrigues of J. F. Archibald and other Teutonic agents. A graver crisis was reached with the torpedoing of the Channel steamer "Sussex" on March 24 1916. "The Government of the United States," wrote Mr. Lansing on April 18, "has been very patient. . . . Unless the Imperial Government should now immediately declare and effect an abandonment of its present methods of submarine warfare against passenger and freight carrying vessels, the Government of the United States can have no choice but to sever diplomatic relations with the German Empire altogether." On May 4 the German Government made some concessions, and as President Wilson expressed it on April 2 1917, "somewhat restrained the commanders of its undersea craft." The reason for its complaisance, given later on by Bethmann Hollweg, was that it had not yet sufficient submarines to carry out unrestricted submarine warfare effectively.

That time came with the beginning of 1917. The decision was taken on Jan. 9, and it was Germany's real answer to the President's note of Dec. 18. But it was based on a serious miscalculation. The German naval authorities thought it would compel Great Britain to sue for peace within six months, and Bethmann Hollweg has cast the responsibility for its effects upon them. Hindenburg's plea that the Chancellor failed to inform him of the impression it would produce in America is less convincing, for Ludendorff says that "we reckoned that the adoption of the submarine campaign would effect a favourable decision for us, at latest before America's new troops could participate in the war." So American intervention was anticipated and discounted. But eighteen months were yet to pass before American intervention took a form which was materially to disconcert Ludendorff's military calculations. For more than a year diplomatic relations had practically been severed between the United States and Austria-Hungary, and it did not at once appear that the resumption of unrestricted submarine warfare would be followed by more drastic American action with regard to Germany.

On Jan. 22, ignorant of Germany's decision, Mr. Wilson addressed Congress on the results of his note of Dec. 18, and sketched the conditions which would justify the United States in guaranteeing peace with a view to making it permanent.

"In every discussion of the peace that must end this war it is taken for granted that that peace must be followed by some definite concert of power which will make it virtually impossible that any such catastrophe should ever overwhelm us again. . . . Such a settlement cannot now be long postponed. It is right that before it comes this Government should frankly formulate the conditions upon which it would be justified in asking our people to approve its formal and solemn adherence to a League of Peace. . . . No covenant of coöperative peace that does not include the peoples of this New World can suffice to keep the future safe against war. . . . It will be absolutely necessary that a force be created as a guarantee of the permanency of the settlement. . . . There must be, not a balance of power, but a community of power. . . . But the implications of these assurances . . . imply, first of all, that it must be a peace without victory. . . . Only a peace between equals can last. . . . And there is a deeper thing involved than even equality of right among organized nations. No peace can last, or ought to last, which does not recognize and accept the principle that governments derive all their just powers from the consent of the governed, and that no right anywhere exists to hand peoples about from sovereignty to sovereignty as if they were property. . . . Statesmen everywhere are agreed that there should be a united, independent, and autonomous Poland. . . . And the paths of the sea must alike in law and in fact be free. The freedom of the seas is the *sine qua non* of peace, equality, and coöperation. . . . The question of armaments, whether on land or sea, is the most immediately and intensely practical question connected with the future fortunes of nations and of mankind. . . . I am proposing, as it were, that all nations should with one accord adopt the doctrine of President Monroe as the doctrine of the world; that no nation should seek to extend its polity over any other nation or people . . . that all nations should avoid entangling alliances. . . . There is no entangling alliance in a concert of power. . . . These are American principles, American policies. We could stand for no others."

But while it was "inconceivable that the people of the United States should play no part in that great enterprise" of laying "afresh and upon a new plan the foundations of peace among the nations," the present war must first be ended, and the United States would "have no voice in determining . . . the treaties and agreements which would bring it to an end," only "in determining whether they shall be made lasting or not by the guarantees of a universal covenant."

American Intervention.—Such was the President's frame of mind when, nine days later, on Jan. 31, Bernstorff communicated Germany's revocation of its pledge of May 4 1916 and its decision to recommence unrestricted submarine warfare on Feb. 1. On Feb. 3 he simply and literally fulfilled his threat of April 18 and "severed diplomatic relations with the German Empire altogether." "I take it for granted," he said to Congress, "that all neutral governments will take the same course," but "we do not desire any hostile conflict with the Imperial German Government." On the 26th he pointed out that the caution of shipowners and consequent congestion of commerce "might presently accomplish, in effect, what the new German submarine orders were meant to accomplish, so far as we are concerned," and proceeded to arm American merchant ships; but he was "not now contemplating war or any steps that need lead to it. . . . War can come only by the wilful acts and aggressions of others."

It came with speedy steps. Germany denied the right of neutrals to use arms at all, and intimated that the armed guards placed on American merchant ships would be treated as pirates. "Armed neutrality," confessed the President, "it now appears, is impracticable." There had, too, been intercepted a note dated Jan. 19 from Berlin to Mexico, proposing in the event of war an offensive and defensive alliance between Germany, Mexico, and Japan, and the reconquest of Mexico's "lost territory in New Mexico, Texas, and Arizona"; and on April 2 Mr. Wilson advised a special session of Congress "to declare the recent course of the Imperial Government to be in fact nothing less than war against the Government and people of the United States." "We are," he had declared in his second inaugural address on March 5, "provincials no longer. The tragical events of the thirty months of vital turmoil through which we have just passed have made us citizens of the world. There can be no turning back." And now "the world must be made safe for democracy." "The great, generous Russian people have been added in all their native majesty and might to the forces that are fighting for freedom in the world, for justice, and for peace. Here is a fit partner for a League of Honour. . . . We have no selfish ends to serve. We desire no conquest, no dominion. We seek no indemnities for ourselves, no material compensation for the sacrifices we shall freely make. We are but one of the champions of the rights of mankind." The resolution was passed in the Senate on April 4 by 82 votes to 6, and in the House of Representatives on the 5th by 373 to 50, and on the 6th the President declared war. Austria was not included, but Tarnowski, Dumba's successor, had been refused recognition, and relations were suspended; on April 13 they were severed with Turkey.

The President's somewhat naïve assumption that all neutral governments would follow his lead into armed neutrality had been promptly belied; and all European neutrals excused themselves. They were even less likely to follow him into war; but New World States, which were more immune from the consequences, were more amenable to his example. Cuba declared war on April 7, and on the 8th Panama associated itself with the United States. Brazil broke off diplomatic relations on April 11, Bolivia on the 13th, and Guatemala on the 27th, Honduras on May 17 and Nicaragua on the 19th, Haiti on June 15, Costa Rica on Sept. 23, Peru on Oct. 6 and Uruguay on the 7th, and Ecuador on Dec. 9. Brazil declared war on Oct. 26, while the Argentine declared her benevolent neutrality on April 11: but Chile and Venezuela remained neutral without benevolence. The contagion, however, spread into the Eastern Hemisphere: Liberia severed diplomatic relations on May 8 and declared war on Aug. 7: Siam declared war on July 22, and China on Aug. 14. *Securus judicat orbis terrarum:* but the world of little States needed

[1] See a provisional list of these and other crimes in J. B. Scott, *Diplomatic Correspondence*, pp. ix.–xv.

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some security before it would pronounce judgment. Nevertheless, more than half the States of the world had now declared war on, or broken off diplomatic relations with, Germany and her three allies; the Entente had become a War League of Nations; and the peace that would be made in case of victory would represent the judgment of the world and be very different from that contemplated in the secret agreements.

But there was a yawning gulf between judgment and execution, and a painful interval between the President's declaration and the time when, in Ludendorff's words, "America became the decisive power in the War." Financial coöperation began to relieve the strain at once, and naval coöperation to ease the submarine situation in May; and at the end of June the so-called "sentimental Division" arrived as an earnest of what was to follow on the field of battle. But as late as March 1918 there were only five American divisions in France, of which two were untrained; and meanwhile the endurance of the European Allies was sorely tried. The French army was seriously demoralized by the failure of Nivelle's offensive, and Caillaux began to undermine its political fortitude. The sinking of 25% of British merchantmen at sea in April was an almost more fearful menace; Russia had become a broken reed; the British campaign in Flanders proved a disappointment; Stockholm was holding out the lure of a "peace by negotiation" to Labour: Mr. Henderson resigned from the British Cabinet on Aug. 11; the Pope had appealed on the 1st for a peace on the basis of the *status quo*, disarmament, and arbitration; and tentative discussions were proceeding by more or less authorized agents in Switzerland. Michaelis secured an equivocal answer to the Pope's note in his effort to please both his militarist and his parliamentary masters. But the situation in Germany was as equivocal as its Chancellor: for while at the end of Oct. he was replaced by Hertling, a *persona grata* to the Pope as the first Roman Catholic Chancellor of Protestant Germany, for receding from the July resolutions, Germany was receding quite as fast with the apparent improvement in her military situation. "The future will show," declared Czernin after the Armistice, "what superhuman efforts we made to induce Germany to give way. That all proved fruitless was not the fault of the German people . . . but that of the leaders of the German military party, which had attained such enormous power in the country."

Greece in the War.—The only set-back had been the constrained entry of Greece into the Entente fold. Since the dismissal of Venizelos in Oct. 1915, Constantine had governed by means of phantom ministers; and in May 1916, acting under his orders, the Greek commanders admitted Bulgarian forces into Forts Rupel and Dragotin, the keys of the Struma valley, while in Aug. Greek garrisons surrendered Seres, Kavalla, and Demirhisar to the same racial enemies. This was too much for the better part of Greece. A revolution broke out at Salonika, which swept over Crete, Mytilene, Samos, Chios, and the other Greek islands in Sept.; and a provisional government of insurgent Greece was formed under Venizelos, Condouriotes, and Danglis, which was tardily—owing to Russian and Italian influence—recognized by the Entente and declared war on Bulgaria. But Constantine controlled the mainland of Old Greece, and constantly intrigued against the Entente. At length, in June 1917, Tsarist protection having been removed by the Russian revolution, the Entente intervened by force of arms, and Constantine was deposed on the 11th and removed to Switzerland. Venizelos returned to Athens on the 21st, and on the 30th diplomatic relations were severed with Germany and Austria. The high-handed proceedings of the Entente were, no doubt, necessary measures of war; but Venizelos had to pay the penalty later for the violent patronage he had enjoyed, and the Entente needed the moral support which President Wilson gave it in the drastic reply he returned to the Pope's peace note on Aug. 27. To deal with Germany by way of peace upon the plans proposed by His Holiness would, the President declared, "involve a recuperation of its strength and a renewal of its policy."

Brest Litovsk.—The recuperation of its strength was exemplified in Oct. by the further advance into Russia and the Italian disaster at Caporetto: and the renewal of its policy was seen at Brest Litovsk. On Nov. 20, a fortnight after the successful Bolshevik revolution, Lenin proposed to all the belligerents a general armistice and discussion of peace, and on the 29th Germany accepted the invitation. The armistice was concluded at Brest Litovsk on Dec. 15. The Bolsheviks inserted a clause to the effect that German troops were not to be transferred from the eastern to the western front; but the Germans simply ignored it. It was mainly for that purpose that they signed the armistice; the idea of a great offensive on the W. had already occurred to them, and in Nov. and Dec. 24 divisions were transferred. Austria's main idea was much the same: "peace at the earliest moment," said Czernin, "is necessary for our own salvation, and we cannot obtain peace unless the Germans get to Paris, and they cannot get to Paris unless the eastern front is free." Czernin, and possibly even Kühlmann, the German Foreign Secretary, were prepared for such terms as might have secured this freedom and given Ludendorff a reasonable prospect of getting to Paris; but the grasping nature of the militarists stood in their own way. A preliminary conference at German Headquarters on Dec. 18 agreed to demand the acquisition of a protective belt of territory along the Russian-Polish frontier, and a personal union of Courland and Lithuania with Germany or Prussia, and to suggest the evacuation of Esthonia and Livonia by the Russians in the interests of self-determination.

At the Conference of Brest Litovsk, which opened on the 22nd, Kühlmann and Gen. Hoffmann represented Germany, Trotsky and Joffe the Bolsheviks, and Czernin Austria-Hungary. The Bolsheviks insisted on open diplomacy, and the arguments of the diplomatists were published throughout Europe from day to day by wireless telegraphy. This was essential for their schemes, for they relied upon propaganda to rouse the proletariats in all the belligerent countries to demand a cessation of the national wars which divided their forces, in order to combine them in a universal revolutionary movement. Their proposals were the evacuation of all conquests, restoration of independence to all nations subjected during the war, self-determination for those which had not previously secured independence, and no indemnities. Czernin replied for the Central Powers on the 25th, accepting the principles of no forcible annexations and no indemnities, but making the whole bargain conditional upon the acceptance of a general peace by the Allied and Associated Powers, who were given until Jan. 4 to signify their assent. No formal reply was made by them to the invitation; but one of the most important results of the Brest Litovsk negotiations was to clinch the case for a restatement of the Entente aims in the war.

Peace Moves, 1917–8.—Russia had asked for that restatement as far back as May 30, and in a communication addressed to the Provisional Government on June 9 President Wilson had replied that "no people must be forced under sovereignty under which it does not wish to live. No territory must change hands except for the purpose of securing those who inhabit it a fair chance of life and liberty. No indemnities must be insisted on except those that constitute payment for manifest wrongs done. No readjustments of power must be made except such as will tend to secure the future peace of the world and the future happiness of its peoples. And then the free peoples of the world must draw together in some common covenant . . . that will in effect combine their force to secure peace and justice in the dealings of nations with one another." On Nov. 18 M. Clemenceau, the new French premier, spoke slightingly of a League of Nations, remarking that he was only out to win the war; and the Bolshevik publication of the Secret Agreements which began on the 22nd revealed the gulf which separated the Old World ambitions of the Entente Powers from the objects for which Mr. Wilson had told revolutionary Russia "we can afford to pour out blood and treasure." On the 29th Lord Lansdowne published a letter in the *Daily Telegraph* (*The Times* having declined to give it publicity) coupling a demand for a restatement of war aims with a more dubious proposal for peace negotiations. To the latter suggestion Wilson made an

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effective reply by declaring war on Austria on Dec. 4, and fulminating against German power as "a thing without conscience or honour or capacity for covenanted peace" and refusing to negotiate until the "German people have spokesmen whose word we can believe" and "those spokesmen are ready in the name of their people to accept the common judgment of the nations as to what shall henceforth be the bases of law and of covenant for the life of the world. . . . Our immediate task is to win the war." But even he had not grasped all the implications: "We do not wish in any way to impair or to rearrange the Austro-Hungarian Empire," and it was left to France to recognize on Dec. 19 the Czechoslovak forces as "an autonomous army."

The Fourteen Points.—The initiative in a comprehensive and radical restatement of war aims was taken in a British Labour Memorandum, which was adopted without amendment by a special Labour conference on Dec. 28 and was then, with changes due to President Wilson's address of Jan. 8 1918, accepted by the Inter-Allied Labour and Socialist Conference in London on Feb. 22. Basing itself on Wilson's principle that "the world must be made safe for democracy," it emphasized the necessity, and sketched a plan, for a League of Nations, declared that the problem of Alsace-Lorraine was one of right and not of territorial readjustment, demanded restoration and reparation for Belgium and the Balkan States (with a Customs and Postal Union for the latter), the independence of Poland with access to the sea, the liberation of subject peoples from Turkish rule with the neutralization of the Dardanelles, condemned German annexation in Livonia, Courland, or Lithuania, and "the aims of conquest of Italian imperialism," and while "not proposing as a war aim the dismemberment of Austria-Hungary" protested against regarding "the claims to independence made by the Czechoslovaks and the Yugoslavs merely as questions for internal decision." Most of these aims were accepted in principle by Mr. Lloyd George on Jan. 5 after consultation with Dominion statesmen, Labour leaders, and Lord Grey and Mr. Asquith; but he made some notable concessions to what seemed to be the realities of the situation, and disclaimed any idea of fighting to "alter or destroy the imperial constitution of Germany," "to destroy Austria-Hungary," or even "to deprive Turkey of its capital or of the rich and renowned lands of Thrace, which are predominantly Turkish in race"; and he seemed lukewarm about the League of Nations. Then on Jan. 8, in an address to Congress, President Wilson laid down his famous "Fourteen Points," demanding:—

I. Open covenants of peace, openly arrived at, after which there shall be no private international understanding of any kind, but diplomacy shall proceed always frankly and in the public view.

II. Absolute freedom of navigation upon the seas, outside territorial waters, alike in peace and in war, except as the seas may be closed in whole or in part by international action for the enforcement of international covenants.

III. The removal, as far as possible, of all economic barriers and the establishment of an equality of trade conditions among all the nations consenting to the peace and associating themselves for its maintenance.

IV. Adequate guarantees given and taken that national armaments will be reduced to the lowest point consistent with domestic safety.

V. A free, open-minded, and absolutely impartial adjustment of all colonial claims, based upon a strict observance of the principle that in determining all such questions of sovereignty the interests of the populations concerned must have equal weight with the equitable claims of the Governments whose title is determined.

VI. The evacuation of all Russian territory and such a settlement of all questions affecting Russia as will secure the best and freest coöperation of the other nations of the world in obtaining for her an unhampered and unembarrassed opportunity for the independent determination of her own political development and national policy and assure her of a sincere welcome into the society of free nations under institutions of her own choosing; and, more than a welcome assistance also of every kind that she may need and may herself desire. The treatment accorded to Russia by her sister nations in the months to come will be the acid test of their goodwill, of their comprehension of her needs as distinguished from their own interests and of their intelligent and unselfish sympathy.

VII. Belgium, the whole world will agree, must be evacuated and restored, without any attempt to limit the sovereignty which she enjoys in common with all other free nations. No other single act will serve as this will serve to restore confidence among the nations in the laws which they have themselves set and determined for the government of their relations with one another. Without this healing act the whole structure and validity of international law is forever impaired.

VIII. All French territory should be freed and the invaded portions restored, and the wrong done to France by Prussia in 1871 in the matter of Alsace-Lorraine, which had unsettled the peace of the world for nearly fifty years, should be righted, in order that peace may once more be made secure in the interest of all.

IX. A readjustment of the frontiers of Italy should be effected along clearly recognized lines of nationality.

X. The peoples of Austria-Hungary, whose place among the nations we wish to see safeguarded and assured, should be accorded the freest opportunity of autonomous development.

XI. Rumania, Serbia, and Montenegro should be evacuated; occupied territories restored; Serbia accorded free and secure access to the sea; and the relations of the several Balkan States to one another determined by friendly counsel along historically established lines of allegiance and nationality; and international guarantees of the political and economic independence and territorial integrity of the several Balkan States should be entered into.

XII. The Turkish portions of the present Ottoman Empire should be assured a secure sovereignty, but the other nationalities which are now under Turkish rule should be assured an undoubted security of life and an absolutely unmolested opportunity of autonomous development, and the Dardanelles should be permanently opened as a free passage to the ships and commerce of all nations under international guarantees.

XIII. An independent Polish state should be erected which should include the territories inhabited by indisputably Polish populations, which should be assured a free and secure access to the sea, and whose political and economic independence and territorial integrity should be guaranteed by international covenant.

XIV. A general association of nations must be formed under specific covenants for the purpose of affording mutual guarantees of political independence and territorial integrity to great and small states alike.

The Humiliation of Russia.—In introducing these points President Wilson referred to the Brest Litovsk negotiations as having been broken off, and described "the whole incident" as "full of significance." There had, indeed, during the interval allowed for the Entente to reply, been a violent disagreement between Ludendorff and Kühlmann, who was supported by Czernin and Hertling. On Dec. 28 the militarists secured a German declaration to the effect that the representative bodies existing in the occupied territories under German protection expressed their "self-determination" and that plebiscites were superfluous. On Jan. 2 Trotsky denounced these claims as hypocritical, and proposed to change the seat of the conference from Brest to Stockholm. He reappeared at Brest, however, on Jan. 7, asseverating that the Bolsheviks would make no peace that was not "just and democratic": and there followed weeks of discussion on the meaning of "self-determination" and its methods of expression. Trotsky's flank was turned by the appearance of delegates from the Ukraine asserting their independence of Russia. They represented only the middle-class Rada, while Ukraine revolutionaries sided with the Bolsheviks, seized Kiev, and overran most of the Ukraine. The Rada thereupon signed a peace with the Central Powers on Feb. 9, which gave Polish Kholm to the Ukraine and sowed the seeds of discord between the two nationalities, and invited the Germans and Austrians to drive the Bolsheviks out of the Ukraine. They were willing enough; food was their real quest, and alarming strikes had already broken out in Vienna, Berlin, and elsewhere.

These seemed to give Trotsky the leverage he had been seeking, and on the day the Ukraine treaty was signed he issued a wireless call to the German army to refuse obedience to the Kaiser. Next day he declared war to be at an end, but refused to sign a German peace. On Feb. 13 Germany denounced the armistice, and on the 18th recommenced the march toward Petrograd and the occupation of the Ukraine. There was no organized resistance; the peace of Brest Litovsk was signed on March 3 and ratified by a congress of Soviets at Moscow, after a three days' debate, on the 16th. The Baltic nationalities were surrendered by Russia for their fate to be determined between themselves and Germany; the Ukraine treaty of Feb. 9 was accepted by the Bolsheviks; Russia was also required to cede the districts

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of Kars, Ardahan, and Batum to Turkey; commercially she was made a preserve for the Central Powers; and the two million German colonists in Russia were exempted from the legislation of, and allegiance to, the Bolshevik Government. Trotsky had given up foreign affairs on March 8 and devoted himself to the more promising task of organizing a Red army; it was left for Lenin to persuade the Soviets of the necessity of temporarily bowing to the inevitable. Consequential and similar treaties were signed between the Central Powers and Finland on March 7 and with Rumania, provisionally, on March 5 and finally on May 7. German control over their commerce, industry, and finance was established in both, and Rumania further ceded the Carpathian crests and the Dobruja.

Germany and the Fourteen Points.—These deeds were a more convincing reply to President Wilson's "Fourteen Points" than the disingenuous speeches made in concert by Kühlmann and Czernin at Berlin and Vienna on Jan. 24. The Central Powers had been given the opportunity of demonstrating the interpretation which they put on victory; and there could not remain the slightest doubt that they would impose similar, if not severer, conditions upon the rest of the world if they got the chance. Nothing could have been more sinister or more impressive than the complete contradiction between their words to Powers which they did not yet control and their deeds to those which they did; and whatever criticisms might be made of the ultimate settlement, they would have to be based not on the ground that the Central Powers suffered more than they deserved, but that the penalties were impolitic and fell on the wrong shoulders. The treaties were approved of by all parties in the Reichstag except the Minority Socialists and the Poles; and early in March the Minority Socialists lost a seat at Nieder Barnim.

There was little more for diplomacy to say. It was obvious, although the fact was not universally recognized, that the speeches of Teutonic ministers afforded no basis for negotiation, since from Brest Litovsk onward the German G.H.Q. superseded the Government; but it was a blunder on the part of the supreme war council at Versailles to issue on Feb. 4 a statement that it would not accept Hertling's and Czernin's professions and had decided on a vigorous prosecution of the war, thereby creating the impression that the same supersession of the civil by military power was also taking place in the Entente. Nevertheless, President Wilson did, indeed, on Feb. 11 give a useful definition of Four Principles on which the settlement must be based; and he used what his Secretary of State, Lansing, subsequently denounced as an explosive expression when he declared that "'Self-determination' is not a mere phrase. It is an imperative principle of action which statesmen will henceforth ignore at their peril." But he was in closer touch with the realities of the situation when on April 6, commenting on the contrast between Hertling's professed acceptance of those four principles and the militarist terms dictated at Brest Litovsk, he declared: "Germany has once more said that force, and force alone, shall decide whether justice and peace shall reign in the affairs of men, whether Right as America conceives it or Dominion as she conceives it shall determine the destinies of mankind. There is, therefore, but one response possible from us: force, force to the utmost, force without stint or limit, the righteous and triumphant force which shall make Right the law of the world, and cast every selfish Dominion down in the dust."

It needed, however, a crisis to elicit an adequate display of American force on fields where the issue would be decided. In the previous Nov. the Kaiser had declared that the only means to secure peace was for Germans to hew their way through those who would not make it; and the terms of the Treaty of Brest Litovsk are intelligible only on the assumption that he relied upon a German offensive on the western front to constrain the Entente to recognize those terms if not to accept similar ones for themselves. From the beginning of the German offensive on March 21 until the first Austrian peace-note on Sept. 15 the pen gave way to the sword. Czernin resigned on April 15 after his controversy with Clemenceau over the Sixte of Parma *pourparlers* in the summer of 1917, but the fact that he was succeeded by Burian indicated a stiffening rather than a relaxation of the Austrian attitude. Nor had the growing discontent and the declining *moral* of the German people any effect upon the diplomatic situation, although in Jan. strikers had demanded peace on the basis of self-determination without annexations or indemnities, and crowds in Berlin had vociferated against a fresh offensive on the western front.

War Weariness.—More potent than social ferment in Germany was imperial disintegration in Austria. The disaster at Caporetto had a wholesome effect upon the Italian attitude toward the Yugoslavs, and the revelation of the secret Treaty of London by the Bolsheviks gave more progressive opinion in Italy an opportunity of expressing itself. In Feb. 1918 a committee was formed to promote an understanding with the Yugoslavs, and on March 7 Signor Torre on a visit to London arranged with Dr. Trumbitch the holding of a congress of oppressed nationalities at Rome. It met early in April, and on the 10th produced the "Pact of Rome," by which the "unity and independence" of the Yugoslav nation, "known also as the nation of Serbs, Croats, and Slovenes," were recognized as a vital interest for Italy, and the completion of Italian unity as a vital interest for the Yugoslavs. It was also mutually agreed to defend the freedom of the Adriatic against every enemy present or future, and to decide amicably the territorial questions between them on the basis of nationality and self-determination. This entente was of the utmost value in promoting the successful Italian resistance on the Piave in June and victory in Oct. President Wilson hastened to bless the practical application of his own principles; on June 28 he asserted that all branches of the Slav race must be completely freed from German and Austrian rule; on Sept. 3 he formally recognized the Czechoslovak National Council as a belligerent Government; and on Oct. 18 in reply to the Austrian peace-note declared that he was no longer at liberty to accept the "autonomy" of these peoples—as indicated in the tenth of his Fourteen Points—as a basis of peace, but "is obliged to insist that they, and not he, shall be the judges of what action on the part of the Austro-Hungarian Government will satisfy their aspirations and their conceptions of their rights and destiny as members of the family of nations."

For the time, the success of the German offensive made all talk about terms of peace irrelevant except on the German side, where it generally took the form of repudiating the peace resolution of July 1917. But before the end of April confidence began to wane, first at G.H.Q. and then in the public mind in Germany itself. The difference was that the worse the situation became, the more determined Ludendorff grew in his persistence, and the more sceptical the public showed itself of his success; the reason was that the militarism of the German Government became more and more involved in the fortunes of the war. On June 24 Kühlmann in a long speech let fall the phrase, "an absolute end can hardly be expected through purely military decisions alone"; and a fortnight's disputation over his meaning ended in his resignation at Ludendorff's behest on July 9. It had become heresy, in the waning prestige of militarist orthodoxy, to dispute what the German G.H.Q. could do; and Kühlmann's successor was von Hintze, its nominee without any pretence of that "parliamentarization" which both the Reichstag and President Wilson had demanded as a preliminary to peace. On July 4 President Wilson laid down four great ends of the war, which he said "can be put into a single sentence. What we seek is the reign of law, based upon the consent of the governed and sustained by the organized opinion of mankind." Next day Mr. Lloyd George said the Kaiser could have peace to-morrow if he would accept the President's terms. But Ludendorff's conception of the reign of law was the will of G.H.Q. sustained by German arms, and he was desperately bent on giving it effect.

He refused to admit in words that his increasing lack of success and resources, or even Foch's counter-offensive on July 18, had made his position hopeless. But he confessed that Aug. 8 was Germany's "black day," and on the 14th at a crown council at Spa the Kaiser decided that negotiations must begin on the

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first suitable occasion. The Austrian Emperor and Burian emphasized the need on the 15th, and wanted to begin at once. A fortnight was spent in arguing, and on the 30th Austria threatened an independent overture. But both parties assumed that defensive war could still be successfully carried on in France, while the offensive submarine inclined the enemy to a peace which would leave the Central Empires their ill-gotten gains in the east; and they were at the moment engaged on the supplementary treaties of Brest Litovsk, which, as signed on the 27th, compelled the Bolsheviks to oppose the Entente forces in N. Russia, to renounce sovereignty over Esthonia, Livonia, and Georgia and to pay heavy gold indemnities, and riveted the German economic yoke more firmly than ever. The German public and even the civil government looked helplessly on while G.H.Q. wasted their opportunities for peace. There was no foresight, and no discussion of any terms that might have satisfied enemies whom Germany found it increasingly difficult to resist. Civil intelligence had abandoned its functions for so long to the soldier that it was simply atrophied for lack of use; and it was not until late in Oct. that ministers screwed up their courage to action independent of General Headquarters.

Concluding Stages.—By that time the Hindenburg defences on which the army and public relied had broken down. On Sept. 2 the Wotan line was pierced, on the 12th the Americans wiped out the St. Mihiel salient, and on the 15th, the day on which the Bulgarian line in the Balkans was broken, Austria addressed a peace-note to belligerents, neutrals, and the Pope proposing a confidential and non-committal discussion in some neutral country. President Wilson replied on the following day that the United States "can and will entertain no proposal for conference upon a matter concerning which it has made its position and purpose so plain"; and Austria retired from the diplomatic struggle. German G.H.Q. were not reduced to a suppliant attitude until the 29th, the day on which Bulgaria signed her armistice and went out of the war, abandoning the whole of the Balkans to the Entente. Meanwhile Allenby had destroyed the Turkish armies in Palestine, the Hindenburg lines in front of Cambrai had been broken, and a combined offensive in Belgium had undermined Germany's hold on the coast. On the 27th President Wilson added "Five Particulars" to his "Fourteen Points," "Four Principles," and "Four Ends." Some details, he said, were needed to make his general terms "sound less like a thesis and more like a practical programme." But even these particulars were less terms of peace than principles which must govern those terms, and they were as follows:—

First, The impartial justice meted out must involve no discrimination between those to whom we wished to be just and those to whom we did not wish to be just.

Second, No special or separate interest of any single nation or any group of nations can be made the basis of any part of the settlement which is not consistent with the common interest of all.

Third, There can be no leagues or alliances or special covenants and understandings within the general and common family of the League of Nations.

Fourth, And, more specifically, there can be no special selfish economic combinations within the League, and no employment of any form of economic boycott or exclusion, except as the power of economic penalty, by exclusion from the markets of the world, may be vested in the League of Nations itself as a means of discipline and control.

Fifth, All international agreements and treaties of every kind must be made known in their entirety to the rest of the world.

Two days later Hertling and all his ministers resigned in order that the Kaiser might be provided with an administration supported by the Reichstag to meet the President's objection to negotiating with an autocratic government; but the Kaiser in accepting this principle would only say that it was his "will that men who are supported by the confidence of the people should, to a large extent, participate in the rights and duties of the Government." Prince Maximilian of Baden was appointed German Chancellor, and he had to deal with a veritable panic at G.H.Q. Ludendorff was in despair. "To-day," he declared, "the soldiers hold their ground; it is impossible to foresee what may happen tomorrow . . . the peace offer must be made to-day." Hindenburg was hardly less emphatic: "Every day of delay will cost thousands of brave soldiers their lives." So on Oct. 4 a first peace-note was despatched by Germany. The appeal was to President Wilson alone, asking him to take steps for the restoration of peace. The German note accepted the Fourteen Points as a programme; the Austro-Hungarian note, which followed on Oct. 7, accepted also the Four Principles of Feb. 11 and agreed that the Five Particulars should "also be taken into account."

The President's replies to these and to the succeeding notes constituted a process of depriving the German Government one by one of possible loopholes of escape, and of the means, such as defensive warfare on French soil, delay for recuperation, and the submarine campaign, by which Ludendorff still hoped that the situation might be improved. On Oct. 8 he pressed for more specific acceptance of his principles, declined to propose an armistice unless the Central Powers consented "immediately to withdraw their forces everywhere from invaded territory," and pointedly asked whether the German Chancellor was merely speaking for the imperial authorities who had so far conducted the war. Satisfactory assurances were given by Germany on the 12th with regard to the first; but as to the second she proposed a mixed commission, and as to the third was not conclusive. Her acceptance of the first justified the President, as he said on the 14th, in being frank with regard to the other two points; the process of evacuation and terms of the armistice must be left to the advice of the military authorities, but no arrangement could be accepted which did not guarantee the present military supremacy of his Government and its Allies. Nor would he or they consent to consider an armistice so long as German submarines continued their sinking of passenger ships, and German troops the pillage and destruction which marked their withdrawal. With regard to the democratic character of the German Government, he referred to his "Four Ends" speech of July 4, in which he had plainly intimated that if the Germans wanted peace they must change their constitution. To the Austro-Hungarian note he returned a separate reply on the 18th, explaining his change of attitude toward Czechoslovak and Yugoslav "autonomy."

Both Governments made in reply concessions, in view of which the President said on the 23rd he could not decline to take up the question of an armistice with his Allies. He had therefore transmitted the correspondence to them; but he pointed out that extraordinary safeguards would have to be demanded in view of the fact that "the power of the King of Prussia to control the policy of the Empire is unimpaired . . . that the nations of the world do not and cannot trust the word of those who have hitherto been the masters of German policy." If the Government of the United States "must deal with the military masters and the monarchical autocrats of Germany . . . it must demand not peace negotiations but surrender. Nothing can be gained by leaving this essential thing unsaid."

The German reply was dated the 27th. Incidentally that was the date of the Austrian *débâcle* on the Piave; but Germany's action was dictated by events nearer home. Almost the last vestige of the Hindenburg defences had disappeared. But Ludendorff had recovered his obstinacy, if not his nerves, and urged the rejection of Wilson's terms. At last the civilian ministers acted on their own responsibility, and Ludendorff had to resign on the 27th. Next day, when the High Seas Fleet, the submarine having been barred, was ordered out, it mutinied; and the German note merely intimated that the German Government awaited the proposals for an armistice. But the President's Allies had still to be heard; and on Nov. 5 he informed Germany that they reserved complete freedom of action at the Peace Conference with regard to the freedom of the seas, and understood by "restoration" "compensation for all damage done to the civilian population of the Allies and their property by the aggression of Germany by land, by sea, and from the air." No reference was apparently made to the Secret Agreements, which therefore would not be binding on the Conference.[1]

[1] *See* PEACE CONFERENCE for the actual proceedings.

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Germany raised no further objections, and on Nov. 7 the Armistice Commission met. It continued its deliberations, to the accompaniment of popular insurrections and monarchical abdications, until on the 11th an Armistice was signed on the day that Americans fought their way into Sedan and Canadians into Mons. Verily a New World had been called in to redress the balance of the Old. For subsequent events see especially articles on GREECE, RUSSIA, OTTOMAN EMPIRE, and other countries of Eastern Europe. (A. F. P.)

WRANGEL, PETER NICHOLAIEVICH, BARON (1879–), Russian general, was born in Petrograd in 1879, the eldest son of an impoverished Baltic nobleman of Swedish descent. His father, Baron Nicholas Igorevich, held an important post in the International Bank, at Petrograd. At the age of 20 Wrangel entered the Mining Institute at Petrograd and finished its course brilliantly. He served as private in the Horse Guards for one year. Leaving the regiment with the rank of N.C.O. he went to Siberia and worked there as a mining engineer until the Russo-Japanese War. At the beginning of that war he joined the Trans-Baikal Cossack Regt., which he left at the end of hostilities with the rank of captain. He retained his rank in the Horse Guards, which he rejoined after the war, thus devoting his life to the military profession. At the beginning of the World War he was in command of a squadron, but was soon promoted colonel, received the St. George Cross and was made A.D.C. to the Tsar. In 1915 he was appointed commander of a Cossack regiment at the Galician front. Later he rose to the command of a Cossack division. Wrangel was among the first officers who joined Gen. Kaledin in his fight against the Bolsheviks, and after Kaledin's suicide he took part in the organization and struggle of the volunteer army under Alexeyev and Denikin, and distinguished himself especially by the defence of Tsaritsyn. After the disastrous retreat of Gen. Denikin, from Orel to the Black Sea, Wrangel was appointed on April 4 1920 commander of the volunteer army. Men and officers of the army were demoralized, and the lack of munitions and food supplies made the situation almost desperate. Fortunately for Wrangel, the Bolsheviks considered the volunteer army to be out of action, and they had to send a large part of their forces against the Poles who were approaching Kiev. This made it possible for Wrangel to attempt the reconstruction of the southern army; and for some time his attempt was successful. His nomination to the post of commander-in-chief corresponded with the attempt of Mr. Lloyd George to induce the volunteer army to begin peace negotiations with Soviet Russia. In a note to this effect the volunteers were warned that, in case of refusal, they would be deprived of all British support; this note was handed to Gen. Denikin on April 4, and seems to have been one of the chief causes of his resignation. Replying to this proposition Wrangel refused to enter into direct negotiations with the Bolsheviks, and asked the Allies to guarantee the life and safety of his troops and of the refugees under his protection. These negotiations proved eventually a failure. In the meantime Wrangel did his best for the reorganization of the army and the administration. A Council was formed which continued the work of Denikin's Government. Krivochin was nominated president of the council; Peter Struve received the portfolio of Foreign Affairs, Bernadsky that of Finance. The Government was modelled on the basis of personal dictatorship. In the "Statute" published on April 14 it was proclaimed that the "Ruler and Commander-in-Chief of the armed forces of South Russia holds full military and civil power without any limitation whatever." It was intended that this temporary dictatorship should lead in the future to the reconstruction of Russia. The main points of Wrangel's programme were outlined by Struve in an interview to the representative of an English paper in the following way:—

"The seizure by the peasants of large properties should be recognized wherever it has actually taken place. It constitutes the starting point for wide agricultural reform destined to assure the peasants the full ownership of the land which they cultivate. The agrarian revolution which has taken place in favour of peasants would thus be legalized, and, to the profit of the new owners of the soil, would result in an agrarian organization based on the principle of private property, which corresponds beyond doubt to the aspirations of the peasants." (These principles served as a foundation to the "Rules for the transfer of agricultural land to the tillers of the soil" of March 25 1920.) "The future organization of Russia should be based on an agreement between the existing political formations. The union of the different parts of Russia, at present divided, in a large federation would be founded on voluntary agreement between them, resulting from the community of interests, and, above all, from economic needs. This policy in no way seeks to enforce union by violence. Whatever may be the future relations of the different parts of Russia now separated from one another, the political organization of these territories and the constitution of their federal union should be founded on the free expression of popular will by means of representative assemblies elected on democratic basis. The underlying motive of Wrangel and those who supported him in attempting to establish themselves in Southern Russia was the conviction that while, sooner or later, the Bolshevist system must come to an end, it is nevertheless essential that its disintegration should be assisted by outside action."

The reorganization of the army by conscription proceeded successfully, and the events of the Polish front as well as the shortage of food in Crimea obliged Wrangel to try a new offensive. On May 25 he began an advance on the whole front, combined with landings on the coast to the east and west, which resulted in a series of defeats for the Bolsheviks. The whole of the fertile corn lands of the Taurida Province were occupied, and the position of the army was greatly strengthened. At the end of June the new line of the front passed approximately through Berdyansk (Sea of Azov), Tokmak (Sevastopol-Kharkov railway), Alioshki (on the Dnieper, near Kherson). The front of 30 km. had been extended to one of 250 kilometres.

With the defeat of Poland Mr. Lloyd George renewed his proposals as to settlement with the Bolsheviks at the conference of Spa. On the contrary, on Aug. 11 the French Government issued a statement which declared, "that taking into consideration the military successes and the growing strength of the Soviet Republican Government" it was recognized by France as the *de facto* Government of Russia under the obligation of recognition of Russian debts, and the promise to follow a democratic policy with regard to domestic affairs.

Wrangel and his Government tried to follow these advices in spite of the opposition of a section of the Russian society. But the heavy hand of the military dictatorship made itself often felt in spite of the democratic programme. For example, in his order of Oct. 3 Wrangel prohibited all "public speeches, sermons, lectures and conferences tending to arouse political or national disorder." His relations with the Caucasus, Ukraine, Poland and other territories, which had been parts of the Russian Empire before the revolution, were of vital importance for the success of the undertaking. The principle of federation was proclaimed and resulted in the agreement of July 22 (Aug. 4) between Wrangel on the one side and the Atamans of Don, Kuban, Terek and Astrakhan on the other. Complete self-government was granted to the Cossacks in their internal organization and administration, but the direction of foreign relations and of military affairs was reserved for the Commander-in-Chief. A delegation of the Paris Ukrainian National Committee was received by Wrangel at Sevastopol on Sept. 23, and established coöperation of the non-separatist Ukrainians with Wrangel. In order to facilitate the organization of a special Ukrainian administration and the formation of Ukrainian military units, a Commissioner for Ukrainian affairs was appointed in Wrangel's Government with the rank of Minister. Wrangel was also recognized as the supreme chief of the anti-Bolshevik movement by the leader of the Siberian Cossacks, Ataman Semenoff, and the chiefs of different independent guerilla units acting in the south of Russia, the best known of whom is Makhno. Wrangel successfully repulsed all Bolshevik attacks until the end of Oct., and even found it possible to extend the area of his occupation. An official *communiqué* at the end of Oct. reports "that between May 25th and October 25th the Russian army had captured 70,500 prisoners, 250 guns, 17 armoured trains, 21 armoured cars, hundreds of horses, and considerable amount of other booty." But these successes were only of a short duration. Peace with Poland had freed considerable Bolshevik forces, which were transferred to the southern front against Wrangel. The small

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army numbering 45,000 trained soldiers was unable to defend a front of 400 km. against the overwhelming number of Bolsheviks, well provided with heavy artillery and unlimited munitions. The isthmus of Perikop had to be abandoned in consequence of a turning movement by the Reds across the "Putrid Sea." On Nov. 15 Sevastopol was occupied by the Bolsheviks.

The evacuation of the army and of thousands of refugees was carried out in good order under the personal supervision of Wrangel, who was the last to leave on board the "Korniloff." A total of 130,000 people were evacuated, of whom 70,000 were soldiers (30,000 fighting men, and 40,000 from the rear), about 7,600 wounded, the rest being civilians. One hundred and fifty million fr. were advanced by the French Government for the relief of the army and refugees, who were in the most awful condition. The refugees were sent to Lemnos, to Egypt and to Yugoslavia.

Wrangel hoped that the evacuation would enable him to keep his army together as a fighting unit to be used at the first opportunity against the Bolsheviks. The excellent discipline and gallantry of the troops and their devotion to their chief favoured such a plan; but it could not be effected without the support of the Allies, and this resource proved to be exhausted.

The French Government, which had done most for the forces in the Crimea, was unwilling to continue a policy which it considered hopeless. M. Leygues, the successor of M. Millerand as prime minister, demanded categorically the disbandment of Wrangel's army, and the General was directed to announce to the troops that he was not their chief any more and that they were free to disband. About 10,000 were "repatriated" to Soviet Russia, about 12,000 accommodated in Serbia and Brazil. The best part of the army kept together in the camp of Gallipoli in their regimental formations, maintaining—according to the testimony of foreign officers—excellent discipline and sturdy spirit. The problem as to what was to be done with these picked troops was still unsolved in the winter of 1921. France had withdrawn her support; Serbia had taken over 5,000 cavalry to serve as frontier guards; the rest were expecting assistance from Russian institutions abroad, such as the Russian embassies in Washington and Tokio, and from the intervention of the League of Nations. (P. VI.)

WRENBURY, HENRY BURTON BUCKLEY, 1ST BARON (1845–), English judge, was born in London Sept. 15 1845. His father was for many years vicar of St. Mary's, Paddington, and Arabella Buckley, the author of *The Fairy Land of Science* (1878), was his sister. He was educated at Merchant Taylors' school and Christ's College, Cambridge, being ninth wrangler in 1868. In 1869 he was called to the bar, and rose to a position of eminence as an authority on company law. He became a Q.C. in 1886 and a bencher of Lincoln's Inn in 1891, while from 1883 to 1898 he was a member of the Bar Committee and the Bar Council. In 1900 he was made a judge of the Chancery division, and in 1906 became a lord justice of appeal and a privy councillor. He retired in 1915, and was raised to the peerage, his high legal authority adding strength to the House of Lords. Lord Wrenbury founded in 1904 the Buckley scholarship in political economy at Cambridge, later styled the Wrenbury scholarship, to be held by scholars from Merchant Taylors' school. His *Law under the Companies Acts* (1873; 9th ed. 1909) is a standard work.

WRIGHT, SIR ALMROTH EDWARD (1861–), British bacteriologist, was born at Middleton Tyas, Yorks, Aug. 10 1861. He was educated at Dublin University, and afterwards studied law, subsequently obtaining his medical and scientific education at the universities of Leipzig, Strassburg and Marburg. In 1887 he became a demonstrator of pathology at Cambridge, in 1889 went to Sydney as lecturer in physiology, and from 1892 to 1902 was professor at the army medical school at Netley, being then appointed professor of experimental pathology in the university of London. He was knighted in 1906. Sir Almroth Wright came into prominence primarily by his remarkable researches into the problems of parasitic diseases. He introduced the system of anti-typhoid inoculation (*see* 20.775, 783), and also did much valuable work on the preparation of other vaccines and toxins, while he carried out many important experiments in bacterial infection and in measuring the protective matter of human blood. He acted as a consulting physician to the army in France from 1914–9, and was in 1918 created K.B.E. He has published *System of Anti-Typhoid Inoculation* (1904); *Principles of Microscopy* (1906) and *Studies in Immunisation* (1909), besides many papers in medical and scientific periodicals. In 1913 appeared *The Unexpurgated Case against Woman Suffrage*, which provoked much discussion.

WRIGHT, WILBUR (1867–1912), American inventor, was born near Millville, Ind., April 16 1867. He was the son of Milton Wright, a bishop of the United Brethren in Christ. He secured a high-school education in Richmond, Ind., and Dayton, O. Together with his brother Orville he opened a shop for repairing bicycles at Dayton in the early 'nineties. The Wright brothers early became interested in the problem of flying, and from about 1900 made many experiments with gliding machines at Kitty-hawk, N.C. On Dec. 17 1903 such a machine with a petrol motor attached flew 260 yd., the first successful flight of an aeroplane; and on Oct. 5 1905, near Dayton, they accomplished their first successful long flight, more than 24 m., at the speed of 38 m. an hour. In spite of this proof of the practicability of flight in heavier-than-air machines, they were unsuccessful in enlisting financial support in America. In 1908 Wilbur Wright went to France, and on Sept. 21 won the Michelin prize by a flight of 56 miles. This brought him international fame. In Dec. of the same year he made from Le Mans, France, a flight of 77 m. in 2 hours and 20 minutes. In 1909, during the Hudson-Fulton Exposition in New York City, he flew from Governor's I. up the Hudson river to Grant's tomb and back, travelling 21 m. in 33 minutes and 33 seconds. On March 3 1909 Congress awarded the Wright brothers a special medal. Later the U.S. Government purchased a machine for $30,000, and afterwards the invention was officially adopted by the U.S. army. The French patents were sold for $100,000. After 1910 Wilbur Wright gave up public flying and devoted his time to mechanical improvement of the Wright machine. He received many medals and honours from European countries. He died at Dayton, May 30 1912.

His brother, ORVILLE WRIGHT (1871–), was born at Dayton, O., Aug. 18 1871. He was educated in the Dayton schools, worked with his brother Wilbur in the bicycle repairing business, and was closely associated with him in all his experiments in developing a practicable aeroplane. He shared in the many honours awarded by foreign countries, and after the death of his brother became director of the Wright Aeronautical Laboratory at Dayton. In 1913 he received the Collier trophy for developing the automatic stabilizer. In 1915 he was appointed a member of the U.S. Naval Consulting Board. The same year the Wright Aeroplane Co. sold its patents to a New York syndicate, Orville Wright remaining chief engineer.

WRIGHT, WILLIAM ALDIS (1836–1914), English man of letters (*see* 28.847), died at Cambridge May 19 1914. His last publication was *The Hexaplar Psalter* (1911). In 1912 he resigned the vice-mastership of Trinity College, Cambridge, and lived in retirement till his death.

WUNDT, WILHELM MAX (1832–1920), German philosopher (*see* 28.855), died at Leipzig Sept. 1 1920. His principal work was done before 1907. At the outset of the World War he published an address justifying Germany, and his *Die Nationen und ihre Philosophen* (1915) eulogizes German thought and culture whilst belittling those of England and France.

WÜRTTEMBERG (*see* 28.856). Pop. according to 1919 census, 2,518,773. During 1910–1921 the constitutional question in Württemberg passed through decisive developments. The constitution dating from Sept. 20 1819 was one of the oldest in Germany. Created by a contract between the King and the Assembly of Estates, it was based upon the people's will and could, for that very reason, be maintained almost without alteration for close upon a century.

The first alteration of any importance was made in 1906, when Württemberg introduced, before any other German state, the proportional system of election for the Second Chamber of

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the Diet. The result of the elections of 1906 was such that the two Liberal parties on the one side and the Catholic Centre and the Conservatives on the other were equally strong, so that the Social Democrats held the balance. The elections of 1912 brought about a fresh grouping of parties. The Conservatives and the Catholic Centre (forming together the so-called "Black-and-Blue *bloc*") returned as many deputies as all the other parties together, with the consequence that very keen opposition developed between the Right and the Left. The composition of the Ministry, it is true, was not affected by the constellation of parties, as the government of Württemberg was not on the parliamentary system. The Weizsäcker Ministry remained in office and continued to conduct its policy on the liberal lines which had always been followed in Württemberg. The demand for the appointment of parliamentary ministers, which had been vigorously prosecuted by the Democratic (non-Socialist) party during the World War, was rejected by the Weizsäcker Ministry, notwithstanding its liberal tendencies, until the change in the constitution of the Empire under Prince Max of Baden's chancellorship in Oct. 1918 compelled the Württemberg Government to give way. The Weizsäcker Ministry resigned. A new Ministry was formed, containing a member of each of the four parties, the Catholic Centre, the National Liberal, the Democrats and the Social Democrats. The Democrat Liesching was made president of the Ministry. This new Ministry was going to meet on Nov. 8, but on Nov. 9 the revolution broke out in Stuttgart and on Nov. 10 the Liesching Cabinet resigned. A provisional Government was formed, consisting at first entirely of Social Democrats. The most extreme members of this Government, however, were ejected on Nov. 11, and a member of each of the three parties, the Centre, the Democrats and the National Liberals, entered the Cabinet. After the disturbances which broke out in Jan. 1919 the Independent Socialists left the Ministry, and its composition then remained unaltered until the general election of the year 1920.

The King, William II. (born 1848), had abdicated on Nov. 30 1918 and retained only the title of Duke of Württemberg. He subsequently lived mostly at Bebenhausen Castle in the Black Forest, where he died on Oct. 2 1921. The headship of the family passed to Duke Albrecht of Württemberg. The abolition of the monarchy in Württemberg was solely a consequence of the fall of the Hohenzollern monarchy in the empire. The King of Württemberg himself had enjoyed great popularity, which extended into the ranks of the Social Democrats. The democratic tendencies which had always prevailed in Württemberg had, after the revolution, the favourable effect of enabling the Territory (*Land*) to settle down with comparative rapidity, and the coöperation of the so-called "bourgeois" (*i.e.* non-Socialist) parties with the Social Democrats took place without any serious friction.

After Nov. 9 1918 Württemberg experienced no further political convulsion of a serious character. The disturbances of Jan. 1919 were quickly suppressed. The attempt of the extremists among the working classes to cause disturbances by a general strike was frustrated by the action of the railway officials in paralysing the communications with Stuttgart. The Bavarian Communist insurrection produced no effect in Württemberg; it was, on the contrary, suppressed with the aid of Württemberg troops before it could spread across the border. During the so-called Kapp "Putsch" (March 1920) the Government of the Reich and the National Assembly removed for a short time from Berlin to Stuttgart because they felt that they would be safest in the capital of Württemberg.

The provisional Government of Württemberg issued on Nov. 2 1918 regulations for the election of a Representative Assembly which should meet and vote the new constitution. The elections of Jan. 12 1919 resulted in the return of 52 Social Democrats, 38 Democrats, 31 members of the Catholic Centre, 25 Conservatives and 4 Independent Socialists. The Assembly first confirmed the Government in office and then proceeded to deal with the new constitution. It was voted on April 26 against a minority of nine by the whole of the rest of the House. Most of the Conservatives were amongst the majority; the minority consisted of a few Conservatives and the Independent Socialists. Württemberg was the second state of the Reich which deduced the consequence of the revolution by setting up a new constitution; Baden alone preceded it. The constitution of Württemberg naturally resembles that of Baden in many respects, but also differs from it in several important particulars. Moreover, the constitution which came into force on May 23 1919 was not definitive. As the constitution of the Reich had considerably restricted the rights of the separate states which composed it, a reconsideration of the constitution of Württemberg became necessary and large sections of it were eliminated. On Sept. 25 1919, exactly 100 years after the adoption of the first Württemberg constitution, the new constitution was finally voted.

The constitution of Württemberg could not fail to resemble that of the other German states, since the constitution of the Reich prescribes for all the states that they must be republics and have a parliamentary government. The powers of the state in Württemberg proceed from the people and are transferred by the people to the Diet; the people can, however, resume the powers of the state by dissolving the Diet or by giving a popular vote (*Volksabstimmung*) on a law. Such a vote may be passed either upon a referendum or upon a popular initiative. In contrast to Baden, there is no compulsory referendum.

The Diet transfers the executive power to the Government. At the head of the Government there is the Minister-President, who has the title of President of the State (*Staatspräsident*); but in Württemberg, as in Baden, there is no head of the state independent of the Diet. The Ministry is formed by the Diet's electing the President of the State, who selects the Ministry in accord with the Diet. (The same procedure is followed in Bavaria and Baden.) The administration, however, is not conducted by the Ministry as a whole, but by individual ministers. A peculiarity of the Württemberg constitution is that councils (*Beiräte*), formed from the different classes according to occupations (*Berufsstände*), are attached to the ministries. Elections for the Diet take place every four years. No provision is made for a dissolution of the Diet except that, as already mentioned, the Diet can be dismissed by a vote of the people.

The constitution of Württemberg was framed by those parties which restored order in the country after the revolution—the Social Democrats, the Democrats and the Catholic Centre. At the elections of June 1920 these parties, particularly the Social Democrats and the Democrats, were considerably weakened, while the parties to the Right and the Left of them gained. As in the Reich the result of the general elections compelled the Government to resign; the Württemberg Government took this course, although there was no absolute necessity. The new Government of Herr Hieber was composed of members of the Democratic and the Catholic Centre parties, but was nevertheless supported by the German People's Party (former National Liberals) and the Social Democrats. The change of government did not entail any essential alteration in the policy of Württemberg. (W. v. B.)

WYNDHAM, SIR CHARLES (1837–1919), English actor (*see* 28.872), died in London Jan. 12 1919. In 1916 he married, as his second wife, Miss Mary Moore, who had been for many years his leading actress and his partner in management. His last appearance on the stage was made in a revival of *Mrs. Dane's Defence* at the New theatre, London, in 1912.

WYNDHAM, GEORGE (1863–1913), English politician and man of letters, was born Aug. 29 1863, the eldest son of the Hon. Percy Scawen Wyndham, and grandson of the 1st Lord Leconfield. His mother was Madeline Caroline Frances Eden, daughter of Sir Guy Campbell, 1st baronet; and through her he was great grandson of Lord Edward Fitzgerald, the Irish rebel. He was educated at Eton and Sandhurst, obtained a commission in the Coldstream Guards in 1883, and served through the Suakin campaign of 1885. But his military career was a very short one. Interested as he was in soldiering, his eager temperament impelled him still more to adventure in politics and letters. He left the army in 1887, married Sibell Mary, daughter of the

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9th Earl of Scarbrough, widow of Earl Grosvenor, mother of the 2nd Duke of Westminster, and became private secretary to Mr. Balfour, at the time Irish Secretary, a position which he held till 1892. In 1889 at the age of 26 he entered Parliament as Conservative member for Dover, and retained the seat till his death. In 1898 he was appointed financial secretary to the War Office, a post in which he distinguished himself during the Boer War, in particular by a brilliant defence, in the debate on the Address in 1900, of the conduct of his office in regard to intelligence and reinforcements. But his chief claim to political remembrance is based on his tenure, from 1900 to 1905 (after 1902 as a Cabinet minister), of the office of Chief Secretary for Ireland. Having been private secretary for several years to the most successful chief secretary of modern times, he started with a large store of experience, and his appointment was regarded with benignity even by the Nationalists on account of his descent from Lord Edward Fitzgerald. His early work in Ireland met with general approval. He developed enormously the policy of land purchase, which the Unionists had found to exercise such a calming and beneficial effect; and the Land Purchase Act which he successfully carried in 1903 was the most comprehensive measure of the kind ever submitted to Parliament. He entertained hopes of arranging some form of local government which should sufficiently meet Nationalist hopes; and with this in view appointed an eminent Anglo-Indian, Sir Antony (afterwards Lord) Macdonnell, who was known to be a decided Home Ruler, to the permanent secretaryship in 1902, giving him at the same time greater authority and wider scope than is usually conferred on a civil servant. The Unionist party, both in Ireland and in England, became suspicious of the tendencies of his administration, and he was driven to resignation. He never held office again, but he was very active in support of the causes which he had at heart, such as tariff reform, and woman suffrage; he was a keen critic of Lord Haldane's army reforms, and threw himself vigorously into the " die-hard " campaign of 1911.

This varied political activity was however but a portion of his life. He was also a man of letters, possessed of fine taste and a graceful style. Here his genius was stimulated by his friendship with W. E. Henley, who dedicated a book to " George Wyndham, soldier, courtier, scholar." His principal published work was an edition of *Shakespeare's Poems* (1898); but he wrote also on North's *Plutarch* and Ronsard. The Admirable Crichton of his day, he was keen alike on field sports and the arts, the friend and admirer equally of Cecil Rhodes and of Rodin, a railway director and a yeomanry colonel. Oxford, Edinburgh and Glasgow gave him honorary degrees; the two Scottish universities made him lord rector.

By his father's death in 1911, Mr. Wyndham came into possession of his beautiful house, Clouds, in Wiltshire. Two years later, at the early age of 50, he died in Paris, of congestion of the lungs, after only a few hours' illness. Lady Grosvenor survived her husband. They had one son, Lt. Percy Lyulph Wyndham, who followed his father in the Coldstream Guards, was married in 1913, a few weeks before his father's death, and was killed in action in France on Sept. 15 1914, leaving no child.

WYOMING (*see* 28.873).—The pop. of the state in 1920 was 194,402 as compared with 145,965 in 1910, an increase of 48,437 or 33.2%, as against an increase of 57.7% in the preceding decade. The density of pop. was two per sq. m. in 1920. The urban pop. (in places having 2,500 inhabitants or more) in 1910 was 43,221, or 29.6% of the whole; in 1920, 57,348, or 29.5%. The rural pop. was 102,744 in 1910, 137,054 in 1920. The cities in Wyoming having a pop. in 1920 of over 5,000 and their percentage of increase were:—

	1920	1910	Percentage Increase
Casper	11,447	2,639	333·8
Cheyenne	13,829	11,320	22·2
Laramie	6,301	8,273	23·5
Rock Springs	6,456	5,778	11·7
Sheridan	9,175	8,408	9·1

The increase of pop. has been chiefly elsewhere than in the southern parts of the state, which had been the first to be settled.

Agriculture.—The number of farms was 6,095 in 1900, 10,987 in 1910, 15,748 in 1920. The acreage of all crops was estimated for 1920 as 1,826,000. The number of sheep in 1919 was 4,000,000 valued at $49,200,000. In 1920 the number was 3,200,000 valued at $32,640,000, being one-fifteenth in numbers and value of the total sheep in the United States. The estimated product of wool in 1919 was 33,415,000 lb., the average weight per fleece 8·5 lb. The total number of neat cattle in 1919 was 1,180,000 valued at $75,580,000; in 1920 there were 869,000 valued at $47,370,000. Other figures are correspondingly higher for 1919. In 1920 there were 258,000 horses valued at $11,925,000; mules 4,000, valued at $360,000; and swine 63,000, valued at $1,159,000. Other agricultural products of Wyoming and their value in 1920 were as follows:—

Crop	Ac. sown	Production	Value
Hay, cultivated	740,000	1,850,000 tons	$22,200,000
Hay, wild, salt and prairie	360,000	360,000 tons	5,148,000
Oats	300,000	11,400,000 bus.	7,068,000
Wheat	254,000	5,080,000 bus.	6,858,000
Corn	65,000	1,560,000 bus.	874,000
Barley	28,000	1,008,000 bus.	1,109,000
Potatoes	27,000	3,375,000 bus.	4,050,000

The irrigated area was 1,133,302 ac. in 1909, 1,209,527 in 1919. In 1920 the acreage capable of irrigation was 1,799,361. There were, in 1918, 978,681 ac. of land used for dry farming.

Mining.—The annual gross value of Wyoming's mineral products at the places of production was estimated at $68,250,000 for 1920. In 1917 the state ranked ninth in the output of bituminous coal with 8,575,000 tons valued at $16,593,619; in 1918 it was 9,300,000 tons; in 1919 7,145,000 tons (the decrease being attributed to labour shortage). The largest product comes from Sweetwater, Lincoln and Sheridan counties. The total production of coal to the end of 1917 was 148,000,000 short tons. Copper mining has decreased, the annual production averaging in value about $200,000. The gypsum production in 1917 was 55,804 short tons valued at $197,867. The average output of iron ore was about 500,000 tons, worth $1,500,000 at the mines. A deposit of carnotite (uranium, radium), accidentally discovered near Lusk in Niobrara county, produced in 1919 71·86 tons valued at $382 per ton. Most important in the state's mining development is the petroleum industry. In 1918 the output was 12,596,287 bar., in 1919 13,580,000 bar., and the estimate for 1920 16,000,000 bar. of crude oil, valued at over $45,000,000 at the wells. There were 17 fields in the state where oil was produced for market. About one-half the state's output was from Salt Creek field in Natrona county. Converse county came next in 1919 with 3,267,302 bar., Hot Springs followed with 2,151,867 bar., and Park with 773,893 bar.

Manufactures and Railways.—Wyoming's manufactures continue to be of little relative importance, aside from the petroleum refining industry to which this great increase of 1919 is due. The following figures are from the census report:—

	1919	1909
Number of establishments	576	268
Persons engaged	8,095	3,393
Value of products	$81,445,394	$6,249,078
Value added by manufacture	39,194,866	3,640,889

Of the 8,095 persons engaged 3,057 were wage-earners in the steam railway construction and repair shops. Railway mileage in 1917 was 1,924 m. as compared with 1,623 in 1909.

Education.—The educational system was reorganized in 1919 by Act of the Legislature providing for an elective state superintendent of public instruction, a state Board of Education appointed by the state superintendent with the approval of the governor, and a commissioner of education appointed by the state Board with the approval of the governor.

History.—Wyoming in 1921 was still governed under its first constitution. The six amendments which had been adopted gave additional powers to the Legislature—notably for workmen's compensation measures, highway construction and protection of live stock from disease. An eight-hour day for underground work in mines was established in 1909. A direct primary law was passed in 1911, and a Mother's Pension Act in 1915, the latter to be administered by the county commissioners. A Public Service Commission was established in 1915, composed of members of the state Board of Equalization, with power to supervise and regulate any public utility doing business in the state. In 1919 a " blue sky " law was passed. In the same year the Executive Budget system was adopted. In 1921 a system of rural credits, to be managed by a Farm Loan Board, was pro-

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vided for, and an Act passed allowing towns of 1,000 inhabitants or more to adopt the commission-manager form of government. By an Act of 1919 the commissioner of taxation was replaced by a state Board of Equalization with power to increase or decrease the assessed value of any class of property in any county. The law of 1909 limiting county taxes was replaced by the Act of 1911 grading the tax limit according to the assessed valuation of the county. A beginning was made in 1921 in the revision of the taxation system by provision for an effective inheritance tax. The bonded debt was reduced from $140,000 in 1910 to $99,000 in 1918, but in 1920 it was increased to $1,935,000, due to the issue of bonds for the construction of roads.

Wyoming has been normally a Republican state in politics, but Republican control was seriously threatened for some years, beginning with the Insurgent Republican movement of 1910. Joseph M. Carey headed that movement, and a combination of Insurgent Republicans and Democrats resulted in the election in 1910 of Carey as governor, and of a majority of Democratic state officials. But the Republicans retained their control of the state Legislature throughout the decade 1910–20, and controlled the judiciary until the Act of 1918 providing for election of judges on a non-partisan ticket. Frank W. Mondell (Rep.) was reëlected as the state's one representative in Congress in 1910 and in every succeeding election of the decade. Clarence D. Clark (Rep.) was reëlected to the U.S. Senate in 1910 and Francis E. Warren (Rep.) in 1912 and again in 1918. In 1914 John B. Kendrick (Dem.) was elected governor by a vote of 22,387 to 19,174 for his Republican competitor; in 1916 he was elected to the U.S. Senate over Clark (Rep.) by a vote of 26,324 to 23,258. In 1918, however, the Republicans won the elections by substantial majorities, and in 1920 they swept the state for both state and national tickets. The presidential vote in 1912 was 15,310 for Wilson, 14,560 for Taft, and 9,232 for Roosevelt; in 1916 it was 28,316 for Wilson and 21,698 for Hughes; in 1920 it was 35,091 for Harding and 17,429 for Cox.

During the World War Wyoming supplied to the U.S. army 11,393 men, to the navy 638, and to the marine corps 111. The subscriptions to the war loans, in each case exceeding the state's quota, were as follows: First Liberty Loan, $1,568,900; Second, $5,132,650; Third, $6,737,000; Fourth, $10,183,150; Victory Loan, $6,862,250.

The recent governors have been: Joseph M. Carey (Prog.), 1911–5; John B. Kendrick (Dem.), 1915–7; F. L. Houx (acting, Dem.), 1917–9; Robert D. Carey (Rep.), 1919– . (L. A. W.*)

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YACHTING: *see* SPORTS AND GAMES.

YALE UNIVERSITY (*see* 28.899*).—In 1919 President A. T. Hadley announced his decision to resign the presidency of Yale at the close of the university year; and on June 22 1921 his successor, James Rowland Angell, was inaugurated. Developments in 1910–20 were marked in many respects. The university's endowment increased from $11,967,166.29 to $24,048,730.45. The university began to be the beneficiary under the will of the late John W. Sterling of New York City, a graduate of Yale College, of about $20,000,000, held by trustees for the university under his bequest. The money was to be used for memorial buildings and devoted "to some extent to the foundation of Scholarships, Fellowships or Lectureships, the endowment of new Professorships and the establishment of special funds for prizes." At the same time the university's property holdings were augmented, and several important buildings constructed, including the Osborn Memorial Laboratories, the Sloane Physics Laboratory, the Dunham Laboratory of Electrical Engineering, the Mason Laboratory of Mechanical Engineering, Sprague Memorial Hall (Music), the Brady Memorial Laboratory (Pathology), Artillery Hall and the Artillery Armoury, and the magnificent Memorial Quadrangle, the gift of Mrs. Stephen V. Harkness, of New York City. This quadrangle includes seven courtyards in collegiate Gothic, designed by James Gamble Rogers of New York City, and erected at a cost of several million dollars. It is recognized as one of the most perfect groups of modern Gothic buildings in the world.

The number of students in 1920 who were candidates for a degree was 3,214, practically the same as ten years earlier. Educationally the university underwent a thorough reorganization in its administrative and educational system to meet modern conditions. The medical school was allied to the New Haven hospital and placed on full-time basis; the law school introduced the requirement of a college degree for entrance, except for Academic Seniors; the undergraduates' courses in the Sheffield Scientific School were placed on a four-year basis; and the higher engineering degrees were transferred from the scientific school to the graduate school. Several new university officers were appointed, including a Provost, who represented the Faculties before the Corporation and assisted the President in the educational administration of the university; the Dean of Students, who was primarily concerned with student *moral;* and a Dean of Freshmen, who had under his jurisdiction all undergraduate freshmen. These were formed into what is called the Freshmen Year, at the close of which undergraduates pursued three years of study in the Sheffield Scientific School leading to the degree of Bachelor of Science, or three years of study in the college leading to the degree of Bachelor of Arts, or in the case of students without Latin, Bachelor of Philosophy. The admission of all students was centralized in a Board of Admissions, under a chairman appointed by the Yale Corporation.

In connexion with the literary activities of the university the Yale University Press was started in 1908, by Mr. George Parmly Day, the treasurer of the university, under an agreement with the university by which all books published and bearing the Yale name must receive approval in advance by the Yale University Council's Committee on Publications. The Press was affiliated with the Oxford University Press, and became an important publishing agency in America for works of a literary and scholarly character. The number of books published in 1919 was seventy-eight. The number of books sold was 184,145. The *Yale Review* was transformed in 1911 into a quarterly review under the editorship of Wilbur L. Cross, Dean of the Yale Graduate School, and it is recognized as one of the most representative organs of sober thought in America.

Eight thousand Yale men, including graduates, former students and students, entered the military and naval services of the United States during the World War. The university had the most important artillery school in the country outside of Fort Sill and Camp Zachary Taylor. It also had one of the largest naval training units, and was the centre of the scientific work of the chemical warfare service. It was also the seat of the leading army laboratory school. Two hundred and twenty-five Yale men lost their lives in the service of their country. A memorial has been dedicated in their honour. (A. P. S.)

YAMAGATA, ARITOMO, PRINCE (1838–1922), Japanese field-marshal (*see* 28.902), died in Odawara, Japan, Feb. 1 1922.

YANUSHKEVICH, NIKOLAI (1868–), Russian general, was born in 1868 and entered the army in 1888. He passed through the academy of the general staff, and was appointed on the general staff. By 1909 he had reached the rank of general, but all his service was spent in the offices of the War Ministry, out of contact with troops. Very strict as a bureaucrat, he earned the special favour of the War Minister, Sukhomlinov, and, though he was quite untrained in the leading of troops in modern warfare (at the academy of the general staff he had taken an administrative course), he was, thanks to his even temper and enterprise, quickly promoted to the higher posts. Just before the World War he was appointed head of the general staff. Unable to introduce improvements, he limited himself merely to formal direction, which toned in well with the régime which the careless War Minister, Sukhomlinov, had established. With the declaration of war Yanushkevich, as head of the general staff, became the head of the staff of the supreme commander-in-chief. But at the commencement of operations, feeling himself completely unprepared for leadership on active service, he withdrew and left the work in the hands of his subordinates.

YARMOUTH (GREAT YARMOUTH), Norfolk, England (*see* 28.905).—The pop. had increased from 55,905 in 1911 to 60,710 in 1921. A new art school was opened in July 1913, and the esplanade was extended northward by about ½ m.; in 1921 a town-planning scheme of a very comprehensive nature was in course of preparation. Yarmouth was subjected to zeppelin and other aircraft raids on Jan 19 1915, April 24 1916, and Jan. 14 1918, and was bombarded from the sea on two occasions (Nov. 3 1914 and Jan. 26 1915); the material damage was slight.

YEATS, WILLIAM BUTLER (1865–), Irish author (*see* 28.909). In 1911, after the death of his friend J. M. Synge, Yeats wrote the essay *Synge and the Ireland of his Time.* His fervent Irish nationalism had been tried somewhat during his encounter with a section of the Irish public at the time of the *Playboy* disturbances in the Abbey theatre, and was further tried when the Dublin corporation refused a building for Sir Hugh Lane's collection of pictures. These affairs suggested to him a good deal of topical verse, especially in the most important of his later volumes, *Responsibilities* (Cuala Press, 1914). The volume includes the lines, familiar now in Ireland, "Romantic Ireland's dead and gone"; and as if to dwell a little longer in the Ireland of his earlier years, he wrote an account of these in *Reveries over Childhood and Youth* (1915). In his poetical work, from this period, he seemed to write with Synge's ideal of the poet in his mind, as one who "uses the whole of his personal life as his material." *The Wild Swans at Coole* (1917) marks the beginning of his preoccupation with the special doctrines expounded (1918) in *Per Amica Silentia Lunae,* a little prose treatise which the reader who wishes to understand Mr. Yeats' later work must study. Some of the poems in *Michael Robartes and the Dancer* (1920) are concerned with the events of 1916 in Ireland (the volume contains a sort of palinode to "Romantic Ireland's dead and gone"), but the author had become more and more a poet of esoteric doctrine. In literature and on the platform he had become a champion of belief in survival after death, a subject which interested him chiefly because of the possibility it offered of necromancy and "magic." "I have always," he says, "sought to bring my mind close to the mind of Indian and Japanese poets, old women in Connaught, mediums in Soho."

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He was one of the first to welcome the English poems of Rabindranath Tagore, for whose *Gitanjali* he wrote an introduction. Another late influence with him was represented by the Noh-plays of Japan, and he wrote an essay on the subject which is included in the prose collection, *The Cutting of an Agate*. Under the Japanese influence he wrote his plays *At the Hawk's Well* (1917), and *Two Plays for Dancers* (1919). He married in 1917 Georgia Hyde Lees, by whom he had first a daughter and in 1921 a son.

An elaborate critical study of Mr. Yeats' poetry, by Forrest Reid, appeared in 1916; also, in the series "Irishmen of To-day," *W. B. Yeats: The Poet in Contemporary Ireland*, by J. M. Hone; there is a good account of Yeats' work in *Ireland's Literary Renascence*, by Ernest A. Boyd (1916).

YELLOW FEVER (*see* 28.910).—In 1918 the study of this disease was carried a stage forward by the discovery of Noguchi that the disease could be transmitted to guinea-pigs, and that the blood of these, examined by dark-ground illumination, contained numbers of a delicate Spirochæte which he called *Leptospira icteroides*. This organism is closely allied to the *Leptospira icteroidæ morrhagiæ*, the organism of infective jaundice.

It was found possible to cultivate the new organism under anærobic conditions without excessive oxygen supply in solid media containing blood serum. Different strains of the organism vary greatly in virulence. Some are so virulent that 0·0001 c.c of a culture is sufficient to induce fatal symptoms in a guinea-pig. The organism is killed within ten minutes at 55° C. and by desiccation or freezing. It is an extremely delicate filament, 4–9 μ in length by 0·2 μ in breadth. It breaks up into a number of refractile granules, and the virus can pass through Berkefeld filters V. & N. The organism is scanty in the blood of yellow fever patients.

Those early statements were confirmed by later work, and the chain of evidence in favour of this organism being the cause of Yellow Fever was well-nigh complete by the middle of 1921. Noguchi prepared a serum by infecting horses with his organism, and this exercised marked curative effects on guinea-pigs when administered within a short period of the time of infection. It was further found possible to infect a guinea-pig from a culture of the organism and then use a mosquito (*Stegomyia fasciata*) to carry the infection from this animal to another. The whole course of the disease could thus be reproduced by means of new organism. (R. M. Wi.)

YOSHIHITO (1879–), 122nd Emperor of Japan, third son of the Emperor Meiji (Mutsuhito), was born on Aug. 31 1879, at Tokyo. The Prince was physically somewhat weak during his early life and Marquis Tadayasu Nakayama and Marchioness Nakayama were appointed his guardians. On the eighth anniversary of his birthday the Prince was proclaimed heir apparent, the first and second sons of the Emperor Meiji having died in infancy. In Sept. 1887 the Prince commenced attending the Peers' school and on Nov. 3 1889 he was declared Imperial Crown Prince. In 1892 the Crown Prince was appointed to the rank of a first lieutenant in the imperial army, and two years later left the Peers' school to continue his studies at the palace under private tutors. In 1895 he was promoted to the rank of captain and in 1897 took his seat, in accordance with prescriptive right, in the House of Peers. In 1898 he was promoted to the rank of major of infantry and appointed a lieutenant-commander in the imperial navy.

On May 10 1900 the Crown Prince married Sadako, fourth daughter of the late Prince Michitaka Kujo, and on April 29 1901 a son, Hirohito, was born, followed by a second son, Prince Yasuhito, on June 25 1902, and a third, Prince Nobuhito, on Jan. 3 1905. In 1903 the Crown Prince was promoted colonel in the army and captain in the navy and in 1909 lieutenant-general and vice-admiral. On July 30 1912, at the moment of the demise of his father, the Crown Prince ascended the throne; but, owing to the national mourning, the formal ceremony of enthronement did not take place until Nov. 1914. In the following year a fourth son, Prince Takahito, was born on Dec. 2.

YOUNG MEN'S CHRISTIAN ASSOCIATION (*see* 28.940).—For several years before the World War the British Y.M.C.A. had been doing effective work in the summer camps of the Volunteers and Territorials. When the war started it had therefore the necessary experience, together with trained personnel and a programme adapted to meet the needs of men on active service. It entered the field at once, and within ten days of the outbreak of war had opened up 250 different centres for the recreation and welfare of the troops in all parts of the United Kingdom. The whole organization of the Y.M.C.A. was brought to bear on the national emergency, and the Red Triangle, unknown before the war, soon became as familiar as the Red Cross itself. It touched the men at every point and in almost every place. It became a habit—they found it in the training camps; the base camps overseas; the support trenches, and sometimes even in those in the front line. The Y.M.C.A. meant warmth, shelter, comfort and rest to the soldier on active service under Christian auspices. It was a counter-attraction to the "wet" canteen, and helped to keep the men from undesirable places in the towns and villages adjacent to the camps. It kept them in touch with home—more than a thousand million sheets of writing paper and envelopes being sent out from headquarters in London for free distribution at home and overseas. The steadying effect of the work on the *moral* of the men was universally admitted. Sports and competitive games were organized on a large scale by the Association at a time when the army authorities had no leisure to devote to looking after the recreation of the troops. Education classes and lectures were included in the programme, and the Y.M.C.A. was appointed agent for carrying out the army scheme of education on the lines of communication in France. From May 1918 till the end of the following year 70,067 separate students were enrolled in the educational classes, and over 670,000 attended the lectures on the lines of communications. Wimborne House, London, was loaned by Lord Wimborne as headquarters of the overseas library, and more than a million books and magazines were sent to the front. The total cost of the educational work, which was carried out under the direction of a special committee on which all the universities were represented, exceeded £140,000. More than 150,000 concerts by professional artists were given, and in every case admission was free.

The primary object of all the work of the Association was the building and safeguarding of character. Religious work amongst the troops was organized on an extensive scale. Testaments, Gospels and religious booklets were distributed in hundreds and thousands. Family prayers in the huts usually closed the proceedings for the day, and, wherever possible, a quiet room or chapel was included as part of the equipment. Many distinguished preachers and evangelists served with the Y.M.C.A. The huts and tents were placed at the disposal of the official chaplains—Protestant and Catholic alike—every Sunday morning, and similar facilities were extended to the Jewish chaplains.

Personnel.—Twelve members of the Y.M.C.A. won the Victoria Cross during the World War, and the names of 2,621 are inscribed on the Roll of Honour in the central building in Tottenham Court Road of those who were killed or died when on active service. For its war work the Association had to depend almost entirely on men over military age or disqualified for active service, together with clergy and ministers of all denominations, whilst for the first time in its history women took a considerable part in the executive work of the Association. At one time there were as many as 40,000 ladies working under the Red Triangle. A splendid lead was given by H.H. Princess Helena Victoria, ably assisted by some of the leading ladies of the United Kingdom.

The Navy and Mercantile Marine.—During the war men of the Royal Navy had comparatively little shore leave, but many large institutes were opened in the naval bases and extensively used. After the Armistice work was opened up for the men of the British fleet based on Copenhagen. Y.M.C.A. cabinets, each containing a small library, writing materials, games, a gramophone and records, were supplied gratis to 200 centres for the use of men serving on coastguard, wireless, hydrophone and war signal stations.

Munitions.—To meet an urgent national need the Munition Workers' Auxiliary Committee was formed in 1915, with H.H. Princess Helena Victoria as president and Lord Derby as chairman. Two hundred canteens were opened before the end of 1918 in shell factories and other munition centres. Fifteen large hostels were established and more than 50 million meals supplied at cost price. Seven thousand voluntary women workers assisted. Lectures and concerts were given.

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Prisoners of War.—In 1915 welfare work was initiated in the German prisoner-of-war camps at home by the late Mr. F. L. Porter, of the English National Council, but ultimately it was handed over to the American Y.M.C.A., and under their aegis extended to most of the European countries. In the British internment camps in Switzerland centres were opened at Murren, Leysin, Seeburg, Interlaken and Geneva, whilst in Holland the Association operated at Groningen, The Hague, Scheveningen, Rotterdam, etc.

Officers.—A similar work for officers to that carried on for the ordinary soldier was developed on the same lines, though on a smaller scale. The late Lord Brassey lent his mansion in Park Lane as a Y.M.C.A. club for overseas officers, and hostels were opened in London and the provinces, and also overseas.

Y.M.C.A. Work in London.—Tottenham Court Road, the White City and the Crystal Palace were amongst the biggest centres of Y.M.C.A. activity in London during the war. Ciro's was a popular mixed club. £250,000 was spent on erecting and equipping hostels for troops passing through the City, and from Dec. 1 1918 to Aug. 13 1919 1,359,494 service men slept in the Y.M.C.A. hostels in the metropolis, and 1,068,913 in those in the provinces. The grand total from Jan. 1916 to Nov. 1919 was 5,478,774. Primarily for the benefit of overseas troops, enquiry kiosks were opened up by the Y.M.C.A. International Hospitality League in Trafalgar and Leicester Squares, Charing Cross, Victoria and Euston stations, the Strand, and in Parliament Square. From Jan. 1918 to April 1921 826,338 men were dealt with by Y.M.C.A. street patrols; 1,195,496 were welcomed in the social rooms; 55,008 provided with free hospitality and entertainment in private homes; thousands of men were taken from the streets and assisted to their quarters; 301,548 were kept from the temptations of the streets by free entertainments in theatres and other places of amusement; 170,637 were piloted round historic London by honorary guides, whilst no fewer than 2,197,840 enquiries were actually registered at the enquiry bureaux.

Motor Transport.—969,970 service men on leave were conveyed free of any expense from station to station and from hut to hut by the Y.M.C.A. volunteer night motor transport during the war, and 254,000 after the Armistice. These figures apply to London alone, but similar service was rendered in many other parts of the country.

On the Western Front.—The Y.M.C.A. started work for the men of the B.E.F. in France in Nov. 1914. Centres were opened in all the bases, and, later, the Red Triangle appeared on ruined buildings, cellars and dug-outs up the line. In the great German advance in the spring of 1918 no fewer than 198 Y.M.C.A. centres were destroyed, involving a loss of £158,000. At the time of the Armistice there were more than 1,700 workers in France. Specialized work was carried out for Chinese coolies in 124 huts, and many centres were devoted to the use of the Indian troops and others opened for the Portuguese. 69,300 service men on leave stayed in the three Y.M.C.A. hostels in Paris. Seventy-seven Y.M.C.A. cinemas in France were attended by 35,000 men nightly. Y.M.C.A. service to the walking wounded and to the relatives of the dangerously wounded was given free of charge, and after the war many of the huts were retained as hostels for relatives visiting graves, and others for men working in the devastated areas.

In Italy 82 centres were operated by the Y.M.C.A.

Y.M.C.A. Work in the East.—There were 10 Y.M.C.A.'s in Malta, serving especially the hospitals and convalescent camps, and one in Gibraltar.

The Indian National Council did effective war work in Egypt and Palestine, France, England, Mesopotamia, and also in East Africa, where there were 51 war Y.M.C.A.'s, 32 being for British troops, 6 for Indians and 13 for Africans. In India there were 115 war Y.M.C.A.'s, 74 for British and 41 for Indian troops, and altogether 412 full-time salaried officers were employed. In Mesopotamia 102 centres were operated by 100 secretaries. The Y.M.C.A. had two steam launches on the Tigris. In Egypt there were 15 centres in and around Cairo, where the *bourse* was acquired as a hostel for troops, and the Esbekia gardens as a recreation centre. The Y.M.C.A. penetrated south as far as Khartoum and Port Sudan, and was established in 35 centres in the canal zone, 6 in Alexandria, and others in Cyprus, Beirut, Suez, Port Said and Aden. In Gallipoli work was opened up in Anzac Bay and at Cape Hellas. Thirty-five centres were opened in the base camps in Palestine and 25 actually in the front line, with extensions as far as Damascus and Aleppo. There were 65 on the Salonika front, and others in the islands of the Aegean and Adriatic. In 1915 a relief ship, the s.s. "Nero," was despatched with comforts and delicacies for the men serving in the Dardanelles.

Russia.—The main operations of the Association commenced in July 1918, and continued until the evacuation of the North Russian Expeditionary Force. In the Archangel district 35 centres were opened and 4 railway coaches were equipped as mobile Y.M.C.A.'s. In the Murmansk district there were 21 centres.

The Armistice.—With the close of hostilities a much wider field had to be covered; the men were more scattered, and transport—never easy—became increasingly difficult day by day. With the Armistice there came a constant flow of repatriated prisoners of war across the frontiers, whose first contact was with the Y.M.C.A. The men were practically starving, and more than 7,000 were fed in Brussels alone, whilst large numbers were dealt with at Mons, Rotterdam, Aachen, Antwerp, Valenciennes, Vermelles, Nancy, Metz, Amiens, Lille and other centres. At all of these places, as well as at Cannon Street station in London, refreshments were given free at a cost to the Association of £50,000.

The Y.M.C.A. accompanied the British troops to Germany, and 5 big centres were opened up in Cologne, 3 at Düren, 79 for the use of corps troops, 6 on the lines of communication, and 8 on the Rhine demobilization boats.

Operations were on a big scale in Belgium, where a very strong Belgium Y.M.C.A. developed. Five thousand meals were served daily at the central Y.M.C.A. in Brussels, where there was sleeping accommodation for 1,600 men. The Hotel Weber was the largest Y.M.C.A. in Antwerp. Big centres were opened in Namur, Bruges, Ghent, Mons, Tournai, Roubaix, Aachen, Liége, Ostend, Zeebrugge, Spa, Beverloo and other places.

In Constantinople there was a large central Y.M.C.A. and tea gardens overlooking the Golden Horn, whilst several other branches were opened in the vicinity. In the Dardanelles centres were opened at Chanak, and Kum Kale. In the Caucasus there were centres at Batum, Tiflis and Baku. In southern Russia at Taganrog, Novorossisk and Ekaterinodar. There were eight posts on the Vardar and Doiran fronts. A mobile railway Y.M.C.A. ran between Salonika and Constantinople. There were three Y.M.C.A.'s on the Danube, and seven along the Anatolian railway.

In Serbia centres were opened at Monastir, Uskub, Velles, Nish, Belgrade and Mitrovitsa.

Work for Ex-soldiers.—During the closing stages of the war a Y.M.C.A. labour exchange was opened in London. Within two and a half years 29,000 ex-service men had been placed in situations, and more than 19,200 enquiries registered regarding pensions, allowances and other matters of vital interest to the ex-soldier. Seven large hostels and many huts were set aside for the use of demobilized men in London, and others in the provinces. Training schemes were carried out at Kinson (Dorset), Woldingham and in London.

Finance.—The total net cost of the work in all the war areas (excluding goods purchased for sale) was £8,189,406. This cost was met as follows: gifts from the public, £2,848,374; grants from American, Canadian and Australian Y.M.C.A.'s, £448,082; *gross* "profits" on sale of refreshments, £3,625,522; receipts from beds, baths and billiards, £369,756; proceeds of sales of properties and equipment, £212,574; sundry other receipts, £78,321; payment by War Office in respect of services rendered, £610,500. That left the Association with a surplus in hand of £3,723 with which to begin its extensive and costly after-war work for the troops.

It is interesting to note that out of every £1 spent on the war work of the Y.M.C.A. 6s. 11d. came from the public; 1s. 1d. from the American and Dominion Y.M.C.A.'s; 9s. 9d. from *gross* "profits" on sale of refreshments and receipts from beds, baths and billiards; 9d. from the sale of properties and equipment and sundry sources; 1s. 6d. from the War Office.

It will thus be seen that there were no net profits from the war work whatever. Every penny of the *gross* "profits" on sales of refreshments, etc., was spent upon the work, and the Y.M.C.A. had every reason to be proud of its business record in this matter. The prices to be charged were fixed by the military authorities, so that there was no question of profiteering. The Y.M.C.A. began without any intention of becoming a trading concern in any respect, but it was soon evident that by supplying cheap refreshments it had its biggest opportunity. The scope of the work was enormous; the total sales amounted to £17,387,804, and the percentage of *gross* "profits" was 20·8. The great bulk of the turnover consisted of the sale of penny cups of tea, penny buns, etc. No less a sum than £991,216 was returned to the troops in the form of direct gifts, including free stationery, games and sports, concerts and lectures, hot cocoa and refreshments given free at night in danger areas; to the walking wounded; to returning prisoners of war, and in hospitality to the relatives of the wounded. (A. K. Y.)

United States

The activities of the American Y.M.C.A. in connexion with the World War were so extensive and novel in character that its normal routine of work was eclipsed. But the usual educational and physical work continued through the decade 1910–20 and the Association experienced a healthy growth. In 1910 there were in the United States and Canada 2,017 associations with 496,591 members, of whom 91,756 were boys; the total operating expenditures were $7,809,625, and the total net property and funds $60,377,122. In 1920 there were 2,194 associations with 868,892 members, of whom 199,615 were boys; the total operating expenditures were $38,484,800, and the total net property and funds $128,019,000. In the summer of 1916 when the National Guard was sent to the Mexican border, the Y.M.C.A. followed and afforded help and means of recreation for some 150,000 troops. For this purpose over $300,000 was raised during its

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eight months' service there, and 42 buildings and 6 tents were provided as social centres. The estimated attendance at entertainments during that period was 2,851,316, and free stationery for over 5,000,000 letters was furnished.

The Y.M.C.A. began its work in Europe immediately after the outbreak of the World War in 1914. It helped the French and British troops in Europe and the Near East and the Russians. Arrangements were made with the belligerents, both Allied and Teutonic, for assisting prisoners of war. Huts were erected in the various prison camps, secretaries detailed, and recreation provided for large groups of restless men. In conjunction with the Red Cross, kitchens were built and attendance provided for the sick. During the first 17 months of the war $300,000 was raised in America by the Y.M.C.A. for this work. Before America entered the World War in 1917 the Association had expended in Europe more than $1,500,000. Immediately after the breaking of relations between the United States and Germany the Y.M.C.A. offered its services to the U.S. Government and the offer was accepted. A week later the War Work Council of the Association was organized, and to it was given the task of adapting the usual Association programme of recreation, education, and religious work to the needs of the national army. This Council was composed of some 200 well-known business and professional men, with some members of the Association. Considerable experience in work with soldiers had already been gained by the Association, as noted above. Its activities had made the organization known to military authorities in all countries, and had given it a body of men trained for the new task.

The local Associations in the United States at once opened their buildings and offered their advantages to all men in the U.S. service, an arrangement that continued till three months after demobilization. The raising of funds was put in charge of men prominent in their communities. The first drive was made during one week in April and May, and the second in Nov., the two raising over $58,000,000. The final drive was that of the United War Work Campaign the Association's share of which was $100,760,000. Committees, corresponding to the military departments into which the United States were divided, were formed to secure men and women for the work at home and abroad, the headquarters at New York having special oversight of those going overseas. When the nature of the overseas work and the need of large numbers of secretaries became clear, each candidate was required to take a week's course of preparation, that for the women being held at Barnard, that for the men first at Princeton and later at Columbia University.

Within a month after the declaration of war huts were equipped in the permanent camps already opened in the United States. During the two years following 1,200 of these stations were carried on for the men in training; 952 of them were huts built by the Association, most of them being ready on the arrival of the men. Huts were opened also in the munition and shipbuilding and other government plants, as well as in the internment camps, and work was continued with the troops on the Mexican border, at Panama and in the Philippines. Workers were on more than 5,000 troop trains, and also on the transports, where they showed motion pictures and supplied games, reading matter and such small conveniences as the men lacked. Over 12,000 men and women were on the regular staff, carrying on the varied duties of the hut and transportation service, and besides these were hundreds who gave part time.

The type of building used in the home camps and overseas had been adopted by the Association during service on the Mexican border. It was a wide, low structure, of upright boarding, easily transported in sections. One large room served in the smaller camps as lounge, writing and reading room, library, gymnasium, theatre, church and restaurant, while in the larger camps smaller rooms opening from this main room separated the different activities. The plan of the Association was to provide the men with attractive meeting places, conveniences for letter writing, books, papers, athletics, entertainments, classes and religious services. Lecturers, musicians and actors were on circuit among the huts, and motion pictures, carefully selected by the Community Motion Picture Bureau, were given at most points twice a week.

The work for the American Expeditionary Force in Great Britain, France, Italy, and Siberia, although of shorter duration than that in the United States and reaching fewer men, attracted more attention both because it was carried on under greater difficulties and because it developed features entirely new to welfare work among soldiers and sailors. In Great Britain Eagle Hut in the Strand, London, was the first of the 1,500 "huts" or stations, ranging from hotels and large buildings at sources of supplies to dugouts in the Argonne, which within 14 months were established overseas. More than 8,000 Y.M.C.A. men and women worked overseas with the A.E.F. between July 1917 and Dec. 1919.

The acceptance by the Y.M.C.A. of the army post canteen service, at the request of Gen. Pershing, which set free for military duty many hundreds of officers and soldiers, added greatly to the task of the Association, and being a business foreign to its programme and new to its personnel was handled with much difficulty. In connexion with this work the Y.M.C.A. met with much criticism; some of it probably warranted, much of it hardly fair under the circumstances. Under Gen. Pershing's orders the Association was to obtain the goods, purchasing in the open market, and to sell at prices covering the cost and the transportation charges. The first cargo of supplies was torpedoed. As the sending over of troops increased it became more difficult to secure transportation for the Y.M.C.A. supplies. The Association was therefore early forced to open factories in France, 42 in all, and to manufacture for itself huge quantities of chocolate, cocoa, biscuit, candy and jam, just as it had to manufacture paper in Spain to supply its stationery. This meant high cost and therefore high prices for the commodities and a dissatisfaction among the men purchasing them. Initially the prices charged by the Y.M.C.A. were higher than those charged by the quartermaster's department of the army, and this led to a suspicion, unfounded though very prevalent, that the Y.M.C.A. was seeking to make a profit at the expense of the fighting men. Resentment on this score was increased because of the belief that the people of the United States had contributed huge sums to the Y.M.C.A. for the purpose of giving free supplies to the soldiers. But the Y.M.C.A. had expressly decided at the outset not to give away supplies except at the front lines, and it never solicited funds for this purpose. The prices charged in the canteens were later reduced, and for the most part goods were sold at a loss. At the request of the Association the canteen service was taken back by the army after the Armistice, when officers and men could be spared for this work. Had not the Governments of the United States and France decided to remit transportation charges to all the welfare organizations, the Association would have lost about $1,500,000 on its post canteen service. With the remission of these charges, however, it found itself with a balance of $500,000, which was handed over to the American Legion.

Secretaries were attached to each division of the A.E.F., but whether they should go forward with the troops, or how many should go, was decided by the individual commander. The work at the front consisted of the free distribution of cigarettes and whatever other supplies could be brought up, the serving of hot chocolate to the passing troops and work in the field hospitals and dressing stations, the front being the one place where the Association was allowed to work for the wounded. Over 700 Y.M.C.A. men and women were under fire, at Soissons, at Château-Thierry, in the St. Mihiel drive, and in the battle of the Argonne. Fourteen lost their lives and 133 were wounded or gassed in the battle zone, while 67 died from accidents or other causes. The Croix de Guerre was awarded to 41 and the Distinguished Service Cross to four. The entire personnel attached to 12 of the divisions was officially commended for front line service. Two hundred and fifty secretaries, both men and women, were either decorated or received special mention for their services.

Religious work, always a part of the Association programme, continued overseas as in the home camps. The huts were open for services of all faiths. There was always one service on Sunday, sometimes two, and sometimes another during the week. In many of the leave areas there were services daily. Most huts also had classes for Bible study. A special collection of hymns was prepared for use in the huts; much religious literature and many Testaments and portions of the Bible were distributed. A number of well-known clergymen, who had proved their strength with soldier audiences, made a circuit of the army, song leaders often going with them. Direct effort in the line of social purity was made by the Association, both in its practical work with the Hospitality League, on the streets of Liverpool, London and Paris, and in lectures in the huts by men specially fitted for this work.

The entertainment work in England and on the continent began in the fall of 1917 with a few musicians and speakers. Under E. H. Sothern and Winthrop Ames the Over There Theatre League was formed, and under its care singers, actors, magicians, professional entertainers of all sorts, were enlisted for the entertainment of soldiers both in the United States and overseas. The Entertainment Department of the Association and the League together recruited over 1,400 entertainers, many of whom, after the Armistice, became trainers of the 15,000 soldier actors and musicians who made up the soldier shows of the A.E.F. For this department the Association provided instruments, music, costumes, and finally really entered the dramatic profession as owner of four "play factories," which were the centres of training and equipment for the soldier shows. Motion pictures were supplied regularly to all the huts, and were often given in the French village streets where there was no adequate building, and on the roadside, as with the troops on the march into Germany. Films were supplied to U.S. troops in Great Britain, Italy, and Siberia, to the French *foyers* and the Italian *case*, to the Chinese labour battalions, the Portuguese and Russian troops in France, and the prisoners of war. Besides this the Association furnished films to all the other American welfare organizations overseas.

The question of what to do with the American soldiers on leave began to concern both French officials and American officers almost before any men had reached France. The Association proposed that it should take over certain regions, chosen by the French Government and run them as pleasure grounds for soldiers' holidays. The first opened was at Aix-les-Bains which was followed by 35 others the largest being those on the Riviera. Here some of the

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most famous pleasure resorts of Europe were thrown open to the enlisted men. Many casinos became their clubs. Sight-seeing trips, dances, tournaments, concerts, plays, and motion pictures were provided, and more than a million men were given decent and wholesome enjoyment while on leave.

Though French classes and lectures were provided at the permanent camps by the Association little educational work was done before the Armistice. An educational plan for the whole army, however, was then ready. It included classes for all grades from illiterates to university students, and made use of teachers found in the ranks as well as those brought from the United States for the purpose. It also included privileges at French and English universities. In March 1919 the entire educational work was turned over to the Army Educational Commission. Though demobilization went on too rapidly to permit a full test of this work, it showed itself to be so practical and valuable that it was adopted as a regular part of the U.S. army system.

A special feature of the Association work overseas taken over by the U.S. army was the use of women as welfare workers in the camps. Women were accepted in order to save men for military service, but their duties were supposed to be confined to preparing and serving food. Distinctions of sex in service, however, disappeared under the pressure of work, and women managed *cafeterias* or concerts, religious meetings or "hikes," led dances or maintained "mother's corners," were decorators or scrubbers, as need arose. So evident was the acceptability of service by women that not only have women been included among the welfare workers under the U.S. War Department, but the Associations in the armies of Greece and Poland and the French *foyers* include them in their personnel.

The Soldier's Remittance Bureau was established to meet the difficulty the soldiers had in reaching the army post offices. By this plan any secretary, anywhere, could send a soldier's money home for him free of charge. Money was thus taken not only at the sources of supply but at the front, where days might pass before it could be handed in at the local headquarters, and many more pass before it could reach Paris, by the usual channels. These remittances numbered 351,468, and were sent to destinations in many countries. Only 92 remained undelivered by reason of wrong address or the disappearance of the payees. The soldiers sent home in this way, free of charge, $1,558,339, the average length of time from acceptance to delivery being 62 days.

The favourite athletic recreations of the A.E.F. were informal baseball and group games until after the fighting was over. The Association's part in such activities before the Armistice was mainly in supplying equipment. But before Nov. 11 1918 the physical directors of the Association had proposed an inter-allied meet to celebrate victory. This plan was laid before the commander-in-chief, and, shortly after the close of hostilities, was approved and a committee appointed consisting of two officers and two Association men. The invitations to the Allies were sent out by Gen. Pershing, and the training of teams throughout all the armies went on during the winter of 1918–9. In the meantime a large stadium was building near Paris, the labour being given by the army, the land by the French, and the plans and the material supplied by the Association. For a fortnight in June and July 1919 1,500 contestants competed, representing 18 countries, all fellow soldiers in the World War.

As the result of an increasing volume of criticism, much of which, as already noted, was concerned with the conduct of the canteen service, the Y.M.C.A. in Dec. 1918 invited a committee composed of George W. Perkins, Mortimer L. Schiff and F. S. Brockman, none of whom had been connected with the Y.M.C.A. before the war, to go to France and make an investigation. Subsequently the War Department also undertook an inquiry. In the meantime the attitude of returning soldiers made it evident to the people of America that in France, at least, the Y.M.C.A. was held in less regard by the A.E.F. than certain other welfare organizations. Apart from the canteen question, soldier opinion seemed to point first to an unfortunate selection of some of the Y.M.C.A. personnel, and second to a well-meaning but sometimes officious effort to promote the moral and religious welfare of the A.E.F. It is clear that the validity of such criticisms will depend somewhat on the point of view. In his report on the work of the Y.M.C.A. Mr. Perkins, as chairman, said that in civilian life an organization that is 90% efficient is regarded as satisfactory. "If 10% of the 11,229 people operating in France for the Y.M.C.A. were inefficient," he continued, "it would mean that there were 1,122 men and women who were more or less of a failure. I do not believe anything like this number of people were unsuccessful." While Mr. Perkins found a number of instances of mistakes and bad judgment in the conduct of the Y.M.C.A. work, his general conclusion was that the organization deserved high praise for the manner in which it had accomplished a difficult task. A similar conclusion was reached by the War Department, and on several occasions Gen. Pershing expressed the opinion that the Y.M.C.A. had been unjustly blamed for circumstances over which it had no control.

Although with the return to the United States of the Expeditionary Forces the welfare work for the army and navy was taken over by the War and Navy Departments, at the request of the officers the Association was retained for service with the Army of Occupation in Germany. This work continued with a personnel of about 120, half being women. Huts were continued also for the navy and for the merchant marine in various foreign ports. Another outgrowth of the war work was the Soldier Scholarships. Under grants from the Association some 55,000 ex-service men continued their studies, in colleges, technical schools, or correspondence courses.

Service to prisoners continued throughout the war, and as late as 1921, when there were still Russian prisoners in Germany and Poland. Y.M.C.A. secretaries were with the Czechoslovak troops during their journey across Russia after their internment in Siberia. Association workers also met the thousands of German, Austrian and Hungarian prisoners when they at last reached eastern Siberia; and secretaries either went with them on the transports that finally bore them to their homes, or supplied motion picture outfits, paper, books and comforts for the men's use during the long voyage.

Perhaps the best comment on the war work of the Association is found in the requests from certain of the Allied Governments, whose officers saw the work in France, for its introduction into their armies. In answer to such demands the Association was organized in the armies of Poland, Czechoslovakia, Rumania, Greece and Portugal, and American workers remained with the *foyers* in France.

See also Katherine Mayo, *That Damned Y.* (1920). (V. L. K.)

YPRES (*see* 28.941).—Pop. (1914) 17,497. The town, though never taken by the Germans, was systematically bombarded from Nov. 1914 to May 1915, and it remained a "salient" of the Allied armies throughout the World War. The terrific attacks to which the town was exposed during the war resulted in its almost entire obliteration. The famous Cloth Hall became a scarcely recognizable ruin; of the cathedral of St. Martin, only part of the eastern doorway remained intact, and most of the works of art in the church were destroyed.

YPRES AND THE YSER, BATTLES OF.—Under this heading, accounts are given of the main battles in this area of the Western Front: those of 1914, 1915, 1917 and 1918.

I.—Battles of Oct. 12–Nov. 20 1914

General Situation.—The Belgian army, after its unsuccessful defence of Antwerp, had retired by way of Ghent and Bruges to the line of the Yser, between Dixmude and the sea, where it had established itself by Oct. 12. It consisted of six infantry and two cavalry divisions, in all about 48,000 rifles, with 300 guns; the 2nd, 1st and 4th Divs. in that order from the N. held the front from the coast as far as Dixmude, with two brigades of the 3rd Div. and the 2nd Cav. Div. in reserve behind. A brigade of the 3rd Div., a French Fusilier Marine Brigade, which had been sent up to the N. to assist the Belgian army, and the 5th Div. continued the line from Dixmude to Boesinghe, while the 1st Cav. Div. screened the whole front of the army. Farther to the S. the 87th and 89th French Territorial Divs. were coming into line E. of Ypres, on the left of the British IV. Corps (7th Div. and 3rd Cav. Div.) which was falling back from Ghent, where it had been posted to cover the right flank of the retiring Belgian army, by way of Thielt and Roulers to the S. and E. of Ypres.

To the right rear of the IV. Corps the remainder of the British army was advancing. The II. Corps, detrained at Abbeville, had pushed forward to the line of the Aire–Béthune canal, and was on the 12th advancing further to the line Givenchy–Merville, meeting with stubborn resistance from the German XIII. Corps. To the left front of the II. Corps the French I. and II. Cav. Corps and the British Cav. Corps were driving before them the German IV. Cav. Corps and had reached the area of Vermelles, and Estaires to the S. of the Lys and Merville, Merris, and Cassel to the N. of that river. Behind the British cavalry the III. Corps, detrained at St. Omer, had reached the region of Hazebrouck. The I. Corps was not yet up from the Aisne; in fact its leading units were only entraining on this day and its transport to Flanders was not to be completed till the 19th.

In face of these forces the right wing of the German VI. Army, under Prince Rupprecht of Bavaria, consisting of the XIII. and XIX. Corps, and covered on front and flank by the I., II. and IV. Cav. Corps, were moving into position on both sides of Lille, extending as far N. as the Lys, and beyond. To the N. of this army a new one was moving forward with the object of forcing back the Allied left and securing possession of the Channel ports. This Army, the IV., under the command of Duke Albrecht of Württemberg, consisted of the newly formed XXII.,

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XXIII., XXVI. and XXVII. Reserve Corps together with the III. Reserve Corps, from Antwerp, and the 4th Ersatz Div. These new corps were detraining S. of Brussels on the 12th, covered by the III. Reserve Corps and the 4th Ersatz Div.

The Allied Plan.—On Oct. 4, when it became clear that the forthcoming operations in Artois and Flanders would of necessity be carried out not only by French but also by British and Belgian forces, Joffre had entrusted Foch with the coördination of the Allied contingents in the N. The French X. Army (Maud'huy), around Arras, thus came under Foch's command and formed his right wing, while to reinforce the British in the centre and the Belgians on the left, there was formed an "Army Detachment of Belgium" under d'Urbal, shortly to become the VIII. Army. The instructions given to d'Urbal were that he should assume the offensive as soon as possible from his detraining points in the general direction Roulers–Thorout–Ghistelles, while the British on his right advanced on Courtrai and Menin, and the Belgians on his left along the coast. It was hoped by these means to separate the enemy forces, which were following up the Belgians retiring from Antwerp, from the main body of the German army, and hem them in along the coast, and then to push forward against the right flank and rear of the German VI. Army S. of Lille.

Unfortunately it was found impossible in the event to carry out this far-reaching scheme. Not only was the Belgian army too weak and exhausted to be able to take part in an offensive without a breathing space for rest and refitment, but the first troops of the French VIII. Army only became available on Oct. 23; and by that time the situation had radically altered. It became evident that, so far from being in a position to drive back the enemy, the Allied forces were outnumbered and would do well if they could even hold their own. Consequently, although the idea of an Allied offensive was never entirely abandoned, the necessity for using the various formations as they arrived prevented it from being effectively put into execution.

The First Stages of the Battle of the Yser.—The detrainment of the German IV. Army was completed on the 13th, and its units, moving forward at once, had reached by the 17th the area Bruges–Thielt–E. of Courtrai. The III. Reserve Corps pushing eastward in front of the army, with its right along the coast and its left on Roulers, screened the advance of the newly arrived Reserve Corps. It was then ordered to clear the front by closing up on its right, which had on the 15th entered Ostend. On Oct. 16 it came into contact with the Belgian cavalry and forward posts E. of the Yser, and after two days of desultory fighting forced them to withdraw to their main position.

On the 18th the first encounters took place between the main bodies of the Belgian 2nd, 1st and 4th Divs., holding the Yser line from Dixmude to the sea, and the German III. Reserve Corps, which had been ordered to reach the neighbourhood of Furnes. The advancing Germans early came into contact with the Belgian outpost positions on the E. bank of the river on the line Lombartzyde–Mannekensveere–Schoor–Keyem. The northern part of this line held fast against repeated attacks but by nightfall the Germans had taken Schoor and Keyem; the latter however was recovered during the night. The attacks were renewed next day; the German XXII. Reserve Corps, coming into line to the S. of the III. Reserve, moved against the French and Belgian positions around Dixmude. Keyem and Beerst fell into its hands early in the day; Beerst was retaken about noon by the Belgian 5th Div. and the French Fusilier Marines, who were however forced to fall back in the evening to their former positions owing to the approach of further strong hostile forces (the XXIII. Reserve Corps) astride the railway from Thourout. On this flank the Allied units were now withdrawn behind the Yser, with the exception of the garrison of Dixmude. The preparatory fighting continued on the 20th on both flanks; the III. Reserve Corps, reinforced by the 4th Ersatz Div., attacked and carried Lombartzyde in the N. while to the S. a concentric attack of the XXII. and XXIII. Reserve Corps from three sides was repulsed with heavy loss by the Fusilier Marines holding Dixmude.

The German IV. Army was now completely deployed against the Yser line. The 4th Ersatz Div. in front of Nieuport, the III. Reserve Corps thence to Keyem, the XXII. Reserve Corps around Beerst and the XXIII. Reserve Corps E. and S.E. of Dixmude, in all seven divisions with over 400 guns, were aligned in face of the five Belgian divisions with their 350 guns. On the 21st, after a violent bombardment lasting throughout the night, the Germans advanced all along the line, their young troops fighting with the greatest courage but meeting with little success; and the French and Belgians, at the price of serious losses, held their ground at all points. In the night, however, the III. Reserve Corps succeeded in throwing a temporary bridge over the Yser, in the bend N. of Tervaete, and in passing over to the western bank infantry and machine-guns, while their artillery were brought close up to the stream to cover the advance of strong reinforcements. The 1st Belgian Div.'s counter-attacks failed to retrieve the situation; the Germans not only held their ground but extended it during the 23rd by seizing Tervaete itself to the S. The Belgian 3rd Div. was thrown into action from general reserve, without effecting more than the temporary checking of the hostile advance; during the day, the French 42nd Div., which had carried out a successful counter-attack on the 23rd to the E. of Nieuport, was placed at the disposal of the Belgian Higher Command and transferred near Tervaete, with the object of striking into the southern flank of the German troops who had crossed the Yser.

The French counter-offensive in the centre, supported as it was by all the available units of the Belgian 4th Div., though it failed to throw back over the river the two battalions of the III. Reserve Corps which held the Tervaete bridgehead, was successful in checking any further progress on their part. By the evening of the 24th indeed, both sides were showing signs of exhaustion. The efforts of the 4th Ersatz Div. before Nieuport and those of the XXII. Reserve Corps before Dixmude had met with no success; despite the powerful artillery fire from the heavy German artillery, which had reduced Dixmude to ruins, the Fusilier Marines still held the town, repulsing on the 24th 15 successive attacks. The Belgian army, however, had bought its success at the price of the severest losses; over 25% of its combatant strength had been placed *hors de combat*, and only 180 guns with only from 160 to 190 rounds apiece were left fit for service. The situation appeared to the Belgian Higher Command to demand extreme measures; it was doubtful if their troops could withstand another series of assaults such as those which had just been delivered, and on the 25th it was decided (it is said on the suggestion of Foch) to open the sluices of the Yser and inundate the country E. of the Nieuport–Dixmude railway. The sluices of Nieuport were opened at 4 P.M. on that day, under cover of darkness; the line of defence in the centre was withdrawn to the railway embankment, which it was intended to hold during the few days that must elapse before the slowly moving waters, fed by the successive tides, should engulf the country to the E. and form an impassable barrier.

Before recounting the last German assaults on the Yser front, we must return to the British sector, to the south.

First Stages of the Battle of Ypres.—The presence of the new German IV. Army in his front, and in particular the approach of the fresh Reserve Corps toward the gap at present open between himself and the Belgians, was at this date (the 15th) unsuspected by Field-Marshal Sir John French, whose attention and energies were concentrated on the offensive which he had arranged to carry out in conjunction with the Allied forces to his right and left in the direction of Courtrai and Menin. His instructions to his corps commanders were that the advance should be continued during the next few days on the whole front, the II. Corps on the right advancing due E., the III. Corps in touch with it securing the Lys crossings from Sailly to Armentières, and the cavalry passing over the river at Menin and advancing N.E., while Rawlinson with the IV. Corps on the extreme left moved on and to the N. of Courtrai. The last-named was warned to watch his left, beyond which hostile detachments were reported near Bruges and Roulers.

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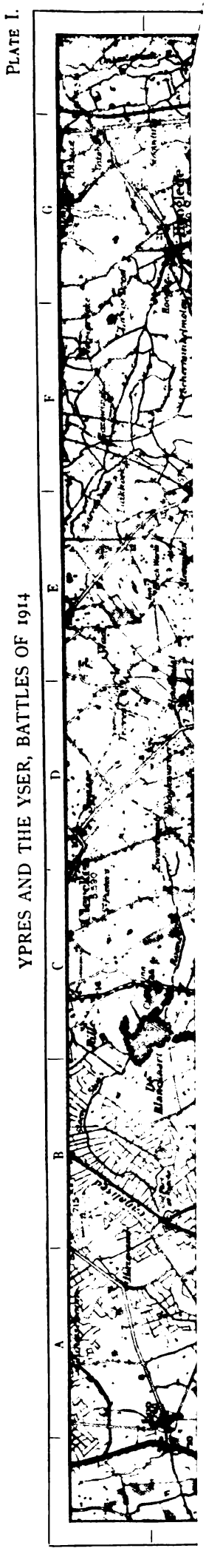

YPRES AND THE YSER, BATTLES OF 1914

PLATE I.

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These operations, undertaken on the 15th and 16th, had hardly begun before it became evident that their continuance on the original lines was no longer warranted by the situation. The resistance met by the IV. Corps on the line Houthem–Gheluvelt–St. Julien–Westroosebeke convinced French that it was indispensable first to clear the hostile forces from the area N. of his left flank. Foch, however, on being asked to assist in this, could promise no more troops before the 22nd at the earliest, as his forces were still assembling. Accordingly, the IV. Corps was ordered to push on along to Menin on the 18th, the 3rd Cav. Div. screening its left, in conjunction with de Mitry's French Cav. Corps, which had come into line on the previous day W. of Houthulst forest. This task Rawlinson felt himself unable to carry out owing to the advance of strong hostile columns, consisting of the XXVI. and XXVII. Reserve Corps, against his left S. of Roulers, and by the evening of the 19th he had fallen back to the line Kruxiseik–Zonnebeke.

On the same day the concentration of the I. British Corps in the N. was completed in the area Poperinghe–St. Omer. French had now given up his ideas as to the possibilities of an Allied offensive and, realizing he was face to face with strong hostile forces which were being rapidly reinforced, began to fear for the weakness of his long and thinly held line, reserves for which were lacking. Although the II. and III. Corps were fighting against powerful positions and had been heavily taxed, French considered that the danger was greatest in the N., where the IV. Corps was holding altogether too extended a front, and that a break through there, while less fatal in its results than a similar disaster in the S., was inevitable unless reinforcements were sent at once. Accordingly the I. Corps was sent N. with orders to advance on Thourout with the object of capturing Bruges, if possible, before the enemy reinforcements, now believed to be in movement across Belgium, could be brought into line. French, however, was not too confident that this would prove feasible, and his instructions to Haig therefore envisaged not only the further prosecution of an eventual success toward Ghent, but also the possibility of the I. Corps having to go to the help of the IV., if the latter were heavily attacked.

Meanwhile the II. and III. Corps and the cavalry were ordered to confine themselves to the defensive, in view of the hostile superiority in their front.

The I. Corps only came into line to the S. of the IV. Corps on the 21st and by that date the advance of this latter toward Menin had, as we have related, come to an end; the 3rd Cav. Div. and de Mitry's horsemen to the N. had also been forced back, while the British Cav. Corps had retired to the Messines–Wytschaete line. To the S. Conneau's French cavalry were in line between the British II. and III. Corps.

It was only on Oct. 21 that the full extent of the menace to the British front burst on French, to use his own words, "like a veritable bolt from the blue." He at once realized that, in face of this overwhelming hostile superiority, all hope of a successful British offensive must be given up and indeed that he might have serious difficulty in maintaining his present positions. The British situation was certainly no easy one, for at the moment all available troops were in line, and the only reserves and reinforcements that seemed likely to be available for some weeks consisted of the Indian Corps, one division of which had just detrained W. of Hazebrouck, two Territorial battalions, and one cavalry and two yeomanry regiments.

Fortunately, French reserves were being hurried up from the S. The first of them, the IX. Corps, began to detrain in the Ypres area on the 23rd. During these three days from the 21st to the 23rd, when the British army was left to itself to withstand the shock of the enemy, it succeeded in holding its own without great difficulty. By the evening of the 21st the I. Corps had even commenced an advance, but the withdrawal of the French cavalry and Territorials on its left, which had been forced back by the advance-guard of the XXIII. Reserve Corps, compelled Haig to halt on the line Bixschoote–Langemarck–Zonnebeke. Here he held his ground against repeated attacks that night and all next day despite the wideness of his front; and, though the positions of the 1st Div. were broken into N.W. of Langemarck late on the 22nd, counter-attacks held up the German advance and finally on the 23rd recovered practically all the lost ground. Meanwhile the rest of the 1st Div. line held its positions against the attacks of the XXIII. Reserve Corps until the evening of the 23rd, when the 2nd Div. was relieved by the newly arrived troops of the French IX. Corps; 24 hours later the 1st Div.'s place was taken by French territorials.

The 7th Div. on the front Zandvoorde–Zonnebeke had also had heavy fighting to do from the 20th onward. The German XXVI. and XXVII. Corps, despite some success against the French on Rawlinson's left, which compelled him to retire that flank somewhat, were unable to make any impression on his front until the 24th, when units of the XXVII. Reserve Corps forced their way into Polygon wood and had to be ejected by the reserves of the 7th, assisted by units of the 2nd Division.

By this time the French Command considered that the time had come to undertake a general offensive. The French IX. Corps had just come into line and the XVI. Corps was on its way northwards. The British 2nd Div. was also available and was ordered to coöperate, as were also de Mitry's cavalry from Bixschoote and the French 42nd Div. along the coast from Nieuport. As a matter of fact the moment chosen was favourable from factors which the Allied leaders could not be aware of. The Germans were suffering from a local shortage of munitions; their new troops had suffered heavily, thanks to their enthusiasm untempered by training and experience and had everywhere been brought to a halt before the Allied lines. But the odds against the attack proved too great. The French IX. Corps and the 2nd Div. to its right made little progress on the 24th, despite their valiant efforts, and the offensive gradually petered out, not without taking heavy toll of the Germans, on the line N. and E. of Langemarck–W. of Poelkapelle, Paschendaele, and Moorslede. The 7th Div. on its front had only been able to hold its ground, and, in view of its weakness after three weeks of incessant marching and fighting, was on the 27th put under the I. Corps, together with the 3rd Cav. Div.; at the same time Haig's two other divisions were again put into line. The right of the 7th was now at Zandvoorde, that of the 1st on the Menin road, that of the 2nd just in Polygon wood.

To the S. of the I. Corps the 2nd Cav. Div. on the 20th held the front from Hollebeke to Messines; the 1st Cav. Div. extending thence to St. Yves; the 3rd Cav. Div. came into line later on the left of the 2nd and three Indian battalions were moved to Wulverghem in support. This part of the front, despite repeated attacks by the German XIX. Corps, remained intact till the 30th. On the right of the cavalry the II. and III. Corps also succeeded in maintaining their general line.

By the evening of the 27th the German IV. Army had been brought to a standstill on the whole front. "The XXVI. and XXVII. Reserve Corps were by this time" (Oct. 24), says the German official account, "completely held up in front of strongly entrenched positions on line Langemarck–Zonnebeke–Gheluvelt. . . . For the time being any further thought of a break-through was out of the question," and the decision which appeared at the moment to be "imminent" on the Belgian front near the coast had not yet been achieved. To assist the efforts of their comrades in this sector, and to cover the bringing up of further reinforcements to drive home the attack against the British line, the XXIII., XXVI. and XXVII. Reserve Corps were urged on to deliver holding attacks on their front. Despite their courage and persistence, the Germans, however, not only failed to make headway but were compelled in places to give back before the Allied counter blows; their only gain was registered at Kruiseik, which was wrested from the 7th Div. on the 28th after to and fro fighting. To the S. also the enemy pressed heavily against the front held by the British II. and III. Corps, assisted from the 23rd onward by a brigade of the Lahore Div. which relieved Conneau's Cav. Here the XIX. and VII. Corps made some headway and by the 29th had pressed the British front back to the line Givenchy–W. of Neuve Chapelle–S.E. of Armentières–Messines, where the Cavalry

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Corps' right rested. The fighting was bitter and bloody, so much so that on the 28th the II. Corps, much reduced, had to be relieved by the Indian Corps, under Willcocks.

Meanwhile the French XVI. Corps, which had detrained its leading division on the 26th, was sent forward to reinforce the French IX. Corps S. of Houthulst forest, in order to participate in a new advance in the direction of Roulers. This attack, carried out on the 28th, failed to make much progress, and in the evening the French VIII. Army's line, which was held from N. to S. by the 4th Cav. Div., the 89th and 87th Territorial Divs., the 5th and 7th Cav. Divs., the 31st Div. (XVI. Corps), the IX. Corps, and the 6th Cav. Div., ran from the Yser just above Dixmude by the W. and S. edges of Houthulst forest—W. of Poelkapelle and Passchendaele—to Becelaere. To the left this line connected with the French Marine Fusiliers at Dixmude; to the right with the British I. Corps. Despite the slight progress made on the 28th, d'Urbal's orders were still for the continuance of the offensive.

Final Stages of the Battle on the Yser, Oct. 26–Nov. 4.—We left the Belgians and French on the evening of the 25th, re-forming their lines behind the embankment of the Nieuport–Dixmude railway, with orders to hold that line at all costs until the full effect of the inundation should make itself felt, and forbid any further German attacks. This could hardly be before the 31st, and meanwhile the III. and XXII. Reserve Corps were bringing up their artillery over the river, pushing forward patrols to occupy the ground up to the new Allied position, and making all preparations for a renewal of the attack. By the evening of the 29th these preparations were completed. Only one brigade of the 4th Ersatz Div. was left facing Nieuport, the Marine Div. being brought forward to fill its place; the rest of the Ersatz Div. thus became available for the decisive attack against the Belgian centre. At 6:30 A.M. on the 30th this assault took place under cover of a violent bombardment. The first rush carried the Germans up to within a few yards of the railway embankment; bombing their way forward they swept over it and, taking the defenders in enfilade, drove a wide gap in the Allied line from Ramscapelle to Pervyse, both of these villages falling into their hands. The Belgian 2nd Div. was broken through and the situation was critical in the extreme. A counter-attack by four French and Belgian battalions was immediately put in by Gen. Grosetti, commanding the French 42nd Div., and succeeded in holding up the enemy flood. A second counter-attack, delivered about 4 P.M., penetrated into Ramscapelle, where fighting continued to rage furiously all night. On the flanks of the attack the Allied line of defence had held fast, and the 4th Ersatz Div. and the XXII. Reserve Corps had been held up.

The crisis was past. The German intention was to renew the attack on the 31st, but at 11:30 P.M., as orders to this effect were being prepared, a staff officer from one of the divisions arrived at the headquarters of the III. Reserve Corps with the report that in view of the rise of the river the attack could not be continued. A belt of water 2,000–3,000 yd. wide and reaching as high as a man's waist covered the country behind the German front-line units and threatened to cut them off from their comrades unless they were hastily withdrawn. Accordingly, on the 31st the III. Reserve Corps was ordered back to the E. bank of the river, only weak rear parties being left to cover the movement. By 9 A.M. the Belgians were once more in possession of Ramscapelle and the railway embankment. Farther to the S. the positions held by the XXII. Corps on the W. bank of the river N. of Dixmude were also menaced by the rising tide of water, and the troops holding them were withdrawn on the night of Nov. 1. By the morning of the 2nd there were left of all the German gains on the left bank of the Yser only the villages of Schoorbakke and St. Georges and two farms N. of Dixmude.

On either flank of the Allied line where bridgeheads existed over the river, the first days of Nov. saw a series of small attacks with the object of improving the local positions. Such operations took place on Nov. 3 and 4 in the Nieuport sector, when Lombartzyde was occupied temporarily but lost again. A French attack also took place on the 3rd E. of Dixmude, and others on the 4th against St. Georges and Schoorbakke, but generally speaking, the Germans maintained their positions.

The battle of the Yser, strictly speaking, was over, and the plan of the German Higher Command, to seize the Channel ports and envelop the Allied left flank, had failed thanks to the heroic resistance of the French and Belgian troops. It was estimated that the battle had cost the Belgian army 18,000 casualties, the French some 5,000 (inclusive of the action at Dixmude on Nov. 10), and the Germans some 28,000.

Crisis of the Battle of Ypres, Oct. 29–Nov. 8.—In conjunction with the decisive attacks on the Yser line in the N., the German IV. Army was also preparing for a renewal of the assault on the Ypres front. A new army group was formed, under the command of von Fabeck, consisting of the Bavarian II. and the XV. Corps and the Bavarian 6th Reserve and 26th Div., with some heavy artillery from the VI. Army. This new group, assembling behind the junction of the IV. and VI. Armies, was to come into line on the 28th on the front Wervicq–Deulemont, in order to deliver a decisive attack also on the 30th. Both the German armies already in line were to coöperate.

Their preparatory attacks commenced on the 29th with extreme vigour. The Bavarian 6th Reserve Div., which had preceded the remaining troops of the new group into the battle-line, under cover of the early morning mist drove in the 1st and 7th Divs. at their point of junction E. of Gheluvelt. The reserves of the former division threw them back again out of all but the front trenches they had gained; the losses of the assailants were heavy. But this was only the prelude to the drama about to open. During the night of the 29th–30th the Fabeck group relieved part of the VI. Army Cav. in the line and went forward at 9 A.M. next morning. The XV. Corps on the right, moving with its right on the Menin–Ypres road and with its left on Zandvoorde, fell upon the 7th Div. and pushed them out of Zandvoorde after fierce fighting, but were then checked by the I. Corps reserves. On their left the Bavarian II. Corps advanced, and the French XVI. Corps and the British 3rd and 2nd Cav. Divs., after giving up some ground, made head against the enemy just E. of St. Eloi and Wytschaete. The 26th Inf. Div. failed however to dislodge the 1st Cav. Div. from Messines; a temporary success by the I. and II. Cav. Corps E. of Ploegsteert wood was retrieved by the 4th Div., and the XIX. Corps also failed to hold their gains at Bois Grenier, against the 6th Div.

The situation of the British, despite the fact that they had for the moment held their front intact, gave rise naturally to considerable anxiety at French's headquarters and the promise of Foch, who visited French at 2 A.M. on the next morning, to dispatch strong reinforcements to the I. Corps on the morrow, must have been very welcome. It was agreed that a French force of five battalions and three batteries under Moussy should be put in near Hollebeke, and another detachment at Becelaere; while the 32nd Div. would be sent to support the cavalry astride the Ypres–Comines canal. Before these forces could be brought up on the 31st, the enemy renewed his assaults. The 4th Div. in the S. was first attacked shortly after dawn; the action soon spread to the N., where the 26th Inf. Div. strove with the British Cav. Corps for the possession of Messines. The village was lost at 9 A.M., re-entered at 1 P.M., disputed hotly till dark and finally left in British hands. Farther to the N. the Bavarian 6th Reserve Div. vainly assailed the front of the 2nd and 3rd Cav. Divs., whose sector was taken over before long by the French XVI. Corps; but though the latter on their part delivered a series of counter-attacks, they were unable to achieve much.

The main crisis of the battle, however, was played out N. of the Ypres–Comines canal. Here the Bavarian II. and the XV. Corps had, as early as 10:30 A.M., forced back the 1st Div. front N. of the Menin road and followed this up by a strong attack along the road itself. Eight battalions employed against Gheluvelt quickly overmastered the two battalions in garrison there, and by 1:30 P.M. had seized the village and driven a gap in the British line. The situation was perilous in the extreme; the left of the 7th Div. was enveloped, and the right of the 1st Div. forced back in disorder down the Menin road. At the same time

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the commanders and some of the staff of the 1st and 2nd Divs. were knocked out by a shell which struck their headquarters; Haig prepared to retire to a line just in front of Ypres and hold on there at all costs.

But the Germans could not exploit their success; the Worcesters, in local reserve, thrown in at 2 P.M., checked the enemy's progress, and secured a position from which they could flank any further advance beyond Gheluvelt. The left of the XV. Corps had been held up by the 7th Div., assisted by the local reserves, and had been unable to exploit the exposure of its immediate enemy's flank caused by the loss of Gheluvelt. The Bavarian II. Corps indeed forced its way forward somewhat against the right of the 7th Div. and the 3rd Cav. Div., but its advance also eventually came to a stand, as had that of its comrades on the right and left of it. A gap which opened in the right wing of the 7th Div. late in the afternoon was opportunely filled by the arrival of the 7th Cav. Bde. which threw back the enemy.

It was clear that the enemy would not desist from his efforts, which had on the 31st brought him so near to success, but that further fierce attacks might be anticipated on the following days. The situation seemed therefore dark enough; the troops of the French VIII. Army, with which it had been intended to assume a large scale counter-offensive against both flanks of the enemy group attacking the British I. Corps, had had to be thrown in piecemeal to support various weak points in the line, and only one division, the 43rd, was left in general reserve W. of Ypres. Certain units even of this division had been sent into line before nightfall on the 31st in the vicinity of St. Eloi.

The fighting on Nov. 1, as was expected, was little if at all less severe than on the two preceding days. The main pressure, however, had shifted from the front of the British I. Corps over the Ypres–Comines canal to that of the cavalry corps. In the N. the enemy's efforts, which were not very vigorous, broke down before the readjusted lines of the 1st and 7th Divs., and the 3rd Cav. Div. The fighting, which had continued all through the night of the 31st–1st around Wytschaete and Messines, had already placed the cavalry corps in a difficult position, their line being broken at several points, and only partly reëstablished; however, the main German attack did not take place till noon, when the Bavarian 6th Reserve Div. and the 26th Div. advanced. Wytschaete, lost between 2 and 3 A.M. on the 31st, was still at this time in German hands, despite the efforts of reinforcements from the 3rd Div., sent up from the S. and from the 5th Cav. Bde. with French units of the 32nd and 43rd Divs., but the village was recovered about 6 P.M. and held firmly by the French. The loss of Wytschaete had been followed by that of Messines; the 1st Cav. Div. were drawn back to an entrenched line N. of Wulverghem, and later relieved by parts of the French XVI. and XX. Corps and of Conneau's cavalry. The situation, which had at one time seemed critical, was thus saved by the arrival of French and British reinforcements, and by the evening gave rise to less anxiety. The attack was continued next day by the Germans, who had put in a new division, the 3rd, on the left of the Bavarian 6th Reserve, and the fight swayed to and fro all day. By the evening Wytschaete and the crest of the ridge had been lost, but the French line was firmly settled on the rear slopes of the ridge to the west.

Gen. d'Urbal had not yet however abandoned all hope of a successful offensive, but the attempts of the French to advance on the 2nd and following days were neutralized by renewed efforts on the part of the enemy, and only in the Merckem–Bixschoote area was some slight progress made. On Nov. 5 d'Urbal received instructions from Joffre, which stated that the Flanders theatre of operations had lost some of its importance since neither Allied nor German attacks could hope to gain any further appreciable result, and that it was intended shortly to withdraw troops from the VIII. Army for use elsewhere.

Meanwhile the British dispositions had undergone some changes; the 7th Div. being relieved by two composite brigades from the II. Corps, and the French IX. Corps taking over part of the I. Corps front.

A renewed period of activity on the British front occurred in a few days, when these reliefs had been barely completed. On the 6th and 7th the 7th Cav. Bde. and units of the 7th and 1st Divs. recovered some ground lost by the French near Zwartelen; attacks on the 7th and 8th against the 3rd Div. E. of Herenthage wood and the 1st Div. and the French farther N. were also successfully dealt with. This was but the muttering before the bursting of the last storm.

The Germans, determined to make one last push for Ypres, formed on the 9th a new army group under von Linsingen, consisting of the XV. Corps and a composite corps, made up of the 4th Div. and a division of the Guard. This was put in on the left of the Fabeck group with orders to drive back and crush the enemy N. of the Ypres–Comines canal. The Fabeck group was to coöperate with infantry and artillery. This attack, timed for the 11th, was to be prefaced by an advance of the whole IV. Army on the previous day from Dixmude S. to Polygon wood. The southern part of this attack however did not get going.

The Final Battle, and the Stabilization of the Flanders Front, Nov. 8–20.—The attack on Dixmude was entrusted to the 4th Ersatz Div. and the XXII. Reserve Corps and took place on Nov. 10. The garrison of Belgian infantry and French Marine Fusiliers had been reinforced by French colonial troops and the Germans had to pay dearly for their success. The bombardment opened at dawn and the infantry attack at 7:40 A.M. It failed and was renewed after further artillery preparation at 9:30 A.M. By 1 P.M. the garrison had been driven from the eastern suburb and the town was assailed from N.E., E., and S.E. After desperate fighting, lasting till nightfall, the Germans succeeded in securing possession of the ruins of Dixmude. The garrison withdrew to the W. bank of the Yser and broke the bridges, but the enemy made only half-hearted attempts to follow them. They claimed to have taken in the town about 1,400 prisoners and much material. Further to the S., in the Bixschoote–Langemarck area, the German attacks made little headway. The British front was not attacked on the 10th.

Its turn was to come on the 11th, when the Fabeck and Linsingen groups attacked on the whole front from the Menin road to S. of Messines, about 9:30 in the morning, after two hours' bombardment. A thick mist veiled and assisted their advance. On the right of the assault the 12 battalions of the Guard struck against the line held by the weakened British 1st and 9th Bdes., and some French Zouaves. Their right broke past the S. side of Polygon wood, and swept the defenders out of Nonne Boschen, but their further progress was stayed on the western edge of this copse, and shortly after noon a counter-attack by the 2nd Oxon. and Bucks. L.I. forced them out of it again. The centre and left of the Guard, after some initial success in Inverness copse and Herenthage wood, were also held up and compelled to abandon most of their guns. Further S. also little progress had rewarded the Germans' efforts. The XV. Corps had to content itself with the capture of Hill 60; the Bavarian II. Corps gained some success N. of Wytschaete; elsewhere the attackers had been kept to their trenches.

This day's fighting was the closing act of the Ypres battle. Both sides were entirely exhausted by close on a month of sustained and bitter fighting, which had thinned their ranks, drained their supply of munitions, and left them no available reserves which could be employed in further effort. On Nov. 15 General d'Urbal came to the decision to suspend further offensive activity, consolidate his position and allow his troops a period for rest and refitment. Joffre, however, felt that the operations on the Flanders front had reached their fitting termination with the repulse of the enemy's last desperate effort to bring about a decision in the open field; and accordingly instructed d'Urbal to hold himself henceforward on the defensive.

The Germans on their side had also come to an end of their resources. On the 17th the German IV. Army commander, after the failure of a final effort by the 4th Div. in Herenthage wood, "decided to give up any idea of continuing the offensive—a decision to which he was compelled by the low fighting strength

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of his troops and the bad autumn weather which was affecting their health; . . . the German General Staff fully concurred in the decision."

Meanwhile on the 21st the British were withdrawn from the Ypres salient. French troops took over the front line; the I. Corps and Cavalry Corps remained in reserve; the two brigades of the II. Corps which had been sent up to the N. were also moved back to rest.

The battle of Flanders was at an end, and the armies, their front stabilized along all the line from the sea to Switzerland, settled down with the approach of winter to trench warfare.

(X.)

II. Battles N. of the Lys, 1915

The five weeks' pause in active operations which had followed the battle of Neuve Chapelle was due mainly to the necessity of accumulating ammunition, of which the supply was still far from adequate, but also to the need of timing the next attack to coincide with General Foch's great attack against the Germans N. of Arras. Meanwhile a minor operation carried out by the II. Corps S.E. of Ypres led to extremely fierce local fighting. Where the Ypres–Comines railway cuts through one of the southern spurs of the Broodseinde ridge there is a mound which was of considerable tactical value especially as an artillery observation post. On April 17 1915 this "Hill 60" was successfully stormed by the 2nd K.O.S.B. and 1st Royal West Kents of the 5th Div., but its capture provoked prolonged and vigorous counter-attacks. The hill was lost and retaken more than once and not only the whole of the 13th Bde. but the 1st Devons and 1st E. Surreys of the 14th Bde. and the 2nd Camerons of the 27th Div. had to be thrown into the fight. By the end of a week the Germans had apparently acquiesced in the loss of the position for their counter-attacks died away.

But the struggle for Hill 60 was soon to be eclipsed. During April the British had gradually relieved the French in the Ypres salient. First the 27th Div. took over the line from Zwartelen to Polygon Wood, then the 28th came in on the left to and beyond the Broodseinde cross-roads, by April 17 the Canadian Div., now allotted to the V. Corps, occupied the N.E. face of the salient as far as the Ypres–Poelkapelle road. Thence to the Ypres–Yser canal were French troops, chiefly Africans. It was against this last section that on April 22 the Germans delivered the first gas attack. Some suspicions of this new weapon seem to have reached the Allied Headquarters, but there had been no time for preventive measures, and to the unfortunate Africans the gas-clouds came as a complete surprise. Luckily for the Allies the efficacy of their new weapon surprised the Germans themselves: they hastened to fall upon the Canadians whose left flank the rout of the French had completely exposed, but they had not enough troops to exploit their success.

The Canadians stood the strain of their first serious engagement splendidly. Their front line maintained their positions unshaken; a line was hastily improvised along the Poelkapelle road toward St. Julien to cover the exposed flank and rear of the front line, while local reserves manned the second-line trenches near "Shell Trap Farm" N. of Wieltje in time to check the further advance of the Germans. Divisional and corps reserves were hurried up at once and that evening a counter-attack by the 10th and 16th Batts. temporarily recovered a wood W. of St. Julien. But the position was critical in the extreme. Between "Shell Trap Farm" and the canal a 2-m. gap lay open, Ypres itself was dangerously exposed and all the troops in the salient might have been cut off by a rapid German advance in force. Moreover, during the night of April 22–23 the Germans succeeded in capturing the bridge at Steenstraate over the Yser canal and established themselves on the western bank.

The first need was therefore to close the gap between the Canadians and the French right. But conditions were all against counter-attacks. There was little time for reconnoitring or for coördinating advances, there was hardly any heavy artillery to support them for over 50 French guns had fallen into the enemy's hands. In the course of April 23 attacks were made by a detachment drawn from the reserves of the 28th Div. by the Canadian 1st and 4th Batts. and by the 13th Bde. (5th Div.) hastily fetched up from the rest camp where it was recuperating after its heavy fighting for Hill 60. These attacks did not dislodge the Germans from the position they had already dug and wired along the ridge running westward past Pilckem, but they prevented further advance and by the evening a continuous line had been established from the canal to St. Julien. Elsewhere the position remained unchanged; though heavily shelled and under reverse and enfilade fire the Canadians stuck stubbornly both to their original trenches and to the new flank thrown back to cover St. Julien, and more than one German advance was beaten off.

But with the Germans on the Pilckem ridge their guns could not only enfilade all the roads leading eastward into the "Salient" but could fire into the backs of the troops S. and E. of Ypres whose situation was therefore rendered most unsatisfactory. However, encouraged by promises of large French reinforcements, Sir John French endeavoured to maintain his original position until the French could reëstablish theirs. He had brought up a brigade of the 4th Div. and the newly arrived Northumbrian Territorial Div. (later numbered 50th), while in the course of April 24 the Lahore Div. reached Ouderdom. But before a systematic counter-attack could be launched a successful German attack on the Canadians had changed the position for the worse. On the morning of April 24 an extremely heavy bombardment developed on the original Canadian trenches, followed by the discharge of gas and by infantry attacks in force. The troops N. of St. Julien were overwhelmed and in the course of the morning the Germans, pressing on, made themselves masters of St. Julien and drove its defenders back upon Fortuin. Between Fortuin and the trenches of the Canadian 2nd Bde., which still held out, there was for a time an open gap, but the German efforts to advance were checked by artillery fire at short range and before dark the gap was filled mainly by units of the 28th Div. to whose position, around Broodseinde, the German attacks had now extended though without success. But St. Julien was gone and the next counter-attack had to make the recovery of St. Julien its objective.

This, delivered early on April 25 by the 10th Bde. and various attached units, advanced the line a little, but failed to recover the village. With equal gallantry and equally heavy casualties the Lahore Div. and the French attempted on April 26 to regain the Pilckem ridge, but just as success seemed within reach gas drove the French back and the advanced troops of the Lahore Div., overcome by this new weapon, could not maintain the positions they had reached. The Northumberland Fusilier (T.F.) Bde. attacked St. Julien with the same ill-fortune and meanwhile the Germans had managed despite the stubborn resistance of the Canadian 2nd Bde. to capture most of the Gravenstafel ridge. The 28th Div.'s left, N. of Broodseinde, was thus seriously exposed while simultaneously its infantry attacked it in front, but the arrival of the 11th Bde. (4th Div.) enabled some sort of line to be established across the N. of "the Salient." Still it was only with great difficulty and heavy losses from shell-fire, that the newly arrived units managed to dig themselves in and establish touch with each other. Luckily the German infantry attacks lacked vigour and determination and afforded the defenders welcome opportunities for retaliation.

By the evening of April 26th, however, the situation had not improved. A second attempt by the Lahore Div. (April 27), though gallantly pressed, achieved nothing; the French had made no progress and with the Pilckem ridge firmly held by the Germans the advanced position of the V. Corps was clearly untenable. Accordingly Sir John French decided upon a withdrawal to a new line running N. of St. Jean, N.E. of Wieltje, by Frezenberg, E. of Hooge, through the woods S. of the Ypres–Menin road to join the original line of the V. Corps N. of Hill 60. This line was much less liable to reverse and enfilade fire, but the evacuation of the Broodseinde ridge and Polygon wood meant losing valuable positions only to be recaptured at a heavy cost in the autumn of 1917. The move

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was, however, postponed to allow the French and the Lahore Div. one more attempt upon the Pilckem ridge but this also achieved nothing substantial and was followed by renewed German attacks and desperate fighting. On May 1 an attempt upon Hill 60 in which gas was effectively used was only just beaten off by the gallantry and steadiness of the 1st Dorsets. Next day a violent attack was launched against the northern face of the salient from St. Julien to the canal, bearing hardest upon the 12th Bde., who suffered terribly from the gas. Prompt counter-attacks by the local reserves, including dismounted troopers of the 3rd Cav. Bde., restored the situation and drove the Germans back with heavy losses while elsewhere the line was successfully maintained. The actual withdrawal, begun on the night of May 2–3 and completed on May 4, was covered by a stubborn defence of the left of 28th Div.'s line N. of Broodseinde by the 2nd Buffs and the 3rd Royal Fusiliers, thanks to which the final stages of the retirement were unmolested by the Germans, who did not indeed discover what was happening until too late to interfere. Their one substantial success was the recovery of Hill 60, recaptured on May 5 by a renewed gas attack.

The evacuation of the advanced position of the V. Corps may be taken as ending the first stage of the battle. Fighting continued, however, for another three weeks during which the Germans delivered three major attacks, on May 8, May 13 and May 24. The first of these broke through the 28th Div. near Frezenberg and resulted despite several counter-attacks in the loss of most of that division's front line, though on its left the 4th Div., which had replaced the Canadians, maintained its position. Between May 8 and May 13 there was particularly bitter fighting round Hooge where the 27th Div. was posted astride the Menin road. After repeated attacks the Germans contrived to make a few lodgments in the line, but their advances in mass formation had given good targets and they lost heavily, more than one local counter-attack meeting with success. South of the road against the 81st Bde. they gained nothing substantial, though N. of it the front trenches had to be evacuated in favour of a line just W. of the Bellewarde wood. The attack of May 13 extended from Hooge to the left of the British line. The exhausted infantry of the 28th Div. had now been relieved by the 1st and 2nd Cav. Divs. acting as infantry on whom fell the brunt of the exceedingly heavy bombardment. This was followed up by infantry attacks which had little difficulty in occupying positions which had been almost obliterated. Counter-attacks by the 7th and 8th Cav. Bdes. (1st and 2nd Life Guards, Royal Horse Guards, 10th Hussars and Essex and Leicester Yeomanry) reached the front line only to be forced back again by the violence of the bombardment, and the day resulted in the establishment of a new line some distance in rear of the original position, while the hamlet of Valorenhoek passed into German keeping and the left of the troops in the Bellewarde position had to be flung back to connect up with the cavalry's new line. On the other flank, however, in front of Wieltje the 4th Div. held firm and inflicted heavy losses on the enemy, retaking such portions of the line as the Germans had temporarily captured.

After May 13 ten days of intermittent heavy shelling and occasional sharp local fighting followed, during which the French recovered Streenstraate and thrust the Germans back across the canal. But the Germans had not finished. Early on May 24 a tremendous bombardment opened upon the whole front from the Menin road, northward. Gas was discharged in great quantities and at certain places, notably Hooge, "Shell Trap Farm" and the Bellewarde ridge, the defenders were completely overcome by the fumes. The Germans therefore had only to advance against positions practically denuded of defenders. Counter-attacks were launched, but without much success beyond preventing the Germans from penetrating deeper than the front line, while just S. of Hooge the determined resistance of the 1st Cav. Div. checked the extension of the German success. During the night of May 24–25 some units of the 27th and 28th Divs., hastily recalled from rest camps where they were seeking to assimilate the large drafts with which they had just been replenished, were put in to try another counter-attack. This, however, failed to recover Hooge or the Bellewarde ridge, and similarly, though the 4th Div. maintained most of its front, its centre had to be retired to a new line through Wieltje.

This fighting, however, marked the last serious German effort on this front. With all the advantages of surprise derived from their use of gas, they had not succeeded in taking Ypres and if they had made substantial gains of ground and had inflicted heavy casualties on the defenders their own losses whenever they had ventured on an infantry advance had been heavy. When viewed as a whole the defence of the Ypres salient during April and May 1915 stands out as a splendid achievement. Many battalions were in the front trenches for three weeks and more on end, without any relief, constantly shelled, subjected to repeated attacks, at a fearful disadvantage in having to face gas-attacks with only the most inadequate and improvised protection. Ground was lost, but the main position was held and the II. Army's tenacious resistance supplies a good example of "economy of forces." When the German attack on Ypres was launched the Allied offensive further S. was about to be resumed. The II. Army was asked to maintain its ground without depending upon the men and munitions needed elsewhere. Only one division of the I. Army was employed in the defence of Ypres and it was not because of any diversion of resources to the Ypres area that the British offensive of May 1915 proved a bitter disappointment.

(C. T. A.)

III. Battles of 1917

Continuous fighting of a violent character took place in the Ypres-Yser region during many weeks in the summer and autumn of 1917, but the operations as a whole may be said to have consisted of two distinct phases. The undertaking started with the brilliantly successful combat lasting only a few hours which has come to be known as the Battle of Messines. There followed a period of comparative lull, although progress was made at some points and although counter-attacks had to be beaten off. Then there were launched immediately to the N. of the scene of the Messines combat a series of attacks at short intervals which gained ground as successive waves do on a rising tide and which lasted for more than four months.

The object in view throughout was the occupation of the whole of the belt of high ground which extends from a point about three miles directly N. of Armentières to near Dixmude, beyond the forest of Houthulst. Its general direction is at first north-eastward to about Gheluvelt, then it turns northward to near Staden, and from that point it veers back westward toward the Yser, N. of the above-named forest. A continuation of somewhat more conspicuous high ground lying N. of Hazebrouck and Bailleul, this belt represents the watershed between the basins of the Lys and of the Yser. It rises generally some 100 to 150 ft. above the great Flanders plain, and it reaches a height of over 200 feet at a few points. Its southern portion in the spring of 1917 inclosed to a great extent the Ypres salient and had been the scene of many desperate encounters during the Ypres-Yser battles of 1914 and 1915; here the Allies' trenches gave them possession of some of the lower slopes on their side of the high ground, although all the upper portion was in German hands. Further to the N. the enemy held the whole of the high ground as well as stretches of plain to the W. of it, as from opposite Gheluvelt the direction of the Allies' front ran north-westward, *i.e.* diverging from the line of heights. The general plan of operations was to begin at the southern end, where the belt of high ground was almost contiguous with the British front, and to work from thence northward. This procedure was indeed almost dictated by the fact that the Ypres salient would have to be extended outward ere full use could be made in later undertakings of the important communications which diverge from Ypres itself toward Bruges and Ghent and Oudenarde. The capture of the line of high ground—its total length was about 23 m.—only represented the first part of the general strategical plan, which contemplated the initiating of subsequent operations in the coast district by another force.

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The line which the Allies had been holding to the N. of Armentières since the spring of 1915 formed in plan an inverted letter "S," the lower loop turned to the W., the upper loop turned to the E. and creating the Ypres salient. The lower loop on the other hand represented a pronounced enemy salient jutting into the territory in occupation of the Allies and causing them great inconvenience. Its area consisted almost entirely of high ground which had come to be known as the Messines–Wytschaete ridge. From this dominating position the Germans effectively enfiladed, and to some extent took in reverse, the Allies' trenches to the S. and to the N. of the salient and also commanded the communications leading up to these from the rear, while they overlooked the town of Ypres from within easy field-gun range. Quite apart from any projects for an offensive on a great scale, the filling in of this enemy salient—the wresting of the Messines–Wytschaete ridge out of hostile hands—was bound to ameliorate the situation in Flanders from the point of view of the Entente and to render the task of barring the invader's way toward the Channel ports so much the easier. In framing his plans for the Flanders offensive Sir. D. Haig had already decided to make the high ground about Messines and Wytschaete his first objective months before the date when the attack upon the position, formidable by nature and rendered infinitely more formidable by the labour that had been expended upon it, actually took place.

General Plumer and his II. Army, who had been acting as the wardens of the Ypres front for more than two years, had been selected to carry this operation out. To enable the II. Army to bring its full force to bear, the V. Army under General Gough had been transferred from the positions which it had been occupying between the III. and IV. Armies in Artois during 1916, to the Ypres salient and it was thus on the left of the II. Preparations for the undertaking had been afoot since the previous summer but they had only been carried on in earnest during the preceding winter. Moreover all the necessary labour and material had not been available until the prior demands of the Arras scheme of offensive operations had been satisfied, and very strenuous work had consequently to be carried on up to the last moment so as to insure that all would be ready. The preparations included an elaborate railway scheme. Much road construction was an indispensable part of the plan. Special provision for securing an ample water supply had been made. A great force of artillery had been quietly assembled. But the most noteworthy item of all, owing to its virtual novelty, was the carrying into effect of arrangements for a deep mining offensive on a colossal scale. Twenty great mines had been established at the end of galleries running right under the enemy's front line of defence, but one of them had been blown up by the Germans; a total length of 8,000 yards of gallery had, in spite of very active countermining on the part of the enemy, been driven by the tunnelling companies of miners since Jan., and 600 tons of explosives had been distributed between the 19 mines that were effective. The simultaneous explosion of these mines at the moment when the assault was launched was the most remarkable feature in a battle, the exceptionally decisive issue of which was primarily to be attributed to the labour that had been expended in advance, and to the care and forethought of commander and staff which had preceded the opening of the combat. It should be mentioned that the preparations above ground had been carried out under special difficulties owing to most of this area being overlooked from the German lines.

For the defence of this salient which they occupied, and the importance of which they fully realized, the Germans depended upon two separate sets of lines, coinciding in trace with its arc. The more advanced set of lines of the two was close to the trenches that were occupied by General Plumer's troops, and it was at most points pushed down the forward slope of the high ground. The second set of lines on the other hand, which formed an inner curve, followed the crest of the Messines–Wytschaete ridge along most of its extent. The villages of Messines and Wytschaete had been organized as main centres of resistance capable of offering a stout defence, and many farms, hamlets and copses existing along the line had been utilized to form defensive posts. The Germans had moreover also constructed two chord positions stretching along the base of the salient partly on and partly below the reverse slopes of the high ground. The front one of these two positions represented the final objective given to the assaulting columns by General Plumer.

The troops of the II. Army detailed for the enterprise consisted, enumerating them from right to left, of the II. Anzac Corps under Lt.-Gen. Sir A. Godley (Australian 3rd Div., New Zealand Div., 25th Div.), with the Australian 4th Div. in support; the IX. Corps under Lt.-Gen. Hamilton-Gordon (36th Div., 16th Div., 19th Div.), with the 11th Div. in support; and the X. Corps under Lt.-Gen. Sir T. Morland (41st Div., 47th Div., 23rd Div.), with the 24th Div. in support. There were thus nine divisions in front line and three in support. As the final objective of the troops along the whole battle-front was the chord of the arc forming the salient, it followed that the divisions in the centre would have a greater distance to cover than the divisions on the flanks; this had been taken into account and had been provided for in the time-table. The moment of assault was fixed for 3:10 A.M. on the morning of June 7, and at that hour the 19 mines were exploded beneath the enemy's front line with devastating effect. At a number of points the hostile trenches were completely obliterated and their garrisons wiped out, so that when the assailants reached the enemy's front line under cover of a tremendous bombardment, very little resistance was offered and the first objective was secured almost at once. The consequence was that, as had been anticipated in the programme, the advancing infantry could proceed without delay to the execution of their next task, that of carrying the second German line. The capture of this proved more difficult than had that of the front defences. In some of the skilfully prepared localities the enemy detachments would not yield for some time, in spite of the storm of shell pouring down upon them; but such localities speedily became isolated as the assailants pushed on between them, and their fall was not then long delayed. The strongly fortified village of Messines was, according to the programme, taken by the New Zealanders. Wytschaete was captured after a determined struggle by portions of the 36th (Ulster) and of the 16th (Irish) Divs. fighting side by side. On the left, where a trough which is followed by the Ypres–Comines canal cuts through the belt of high ground, the 47th (London) Div. had very formidable obstacles to overcome but pressed steadily forward and took many prisoners. The movements of the attacking side had been somewhat hampered at the outset by the dim light and by the air being dust-laden owing to the great explosions; but as the morning wore on this impediment to advance disappeared. An interesting feature in the opening phase of the battle had been that the tanks told off to assist the advancing battalions had in many cases been unable to get up in time to share in the struggles for the German second line of defence, so rapid had been the movements of the infantry. The operations had proceeded in almost exact accordance with the time-table, and by early in the forenoon all the upper part of the Messines–Wytschaete ridge and of its extension north-eastward to the limit of the battlefield was in the hands of British and Australasian troops. These moreover had consolidated the ground that they had won, and they were holding a line which, along most of its extent, was on the reverse slope of the high ground and overlooked the German chord lines of trenches; guns had also been pushed forward promptly to assist at closer range the advance which was to be made against these as the final operations of the day.

This closing effort took place in the afternoon and it was completely successful, although the enemy showed some disposition to counter-attack and at some points offered a stubborn resistance. So it came about that by the evening the last objective had been fully attained, and that General Plumer and his army had placed an extraordinarily complete and decisive tactical success to their credit. The extent of the success was not to be measured merely by the importance and extent of the area of ground which had been wrested out of the enemy's

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hands by masterly soldiership. Great captures in men and material had also been effected. 7,200 prisoners (including 145 officers) had been taken, together with 67 guns, 94 trench mortars and 294 machine-guns. Nor had the victory been purchased at a heavy cost in casualties. The total number of killed and wounded—the latter in many cases representing trifling injuries—only amounted to 16,000 in an army of sixteen divisions assailing a position of exceptional strength and that was strongly held. That the defenders realized how thoroughly vanquished they were, was shown by the feeble nature of such counter-attacks as were attempted during the day, as well as by the fact that the conquerors were during the night permitted to consolidate the ground that they had secured, almost unmolested. The battle of Messines was from the point of view of the victors a veritable masterpiece of design and of execution.

Not until the evening of the following day, the 8th, did the Germans adventure a general counter-attack upon the positions which the II. Army had won and which it had by that time prepared satisfactorily for defence. Covered by an intense bombardment, the hostile infantry then advanced to the assault along practically the whole of the new front; but they were beaten off at all points. The enemy drew back somewhat from in front of the southern portion of the ground conquered by the II. Army during the next few days, and on the evening of the 14th General Plumer's troops carried their line forward some distance on either flank. Their front thenceforward for some weeks ran almost in a straight line from where it quitted the line held on June 6, opposite the village of Frelinghien at the southern end, to Observatory ridge, situated a mile E. of Zillebeke, where it joined the line held on the earlier date. This represented a length of about nine miles. In depth, the ground wrested from the Germans opposite the centre of the old enemy salient was nearly three miles.

Some very important re-arrangements in the general distribution of the Allied forces N. of the Lys were being carried into effect about the date of the battle of Messines and during the immediately following weeks, in preparation for the Flanders offensive that was to follow. The actual composition of the different British armies also underwent considerable change. Portions of the old IV. Army were moved N. from Artois, under command of Sir H. Rawlinson, to the extreme left of the Allies' line about Nieuport on the coast; this comparatively small IV. Army was to be expanded at a later date and was to play an important part in the operations, should the earlier stages prove as successful as was hoped. On its right were placed the Belgian forces. On the right of these again, and linking them up with General Gough's British V. Army, was brought in the French I. Army under command of General Antoine, which was to act under the orders of Sir D. Haig. Its right was a little N. of Boesinghe, where it was in contact with the Guards Div. which formed Gough's left; the V. Army front extended from thence to near the Ypres–Comines canal where it joined up with the left of the II. Army.

A pause of some weeks in active operations now took place in Flanders, the time being devoted on the side of the Allies to making the elaborate preparations that were necessary before the contemplated offensive could be launched. The lull was however interrupted by an unfortunate incident on the extreme left of the line. In the coast region, the front between Dixmude and the shore followed a line in rear of the Yser river and canal except quite close to the sea. There it crossed over the enemy's side of the waterway, thereby creating a somewhat isolated patch of territory, occupied by troops whose communications with the rear and with their reserves were dependent upon a few floating bridges. This patch consisted near the sea of sand-dunes which from their nature were particularly difficult to entrench. It had been taken over as it stood by the British 1st and 32nd Divs. of the IV. Army and the 1st Div. was on the left next the sea. Perplexed by the arrival of British troops on the coast and anticipating serious developments in this quarter, the Germans determined to strike a blow against the extremely vulnerable sector of the Allies' front lying on the right bank of the Yser, and they delivered their attack on July 10. The front of the 1st Div. beyond the river was on that day occupied by the 1st Northamptons and the 2nd K.R.R.C. battalions which had been brigaded together since quitting Aldershot in July 1914. Early in the morning the isolated sector was subjected to an intense bombardment by a great number of guns which had been especially concentrated for the purpose. The bridges in rear were destroyed by shell. Dugouts and shelters were flattened out, and the difficulties of the two battalions were much aggravated by the explosions choking their machine-guns and rifles with sand. When the hostile infantry advanced to the attack the small British force was overwhelmed, only a few small parties eventually escaping by swimming the river. But although the enemy by this stroke gained possession of the left of the isolated sector, their effort against its right portion, held by the 32nd Div., failed. No evil result followed to the Allies, apart from the disaster to the Northamptons and Rifles.

Although the capture of the Messines–Wytschaete ridge and of most of the high ground on either side of Ypres–Comines canal gap had put an end to the enemy overlooking Ypres from the S., and tended to limit hostile observation of the place from the S.E., the Germans still dominated it, in a measure, from the E., from the N.E. and from the N. This circumstance exercised a very important influence over the arrangements that were being carried out for the offensive about to be undertaken, the first stage of which was to be directed in the main against the invader's defences sited on the high ground lying in a quadrant round the ruined town.

"The various problems inseparable from the mounting of a great offensive," writes Sir D. Haig in his despatch of Dec. 25 1917, "the improvement and construction of roads and railways, the provision of an adequate water supply and of accommodation for troops, the formations of dumps, the digging of dugouts, subways and trenches, and the assembling and registering of guns, had all to be met and overcome in the new theatre of battle under conditions of more than ordinary disadvantage. On no previous occasion, not excepting the attack on the Messines–Wytschaete ridge, had the whole of the ground from which we had to attack been so completely exposed to the enemy's observation. . . . Nothing existed at Ypres to correspond with the vast caves and cellars which proved of such value in the days prior to the Arras battle, and the provision of shelter for troops presented a very serious problem. The work of the Tunnelling Companies of the Royal Engineers deserves special mention in this connexion. It was carried on under great difficulties, both from the unreliable nature of the ground and from hostile artillery, which paid particular attention to all indications of mining activity on our part."

Preparations for the offensive could not in fact be concealed. The forces with which it was proposed to break out from Ypres and to gain possession of the high ground to the E., further out to the N.E., and still further out to the N., were assembled openly during the latter part of the month of July. The Germans were perfectly well aware that they were going to be subjected to a very formidable attack in this region.

The portions of the coming battle-field that lay nearest to Ypres had already been the scene of fierce combats, which have been dealt with in Parts I. and II. of this article. But certain points in connexion with their topography call for some reference, while the arrangements which the Germans had made for defence must also be described. The little river Steenbeke (or Jansbeke as it is called in its lowest reaches) joining the Yser near Merckem, creates together with its tributary streams, nearly all of which join it on the right bank, a feature that proved of considerable tactical importance during the prolonged operations that followed. The main stream and also the watercourses joining it flow northwestward or westward from their sources on the crest of the high ground between the Ypres–Menin road and the village of Passchendaele, with gentle spurs jutting out between them. The most extensive of these spurs is that between the valley of the Steenbeke itself and the low-lying flats of the Yser immediately N. of Ypres, which had come to be known as

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the Pilckem ridge; it was from this spur that the town was overlooked from the N. But the general direction of streams and spurs alike being that they run from S.E. to N.W., it followed that an offensive directed north-eastward had to cross them successively and that they tended to provide the defenders with a succession of minor positions. Seeing also that, from about the point where the V. Army was in contact with the II. Army, the main ridge ran in a generally northerly direction, while the front occupied by the V. Army before the attack was launched ran from S.E. to N.W., General Gough's forces which were to carry the operation out, with the French I. Army coöperating on their left, necessarily pivoted on their right and in throwing their left forward were confronted by this succession of minor positions. The shallow depressions representing the valleys of the Steenbeke and its affluents tended to be marshy and to flood and become almost impassable in wet weather.

Anticipating that the Allies would embark on a great offensive in this quarter sooner or later, and becoming aware during the spring that such an offensive was actually in preparation, the Germans had taken steps to meet the eventuality with characteristic thoroughness and ingenuity. Experiences on the Somme, on the Ancre and at Arras, as well as on battle-fronts in Champagne where they had been attacked by the French, had taught them that a continuous system of trenches did not proffer an altogether satisfactory form of defence against the terrific bombardments which the Allies could bring to bear, unless abundant underground cover could be provided; and the nature of the soil in Flanders, with water always near the surface, militated against the creation of subterranean galleries. A continuous line in any case offered a favourable target for guns and was objectionable on that account. They were therefore holding the ground over which attack was expected by a system of numerous disconnected trenches and strong points which were arranged in depth rather than in breadth and which permitted of the forward defences being held by relatively small forces, with the idea of gradually absorbing attack rather than of giving no ground at all. Scattered about were small concrete blockhouses with walls of great thickness which could not be harmed by shell of less than about 6-in. calibre, and which contained garrisons of about twenty men each, with two or three machine-guns; the British soldiers when they came to make acquaintance with them called them "pill-boxes." A defensive system designed after this fashion was more difficult to map by aerial photography than were continuous lines, and a preliminary bombardment directed against it was in consequence necessarily so much the less effective. As their front line near Ypres had been in existence since 1915 and as much labour had been expended upon it the Germans were, however, trusting to the old system to meet the first shock in the event of attack. It was rather in the later offensive operations that the Allies found themselves confronted with the new devices.

The front which Sir D. Haig had decided to extend his initial advance along stretched from opposite Deulemont on the right, to beyond Steenstraat on the left—a distance of over 15 miles. But the most important blow was to be delivered by the V. Army in the middle on a front of approximately 7½ m. between the Zillebeke–Zandvoorde road and the village of Boesinghe (inclusive) on the left. The task of the II. Army to the S. was limited to that of increasing the area threatened, so as to occupy the enemy's attention, only a trifling advance being intended. The French I. Army on the British left was to push forward its right in close touch with the left of the V. Army, with the primary object of securing this against counter-attack from the N. The start of the offensive had originally been fixed for July 25. It was however postponed for various reasons until the 31st. Owing to the enemy having retired out of his foremost trenches along the northern portion of the V. Army front, British and French troops on the 27th crossed the Yser canal (which had hitherto formed an awkward obstacle at this point) about Boesinghe; this enabled bridges to be thrown and it greatly facilitated the attack in the left sector when this took place four days later.

The order of battle of the V. Army (II., XIX., XVIII. and XIV. Corps), enumerating the divisions from right to left, was as follows:—24th, 30th, 8th, 15th, 55th, 39th, 51st, 38th and Guards Div., with two divisions to each corps in support. The French 1st Div. was next to the Guards beyond Boesinghe. Starting at 3:50 A.M. on the 31st, the Allied infantry generally experienced little resistance at first and only began to meet with serious loss when advancing towards their second objectives. This was particularly the case on the right, where the 24th and 30th Divs. were endeavouring to gain possession of all the commanding ground about and beyond Shrewsbury forest and Sanctuary wood to the S. of the Menin road; they failed to push forward more than a few hundred yards. But further to the left the assailants were successful at almost all points, reaching the line of the Steenbeke and capturing St. Julien. The French stormed Bixschoote, which was beyond the furthest objective given them. Even if the check to Gough's right discounted the completeness of the victory, the third battle of Ypres had opened most encouragingly for the Allies. The Pilckem ridge had been wrested from the enemy so that the town of Ypres was no longer overlooked by hostile forces to the N. and N.E., the front had been pushed forward along its full extent, and over 6,100 prisoners (including 135 officers) and 25 guns had been taken by the British alone.

But the weather had broken. July had up till the 31st been an almost consistently fine month, but that morning opened threatening, and rain came on during the course of the day. It fell steadily all that night and continued without cessation for four days, while for several days following the weather remained unsettled. The low-lying clayey soil, pitted with shell-holes, became a succession of muddy pools. The valleys became almost impassable except at a few points. The delay that ensued gave the German troops time to recover from their defeat of the 31st and also to bring up reinforcements before there could be any question of continuing the offensive; it was not indeed until Aug. 16 that improving weather had sufficiently dried the ground to justify the launching of a fresh general attack. This was again undertaken by the V. Army and by portions of the French I. Army on its left, the Menin road marking about the southern limit of the offensive operations. The four corps of the V. Army (II., XIX., XVIII. and XIV.) were disposed in line in the same order as on the opening day, but on this occasion the divisions in front line were in most cases those that had been in support before. The advance was timed for 4:45 A.M., and the operations were quite successful on the left, but the result on the right was even more disappointing than it had been on the 31st and on this occasion comparative failure extended further along the line toward the left. Except for some trifling local gains of ground the II. and XIX. Corps improved their position very little, suffering repulse at most points; nor was the resistance of the enemy purely of the passive kind, for the Germans delivered some determined counter-attacks, and as a result of several hours of fluctuating fighting the troops in front line in the right half of Gough's Army lost heavily. The XVIII. Corps on the other hand did much better, its left division indeed gaining all its objectives, while the XIV. Corps, still further to the left, was entirely successful. Langemarck was taken, the Steenbeke passed along a front of two or three miles, and a large gap made in the German third line of defence. The French advanced their line all along their front and occupied Drie Drachten on the extreme left, on the borders of the inundation area. Still, if the Allies were entitled, upon the whole, to claim victory in view of what had been accomplished along the left half of the battle-front and of their having secured 2,000 prisoners and 30 guns, their arms had met with reverse in the other half. Nor was there reason to suppose that the enemy losses had been more severe than those of the assailants.

The Flanders offensive, unavoidably started late, had now been in full swing for more than a fortnight, and little improvement in the position had been effected in what represented the really vital sector of the front—the ground about the crest of the ridge stretching away from the uplands won at the battle

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of Messines toward Passchendaele. Up there the line had only been advanced a few hundred yards as a result of two regularly prepared attacks. Unless progress could be expedited at this critical point, there was little prospect of achieving the object for which the offensive had been undertaken. It was clear that a fresh force was needed to deal with the enemy in this portion of the sphere of operations, and the British commander-in-chief therefore decided to extend the left of the II. Army northward and to entrust the attacks against the higher ground to General Plumer, who was to work in conjunction with the V. Army farther to the left. Experiences gained on July 31 and Aug. 16 had moreover shown that new methods of attack were called for. The enemy's elastic system of defence—forward trenches weakly held while formidable reserves were kept in hand to counter-attack before assailants could consolidate such ground as they had won—suggested limitation in the depth of objectives, and it called for special artillery concentrations to deal with the hostile counter-strokes when they were delivered. The requisite measures took some time to carry out and the weather moreover continued unfavourable during the latter part of Aug., rendering the ground so waterlogged that a long interval became necessary to permit of its drying to some extent. In Flanders it may be remarked, as in England, humidity of the atmosphere increases rapidly from about the middle of Aug. onward, so that periods of fine weather have less and less effect in absorbing the moisture of the ground as the season advances. The first half of Sept. however, proved bright and dry and the date of the next attack was fixed for the 20th of that month.

The plan of operations for this day was that the II. Army (consisting from right to left of the 19th, 39th, 41st, 23rd, Australian 1st and 2nd Divs.) was to push forward between the Ypres–Comines canal and a point a few hundreds yards S. of the Ypres–Roulers railway, while the V. Army (consisting from right to left of the 9th, 55th, 58th, 51st and 20th Divs.) was to press forward on its left to as far N. as the Ypres–Staden railway. At no point was it proposed to gain more than a mile of ground in depth, and, except about the Ypres–Menin road and immediately to the N. of this, the furthest objectives given to the various divisions were not more than half a mile in advance of the existing line. The weather unfortunately broke during the night of the 19th–20th; but in spite of this the attacks achieved their object all along the front and the efforts of the II. Army were crowned with brilliant success in a sector where previous attempts had to a great extent failed, the crest of the main ridge on either side of the Ypres–Menin road being wrested from the enemy. The V. Army likewise appreciably improved its position. The losses of the attacking side on this day were relatively small, in view of the importance of what had been achieved, and 3,243 prisoners and several guns were taken.

Sir D. Haig followed up the success of the 20th without delay. A fresh thrust took place along a more restricted length of front on the 26th, from about half a mile S. of the Menin road to a point about a mile and a half N. of the Ypres–Roulers railway. The forces detailed for the enterprise, enumerating them from right to left, were the 39th, 33rd, Australian 5th and 4th Divs. of the II. Army, and the 3rd, 59th and 58th Divs. of the V. Army. The Germans had in the meantime been making desperate attempts to recover some of the ground which they had lost about the Menin road and Polygon wood, but without success; and in spite of their resolute opposition they were unable to prevent the British troops from attaining practically the whole of their objectives on the 26th. The rest of Polygon wood was captured, the British position was improved all along the line, and 1,600 prisoners were taken. That the losses should have been by no means heavy on this day as on the 20th showed how effective an answer the method of the shallow objective provided to the enemy's new plan of defence by depth. The combats of Sept. 20 and 26 having given almost the entire crest of the main ridge into British hands to a depth of a mile and a half in advance of the line taken up on July 31, Sir D. Haig arranged for a very important operation to take place on Oct. 4, the front this time extending from Polygon wood to the Ypres–Staden railway, although a minor advance was also to take place S. of Polygon wood and S. of the Menin road.

There was a severe gale accompanied by torrents of rain during the night of the 3rd, and the weather conditions on the following morning were so unfavourable that the ground was in most parts of the battle-field little better than a morass. The enemy moreover was in great strength, especially in the centre; two fresh divisions had been brought up into the German line and, as it happened, these together with the troops already on the spot were drawn up ready to deliver an assault which was timed to start ten minutes later than the hour that had been fixed for the British advance. The consequence was that when the British artillery barrage opened it caught hostile forces that were gathered in mass and it did great execution. The order of battle of the II. and V. Armies was as follows:—37th Div. of the IX. Corps on the extreme right, athwart the Menin road, then the X. Corps (5th, 21st, 7th Divs.) covering the front up to in front of Polygon wood, then the I. Anzac Corps (1st and 2nd Australian Divs.) reaching as far as the Ypres–Roulers railway, and, on their left again and forming the left of the II. Army, the II. Anzac Corps (Australian 3rd Div. and New Zealand Div.); the V. Army was represented by the XVIII. Corps (48th and 11th Divs.) next to the II. Anzac Corps, with the XIV. Corps (4th and 29th Divs.) on the extreme left. The attacking side gained a signal victory this day. Nearly all its objectives were secured, and the gains were especially important in the centre where a firm footing was won along the main ridge about the villages of Molenaarelsthoek and Broodesinde for a length of a mile and a half; a gentle spur stretching back north-westward from this and known as the Gravenstafel ridge was also wholly secured. A hold was gained further to the left on the important village of Poelkapelle on the Ypres–Roulers road; and along all the central part of the zone of operations the assailants pushed their line forward several hundred yards, thereby taking possession of ground of great tactical importance. 5,200 prisoners were taken, including 138 officers, and, besides a few guns, a large number of machine-guns and trench mortars were amongst the day's captures. Following as it did rapidly upon the successes of Sept. 20 and 26, the combat of Oct. 4 represented a highly satisfactory achievement, which had moreover been accomplished without very heavy sacrifice. It was not indeed the losses encountered in these well-defined actions that gave grounds for anxiety so much as the casualties which occurred day after day to troops that were clinging to exposed positions, where owing to the condition of the ground it was almost impossible to create effective cover.

A good defensive line had however now been secured. As a result of the offensive operations begun by General Plumer on June 7 and continued intermittently for four months, the crest of the long belt of high ground had been occupied from Messines to within a very few hundred yards of the Ypres–Roulers railway and the situation of the Allies in Flanders had been vastly improved in consequence. Possession of the Gravenstafel ridge would moreover enable Sir D. Haig to establish a strong flanking position, which would render it difficult for the Germans to recover the high ground they had lost by a turning movement from the N. But, regarding the Allied offensive in this part of the theatre of war as a whole, the work was in reality only begun. The Houthulst forest, with the long line of high ground forming the quadrant of a circle beyond it, was still in the enemy's hands. Until the ridge had been secured as far as the vicinity of Staden, it would be premature to embark on the second part of the general scheme of operations—attack on the German positions along the coast between Nieuport and Ostend. Sir D. Haig had now to decide whether he should continue his system of gradual advance N.E. of Ypres, or should call a halt.

"The year was far spent," he writes in his despatch. "The weather had been consistently unpropitious, and the state of the ground, in consequence of rain and shelling combined, made movement inconceivably difficult. The resultant delays had given the enemy time to bring up reinforcements and to organize his defence after each defeat. Even so, it was still the difficulty

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of movement far more than hostile resistance which continued to limit our progress, and which now made it doubtful whether the capture of the remainder of the ridge before winter finally set in was possible. On the other hand there was no reason to anticipate an abnormally wet October. The enemy had suffered severely, as was evidenced by the number of prisoners in our hands, by the costly failure of his repeated counter-attacks, and by the symptoms of confusion and discouragement in his ranks. . . . After weighing these considerations, as well as the general situation and various other factors affecting the problem, among them the desirability of assisting our Allies in the operations to be carried out by them on Oct. 23 in the neighbourhood of Malmaison, I decided to continue the offensive further and to renew the advance at the earliest possible moment consistent with adequate preparation."

That the British commander-in-chief in arriving at this decision was largely governed by considerations to which expression could not appropriately be given in a despatch sent in so early as Dec. 25 1917, there can be little doubt. However favourable Oct. weather might be, the whole of the ridge together with the Houthulst forest was most unlikely to fall into the Allies' hands before the winter set in. The persistent rains had had too great an effect upon the soil for this to recover from it before the spring, even if the rest of the autumn were to be dry and favourable. For the offensive plan, as originally conceived, to be carried out in its entirety even in an ordinary season, Sir D. Haig's forces ought to have attained the positions which they had only secured by Oct. 4, at least two months earlier. But he was aware that the fighting capacity of the French armies was for the moment diminished by grave internal troubles, the Russian collapse had set free large hostile forces which were being rapidly transferred to the western front, and if the British offensive ceased, the enemy would regain the initiative and would be free to assail the French front wherever this happened to be weakest. It followed that the British, in spite of the difficulties in the way, must continue their offensive until the coming of winter put an end for the time being to the danger of a German counter-attack.

The hopes which had been entertained at G.H.Q. that Oct. might bring dry weather after the heavy rains experienced in Aug. and Sept., were doomed to disappointment. The days immediately following the combat of Oct. 4 proved worse than ever, and the troops suffered great hardships besides losing many men from hostile shell-fire owing to the lack of protection; they had to trust for shelter to shallow trenches hastily scooped out to join together adjacent shell-holes. The enemy however had been so roughly handled on the 4th that any counter-attacks which were attempted from the hostile lines had little force in them. In spite of the unfavourable climatic conditions a fresh attack was arranged for Oct. 9, the front on this occasion extending from about the Ypres–Roulers railway to the extreme left near Merckem. The order of battle of the II. and V. Armies was as follows:—Anzac I. Corps (Australian I.), Anzac II. Corps (66th and 49th Divs.), representing the II. Army; XVIII. Corps (46th, 48th and 11th Divs.), XIV. Corps (4th, 29th and Guards Divs.), representing the V. Army. On the left of these again was the French I. Army. The night of the 8th was particularly dark, there was heavy rain, and considerable trouble was met with in mustering the troops for the assault so that this was carried out under conditions of extraordinary difficulty. The advance was on this day, in accordance with the programme, pushed farthest forward on the left and about the left centre. The outskirts of the Houthulst forest were gained by the French in spite of much of the low-lying ground being actually under water, and the British troops on their right made good the ground to a depth of a mile and a half about Langemarck. On the right the assailants were strongly opposed and lost heavily, but they nevertheless gained their objectives along most of their front. 2,100 prisoners in all were taken, with a few guns, and the day's operations could be reckoned as representing a substantial success, if at heavy cost.

A fresh advance was attempted on Oct. 12 in spite of a continuance of the bad weather and of the ground being in a terrible state. It should be mentioned that in all this later fighting forming part of the great Flanders offensive, the Allied infantry were seriously handicapped by lack of heavy gun support. In such a sea of mud the larger types of howitzer could not be got forward, and in spite of bold and skilful handling the field artillery did not provide an effective substitute. With the Germans it was different. Their heavy ordnance when it was required to move was generally traversing ground that had not been torn up by months of shell-fire and where roads were still in being. The front of attack covered on the 12th was approximately the same as that covered on the 9th and the objectives given to the various divisions only called for an advance of a comparatively short distance; but many of the lower valleys were found to be absolutely impassable owing to the floods, and the operation eventually was not persisted in at most points. 1,000 prisoners were taken, but the attacking side lost heavily, and, although the unsatisfactory result of the effort from the British point of view was attributable to the elements rather than to the enemy, this day's fighting amounted to an undoubted reverse to the cause of the Allies.

All hope of making any appreciable gains of ground except in one particular sector was now abandoned by G.H.Q., although the front was slightly pushed forward in the region of the Houthulst forest by dint of some skilfully carried out minor operations during the next few days. The one sector where it was determined to continue the offensive was the ground between the Ypres–Roulers railway and the neighbourhood of Poelkapelle. The II. Army was in possession of the crest of the ridge about Broodseinde and where the railway traverses this; but further to the left the line ran diagonally across the rearward slope of the heights and was commanded from these at short range. Having once pushed forward beyond the front that had been taken up as a result of the successful combat of Oct. 4, it had become almost imperative to secure possession of the village of Passchendaele as well as some rising ground immediately to the N. and N.W. of that place, and to arrange that the line should run back in a westerly direction from this point, at right angles to, and not diagonally across, the ridge. This would create a sharp salient; but Passchendaele was a commanding point, and the lie of the ground between it and Poelkapelle would favour the establishment of a strong defensive line for the winter. Sir D. Haig therefore decided to continue the offensive immediately to the N. of the Ypres–Roulers railway on a narrow front, and in order to give this a fresh impetus he brought the Canadian Corps round from Lens. A number of readjustments of the order of battle of the II. and V. Armies also took place, for some of the troops about Ypres were required for the offensive secretly prepared in the Cambrai region.

The weather after Oct. 12 showed distinct signs of improvement, although at this late season of the year there could be no hope of the saturated soil recovering very appreciably from the effects of those abnormal autumn rains which had proved the most formidable antagonist of the Allies in Belgian Flanders. But the signs proved delusive, for on the 25th, the very day before a fresh attack had been arranged, heavy rain set in again. This operation only covered the front between the Ypres–Roulers railway and Poelkapelle, the main advance being intended to take place in the right centre and right. The troops detailed for the undertaking were, enumerating them from right to left, the Australian 1st Div., the Canadian 4th and 3rd Divs., the 63rd Div., and part of the 58th Div. But what amounted to an independent operation (except in that it must occupy the enemy's attention on a part of the front only about 2 m. from the main attack) was also undertaken on this day by the 5th and 7th Divs. on either side of the Ypres–Menin road. In spite of unfavourable weather and the deplorable state of the ground important progress was made by the Australian and Canadian troops, the latter getting up close to Passchendaele and successfully withstanding heavy counter-attacks in most portions of the ground which they had won. The 63rd and 58th Divs. also reached their objectives; but they were not called

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upon to push the line forward more than a short distance, their task rather being to link up the ground won by the Canadians with the old line near Poelkapelle. Some hundreds of prisoners were taken. The operation further to the S., on the other hand, which only had a very limited objective, was unsuccessful. The purpose had been to capture the village of Gheluvelt and to improve the position somewhat a little further to the N.; the possession of Gheluvelt on its well-defined spur running south-eastward would create as it were a bastion to flank the forward slopes on either hand. But after very nearly gaining their objectives at the outset, both the 7th and the 5th Divs. were driven back to their starting point, and they suffered heavily in casualties during a furious combat. With the ground in the condition that it was in, rifles were apt to become choked with mud, while percussion shell buried themselves in the swamp doing little harm by their explosion; these conditions however affected both sides equally.

Between the 26th and the 28th Belgian and French troops made an important gain of ground on the extreme left of the line, securing possession of the flats as far forward as the Blankaart lake. And on the 30th a fresh attack was made between the Ypres–Roulers railway and Poelkapelle by the same troops as had fought on the 26th, but on a narrower front this day as most of the high ground in the direction of Passchendaele which Sir D. Haig was anxious to occupy had been captured in the previous combat. Some progress was made; but the Germans offered a very stout resistance at important points, although at others they showed some symptoms of losing heart and some of them even abandoned their posts at the outbreak of the fight, Owing to the front of attack now being restricted and to the object which the assailants had in mind being obvious, the enemy was concentrating a very heavy artillery fire upon the area that formed the battle-field, and in their efforts to get to Passchendaele the Canadians suffered heavy losses on this day. The 63rd and 58th Divs., further to the left and attempting to get forward on lower ground, found this almost impassable and they only advanced their line slightly here and there. But up on the main ridge what had been achieved paved the way for a brilliant success a week later. At dawn on Nov. 6 the Canadian 2nd and 1st Divs. suddenly advanced and captured Passchendaele together with the somewhat higher ground immediately to the N. and N.W. of the village, also taking 400 prisoners. This fine achievement can fairly be set down as the closing incident in what has been called " The Third Battle of Ypres." One or two attempts were made within the next few days to improve the position in the sector where the Canadians had made such substantial gains, and these were partially successful, but they did not appreciably modify the situation.

The prolonged succession of combats, many of them (such as the capture of the Messines–Wytschaete ridge by the II. Army and the very successful operations on July 31 and Oct. 4) reckoning as unqualified victories to the credit of the Allies, had transformed the situation in Flanders. The chain of heights from N. of Armentières to Passchendaele had changed hands. The Ypres salient, vastly extended, so far from its constituting a weak and barely defensible sector of the Allies' front, had become a serious danger to the enemy. Sir D. Haig had secured an excellent defensive position between the Yser and the Lys. Great hostile forces had been kept fettered to the north-western extremity of the western front, striving to maintain possession of a tract that had been captured by the invaders some three years before. But the main object for which the offensive had been undertaken had been only very partially attained. The German hold upon the coast district remained unshaken. The line of high ground to the N. of Passchendaele and circling round beyond the further outskirts of the Houthulst forest, as also that forest itself, remained in the enemy's hands. The third battle of Ypres, chiefly perhaps because of unfortunate delays in starting the operations and of untoward weather conditions after they had been started, had not prepared the way as had been intended for subsequent advance upon Ostend and the great plains N. of the Lys. (C. E. C.)

IV. Battles of September 1918

At the end of Aug. 1918, when the French counter-offensive, commenced on July 18, and the British counter-offensive, begun on Aug. 8th, had both been crowned with success, the initiative in strategy had been definitely taken out of the hands of the German command. The enemy had been driven from the salients of Château-Thierry and Montdidier, which were his conquests of March and May.

Thanks to British shipping, each month 250,000 American soldiers were being landed on French soil, and this increasing wave of troops, young and fresh, gave the Allies a superiority in numbers and *matériel* which grew day by day.

Desiring that the enemy should have no opportunity to recover from disorganization and fatigue, Marshal Foch proposed to continue the operations by a triple attack, to which end three actions were to commence about Sept. 25 at 24-hour intervals.

The American I. Army and the French IV. Army were to attack on both sides of the Argonne in the general direction of Mézières. The British I., III. and IV. Armies and the French I. Army were to push towards Cambrai and St. Quentin, and break through the famous Siegfried position or Hindenburg line. The Belgian army, the British II. Army and certain French divisions, who would presently join them, formed the group of the armies in Flanders under the supreme command of H.M. the King of the Belgians, and would undertake the operations in Flanders. This force in the first place was to secure the Flanders ridge and having conquered this to push on the left wing toward Bruges–Ghent with the object of freeing the Belgian coast, while the right wing would push toward Courtrai–Renaix in such a manner as to cause the evacuation without fighting of that vast inhabited region Lille–Roubaix–Tourcoing.

At the request of King Albert, General Degoutte of the French army took over the duties of chief-of-staff of the group of armies in Flanders.

The German Position.—The Belgian army and the British II. Army were ordered to seize the Flanders heights, the line which, starting from Hill 10 toward the S.E. of Dixmude, reaches Hill 43 at Clercken, passes round the forest of Houthulst by the Stadenberg, passes by Westroosebeke, Passchendaele, Zonnebeke, beyond Ypres to Gheluvelt, Hill 60, Wytschaete and Messines. The line continues to the right toward the W. by Mont Kemmel, Mont Rouge, Mont Noir and Mont des Cats, which form the watershed of the rivers Yser and Lys.

At this period nine German divisions held the sector Dixmude–Armentières: three or four being at rest behind the front line. The first line of German trenches passed by Dixmude, Woumen, the Chateau Blanckaert, Langemarck, St. Julien, Zillebeke, St. Eloi, Wytschaete, Messines, and the river Lys to the W. of Armentières. This was a zone of cover behind which the Germans had echeloned four successive positions, the product of four years of stability which had been strengthened with particular care in 1917 to resist the British offensive that year.

These were characterized by the use of concrete groups, very numerous and strong, of the type of the famous "pill-boxes" of Stirling Castle, Inverness Copse and Poelkapelle. Some of these contained sections of artillery with gunners and ammunition: generally they sheltered one or two sections of machine-guns, the fire of which covered the intervals and afforded flanking fire to each other. Everywhere were vast stretches of a network of barbed wire in front of dugouts and trenches affording an entire continuity of obstacles.

The terrain of the attacks had been entirely overturned by the bombardments in the British offensives of 1917: every vestige of cover had disappeared; only some mounds of walls marked the position of villages; the soil was riddled by the shell-holes adjoining each other; the land drainage system no longer functioned, every ditch was full of water and the field of battle everywhere was a vast and foetid bog (slough) in which progress was arduous. The network of roads was hidden under the mud and any advance would be as difficult for the lines of skirmishers as for the artillery horse-teams and the supply convoys.

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The German artillery had the advantage of the commanding positions. Their observation posts on the ridges enabled them to fight effectively over the entire country of the attack. Again, in the centre of the sector assigned to the Belgian offensive stands the forest of Houthulst, a renowned strong-point, and a bastion for artillery which dominated with its fire a great part of the Belgian and British fronts. As Marlborough had said:—"Whoever is Master of the Forest of Houthulst is Master of Flanders."

Plan of Attack.—About Sept. 15 the Belgian army, 12 divs. of infantry and one of cavalry, held a front of 35 km. from the sea at Nieuport-Bains to the northern outskirts of Ypres.

The British II. Army, 10 divs. of infantry (General Plumer), occupied the sector Ypres–Armentières, about 20 km. in length.

The *moral* of the two armies was excellent: the British troops aspiring to seize from the enemy the fruits of their successes in the spring; the Belgians seeing the day at length dawn, which they had so anxiously awaited, when they should leave the lines on the Yser and hasten to the deliverance of their country.

King Albert, commander-in-chief of the group, decided that the first operation should have as its object the conquest of the following objectives. For the Belgian army: Dixmude, Clercken, Stadenberg, Passchendaele, Broodseinde. For the British army: Molenaershoek, Polygon wood, Hill 60. From these points the armies would advance eventually to the attack on subsequent objectives. The Belgian army placed 11 divisions in the line, of which one was a French division; the British army employed six divisions. On the extreme left, two Belgian divisions remained in their sector on the front Nieuport–Dixmude. They were to hold themselves in readiness to push forward on the first order and clean up the left bank of the Yser in the inundated area, and to take the opportunity to release the flood-water. On the extreme right, the British divisions which were furthest S. were to watch for any indication of weakness in the enemy in order to follow up and hasten his retreat. Two divisions of French infantry which were now arriving, and the division of Belgian cavalry, constituted the general reserve.

The Belgian 4th Div. crossing the Yser immediately to the S. of Dixmude was to secure the ruins of the village and seize the former line N. of Dixmude and Zarren and the length of the canal of Houdzaeme. The British 14th Div. formed the flank-guard at St. Eloi. The frontage of the principal attack was—Clercken–Gheluvelt—a little over 20 km. in length, so that the frontage of attack of each division of the first line was about 2 kilometres. The British 9th and 29th Divs. placed two brigades in the first line and one brigade in the second line; the 35th Div. had all three brigades in the first line. All the Belgian divisions uniformly adopted the *carrée* formation: all of their three regiments were together; in each regiment the battalion in the first line pushed straight ahead, the battalion in the second line advanced taking special care to reduce any strong points of resistance and clearing up any such positions overrun by the first line: the battalion in the third line, held as long as possible in reserve, was employed to pass eventually the first line and thus to undertake the continuation of the advance. In this formation the Belgian army had 24 regiments in the front line placed side by side in three lines of battalions. This offensive disposition is noteworthy. Taking everything into consideration, there is no other example in the whole war of the deployment of an army which shows more audacity, more determination, which promised a greater promptitude in employing all units, and greater rapidity in opening up the battle.

The Belgian army, united to a strong contingent of French and British artillery, formed a mass of artillery of 1,550 guns, of which 280 were trench guns and 500 heavy artillery. The British II. Army had about 1,000 pieces, of which half were heavy. Therefore on the actual frontage of the attack Dixmude–St. Eloi (about 25 km.) the Allies possessed some 1,800 guns both heavy and field, independently of trench artillery. The greater part of the Belgian batteries had been placed E. of the Yser canal at Ypres; a certain number held a position to the E. of Martjevaart and also in the peninsula of Luyghem, only those batteries of very long range and insufficiently mobile remained on the W. bank of the canal.

The attack was to be preceded by a violent preparatory bombardment of one duration of three hours. The movement of the artillery during the advance was made the subject of special orders, and it was arranged that in each division of the first line a group of 7·5 would be allotted to accompany it and distributed at the strength of one battery for each regiment of infantry.

Action of Sept. 28.—All the preparations for the attack had been carried out with the greatest secrecy. Artillery action had been very feeble for many days. Batteries and ammunition had been pushed forward and installed in the first lines under cover of careful camouflage; divisions had been concentrated in the sectors of attack and had been deployed for the battle entirely by night marches. On Sept. 28 at 02:00 (morning) the 17 divisions were in their battle positions; a vast body of men ready to march against the enemy with enthusiasm and in perfect order. At 02:30 hours there commenced on the whole front of the two armies a powerful bombardment of preparation which was to last for three hours. At 05:30 hours the infantry left their advance positions preceded by a creeping barrage.

The rain almost at once commenced to fall heavily, making every movement yet more laborious. Overcoming every obstacle they encountered, the Belgians secured in one magnificent sweep the Francken, Preussen and Bayern Stellung.

At 07:30 the last obstacle was passed, except for the northern group, and the field artillery proceeded on their way to accompany immediately the subsequent attacks. The enemy only feebly counter-attacked. The northern group had at the outset encountered a stubborn resistance at the Château Blanckaert which the defenders held to the death, as well as an adjoining farm. These strong-points were not secured until about midday. Beyond the Bayern Stellung the Germans counter-attacked and put up a vigorous defence.

In the northern group the centre of the attack was the conquest of the forest of Houthulst, filled with obstacles and ambushes, and in addition the burnt trunks of trees and torn branches—the result of four years of bombardment—proved an impenetrable entanglement where advance was only possible along the straight drives set at right angles, and these were barred by wire and enfiladed by machine-guns.

On the left, while the Belgian 4th Div. seized Rille and St. Pieters, the Belgian 1st Div. secured the Château Blanckaert, Hoog Kwartier, while with a gallant rush the 22nd Regt., having conquered at the point of the bayonet many batteries which the gunners fired until the last moment, arrived at the crossroads of Houthulst at 11:00 hours and occupied it.

On the right, the Belgian 7th Div. drove right through the forest and arrived at the end of the day on the eastern boundary, having conquered it entirely with many dozen of cannon and important material.

In the centre group the Belgian 3rd Div. reached without difficulty the heights by the station of Poelkapelle, where they held up some violent counter-attacks which debouched from the S.E. corner of the forest; these attacks were strongly thrown back as far as Schaap-Ballie, which the division occupied at the same time as the 9th Div. arrived at the outskirts of Westroosebeke.

In the southern group the 6th and 12th Divs., held up by the terrible condition of the ground, reached halfway to the crest-line Westroosebeke–Passchendaele and found the enemy occupying in force this strong position. Further bombardments by the artillery and many assaults left the situation unchanged. Toward the end of the afternoon a strong German counter-attack forced itself into line after line of the 6th Div. However, the 8th Div., which had seized Broodseinde, advanced on Moorslede and at 20:00 hours the 4th Carabineers took Passchendaele by assault. To summarize, the nine Belgian divisions of infantry which had been engaged, accomplished under heavy rain an advance of about 8 km. across the most appalling country, bristling with every defensive accessory and abundantly fur-

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nished with machine-guns; they had conquered the famous bastion of the forest of Houthulst and captured over 4,000 prisoners besides considerable material.

As for the British II. and XIX. Army Corps, they had reached all their objectives: Becelaere by the 9th Div., Krviseecke by the 29th Div., Zandvoorde by the 35th Div. Thus on the first day over the whole frontage of the Belgo-British attack there had been greatly exceeded the extreme limits of the victories of the third battle of Ypres (July–Nov. 1917)—that battle of giants wherein 51 divisions of British and 78 divisions of the Germans had disputed the same country foot by foot for four months with a vigour unknown in history.

Action of Sept. 29.—It was of importance that this brilliant success should be followed up with the greatest vigour. The following day the battle recommenced at 06:00 hours after artillery preparation of half an hour. It was intended to force the *Flandern II. Stellung*. In the northern group, after the 1st Div. had secured Clercken and Ternst, the 10th Div. conquered Ruvter Hoeck and Zarren. At 09:00 hours the 4th Div. had taken Woumen and Eessen and proceeded to encircle Dixmude. Toward noon the division proceeded to clear up the town. With the central group, the battle was particularly vigorous: the 3rd Div. occupied in the first place Vyewege and in the afternoon made an assault on Stadenberg, which was secured at 16:45 hours after an obstinate fight.

The 9th Div. threw six attacks against Westroosebeke without gaining a foothold.

In the southern group the 8th Div., followed by the 11th Div. and fighting side by side with the British 9th Div., prepared to attack Moorslede when the latter division was carrying Keiberg.

About 13:00 hours the 8th Div. found itself 500 metres W. of Moorslede. The attack was made at 14:00 and secured the position after a severe fight, and completely forcing the enemy line, advanced the 7th Regt. toward St. Pieter, on the road Menin–Roulers, which was occupied at nightfall. On the left, the 12th Div. was taking the woods of Kalve and Calliemolenhoeck; to the right the British 9th Div. secured Keiberg and penetrated into Danizeele. During the day's action four fresh German divisions were encountered.

Action of Sept. 30.—On Sept. 30 the 3rd Div. occupied Staden; the Belgian 9th Div. entered the evacuated Westroosebeke and occupied the outskirts of Oostnieuwkerke.

The other divisions undertook by certain local engagements to rectify a frontage which was based on the first line of the *Flandern I. Stellung*. This position, established by the Germans in 1917, was strongly held, abundantly furnished with machine-guns and barbed wire, and supported by the artillery disposed on the whole front from Handzaeme to St. Pieter.

The first days of Oct. marked a halt in the operations. Only on the outskirts of Oostnieuwkerke and of Moorslede were there any lively combats. In front of the British the Germans menaced by the salient of Moorslede were withdrawing progressively their front line to the line of Wedlghem–Comines–Warneton, in front of which the troops of Gen. Sir H. Plumer installed themselves at 17:00 hours.

To sum up, the Belgo-British offensive which was delivered on Sept. 28 gave the most highly satisfactory results.

The progress realized had carried the Allied front about 15 km. from their starting point. The whole of the heights of Flanders was conquered. More than 8,000 prisoners, of which 6,000 were taken by the Belgians, were captured. 500 guns, machine-guns and material in proportion were the spoil of the victors. Thirteen German divisions had been engaged.

This rapid advance carried the Allied divisions beyond the zone of country so deeply cut up during the battles of Ypres. It was not possible to continue the advance before having built up across this historic stretch of mud sufficient communications for food and supplies for the troops. The reëstablishment of a network of communications in this country, so completely cut up and full of water, constituted a delicate and most arduous task, which in spite of all efforts ought to have stopped the operations for a considerable time.

The crisis was most acute for two or three days, and certain divisions existed altogether on food supplies thrown from aeroplanes. Thanks to the most vigilant activity the troops found themselves ready to take up the offensive on Oct. 14. The success took them this time to Bruges and Courtrai, and assured the freeing of the coast and evacuation of the region round Lille.

Battle of Courtrai–Thielt–Thourout.—The battle of Sept. 28–29 had put the Belgo-British in possession of the heights of Flanders, and had taken the Allied armies in one bound beyond the country of the Ypres battles. The reëstablishment of communications across this zone absorbed the first days of Oct. On Oct. 6 the King of the Belgians sent out instructions for the continuance of operations.

The intention of King Albert was that, taking as a base of departure the positions conquered at the end of Sept., the Belgian right flank and the British on the left flank should push vigorously toward the last and seize the knot of communications at Thourout, Thielt and Courtrai.

These points conquered, an advance should be made from Thourout in the direction of Bruges, which would inevitably insure the deliverance of Ostend and of all the coast. Proceeding from Courtrai and combining their movements with the British I. Army which was marching on Valenciennes, the British II. Army would undoubtedly cause, probably without fighting, the liberation of the populous and industrial region Lille–Roubaix–Tourcoing. In consequence the Belgian army, reinforced by the French VII. and XXXIV. Corps, would seize the plateau of Hooglede–Gits and the centres of Thourout, Thielt and Oostroosebeke, and then be prepared to follow the enemy towards Bruges and Ghent. The British II. Army would carry on the front on the Lys from Harlebeke to Menin. It would proceed to follow the enemy as far as the Scheldt. The II. Cavalry Corps and two divisions of French infantry would remain under the immediate orders of the King as a mobile reserve.

From Oct. 7 the corps commanders had caused the necessary cannonade to effect breaches in the wire entanglements and for the destruction of the most important enemy defences. On Oct. 14 the general attack was launched at 05:30 hours without any further artillery preparation.

The German order of battle was as follows from N. to S.:—38 Div. L.; 3 Div. R.; 36 Div. R.; Div. Guards Reserve; 1 Div. R.B.; 6 Div. R. B.; 11 Div. R.; 56 Div.; 12 Div. These divisions had all their three regiments side by side and in each regiment two battalions were placed in the first line. They were on the alert, and the three battalions occupied their battle positions.

However, the first lines of the enemy were quickly captured. The German defence was chiefly based on the employment of machine-guns. The Allied smoke-shells created a dense cloud which in the majority of cases prevented the enemy from making effective use of his weapons. The reply of the German guns was very serious, and very many heavy pieces on rails were employed. In the course of the day, six support divisions were brought into the line: they were used less for counter-attacking than to strengthen the front where broken.

In the evening the northern Belgian group had conquered Handzaeme as well as Cortemarck: the French, assisted by many sections of tanks, had secured Hooglede and Roulers.

The southern Belgian group, led by the valiant 3rd Div., had completely defeated the Guards Reserve Div. and the Bavarian 1st Reserve Div.: they had taken Rumbeke, Ouckene, pushed almost to the gates of Iseghem and captured 1,300 prisoners and many batteries, of which some had both teams and personnel.

Further S., the British forces had thrown back the enemy on the Lys in the neighbourhood of Menin, and had taken Wynberg, the western outskirts of Gulleghem and Wimkel St. Eloi. 20 enemy aeroplanes had been brought down.

On Oct. 15, while the Belgians in the N. gained ground to within 2 km. of Thourout and the British in the S. captured Gulleghem and then Heule, the indefatigable 3rd Div. (Belgian) passed through Lemdelede at 11:00 hours and Cappelle Ste. Catherine, and the 9th Regt. of the line pushed on irresistibly almost to Bavichove near the Lys.

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On Oct. 16, after half an hour of artillery preparation, the attack recommenced on the whole front. The northern Belgian group captured the wood of Wymedaele and of Thourout, the French pushing on beyond Lichtervelde and Ardoye; the southern Belgian group occupied Iseghem and Ingelmonster, the 3rd Div. touching the canal at Roulers and the Lys at Oyghem and Bavichove. Thus were gathered the fruits of victory. The enemy front, everywhere completely shaken, beat a retreat. The German Marine Divs. evacuated the coast sector which they had guarded for four years.

Explosions and fires announced that the enemy was destroying his installations and his depots at Middlekerke, Smaeskerke, at Ostend and Guistelles. In the evening the coast-guns, levelled for so many months toward the sea, fired in haste some rounds at the Belgian bivouacs before being rendered useless.

On Oct. 18, in the evening, the Belgian front reached Zeebrugge and Bruges. The British bordered all the Lys from Menin to Harkebeke and penetrated into Courtrai.

On Oct. 20 the Germans were thrown back on the canal of the Lys behind which they momentarily held a position from Eccloo to Deynze. The British II. Army crossed the Lys at Courtrai, occupied on the right Rolleghem and Leers, and made certain the evacuation of Roubaix, while the left was pushed toward Anseghem. By Oct. 31 the British had reached the Scheldt from Kerkhove to Pecq, joining the British V. Army.

The battle of Thourout–Thielt–Courtrai was finished. Under protection of their rear-guards the broken German front turned itself to the E., followed by the Allies as quickly as the restoration of the network of roads permitted.

From Oct. 14 to 31 the group of the armies of Flanders had taken 19,000 prisoners and advanced 50 km. It had gloriously achieved the double mission entrusted to it by King Albert: the region of Lille was entered and set free; the coast and an important portion of Belgian territory had been reconquered.

Belgians, British and French had rivalled each other in their ardour and bravery. The submarine base of Bruges, the famous batteries of Tirpitz, Hindenburg and Deutschland, and more than 100 coast-defence guns of very great calibre remained as trophies taken from the enemy,—marking the downfall of the ambitions of the Germans. (R. VAN O.)

YUAN SHIH-K'AI (1859–1916), Chinese statesman, born 1859, first attained distinction in Korea, when, as Imperial resident and the trusted lieutenant of the Viceroy Li Hung-Chang, he strove to preserve China's suzerainty over the Hermit Kingdom in the years of strife which preceded the war between China and Japan (1894). After that disastrous campaign he held office under the Viceroy Li in Chihli; in 1898 he was in command of an army corps and played a decisive part in frustrating the Emperor's plan of constitutional reform and in supporting the Empress Dowager's reactionary *coup d'etat*. After her return to power he rose rapidly; during the Boxer rebellion, as governor of Shantung, he displayed sagacious foresight in the protection of foreigners, and upon the death of Li Hung-Chang succeeded his chief as Viceroy of Chihli. At the time of the death of the Empress Dowager (1908) he was a Grand Councillor and her most trusted adviser; but upon the accession to power of Prince Chun as regent he was dismissed from office (in retribution for his failure to support the Emperor in 1898) and ordered to return to his native place in Honan (Jan. 2 1909). He remained there, in disgrace, until the outbreak of the revolution in 1911, when the regent and the court, alarmed at the rapid spread of the movement, turned to him for help. By an edict of Oct. 14 he was appointed Viceroy of Hunan and Hupeh and commander-in-chief of the Imperial forces. As military dictator he took the field a fortnight later against the revolutionary army at Hankow. Thereafter, until his death (June 1916) the Government of China, such as it was, lay in his hands. After the abdication of the Manchu Dynasty, which he had done his best to uphold, he accepted the Presidency of the Republic and took the oath of office in March 1912; but he did so with mental reservations which were obvious to those who had followed his career and observed his policy. As President he displayed statesmanship of a high order under conditions of exceptional difficulty. Judged by European standards, his methods were often indefensible, but until he aspired to found a new dynasty in his own person (1915) their ruthlessness and venal expediency were generally accepted by the nation without indignation, and regarded as consistent with time-honoured traditions of rulership. All his efforts of statecraft were steadily directed towards restoring the authority of the central Government, shattered by the revolution, and with it, the principles and practice of benevolent despotism. His monarchical plans were skilfully laid and would probably have succeeded if he had had to deal only with his own people; they failed, and he died a broken and humiliated man, because he had not allowed for the probability of intervention by the Japanese Government. His enthronement as Emperor had been fixed by proclamation for Feb. 9 1916; before that date the Yünnan rebellion had vindicated the " advice " of the Japanese minister at Peking, and the end of his career was in sight. But he declined to resign the Presidency, and died, as he had lived, in harness.

YUDENICH, NIKOLAI (1862–), Russian general, was born in 1862 and entered the army in 1881. Passing out of the General Staff College in 1887, he spent the rest of his military service on the general staff and specially in Turkestan, till in 1902 he became a regimental commander. In the Russo-Japanese War of 1904–5, in which he was wounded, he had the reputation of a valiant and careful chief. He became a general and commander of a rifle brigade in 1905, assistant chief-of-staff of the Caucasian military district in 1907, and chief of the same staff in 1913. Having carefully studied the Caucasus and its army, he was quite prepared for the conduct of operations on this front, and at the beginning of the World War he rendered great services in the crisis and victory of Sarikamish as commander of the II. Turkestan Corps. Soon afterwards he was put in command of all the military forces of the Caucasus, which he held during the operations of 1915 until the arrival of the Grand Duke Nicolai. He continued to serve on this front under the new governor-general and played a leading part in the operations which led to the fall of Erzerum on Feb. 16 1916. In the summer campaign further progress was made, and Baiburt and Erzinjan were taken. Later, when the advance had outrun the organization of the rear, the situation was saved by his prompt manœuvres.

In March 1917, on the departure of the Grand Duke, Gen. Yudenich again undertook the command of the Caucasian armies, but here, as elsewhere, further advance was paralysed by the increasing disorganization of the Russian army. In the course of the civil wars Gen. Yudenich in 1920 carried out a campaign from the Baltic provinces against Petrograd, but unsuccessfully.

YUGOSLAVIA, or JUGOSLAVIA.—The " Kingdom of the Serbs, Croats and Slovenes " (*Kraljevina Srba Hrvata i Slovenaca*), more commonly known as Yugoslavia, came into being in the closing months of 1918 as a result of the collapse of Austria-Hungary and the voluntary union of its Yugoslav territories with the former Kingdoms of Serbia and Montenegro. In point of international law, its existence may be said to date from Dec. 1 1918, when the Prince-Regent Alexander of Serbia formally complied with the invitation of the Yugoslav National Council to assume the regency over the sister provinces also. That the Great Powers were so long in according official recognition to the new state was due to purely political reasons connected with the Adriatic dispute.

Yugoslavia consists of the former independent Kingdoms of Serbia and Montenegro; the triune Kingdom of Croatia–Slavonia–Dalmatia (of which the first two enjoyed special autonomy under the Kingdom of Hungary, and sent 40 delegates from their own Parliament in Zagreb to that of Budapest, while the third was one of the 17 provinces of the Austrian Empire, with a local diet at Zara); parts of the Banat, Bačka and Baranja (which were integral portions of Hungary proper); Slovenia (consisting of portions of Carniola, Carinthia, Styria and Istria, each holding a position in Austria analogous to Dalmatia); and Bosnia-Herzegovina (which was from 1878 to 1918 under the joint administration of Austria and Hungary and had its own diet since 1910). Fiume, which from 1867 to 1918 had been an

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autonomous unit under Hungary, has by the Treaty of Rapallo been constituted as an independent State. Italy has acquired almost all the Slovene and Croat districts of Gorizia and Istria.

A census of the new State was taken in the spring of 1921, the total pop. being 12,162,900.

Early Tendencies Toward Unity.—The Yugoslav movement was by no means a recent one, as is often assumed. Despite the different traditions of culture due to the rival ecclesiastical influence of Rome and Byzantium, a sense of kinship had survived throughout centuries of separation, and was strengthened by continual migration. The two most notable cases were the formation of the Uskok pirate settlements along the Dalmatian coast in the 16th century, and the settlement of the Serbian patriarch and many thousand Serb refugee families in Slavonia and S. Hungary, at the invitation of the Emperor Leopold I. in 1690. Ivan Gundulić and the brilliant group of poets that gathered round him at Ragusa in the early 17th century, reflected in their writings the little Slav Republic's intimate connexion with its kinsmen of Serbia and Bosnia. The first advocate of the Pan-Slav idea in Russia itself was Križanić, a Croat Catholic priest from Dalmatia, and early writers in favour of Slavonic racial and literary unity were the Slovene schoolmaster Bohoricz (1584) and the Dalmatian Croat Orbini, who wrote in Italian (*Il regno degli Slavi* 1601). The Franciscan friar Kačić, who did so much for the revival of popular poetry in Bosnia and Dalmatia in the mid-18th century, shows similar traces of Serbophil feeling, and the achievements of Dušan and other Serbian Tsars have bulked almost as largely in the modern literature of the Croats as of the Serbs themselves.

The first active impulse toward political unity was given by Napoleon, when after Wagram he erected the Slovene districts and most of Croatia and Dalmatia into a separate Illyrian State, incorporated in the French Empire, but having its administrative capital at Laibach. This short-lived experiment, which inspired the muse of Vodnik, the first Slovene poet of real mark, had its aftermath in the Illyrian movement of the forties, which centred in Zagreb, the Croatian capital. Its real motive force was supplied by Ljudevit Gaj, who combined to a remarkable degree the qualities of author, philologist and political agitator. His two newspapers, the *Illyrian National Gazette* and the *Danica Ilirska* (*Illyrian Daystar*) provided a literary focus for the rising generation; while his reform of Croat orthography, planned on parallel lines with Vuk Karadžić's epoch-making philological work in Serbia, assured to modern Serbo-Croat literature a definitely unitary development. The fact that linguistically Serb and Croat had thus become interchangeable terms, only to be distinguished by the respective use of the Cyrillic and Latin alphabets, inevitably reacted upon the political situation, and served as an incentive to the movement for unity. In somewhat sensational and affected but prophetic words Gaj compared Illyria to a lyre, "a triangle between Skutari, Varna and Villach. Its strained and inharmonious chords are Carinthia, Gorizia, Istria, Croatia, Slavonia, Dalmatia, Ragusa, Bosnia, Montenegro, Herzegovina, Serbia, Bulgaria and Lower Hungary," and "on the great lyre of Europe they must harmonize once more." He saw in the Magyars the chief obstacle to the realization of his dream, and openly warned them that they were "an island in the Slav ocean," which one day might easily engulf them. The alienation of Croat and Magyar—for centuries close allies in the struggle against the Turk—grew rapidly in the 'forties, mainly owing to the aggressive legislation passed by successive Hungarian diets,

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and tending to curtail Croatia's ancient liberties and extend the sway of the Magyar language. It was a fertile soil for Gaj's agitation, and in 1848 the Croatian nation found in Baron Jelačić a military leader who voiced the Illyrian idea and hoped to realize it in union with the Habsburg Dynasty and the other subject nationalities of Hungary. It is highly significant that Jelačić as Ban of Croatia went hand in hand with the newly elected Serb-patriarch Rajačić: that Croats and Serbs, including many volunteers from the principality of Serbia, fought side by side against Hungary, and that the poet-prince-bishop Peter II. of Montenegro wrote to Jelačić, expressing his solidarity with the movement.

Croatia after 1848.—After the collapse of the Hungarian revolution in 1849, the Croats, in the words of Pulszky, received as reward the same absolutist *régime* which had been imposed upon the Magyars as punishment. Jelačić and Gaj died as disappointed men, and the very general resentment aroused by the ingratitude of Francis Joseph vented itself also against the name of Illyria, which rapidly disappeared from the political arena. But its place was taken more and more by Yugoslavia, which, it should be remarked, was then still used to denote all the territories inhabited by any southern Slav tribe, and so to include the Bulgars no less than the Serbo-Croats and Slovenes. On the intellectual side the new movement found its champion and its Maecenas in Bishop Strassmayer, who for over 50 years devoted the surplus revenues of the wealthy see of Dya Kovo (Djakovo) to national purposes, and was mainly instrumental in founding at Zagreb the southern Slav Academy (1867), the first Croat university (1874) and a modern gallery and school of arts. Historical research and literary criticism flourished under Rački, the first president of the Academy, and his pupils: while Strassmayer did much to revive the Glagolitic, or ancient Slavonic liturgy, and to win for it the favour of Pope Leo XIII. Close relations linked the great Bishop with Prince Michael, Serbia's ablest modern ruler, and with Prince Danilo of Montenegro who assured Michael, "Form the Kingdom of Serbia, and I will mount guard before your palace."

The Dual System.—In the late 'sixties the Yugoslav idea met with a serious set-back. Prussia's victory forced Austria to come to terms with the Magyars: and the bargain was sealed by the *Ausgleich*, or Dual System, at the expense of the lesser nationalities. Within certain limits Croatia's autonomy was respected, but so far from Zagreb being consulted, the terms of the new settlement were in effect dictated from Budapest and only submitted *pro forma* to a carefully "packed" Croatian Diet, after the bargain between Budapest and Vienna had already made of them an accomplished fact. Meanwhile the murder of Prince Michael in the same year deprived Serbia of a great statesman and the movement for unity of a possible head. During the 'seventies Austro-Hungarian policy was increasingly successful in checking intercourse between the Yugoslavs of the monarchy and those outside its bounds. Meanwhile the newly constituted "Party of Right," resting upon a narrow Catholic clerical basis, aimed at the reunion of Dalmatia with Croatia-Slavonia in the so-called Triune Kingdom, within whose bounds it affected to deny the very existence of Serbs. This Pan-Croat ideal was favoured in Vienna as a convenient rival to Pan-Serbism with its centre in Belgrade; but its natural effect was to drive the Serbs of Slavonia and S. Hungary into the arms of Budapest. The insurrection of Bosnia against the Turks only served to increase party discords: for though it aroused the keenest sympathy of all Serbs and Croats, and thus furthered the sense of racial affinity, it gave rise to rival claims upon Bosnia which could be exploited in the interest of Vienna and Budapest. The official policy of Baron Kállay, for 20 years the administrator of Bosnia, was to taboo the name of Serb in the hope of creating a distinct "Bosnian" nationality.

The period between 1883 and 1903 is the most humiliating in the modern history of the southern Slavs. Count Khuen-Hedérváry, as Ban of Croatia, reduced political corruption to a fine art and governed by playing off Croat and Serb against each other, and fanning the dying flames of religious bigotry: while at the same time Serbia under King Milan was reduced to the position of a mere satellite of Vienna. The humiliating secret treaty concluded between Austria-Hungary and Serbia in 1881 had specially pledged the latter to repress any nationalist agitation against the Dual Monarchy, even in respect of that Bosnia for which Serbia had risked her existence four years earlier. Disunion had reduced the Yugoslavs to an almost negligible quantity in Balkan politics.

The National Revival in Croatia.—After the turn of the century, however, a new generation arose both among Croats and Serbs, which had received its education abroad, and especially in Prague, where the ethical and political teachings of Prof. Masaryk exercised a remarkable influence over the progressive youth of all Slav countries. All thinking men were increasingly conscious that no progress was possible until Croat and Serb presented an united front against German-Magyar predominance. The first signs of reviving solidarity came in 1903, when Khuen's rigorous suppression of rioting in Zagreb and several country districts of Croatia, led to demonstrations of protest throughout Dalmatia and Istria. Thirty Croat deputies of those provinces resolved to lay their kinsmen's grievances before the Emperor, and his refusal of an audience played a material part in alienating Croat sympathies from the Crown. It is not uninstructive to note that as the same year 1868 witnessed a setback in both Croatia and Serbia, so the same year 1903 marks a parallel revival in national consciousness in both countries, coincident with the fall of Khuen-Hedérváry and the removal of the Obrenović dynasty. Abroad the new King's position was prejudiced by the hideous crime which led to his accession, but among his own people this was from the first atoned for by the introduction of a real constitutional *régime* and increased political stability. The Serbian court, instead of being a centre of perpetual scandal and misrule, resumed its true position as a focus of national aspirations, and this change was not lost upon the Yugoslavs of "the other side."

Resolution of Fiume.—The advocates of political coöperation between Serb and Croat saw their opportunity in the constitutional conflict which broke out between Crown and Parliament in Hungary: and on Oct. 4 1905 40 Croat deputies from Croatia, Dalmatia and Istria formulated in the so-called "Resolution of Fiume" a complete programme of political reform, and defined the basis upon which solid friendship between Croats and Magyars seemed attainable. The prime movers in this action were Dr. Trumbić, a leading Dalmatian advocate and mayor of Spalato, and Mr. Supilo, also a Dalmatian, the editor of the *Novi List* at Fiume. Ten days later 26 Serb deputies from the various provinces of the monarchy, met at Zara, indorsed the principles embodied in the Resolution of Fiume and declared in favour of joint political action between Croats and Serbs. It is worthy of note that the Resolution of Fiume anticipated the modern doctrine of self-determination by the very explicit assertion that "every nation has the right to decide freely and independently concerning its existence and its fate." On Nov. 14 the Croat and Serb parties in the Diet of Dalmatia publicly affirmed the principle that "the Croats and Serbs are one nation": and this standpoint has never since been abandoned. The Serbo-Croat coalition, formed on the basis of the Fiume Resolution, at once acquired the mastery in Croatia, and even when its short-lived alliance with the Hungarian coalition—in power in Hungary since April 1906—was replaced by acute conflict in the summer of 1907, no amount of repression from Budapest could destroy its solid majority in the Croatian diet. Baron Paul Rauch, the Magyar nominee as Ban, failed, with all his official apparatus, to secure a single seat for his creatures at the general election of 1908, and therefore proceeded to govern without Parliament, by an elaborate system of administrative pressure, press persecution and espionage. Under his *régime* Magyar intolerance of Croat national aspirations joined hands with the designs of the Ballplatz against Serbia in connexion with the impending annexation of Bosnia.

Friedjung Trial.—The treason trial which opened at Zagreb in March 1909 pursued the parallel aims of intimidating the

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Serbs of Croatia, of splitting the new-found unity of Serb and Croat and of proving to the outside world the existence of a dangerous Pan-Serb movement organized from Belgrade inside the monarchy and amply justifying the countermove of annexation. None of these aims were attained; for the trial, which turned on the evidence of the police spy Nastić (already chief witness in the doubtful Cettinje bomb trial of 1908) degenerated into a public scandal, owing to the conduct of the judges and public prosecutor, and rallied Croat public opinion in defence of the 53 Serb victims. Serbo-Croat solidarity became still more apparent when the Austrian historian Dr. Friedjung, in the *Neue Freie Presse* of March 25 1909, openly charged the leaders of the Serbo-Croat coalition with being in the pay of Serbia. This article, which was based upon a mass of incriminating documents supplied to Friedjung by the Austro-Hungarian Foreign Office, had been timed to coincide with the outbreak of hostilities against Serbia, and was to have been the first of a series convicting the Serbian Government and dynasty of aggressive and even murderous designs. When at the last moment war was averted by the surrender of Serbia and Russia, an attempt was made to withdraw the article, but the first copies had already been issued: and Count Aehrenthal now had the double embarrassment of the Zagreb trial, which no longer served any purpose of foreign policy, but suited the aggressive game of Budapest against Zagreb, and of a libel action brought against Friedjung by those leaders of the Serbo-Croat coalition whose honour he had impugned. Despite the Ballplatz's efforts at postponement, the trial took place in Vienna in Dec. 1909, and revealed the documents upon which Friedjung had relied, as impudent forgeries concocted by subordinate officials of the Austro-Hungarian legation in Belgrade, with the connivance of the minister, Count Forgács. The responsibility was finally brought home to Forgács by Prof. Masaryk in a famous speech before the Austrian delegation: and Aehrenthal preserved an embarrassed silence when his minister was bluntly compared with Azev, the Russian *agent provocateur*.

The Cuvaj Dictatorship.—The triumphant vindication of Mr. Supilo and his colleagues of the Serbo-Croat coalition gave a fresh incentive to the idea of unity throughout the southern Slav provinces of Austria-Hungary. Rauch's position had become untenable, and he was succeeded by the more moderate Dr. Tomašić, who brought with him from Budapest the concession of a somewhat extended franchise (260,000 instead of 50,000 electors). His attempt to emancipate himself from the control of the coalition at the general elections of Oct. 1910 failed miserably, and after a year of temporizing, he suddenly threw off all pretence at legal forms, dissolved the Diet almost before it had met, and in Dec. 1911 ordered new elections. But in spite of wholesale terrorism he only succeeded in wrenching five more seats from the coalition, and on Jan. 19 1912 was replaced as Ban by a little known official Mr. Cuvaj, who promptly dissolved the Diet before it had even met, and proceeded to muzzle the press, to close the university and to arrest several prominent politicians. On April 3 the Croatian constitution was completely suspended by royal decree, and Cuvaj invested with far-reaching dictatorial powers. An attempt on his life by the student Jukić (June 8) was followed by still more reactionary measures, and on July 11 the autonomy of the Serbian orthodox church in Slavonia and Hungary was also suspended.

The Cuvaj *régime* had a magical effect in furthering the movement for Yugoslav unity. Specially significant were the Memorandum addressed to the throne by 55 deputies of the Croat party of Right, in the Croatian, Bosnian, Dalmatian and Istrian Diets, and the political strike organized by the pupils of both sexes in almost all the middle schools of the Slavonic South. This gave rise to sympathetic demonstrations in many Dalmatian and Bosnian towns, and to a series of interpellations and speeches by the Yugoslav and Czech deputies in the Parliament of Vienna. The Slovenes—clericals no less than progressives—became increasingly active in the Yugoslav movement, and their press began to demand the abandonment of the distinctive Slovene dialect as a hindrance to unity.

Balkan War.—It was peculiarly unfortunate for Austria-Hungary that the Cuvaj *régime* should have been at its very height when the Balkan League achieved its dramatic victory over the Turks. The battle of Kumanovo in particular was greeted with indescribable enthusiasm throughout the Yugoslav provinces. The Serbian and Bulgarian anthems were sung on the streets, collections were made in every village for the Balkan Red Cross funds, and when Austria-Hungary mobilized, protests were heard on every side against the bare possibility of war with Serbia, which to the Yugoslavs would be a veritable civil war. The Austrian Government committed the grave blunder of answering these demonstrations by press confiscations and by the dissolution of the town councils of Spalato and Sebenico. This, however, was promptly countered by a monster meeting of protest at Zara on Nov. 24, attended by all but three of the Serbo-Croat deputies of Dalmatia, and delegates of almost every municipality in the province. Doctor Drinković, leader of the Dalmatian clericals, openly declared that "in the Balkan sun we see the dawn of our day!" and the Catholic Bishop of Cattaro greeted the news from Monastir by reciting the *Nunc Dimittis*. On all sides Serbia was now regarded as the southern Slav Piedmont: and the Dual Monarchy's consistently hostile policy toward Belgrade, and its only too successful efforts to set Serbia and Bulgaria by the ears, intensified the excitement and resentment among its Yugoslav subjects. The Trialist solution (which would have united the Yugoslav provinces of Austria-Hungary in a third state enjoying equality with the two existing partners) rapidly lost popularity, even among the clerical parties, which had been attracted by the prospect of Catholic predominance in such a State.

On Dec. 27 1912 Cuvaj was replaced by a colourless official, Dr. Unkelhäusser, who marked time until a fresh candidate for the post of commissary or dictator was forthcoming in the person of Baron Skerlecz (July 23 1913). This appointment, at a moment when Austria-Hungary was again contemplating war with Serbia, naturally increased the ferment, and on Aug. 18, a determined attempt was made upon the life of Skerlecz by a young American Croat. At length on Nov. 30 Skerlecz was made Ban, the illegal decrees of Cuvaj revoked, and general elections ordered—the fifth since 1906. The coalition maintained its majority, the Government only obtaining ten seats: but though this time the Diet was allowed to meet, no attempt was made to satisfy Yugoslav aspirations or to solve the real issues at stake between Hungary and Croatia. More and more the situation in the south of the monarchy was allowed to drift. The political leaders were far more conscious than either Vienna or Budapest of the volcanic state of public opinion: but when in genuine alarm and from a sense of impotence they attempted to restrain their followers, the only result was a loss of influence over the younger generation, which had become increasingly infected by revolutionary ideas. Among the Yugoslavs the students had always dabbled unduly in politics, and this tendency was accentuated by the widespread unrest and excitement which followed upon the Balkan upheaval. On the eve of war the university and middle-school students had five or six newspaper organs of their own—notably *Jugoslavija* in Prague, *Val* in Zagreb and *Jedinstvo* in Spalato—which advocated more radical action alike in politics and literature. Nor is it surprising that the hotheads among them, fired by the example of Jukić and other would-be assassins of Varešanin, Cuvaj and Skerlecz, should have indulged in terrorist projects. From this group came the young Bosnian Serb students Princip, Čabrinović, Grabež and others, who murdered the Archduke Francis Ferdinand and the Duchess of Hohenberg at Sarajevo on June 28 1914, and thus lit a spark in the European powder magazine.

The World War.—Immediately on the outbreak of the World War measures of extreme severity were taken by the civil and military authorities of Austria-Hungary throughout their Yugoslav provinces. The exact number of persons arrested or interned will probably never be known, but that the Yugoslavs were regarded, and treated, as a hostile population, is abundantly proved by the three following facts, which could be mul-

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tiplied indefinitely. Doctor Tresić-Pavičić, the Dalmatian-Croat deputy, was informed by one of the judges who examined him that over 5,000 had been imprisoned in Dalmatia, Istria and Carniola. In the single internment camp of Arad there were 3,400 deaths among the victims from Bosnia alone; and Father Nikolić, a Catholic priest from Istria, testified to having himself buried over 2,000 Istrian victims, and Doctor Martinović to a knowledge of 8,000 fatal cases in the Styrian camps. In Dalmatia the leading deputies (*e.g.* Smodlaka, Čingrija, Tresić, Drinković) and many priests, advocates, doctors and other intellectuals were arrested, some being used as hostages and forced to accompany railway patrols, under the threat of instant death in case of sabotage by the population. All the municipal councils in Dalmatia (with the solitary exception of Zara, which had an Italian majority) were dissolved at an early stage in the war. Among the Slovenes of Istria and Carniola there were also numerous arrests, and the *Matica Slovenska*, the chief Slovene literary society, was dissolved and its funds confiscated. Press censorship was of course very rigid throughout the Dual Monarchy, but many Yugoslav newspapers were suppressed altogether. It was perhaps natural that repression should be specially severe in Bosnia. There were wholesale internments, conducted with the utmost brutality: and the horrors of the camps of Doboj, Mostar, Arad, Thalerhof, Möllersdorf, Gmünd, were early in 1918 revealed by Doctor Tresić in the Austrian Reichsrat. After the Archduke's murder the headquarters of various Serbian institutions in Sarajevo had been sacked by mobs, with the open connivance of the police: after the outbreak of war practically all Serb societies and schools were closed in Bosnia. At a later stage the Orthodox calendar and the Cyrilline alphabet were prohibited, and this was actually enforced in Serbia itself during the Austrian occupation, and in the Serbian districts of Hungary from July 1916 onward. Bosnia was also the scene of a succession of monster political trials. In March 1915, 28 schoolboys of Banjaluka were sentenced to terms varying from two years to four months for founding a local Yugoslav society. In July 65 schoolboys from Sarajevo and Travnik received similar sentences, and again in Oct. 38 more boys from Tuzla were condemned to a total of 156 years. In Nov. 1915 at Banjaluka 151 prominent Bosnian Serbs—including 5 deputies and 20 orthodox priests—were put on trial for treason: and eventually 16 death sentences were passed, and terms of imprisonment totalling 858 years and a collective fine of 14 million crowns, were passed. Worse even than this was the system of wholesale expatriation adopted as a punishment for those who had shown a friendly attitude to the invading Serbian army. During the spring of 1915 the official organ at Sarajevo published list after list of Bosnian-Serb families who were thus declared to have forfeited their citizenship: and many thousands of women and children were driven across the Montenegrin frontier, often with only the clothes in which they stood. The motive was avowedly the same which in the Middle Ages led a mediæval garrison to drive the civil population of a town into the camp of its would-be deliverers. With every year of war the number of confiscations of property increased in the Yugoslav provinces, as in Bohemia and Transylvania—vengeance upon the families at home being widely used in order to deter Slav, Italian or Rumanian prisoners from enlisting in the various volunteer corps in process of formation on the Russian, Balkan and Italian fronts. In Croatia alone was there even a semblance of constitutional government. The diet of Zagreb was allowed to meet, and the Serbo-Croat coalition pursued a policy of pure opportunism, avoiding any pronouncement on matters of high policy, but buying a certain relaxation of *régime* in Croatia by supporting the Budapest Government and its nominee Skerlecz. But even this subservient and cautious House sometimes asserted itself: and on one occasion its vice-president Doctor Magdić proclaimed "the nation's constant desire for unification in a single and independent political body."

Yugoslav Propaganda Abroad.—Meanwhile a certain number of Yugoslav leaders had managed to reach foreign soil before the outbreak of war, and during the winter of 1914 constituted themselves as the Yugoslav Committee. Its two foremost leaders were Doctor Trumbić and Mr. Supilo (two of the makers of the Resolution of Fiume) and it also included Doctor Hinković (known as the chief advocate in the Zagreb treason trial), Ivan Meštrović the sculptor, the Slovene deputies Gregorin and Trinajstić, the Bosnian Serb deputies Stojanović, Srškić and Vasiljević, publicists of repute such as Marjanović and Banjanin, and prominent representatives of the Yugoslav colonies in North and South America, such as the scientist Pupin and the shipping magnate Baburica. Their original centre was Rome, but in view of the hostile attitude of the Salandra-Sonnino Government they transferred their activities to Paris and London early in 1915. They were in close and cordial contact with the Serbian Government, but rightly insisted on retaining entire independence of action, their funds being derived from their wealthy S. American supporters, who had long been enthusiasts for the Yugoslav idea. Their first public pronouncement was an appeal to the British Parliament and nation (May 1915) for sympathy with the cause of Yugoslav unity and the dissolution of Austria-Hungary. This formed a natural complement to the unanimous declaration of the Serbian Skupština in Dec. 1914 for a union of Serbs, Croats and Slovenes in one State.

Secret Treaty of London.—The entry of Italy into the war was a serious set-back to the Yugoslav cause, for under the Treaty of London (April 27 1915) she was to obtain, in the event of an Entente victory, wide districts in Gorizia, Carniola, Istria and Dalmatia, peopled by not less than 700,000 Yugoslavs. The frontier was to follow the watershed of the Julian Alps from Tarvis as far east as the Snježnik (Schneeberg) and to reach the sea just east of Volosca, Fiume being expressly reserved to Croatia. To Italy was assigned the northern half of the Dalmatian mainland as far as Cape Planka, and all the islands save Krk (Veglia) and Rab (Arbe) in the N., Solta and Brazza in front of Spalato, and the few which lie to the south of Meleda. The jealously guarded secret was discovered by Mr. Supilo in Petrograd within a few days of the signature of the treaty, and the main facts becoming known in Austria-Hungary, were skilfully exploited by her to rally the Croats and Slovenes in defence of their national territory. It was easy to represent the Entente as having betrayed the interests of Serbia and her kinsmen: and as for a time the Pašić Cabinet, in deference to the narrowly Orthodox influences then all powerful at Petrograd, was prepared to limit its claims to the mainly Serb and Orthodox provinces of Bosnia and Slavonia, and to leave the Catholic Croats and Slovenes to their fate, there was during the summer a certain revulsion of feeling in favour of Austria-Hungary, who appointed a Serb Orthodox frontiersman (Graničar), General Boroević, to the chief command on the Isonzo front. The conquest of Serbia, however, once more closed the ranks of the Yugoslavs, who saw in unity their sole hope for the future: and the desertions to the Entente which were so marked a feature of the first winter, became so rife as to render necessary a drastic revision of the Austro-Hungarian regimental system. Henceforth the various corps lost more and more their territorial character, one nationality was set to watch and control the other, and espionage and delation prevailed.

The Yugoslav Legions.—During the winter of 1915 delegates of the Yugoslav Committee, with the Tsar's special permission, began enrolling volunteers from among the prisoners on the Russian front; and by March 1916 a division of 23,000 men had been concentrated at Odessa, and a second was formed later. Serbian officers under General Živković were sent out, and many officers of the future Czechoslovak legions first saw service in this corps. The Yugoslavs greatly distinguished themselves during the Dobruja campaign (Nov. 1916), and their wounded shot themselves or each other on the battle-field, rather than fall as traitors or deserters into the hands of Austria. It was with this corps that Dr. Elsie Inglis and a detachment of the Scottish Women's Hospitals served as medical unit. After the Russian collapse most of the survivors were gradually drafted through Murmansk, England and France to the Salonika front: one brigade was cut off by the Bolshevik Revolution and had to be

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evacuated through Siberia. In 1916 the Yugoslav Committee had also set itself to recruiting among its compatriots in America, but in this case its success was hampered by many cross currents of republican, clerical, Austrian and Montenegrin feeling: and those who did actually volunteer showed considerable lack of discipline and were not always treated with the necessary tact by the Serbian military authorities.

The Yugoslavs inside Austria-Hungary.—The accession of the Emperor Charles, and the ferment aroused by the Russian Revolution, led to considerable political changes in both halves of the Dual Monarchy, the most notable being the dismissal of Count Tisza from the Hungarian premiership (May 23 1917), the grant of a general political amnesty, and the summons of the Austrian Reichsrat, which had not been allowed to meet since March 1914. No sooner was political life thus resumed than all the Slovene, Croat and Serb deputies of Austria united to form a "Yugoslav parliamentary Club," which entered into close alliance with the Czech Club. At the opening sitting (May 30) Czechs, Poles and Ruthenes defined their national attitude in formal resolutions, and the Slovene leader, Father Korošec, in the name of the Yugoslavs, demanded "the union of all the Yugoslav territories of the Monarchy in an independent state organism, free from the rule of any foreign nation, and resting on a democratic basis, under the sceptre of the Habsburg-Lorraine Dynasty." The last phrase was treated in some quarters as a proof of confirmed Austrophilism: in reality it was a minimum concession to the existing order, without which its framers could not have continued their activity. By this time it was sufficiently obvious that the Yugoslavs were tacitly if not explicitly agreed upon a triple parallel policy, framed for all contingencies. In Croatia the coalition was more opportunist than ever, and sent its delegates to the coronation of Charles as King of Hungary: by its compliance it obtained the appointment of its own nominee, Mr. Mihalović, as Ban, and was thus able to husband Croatian resources and on occasion to practise passive resistance. It accepted the *status quo* as a working basis, but no amount of pressure could wring from it a disavowal of Trumbić and his colleagues. Meanwhile the opposition parties openly allied themselves with the Yugoslav Club in Austria, which agitated for complete national unity, but saved itself from prosecution by occasional references to the dynasty and absolute silence regarding Serbia. It was left to the Yugoslav Committee abroad to claim independence as well as unity, to repudiate the Habsburgs (in a manifesto on the eve of the Budapest coronation) and to exalt the achievements of Serbia and the Karagjorgjević dynasty. The three groups communicated secretly through Switzerland, and it was felt that the time had come for the exiles to take a fresh step forward, in view of the prominence given to the doctrine of self-determination since the Russian Revolution and America's entry into the war. Moreover the collapse of Tsarism had deprived Mr. Pašić of his strongest support abroad, and forced him to abandon his narrowly Orthodox basis and bring his policy more into line with modern democratic tendencies.

Declaration of Corfu.—After some weeks of negotiation the so-called "Declaration of Corfu" was signed on July 20 1917, between Pašić as Serbian Premier (and in this case as the mouthpiece of all the Serbian parties) and Dr. Trumbić as president of the Yugoslav Committee. The signatories were careful to disclaim all idea of a pact or treaty, and to define the declaration as a mere statement of ideals and principles which could not acquire binding force until ratified by elected representatives of the nation as a whole. It may however be regarded as the birth certificate of the future Yugoslavia, and as fixing the lines of future development. After affirming that the Serbs, Croats and Slovenes constitute a single nation and appealing to the right of self-determination, it declared in favour of complete national unity under the Karagjorgjević dynasty, "a constitutional democratic and parliamentary monarchy, equality of the three national names and flags, of the Cyrilline and Latin alphabets, and of the Orthodox Catholic and Mussulman religions, equal rights for all citizens, universal suffrage in parliamentary and municipal life, and the freedom of the Adriatic to all nations." The future constitution was to be established after the conclusion of peace by a constituent assembly, which "will be the source and consummation of all authority in the State." A week later Trumbić and his colleagues were welcomed on the Balkan front by the Voivode Mišić with an impassioned speech in favour of unity. The Declaration of Corfu made a profound impression in Austria-Hungary, which was heightened by Mr. Lloyd George's speech in honour of Serbia at a luncheon given by the Serbian Society of Great Britain to Pašić (Aug. 8). The Zagreb press could only comment indirectly, but conveyed its meaning by insisting that the Reichsrat programme of May 30 was an absolute minimum. The growing self-confidence of the Austrian Slavs was shown by the bluntness of their refusal to coöperate with the new Premier, Doctor von Seidler, whose offer of portfolios to their leaders drew from Count Tisza a strong protest in the Hungarian Parliament. Under Magyar pressure Seidler explicitly condemned all schemes of federalism, and pledged the Government and even the crown itself not to adopt any reforms which did not leave untouched the existing provincial boundaries. The Czechs and Yugoslavs, finding the door thus shut in the face of their national aspirations, even in the modified Habsburg form, naturally stiffened in their opposition. On Dec. 18 they went so far as to demand national representation of their own at the peace negotiations with Bolshevist Russia at Brest Litovsk.

Pact of Rome.—During 1916–7 Italian public opinion, encouraged by Sonnino and his press organs, had been definitely hostile to the Yugoslavs, whom it denounced as mere Austrian agents. The facts regarding the Yugoslav legions and the services rendered by Yugoslav deserters at Gorizia and in the Trentino were simply suppressed. The disaster of Caporetto (Nov. 1917) had a sobering effect, and the need for solidarity on the part of all the subject nationalities of Austria-Hungary,—a category which included also Italians,—if Italy's chief enemy was to be overthrown, became increasingly apparent. Further causes for alarms were the secret meeting between General Smuts and Count Mensdorv, to discuss a separate peace between Austria and the Entente (Dec. 1917) and the public pronouncements of President Wilson and Mr. Lloyd George in favour of "autonomy" for the subject races, instead of the independence held out to them by the Allied pronouncement of Jan. 1917. In Dec. 1917 Mr. Wickham Steed succeeded in bringing together Trumbić and his colleagues first with General Mola and Signori Emanuel and Chiesi (of the *Corriere* and *Secolo*), and then with the Italian Irredentist Socialist leaders. Their informal discussions laid the basis for more serious negotiations between Trumbić and Signor Torre, representing an influential committee of Italian deputies and senators. The agreement signed between them in London on March 7 1918 laid down the basis of Italo-Yugoslav coöperation: it recognized each of the two nations to be equally interested in the completion of the other's national unity, and in the liberation of the Adriatic. It left territorial questions to be decided amicably after the war, "on the basis of the principle of nationality and self-determination," and mutually guaranteed the rights of national minorities. This agreement is known as the Pact of Rome, because it was publicly proclaimed at a "Congress of the Oppressed Nationalities of Austria-Hungary," held on April 8 in the Roman Capitol. The Yugoslavs were represented by Trumbić and his Committee and by 12 deputies of the Serbian Skupština, the Czechoslovaks by Beneš and Štefanik, the Poles by Zamorski, Skirmunt and Seyda, the Rumanians by Draghicescu, Lupu and Mironescu. Baron Sonnino held aloof, but Premier Signor Orlando, greeted the congress with enthusiasm, and the first result was a combined propaganda on the Italian front, organized by Allied delegates and members of all the national committees. The effect of the congress and of this propaganda was to hasten the disintegration in the Austro-Hungarian army, and the High Command (in a communiqué of July 27) admitted that wholesale defections of the Czechoslovaks and the Yugoslavs had materially contributed to Italy's brilliant stand against the

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last Piave offensive in June. Unfortunately, while the new Czechoslovak army was recognized by Italy and took its place in the front line, Baron Sonnino, for political reasons, vetoed the formation of similar Yugoslav legions, though General Diaz had consented, and though the Yugoslavs interned at Nocera and elsewhere were clamouring to be enrolled.

Collapse of Austria-Hungary.—Meanwhile the Roman congress was deliberately imitated by an imposing congress at Prague (May 16), at which Czech, Polish, Italian, Rumanian, Slovak and Yugoslav delegates attended. Among the latter were the mayor of Zagreb, the poet Vojnović, and prominent Serb, Croat and Slovene deputies of all parties, including the peasant leader Stephen Radić and the future minister Pribičević. Their resolutions, though necessarily vague, amounted to a pledge of mutual support in the cause of unity and independence. During 1918, the initiative among the Yugoslavs of the Monarchy fell more and more into the hands of the Slovenes, led by Father Korošec since the premature death of Monsignor Krek. The official recognition accorded to the Pact of Rome by Mr. Lansing in the name of America (May 31) was a fresh encouragement: and Korošec, after constituting a Yugoslav National Council for the furtherance of unity, convoked a new Slav congress at Lyublyana (Ljubljana) on Aug. 18. The demonstrative part taken by the prince-bishop Jeglić and the leading Catholic clergy, and the fact that the Emperor's birthday was entirely disregarded, was intended as an answer to those who claimed the Slovene Catholics as a bulwark of the Habsburg throne. The central authority in Austria was steadily breaking down, and the food crisis was rendered still more acute by the widespread formation of "Green Cadres"—well organized armed bands which held positions in the mountains and defied capture. As early as Feb. a mainly Yugoslav revolutionary committee had almost gained control of the Cattaro naval base, which would have fallen into Entente hands if the ringleaders, who crossed the Adriatic for help, had not been detained by subordinate Italian subordinates until the Pola squadron had time to crush the mutiny. Moreover the High Command viewed with alarm the growth of "Septembrist" doctrine among the troops—*i.e.* the insistence upon "peace by September" and a refusal to face a fifth winter in the trenches.

During the late summer the authorities in Vienna and Budapest keenly debated rival plans for solving the southern Slav question—in every case, however, in accordance with Austrian or Hungarian rather than Yugoslav interests. Strangely enough the only attempts to consult the Yugoslavs themselves were an audience to which the Emperor Charles summoned Father Korošec and a journey undertaken by Count Tisza in Sept., with the crown's approval, to Zagreb, Sarajevo and Dalmatia. This last attempt to win support for the Magyar solution was everywhere met with a blank refusal, and in Bosnia especially the Orthodox, Catholic and Moslem leaders united in a manifesto assuring him of their adherence to the full programme of Yugoslav unity. The surrender of Bulgaria (Sept. 30) naturally rendered the nationalities indisposed to concessions, and the Austrian Premier's admission that national autonomy was now inevitable was icily received. The Czech and Yugoslav spokesmen in the Reichsrat insisted upon separate representation at the peace negotiations, and the absolute right to decide their own future State allegiance (Oct. 1).

Events now followed each other with lightning speed. On Oct. 4 Austria-Hungary, in a note to America, accepted President Wilson's speeches as a basis of discussion, and on the 8th Baron Hussarek admitted that the Monarchy's internal structure must be modified, and "full-grown nations" determine their own future. This only precipitated the collapse, and while Count Tisza voiced Hungarian public opinion in declaring the basis of the Dual system to be shattered, the Yugoslav National Council was transplanted from Ljubljana to Zagreb and strengthened by the inclusion of representatives of all parties (Oct. 10). On the 16th the Hungarian Government declared in favour of personal union, and next day Hussarek published an imperial proclamation, dividing Austria (not Austria-Hungary) into four federal units (German, Czech, Yugoslav and Ukrainian) and leaving the Poles to make their own decision. This project was stillborn and pleased no one. Korošec in the name of the Czech and Yugoslav Clubs unreservedly rejected it and claimed that the future of both nations was an international problem which only the future Peace Conference could solve. Henceforth the Yugoslavs acted independently of both Vienna and Budapest: and when on Oct. 21 the news of President Wilson's answer to Count Burián's final peace note (refusing to negotiate save on the basis of a recognition of Czechoslovak and Yugoslav national claims) became generally known, the old *régime* vanished almost as if by magic. Extraordinary scenes took place in many towns, the troops tearing off their military badges with the Habsburg arms, and trampling them underfoot. National councils were speedily formed in Dalmatia and Bosnia, which arranged for the disarmament of the troops pouring northward from the broken Albanian and Macedonian fronts. As early as the 23rd a Croat regiment stationed in Fiume disarmed the Magyar militia and took possession of the town. On the 24th Count Andrássy was appointed joint foreign minister, but the machinery of State had ceased to work, and both the Austrian and Hungarian Cabinets were in *statu demissionis*. On the 28th (the same day on which the Czechoslovak Republic was born in Prague) the military command in Zagreb handed over its authority to the National Council, and next day the diet proclaimed the independence of Croatia from Hungary, and assumed control of Fiume. The arsenals of Pola and Cattaro were already in the hands of the insurgents; and the Emperor Charles, in the hope either of winning the favour of the new *régime* in Zagreb or of throwing an apple of discord between it and the Entente, signed a decree on Oct. 31 making over the whole Austro-Hungarian fleet to the Yugoslav State. This was not unnaturally interpreted by the Italian Nationalists as a proof of collusion between Zagreb and Vienna; nor was it generally known that as early as Oct. 4 Štepanek and Giunio, as delegates of the Czech and Yugoslav revolutionary committees, reached Italy in a fishing-boat, to concert with the Allies a general rising along the coast, but were closely imprisoned in Rome and not allowed to communicate with Doctor Beneš and Doctor Trumbić till nearly three weeks had been lost. But for this delay the fleet might have been in the Entente's hands a fortnight before the final Italian offensive opened on the Piave. Unhappily every step led to a fresh misunderstanding. The action of the Supreme Council in Paris in prescribing the frontier line of the secret treaty of London as the line of occupation under the Austro-Hungarian armistice was keenly resented by the Yugoslavs as a breach with Wilsonian principles. The Allies very properly insisted that the fleet must be surrendered into their hands, but before this could take place a deplorable incident occurred in Pola harbour, the "Viribus Unitis" being blown up by an Italian mine, with a Yugoslav admiral and crew on board. In Italy Baron Sonnino's frankly anti-Slav attitude threw the Pact of Rome into the shade: and the Consulta worked hard to prevent Yugoslavia's recognition by the Allies.

Rival "Great Serb" and "Yugoslav" Programmes.—That this recognition had not already been accorded before the collapse of the Central Powers began was due to disunion among the Yugoslavs themselves. During the summer America gave a lead to the Allies by accepting the Yugoslav programme, and after Austria's failure on the Piave there was a growing disposition on the part of the western Powers to fall into line with Mr. Lansing's very clear pronouncements. But Pašić, free from the restraints of a coalition and from all parliamentary control, had reverted to his original pan-Serb standpoint, and steadily declined to reconstruct his Cabinet on a wider Yugoslav basis. Trumbić on his part could not enter a purely Serbian Cabinet without prejudicing that freedom of choice of his compatriots in the Dual Monarchy, upon which the moral case of the Yugoslavs depended. A series of incidents proved the difference of outlook to be not merely personal but fundamental. In July Mr. Mihajlović, the Serbian minister at Washington, was summarily dismissed by Pašić, the reason being his refusal as a good

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Yugoslav to transmit to the American Government a project assigning Bosnia to Serbia as "compensation" in the event of a patched-up peace. On July 25 at the London Mansion House Mr. Balfour publicly indorsed the full Yugoslav programme, as formulated by the Serbian minister, Mr. Jovanović: but the latter's full report to his home Government was answered by a severe snub, and during the winter he too was dismissed for his Yugoslav sentiments. When on Aug. 9 Mr. Balfour officially recognized the Czechoslovak National Council as "trustee of the future Czechoslovak Government," he was ready to extend a similar recognition to the Yugoslav cause, but as a preliminary condition he very reasonably insisted upon unanimity between those who claimed to represent the two groups of Yugoslavs. Pašić adhered to his standpoint, and even the efforts of Venizelos and Take Jonescu to bring him and Trumbić together were unavailing. When in the last week of Oct. the rival statesmen moved from London to Paris, all hope of Yugoslav recognition before the opening of the Peace Conference had vanished, owing to the stiffening in the attitude of Italy.

Zagreb declares Independence.—One of the first steps of the new Zagreb Government was to recognize Trumbić and his committee as its representatives abroad, and to send delegates to Switzerland to discuss the measures for consummating national unity. On Nov. 9 the Declaration of Geneva was signed by Pašić as Serbian Premier, Father Korošec, Doctor Čingrija (mayor and deputy of Ragusa) and Doctor Zerjav (a Slovene Progressive) for the Zagreb Council, Trumbić and four others for the Yugoslav Committee, and Trifković, Drašković and Marinković as chiefs of the Serbian opposition parties. "By this act," it was laid down, "the new State appears and stands from to-day as an indivisible state-unit and as a member of the Society of Free Nations. The former frontiers no longer exist." The Governments of Belgrade and Zagreb were to retain their former spheres until a constituent assembly, elected by universal suffrage, could draw up a new constitution. Yielding to the unanimous desire of the other delegates, Pašić officially requested the Entente to recognize the Zagreb Council as the supreme authority in the ex-Austro-Hungarian provinces, and Trumbić as its accredited representative in the West, until unification could be completed. The repeated efforts made by Pašić to avert so distasteful a decision were held to disqualify him from the leadership of the new united Cabinet, but in order to secure his renunciation it was found necessary to exclude the other party chiefs. This arrangement, however, never really came into force, for the simple reason that telegraphic communications between the West and Serbia were hopelessly irregular, and that events continued to move, with the advance of the Serbian army and civil authorities from the South and of the Italians from the West. On Nov. 8 Gen. Franchet d'Esperey received at Belgrade a Hungarian peace delegation under Count Károlyi, and concluded with them an armistice whose provisions still further complicated the situation. No orders were given for the evacuation of Slovakia; in Transylvania an impossible shaped line was drawn, such as left Cluj (Kolozsvar) and many pure Rumanian districts in Magyar hands; while the Rumanians were incensed by the assignment of Temesvár (Temisoara) and the whole Banat to Serbia. The Serbian army was also allowed to occupy the Bačka, Syrmia and Bosnia-Herzegovina, but no territory farther west: and for a moment it seemed as though an attempt was being made to leave the Croats and Slovenes to their fate and to form an aggrandized Serbia on the lines advocated by Pašić and Petrograd in the summer of 1915. Any such development was, however, averted by the advance of the Italian army beyond the Armistice line, in the direction of Ljubljana. For to meet this danger, the Zagreb Government urgently invited the assistance of the Serbian army, which during the final advance contained a large proportion of Yugoslav volunteers. The first Serbian troops entered Fiume on Nov. 18, and a most dangerous situation arose between them and the Italians in Istria and Dalmatia, which was only very partially mitigated by the dispatch of American military and naval forces to Trieste and Fiume. Much of the blame falls upon the Supreme Council, which shrank from the only effective means of allaying friction—immediate Allied occupation of the disputed zone, pending the decision of the Peace Conference. The Council's occasional outbursts against Italy only rendered Baron Sonnino still more intractable, and irritated Italian public opinion. No satisfactory solution was possible unless the Treaty of London was abrogated, and this involved the abandonment of other secret treaties to which Paris and London clung. America pointedly defined the Adriatic problem as a test case, but amid the pressure of other affairs it was allowed to drift.

Union proclaimed at Belgrade.—The equivocal attitude of the Entente toward the new State naturally hastened the process of union. On Nov. 23 the Zagreb National Council proclaimed the union of the territories under its control with the Kingdoms of Serbia and Montenegro, and invited the Prince-Regent of Serbia to assume the regency of the new State. This decision (passed with only one dissentient voice, but that unhappily Stephen Radić, the peasant leader) took formal effect on Dec. 1, when Prince Alexander, at the formal request of 24 delegates from Zagreb, proclaimed the union and repeated their cry "Long live free and united Yugoslavia." Meanwhile on Nov. 26 a hurriedly convoked national assembly at Podgoritsa had proclaimed the deposition of King Nicholas and his dynasty, and the union of Montenegro with Serbia in the new united State. The first Yugoslav Cabinet was constituted under Protić as Premier and Father Korošec as vice-Premier: Trumbić became foreign minister, and the other portfolios were divided more or less equally between Serbia and the new territories. Pašić was appointed principal delegate at the Peace Conference, with Trumbić, Vesnić (minister in Paris) and Žolger (a Slovene professor who had held office under Seidler in Austria).

The Adriatic Crisis.—Apart from agrarian riots in Slavonia and Bosnia, the transition to the new *régime* was accomplished with remarkable ease. Italy's claims upon Istria and Dalmatia rallied the Yugoslavs to the cause of national unity, and intense indignation was aroused by the action of the Entente in drawing an armistice line against Austria-Hungary almost identical with that prescribed by the secret treaty of London, and in sanctioning Italy's prompt occupation of the disputed territory. Friction was increased by a whole series of incidents along the coast, by the deportation of prominent Yugoslavs to Italy and by the entry of Italian troops into Fiume, despite the protests of the Yugoslav civil and military authorities (Nov. 18). Meanwhile the whole Nationalist press of Italy, actively encouraged by Sonnino and his entourage, opened a fierce campaign against the Yugoslavs and their western supporters, which rapidly developed into agitation against the Allies. By the close of the year the situation had become so envenomed that Bissolati, the foremost Italian advocate of conciliation, found it necessary to withdraw from the Orlando Cabinet, and on Jan. 11 1919 was howled down at a great meeting in Milan. At the Paris Conference there was from the first a deadlock in the Adriatic dispute. Clemenceau and Lloyd George found themselves between two irreconcilable standpoints—between Sonnino, who claimed the liberal fulfilment of their treaty pledges, with the addition of the port of Fiume, and President Wilson, who refused all cognizance of the secret treaties and regarded them as expressly abrogated by the Allies when they accepted his successive notes as the basis of the Armistice. The three western Powers were in the impossible position of judges in a dispute to which one was a party, while the other two were accessories: the only Great Powers from whom an impartial verdict could be expected were Japan, who resolutely held aloof from purely European quarrels, and America, who quite logically regarded the Adriatic as a test case for the application of the new order in Europe. It was on these grounds that the Yugoslavs, from whom the treaty had always been carefully concealed and who had of course never recognized its validity, offered to submit the whole dispute to the arbitration of President Wilson (Feb. 11). On March 3, however, Italy, who had steadily refused to recognize the accomplished fact of Yugoslav unity and insisted on the Conference only admitting the Yugoslavs as a "Serbian"

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delegation, declined American arbitration and threatened to withdraw altogether from Paris unless their territorial demands were conceded. This in turn strengthened the hands of the extreme section among the Yugoslavs, who now advanced the full ethnographic claim, involving Trieste and Gorizia as well as Dalmatia and Istria, and at the same time increased their demands against Bulgaria, Austria and Albania. Nor was it very easy for the Serbs and Croats to show moderation toward Italy, without appearing to desert the Slovenes, at whose expense, for obvious geographical reasons, the main amputations must inevitably take place. The bad impression made by the claims now submitted to the Supreme Council was only partially removed by a speech of Trumbić and by his proposal to leave the settlement of frontiers to a plebiscite (April 16). This offer was made in the knowledge that the memorandum addressed by President Wilson two days previously to Orlando and Sonnino had met with rejection, and was indeed well calculated to heighten the contrast between the outlook of the two rival nations toward Wilsonian principles. The American note reaffirmed these principles as the accepted basis of armistice and peace, and insisted on applying the same methods toward Austria-Hungary as Germany. It accepted the Brenner as a fair strategic line on the north, but argued that the Treaty of London was no longer applicable in respect of Italy's eastern frontier, since the line which it traced was designed to secure Italy against future Austro-Hungarian aggression, and Austria-Hungary had by now ceased to exist. It then defined what came to be known as "the Wilson Line," which assigned to Italy Gorizia, Trieste and Istria west of the river Arsa, but not Fiume, which must become an international port, nor any points south of it, save perhaps Lissa and Valona: it also advocated the dismantling of the whole eastern Adriatic coast. On April 23 President Wilson followed up this private memorandum by a public manifesto to the Italian nation, in which he repudiated the Pact of London and appealed for the application of the same principles on the Adriatic as those enforced against Germany. Fiume, he declared, must be the outlet, not of Italy, but "of Hungary, Bohemia, Rumania and Yugoslavia." Unhappily, despite its warm assurances of American friendship, this document met with a most hostile reception in Italy, where it was interpreted as an attempt to undermine the position of her spokesmen and so mete out to her a different measure from that prescribed by France and Britain. Thus the proposal entirely failed of its effect, and as Italy, Yugoslavia and America each adhered to its standpoint, and the two western Powers shrank from any constructive policy, a fresh deadlock ensued. At the end of May, however, M. Tardieu suggested a compromise by which the port and district of Fiume with most of eastern Istria and a total population of over 200,000 (mainly Yugoslavs) would form a small buffer state between Italy and Yugoslavia, under the guarantee of the League of Nations. President Wilson adhered to his own scheme, but made it clear that he would not oppose any direct agreement, whatever might be its terms: while the Yugoslavs, though accepting the idea of a buffer state, insisted upon their enjoying at Fiume a status analogous to that of Poland at Danzig, and added the impossible condition of a plebiscite after three years. During the final stages of the German treaty the Adriatic problem was once more shelved, until on June 29 and July 6 armed conflicts took place in the streets of Fiume between Italian and French soldiers, resulting in several deaths. A commission of inquiry was then at last appointed by the Allies, and ordered elections under inter-Allied control and the dissolution of the terrorist "League of Volunteers." But on Sept. 12, the very day on which American and British police were to be installed, D'Annunzio and his Arditi occupied the town, with the open connivance of the Italian naval and military authorities though to the embarrassment of the Roman Cabinet. The Allies, so far from attempting to restore order, withdrew their forces and allowed their authority to be flouted. The fresh deadlock that ensued was by no means distasteful to Rome, which drew encouragement from Wilson's increasing impotence at home and therefore played for time. At last on Dec. 9 1919 the Supreme Council (Clemenceau, Polk and Crowe) addressed a memorandum to Italy, outlining new terms of settlement—viz. the Wilson line (modified so as to leave Albona in Italy), a demilitarized buffer state, a special *régime* for Zara, cession of Pelagosa, Lissa and Lussin to Italy: Valona in full sovereignty, and an Italian mandate in Albania, under the League of Nations. The Italian claim of territorial continuity with Fiume was definitely rejected. Italy in her reply (Dec. 19) insisted on continuity (the real if unavowed motive of which was to control the port of Fiume in the interests of Trieste and Venice, and so retain some hold over Yugoslavia's commercial development), demanded the island of Cherso and the neutralization of the Yugoslav coast, and suggested a triple division—the *corpus separatum* of Fiume to Italy, the port to the League of Nations, and the rest of the buffer state to Yugoslavia. On Jan. 6 1920 Nitti, meeting with no response, wrote to Lloyd George to demand the execution of the Pact of London. At this stage the Yugoslav delegation committed a grave tactical blunder, Trumbić's views being overridden by the Balkan imperialistic aims of Pašić. While pleading for a plebiscite against Italy and doing lip service to an independent Albania within the frontiers of 1913, it added that in the event of any revision of those frontiers Yugoslavia would claim Skutari and all territory north of the river Drin (Drim). The sole justification for such a claim lay in the terms of the Treaty of London, which the Yugoslavs could not adopt as a basis without stultifying their whole position against Italy. But Italy, in her next memorandum to the Conference (Jan. 9) thus found it easier to reaffirm the validity of the treaty, while arguing that as it had envisaged the creation of three separate states (Serbia, Montenegro and Croatia) rather than of a big Yugoslavia, the clause regarding Fiume could no longer be upheld. On Jan. 13 Clemenceau and Lloyd George addressed new proposals to the Yugoslavs, in the form of a scarcely veiled ultimatum. The buffer state was now abandoned, the *corpus separatum* (with territorial continuity) falling to Italy, Sušak to Yugoslavia and the port of Fiume to the League of Nations: Italy was also to receive Lussin, Lissa and the Albanian mandate, while Zara was to be independent under the League. In originating this impromptu scheme, Lloyd George was influenced by secret indications that the Serbian reactionaries, if promised Skutari in return for Fiume, might throw over Trumbić and abandon the Wilson Line and American principles generally. As however Trumbić rallied the Yugoslav delegation to refuse the Franco-British project, Clemenceau the very next day introduced the important modification that Fiume should be an independent state under the League. When the Yugoslavs placed various conditions upon their acceptance, they were bluntly informed that unless they accepted within four days, France and Britain would authorize the literal execution of the Treaty of London, thus leaving Fiume to Yugoslavia, but all northern Dalmatia in Italian hands (Jan. 20). But this ultimatum was rendered invalid by a wire from Lansing, protesting against any settlement without the participation of America. Paris and London having assured Washington that neither concealment nor lack of courtesy was intended, Belgrade found it quite safe to reject the note of Jan. 20, which it pointedly described as "a friendly proposal, not as an injunction." It further expressed its inability to believe that the Powers wished to impose "a treaty concluded unknown to it by third parties, and whose clauses have never been communicated to it." (Jan. 28.) This incident led President Wilson to address to the Allied Cabinets a series of three notes (Feb. 10 and 25 and March 6) which will remain the classic documents of the controversy, and reduced his opponents to silence, though not to surrender.

After their passage the Adriatic question was again allowed to stagnate, the Powers resuming their negative attitude, while advocating direct discussion between the two parties. At last on April 25 Trumbić, having obtained the special sanction of the Belgrade Cabinet, informed Nitti of his readiness to negotiate, and a meeting between the two statesmen did actually take place at Pallanza on May 11: the commercial experts had

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already reached agreement. But the prospect of a settlement roused the Italian Nationalists to a final effort: the Nitti Cabinet fell, and D'Annunzio, repeating his defiance of Europe, attempted a further raid upon Dalmatia. The continued presence of American warships on the Dalmatian coast alone prevented a series of brawls between Italian sailors and the Croat population from developing into open warfare. Fortunately the new Giolitti and Vesnić Cabinets showed equal moderation and skill in restraining the hotheads on both sides, and the new Foreign Minister, Count Sforza, was assisted by a personal knowledge of Serbian and Balkan problems all too rare among western statesmen. It was not however till the autumn that direct negotiations could be resumed, and by that time the eclipse of President Wilson placed Italy at an advantage. By the Treaty of Rapallo (Nov. 12 1920) Italy acquired a frontier considerably farther east than the Wilson Line, and including the quicksilver mines of Istria, the watershed of the Julian Alps as far as Snježnik (*Monte Nevoso*), almost all Istria with Abbazia and Volosca, and a narrow strip of shore connecting it with Fiume. The *corpus separatum* became an independent unit under the League of Nations, the Croat suburb of Sušak remaining in Yugoslavia and the Baros port being added as an outlet for Yugoslav trade. Zara became a free city under Italian sovereignty, but as a tiny isthmus without hinterland or islands. Italy renounced all claims to Dalmatia, and of the islands retained only Lussin and Cherso. Special linguistic and other privileges were assured to the Italian minority in the Dalmatian towns, but no corresponding charter was granted to the four to five hundred thousand Slovenes and Croats annexed to Italy. The settlement, though far from ideal, involved concessions on both sides: and Italy, though still forgetful of the principles enunciated at the Roman congress, could at least claim to be the only victorious Power which had relinquished its hold upon conquered territory. One practical result of the treaty was that Italy tacitly abandoned the cause of King Nicholas and accepted as inevitable Montenegro's incorporation in Yugoslavia.

The New Frontiers.—The consolidation of the new State was seriously delayed by the prolonged dispute with Italy and by the fact that for nearly two years after the Armistice the danger of an armed conflict could not be overlooked. But in five other directions also the frontiers were unregulated. (1). By the Armistice concluded at Belgrade on Nov. 12 1918 the Serbs were allowed to occupy Temesvár and most of the Banat, the east of which is overwhelmingly Rumanian and which was claimed in its entirety by Rumania, in right of her treaty of Aug. 1916 with the Allies. At the Paris Conference Rumania's enforced conclusion of peace with Germany was treated as absolving the Allies from obligations which were admitted in the parallel case of the Italian treaty: and the necessity of a partition on mainly ethnographic lines was from the first admitted. The special commission, after hearing the views of Trumbić and Bratianu, recommended a line which as nearly as possible balanced the Serb and Rumanian minorities left to Rumania and Yugoslavia respectively, and secured to the latter the essentially Serb districts of Torontál county: but at the instance of the French this line was modified to include Vršac (Versecz) and Bela Crkva (Weisskirchen) in Yugoslavia. This has the disadvantage that while the Serbs are stronger than any other single race in the two towns, their cession involved the loss of many purely Rumanian villages by Rumania, and also her loss of the important railway line connecting Temesvár southward with the Danube. (2). The regulation of the new Yugoslav frontier with Austria proved very thorny. Thanks to the efforts of Trumbić and the Slovene experts in Paris, Marburg (Maribor), a town with a German majority but surrounded by a purely Slovene district, was assigned to Yugoslavia: but under the Treaty of St. Germain a roughly triangular district north of the Karawanken range was referred to a popular plebiscite. The Inter-Allied Commission entrusted with the details was ordered to divide the disputed area into Zone A, mainly south of the river Drava (Drau) and Zone B, consisting of Klagenfurt and its basin, and to hold the plebiscite in the latter, only in the event of Zone A voting for Yugoslavia. After a keen contest between the rival Slovene and Pan-German propagandists, voting took place in Oct. 1920, and resulted in a majority of 12,747 for Austria. The fact that many Slovenes voted against Yugoslavia was largely due to a desire to escape from all military service. Zone B, with Klagenfurt, now automatically passed to Austria. (3). Against Bulgaria the Yugoslav delegation claimed considerable frontier rectifications—(*a*) the Strumnica salient, which threatened the Vardar railway from the east, (*b*) the district of Kochana (Tocana) and the Bregalnitsa (Bregalnica), (*c*) a strip of territory running parallel with the old Serbo-Bulgarian frontier the whole way from Zaječar to Kyustendil, and (*d*) the town of Vidin on the Danube and the salient between it and the Timok. These claims were regarded by the Peace Conference as excessive, and under the Treaty of Neuilly only the two first were allowed, though in place of the third the town and district of Tsaribrod were assigned to Yugoslavia, and thereby the main strategic key to Sofia. This decision is so patently unjust that it has been very widely ascribed to a deliberate design to keep the two countries apart. (4). The Pan-Serb section of opinion in Belgrade, encouraged in this instance by some of the army chiefs for strategic reasons, has always coveted northern Albania: and the Montenegrin Unionists, led by Radović, made every effort to secure the adoption of their full claim by the Yugoslav delegation. This was opposed by Trumbić and all the more progressive elements in the new State, who realized that the claim to Skutari knocked the bottom out of the whole Yugoslav case against Italy and Austria. Thus the advocates of an unscrupulous "deal" on the lines of "Skutari for Fiume" failed to assert themselves, and Yugoslavia pronounced in favour of an independent Albania, merely reserving her right to share the spoils if it came to a general partition. After Giolitti's renunciation of a mandate in Albania the claim to Skutari became untenable, and at last in 1921 the Supreme Council sanctioned the frontiers assigned to Albania in 1913. Yugoslavia's relations with Albania, though simplified by this decision, have been affected by the Albanian counterclaim to Peć, Djakovo and the plain of Kosovo, where since the middle of last century the Albanian element had grown steadily stronger at the expense of the Serbs. The murder of Essad Pasha (June 1920) deprived the Serbs of their chief supporter in Albania: and friction was increased by the bad administration in the Sanjak and Macedonia, by the inability of the Durazzo Government to prevent continual armed raids against Serbian territory, and by the encouragement given from some Serbian quarters to the Mirdite rising in the summer of 1921. (5). The frontier with Hungary was the last to be regulated. The Treaty of Trianon satisfied the most essential claims of Yugoslavia, by dividing the whole Banat (save a small Magyar triangle opposite the city of Szeged) between her and Rumania, and by assigning to her the whole Bačka (except Baja and district), part of the Baranya (forming the angle between Drave and Danube) and the Medjumurje (between Drava and Mur). Thus, in order to secure the town of Subotica (Szabadka) with its large Bunjevac (or Catholic Serb) population, she was allowed to annex not less than 250,000 Magyars. Her claim to Pécs (Fünfkirchen) was disallowed, but owing to the long delay in ratifying the treaty, Yugoslav troops remained in occupation of this district and its valuable coal-mines till Aug. 1921, when at the instance of the Supreme Council it was handed over to Hungary. Meanwhile Pécs had become a centre of the exiled Magyar progressives, who preferred a provisional Yugoslav *régime* to the white terror of Adml. Horthy. On the eve of evacuation an attempt was made in Pécs to reëstablish the Hungarian Republic under Count Károlyi, but owing to the communist views of some of its promoters the Belgrade Government withheld all support, and the movement promptly collapsed.

Internal Politics.—So long as vital frontier disputes were unregulated, the central Government in Belgrade held that elections could not be held, and governed for the first two years through a provisional Parliament, for which no one could claim a really representative character. The deputies for Serbia

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held mandates which had actually expired as long ago as June 1914, but whose renewal war and invasion had effectually prevented: those for Croatia had been elected in Jan. 1914, those for Montenegro were delegated by the revolutionary assembly of Podgorica in Nov. 1918. But in Bosnia and most of the other provinces the deputies had no popular mandate whatever, beyond being members of the self-constituted local committees which had sprung up amid the ferment of the revolution. Meanwhile the union of so many distinct political organisms had reduced the party system to chaos, and the first two years were taken up by a process of regrouping, the dominant issue being Centralism versus Federalism. In accordance with the Declaration of Corfu, the decision regarding the actual form of the State was left to a constituent assembly: but as the machinery of Belgrade was naturally quite inadequate to the task of administering a country three times the size of the Serbia of 1914, the provincial Governments of Croatia (with the Ban at its head), Slovenia, Dalmatia and Bosnia continued to function, though the local diets were no longer summoned.

During 1919 internal politics centred in a struggle between the Radicals, who still possessed the best party machine and stood for a narrowly Serbian as opposed to a Yugoslav programme, and the newly constituted Democratic party, which absorbed most of the Serbian Opposition parties, the old Serbo-Croat coalition of Zagreb, and the Slovene Liberals. The Radicals of Serbia being conservative in all but name, made a working alliance with the clericals of Zagreb and Ljubljana, and under the leadership of Protić favoured decentralization, combined with concessions to the expropriated landowners. But in the land question the Radical party was paralyzed by its Bosnian wing, which sided with the peasantry: and thus in Sept. Protić was replaced by Davidović, the Democrat leader, and though the Government remained a coalition, its weight was transferred farther to the Left. An internal trial of strength continued throughout the winter between the rival governmental groups, until in May 1920 a breach was only averted by a reconstruction of the Cabinet under Vesnić, who as Serbian minister in Paris since 1904 enjoyed wide prestige, and though a Radical, stood aloof from party dissensions. Under his weaker but more neutral guidance, and aided by the unifying force of the Adriatic crisis, the parties reached agreement upon a new parliamentary franchise, based on universal suffrage. Though otherwise progressive, this law committed the injustice of temporarily disfranchising the non-Yugoslav minorities, on the convenient pretext that they could not claim the vote until the expiry of the two years during which the Treaty of Trianon secures their right to choose citizenship in a neighbouring State. This law was the last serious act of the provisional Parliament, which had shown itself singularly barren in legislation, and contrasts most unfavourably with the first assemblies of all the other "Succession States."

The elections to the Constituent Assembly (Nov. 1920) did not clear up the situation as had been expected. No party secured an absolute majority, and the two strongest, the Radicals and Democrats, being almost exactly balanced, were forced to strengthen still further their unnatural alliance. In open opposition stood (1) Stephen Radić, the Croat peasant leader whom the Democrats had unwisely imprisoned in 1919–20, and who now swept the boards in Croatia with a Republican and Federalist programme and induced his party of 50 to absent itself from the Constituent: (2) the Croat and Slovene clericals, who strongly opposed centralization, and (3) the 58 Communists, led by a small group of extreme theorists, but owing their strength to the subversive elements in the Bačka, Macedonia and Montenegro and the secret aid of the Carlists in Vienna and Budapest. As the coalition lacked the necessary majority, it was reduced to gathering support piecemeal among the more neutral groups: and for this task Pašić, who became Premier in Jan. 1921, was specially qualified. By the promise of 100 million dinars to the expropriated Begs, he won over the Moslems of Bosnia, and by similar methods he detached the Slovene section of the newly founded Agricultural party (Zemljoradnici). But though he was thus able to carry the first reading of the new constitution by 227 to 93 votes, he was faced by the passive resistance of the great majority of Croats and Slovenes, who regarded with suspicion his "Great Serbian" and centralizing aims. It is significant that Protić, hitherto Pašić's most intimate associate, withdrew from the Radical party and from Parliament rather than sanction a constitution so inimical to provincial interests: while Trumbić, the foremost advocate of full national unity, recorded his vote against it. In many quarters it was openly accepted on the ground that any constitution was better than none, and that further delays and discussions would arrest the new State's development and discredit it abroad: but the settlement could not be regarded as definitive. On June 28 (Kosovo Day) the Prince Regent took oath to the new constitution, but the ceremony was marred by an attempt to assassinate him and the premier, by a bomb thrown as they drove back to the palace. This outrage, which was traced to the Communists, provided fresh proof that the Democratic leader Drašković, as Minister of the Interior, was justified in his charges of widespread terrorist conspiracy and even in the much debated Decrees (Obznane) by which he sought to combat them. When then on July 21 Drašković was murdered by a young Bosnian Communist, Parliament resolved on reprisals, and 10 days later passed by 190 to 54 laws of extraordinary severity for "the Defence of the State," terrorist agitation being made punishable by death, prolonged penal servitude or heavy fines. The mandates of the 58 Communist deputies were annulled, and eight arrested as privy to the attempt on the Regent. No less an authority than the ex-premier Protić publicly challenged the constitutional validity of such action.

Despite acute party dissensions and bad administration the new State was in 1921 steadily consolidating itself. Separatism was non-existent, for the cogent reason that there was no point toward which a new irredenta could gravitate: the Habsburg cause had no adherents, save a few discredited traitors who congregated in Graz and Vienna: and communism, which was quite alien to an agrarian and peasant-owned State, owed its passing success to the aftermath of war and the blunders of the middle class rather than to its own attractions. There was general agreement on foreign policy, whose pivots were close alliance with Czechoslovakia, the series of bilateral agreements which made up the Little Entente (Czechoslovakia and Yugoslavia Aug. 14 1920: Czechoslovakia and Rumania April 23 1921: Yugoslavia and Rumania June 7 1921), and the anti-Habsburg agreement concluded with Italy simultaneously with the Treaty of Rapallo (Nov. 12 1920). Yugoslavia's economic recovery had been surprisingly rapid, and the chief problems which confronted her in the autumn of 1921 were how best to exploit her vast undeveloped mineral and agricultural resources, improve her very faulty communications, and root out the illiteracy which was a legacy of alien rule.

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(R. W. S.-W.)

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YUKON TERRITORY (*see* 28.945 and 15.847).—Although at one time the pop. of the Canadian province reached 30,000 to 35,000 the decline of the mining industry had reduced it to about 5,000 in 1921. Since the establishment of government in Yukon the administration of justice has been in the hands of the North-West Mounted Police, whose services in preserving law and order have been invaluable.

In the northern portion of the territory the ground below the surface remains frozen throughout the year, but from June to Oct. the climate is warm and sunny and vegetation grows freely in the valleys. Wild fruits such as bilberry, bearberry, crowberry, bog apple, currant, raspberry, foxberry and high-bush cranberry occur, besides numerous species of phanerogams. The Yukon is not an agricultural country, but oats, barley, rye, flax, potatoes, turnips and other garden vegetables are successfully raised. Parts of the territory are wooded with fair sized timber. White and black spruce are the most important trees, reaching 2,400 ft. above sea level: specimens having 21-in. stumps have been noted but the average diameter ranges from 12 to 16 inches. The timber cut is for home consumption. Poplar (two varieties) and canoe birch are found, also willows, alder, juniper and other shrubs, which form thickets and dense undergrowth.

Moose, caribou and sheep are plentiful in most localities, and black, brown and grizzly bears are numerous. Wolverines, marten, lynx, ermine, rabbits and fox are the chief fur-bearing animals. The commonest birds are the Alaska jay, Swainson hawk, northern varied thrush, fox sparrow, grey checked thrush, and there are Hutchin geese, partridge, ptarmigan and ducks of many varieties. The waters of the Yukon are well stocked with fish, especially salmon, whitefish, trout, pickerel and pike.

The old primitive methods of extracting gold have been replaced by dredging and modern hydraulic methods. In 1920 the production of gold from the Yukon territory was 72,140 oz., against 90,705 oz. in 1919. This was obtained almost wholly from the alluvial sands and from the gold ores of the Conrad district. There has been a gradual falling off in production since 1913, when about 283,000 oz. worth $6,000,000 were mined. It was estimated in 1920 that the total output of gold had been over $150,000,000. Coal, copper, silver and other ores are mined and discoveries of silver ores at Kerro Hill have been reported.

The mountain system of the Yukon is the most remarkable in Canada, not only in regard to height and extent of glaciers, but also in scenic grandeur, majesty and imposing nature. It contains Mt. St. Elias, just within Canadian territory as delimited by the joint commission of boundary surveyors (17,978 ft.), and Mt. Logan within 20 m. of it (19,539 ft.). These, along with Mt. McKinley in Alaska, are the highest peaks on the North American continent. (W. L. G.*)

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ZAGLUL, SAAD (*c.* 1860–), Egyptian pasha, was the son of a notable in the district of Ibian, Gharbia Province. He was educated at the village school and afterwards at the university of El Azhar, in Cairo. When he had completed his prescribed course of studies, he was, in 1880, appointed editor of the *Official Journal*. Later he was nominated a Moawin under the Ministry of the Interior and eventually became Chief of the Contencieux for the province of Giza. Involved in the Arabi revolt, he was one of the many notables detained on the occupation of Egypt by British troops in 1882. On his release he ceased to hold office and in 1884, when the native tribunals were instituted, he began to practise at the bar. In 1892 he was appointed counsellor of the native court of appeal. Having become proficient in the French language and in the science of law, he obtained his diploma in law. He became Minister of Education in 1906, and under his "enlightened administration" it was said by Lord Cromer (*Modern Egypt*, vol. ii., p. 535) that "education in Egypt made rapid strides in advance." A change of the Ministry during Lord Kitchener's tenure of the Cairo Agency resulted in Zaglul's ceasing to hold the portfolio for Education, but he was appointed vice-president of the Legislative Assembly and he took a special interest in its deliberations until the outbreak of the World War, when the sittings of that body were temporarily suspended.

On the signing of the Armistice Zaglul, who had for long been considered the principal spokesman of the Nationalist party, appealed to the Residency in Cairo for the recognition of Egyptian independence, basing his demand on President Wilson's self-determination policy to which effect had been given by the British Government's issue of a Proclamation defining the status of the other countries liberated from Turkish rule by the war. When his proposal that he and some representative Nationalists should visit London to press their views was refused by the Government, he became discontented, and his attitude was so hostile that he and three others were arrested and deported to Malta. This was the signal for a murderous outbreak in Egypt in which British officers and others were killed, and the country became much disturbed. Zaglul and his friends were later released, and freedom of travel, which war measures had hitherto restricted, was permitted to all. A special Mission under the chairmanship of Visct. Milner was sent to Egypt in Nov. 1919 to enquire into matters and make representations. Zaglul eventually came to London and discussions between him, Adly Pasha and Lord Milner took place, the results of which were published in the "Milner Report." Zaglul returned to Egypt early in 1921, where he represented the extreme Nationalist party in opposition to the more moderate ministry under the presidency of Adly Pasha. At the end of the year, when trouble again broke out in Egypt, Zaglul was arrested once more and deported to Ceylon.

ZANGWILL, ISRAEL (1864–), English man of letters (*see* 28.956*), subsequently to 1909 published various volumes of essays, *Italian Phantasies* (1910), *The War for the World* (1916), *The Principles of Nationalities* (1918) and *The Voice of Jerusalem* (1920); and a novel, *Jinny the Carrier* (1919). In drama he produced *The War God* (1911, acted at His Majesty's theatre, London), *The Next Religion* (1912, London Pavilion), *Plaster Saints* (1914, Comedy theatre), and *Too Much Money* (1918, Ambassadors theatre). He took an active part as a speaker on behalf of the woman suffrage movement, and also as a pacifist during the World War. His attempts, as founder of the Jewish Territorial Organization, in connexion with the Zionist movement, to combine all the Jewish organizations in a scheme for the acquisition of the highlands of Angola as the "Jewish national home" had proved abortive before the outbreak of the World War; and subsequently, when the British Government gave its support to the setting apart of Palestine for this object, Mr. Zangwill and the J. T. O. declined to work with the Zionists on this basis. The J.T.O., however, organized an Emigration Regulation department for deflecting the stream of Jewish emigration from the Ghetto of New York to the southern states of the American Union, west of the Mississippi, a fund being established for this purpose, to which Mr. Jacob Schiff contributed £100,000, the firm of Rothschild £10,000, Baron Edmund de Rothschild £10,000, and M. Brodsky, of Kiev, £10,000.

ZANZIBAR (*see* 28.958).—The pop. of the protectorate was estimated in 1920 at 198,000; that of Zanzibar I. at 115,000 and that of Pemba at 83,000. Zanzibar city had some 36,000 inhabitants. The Arab aristocracy—large landowners—numbered about 10,000; there was an equal number of British Indians and about 300 Europeans, the British colony being the largest.

The transshipment of goods to and from the mainland of E. Africa and the growing of cloves are the chief sources of wealth. In 1919 it was estimated that some 60,000 ac. were under cloves, with about 5,500,000 trees in bearing. The average output 1910–20 was about 14,000,000 lb. Next to cloves comes the cultivation of the coco-nut palm for copra, there being in 1919 about 2,500,000 trees in the islands. In 1911 the clove crop was worth £436,000, in 1913 £412,000, and in 1918 £595,000. Copra exports in 1911 were valued at £203,000, in 1913 at £216,000, and in 1918 at £151,000 (having been worth £299,000 in 1917).

Apart from cloves and copra most of the exports figure also as imports, being goods in transit. Zanzibar, however, suffered to a considerable extent by the extension of direct steamship communication between Europe and India and the mainland of E. Africa, goods formerly transshipped at Zanzibar being taken direct to or from Mombasa, Tanga and Dar es Salaam. But if Zanzibar ceased to serve as a gigantic go-down or storehouse for the whole coast, it retained its position as the chief city of E. Africa and remained the headquarters of the principal Indian merchants trading with E. Africa. It also retained the dhow traffic, being visited yearly by hundreds of boats from the coast of Arabia and the Persian Gulf. The construction of a concrete wharf 1,300 ft. long, with a minimum of 30 ft. alongside, in progress in 1920–1, and other harbour improvements made Zanzibar port more accessible to shipping. The gross tonnage of shipping clearing the port in 1910 was 1,087,000; it rose to 1,502,000 in 1913, but fell, largely owing to war conditions, to 547,000 in 1916 and to 378,000 in 1918. It had risen to 582,000 tons in 1919. Imports (including bullion and specie) were valued at £993,000 in 1910, at £1,103,000 in 1913, at £2,366,000 in 1918 and at £1,934,000 in 1919. Exports in 1910 were valued at £1,033,000, in 1913 at £1,048,000, in 1918 at £2,133,000 and in 1919 at £2,444,000. The bulk of the trade is with India, England and E. Africa.

Revenue rose from £204,000 in 1910 to £407,000 in 1919; in the same period expenditure increased from £189,000 to £323,000. More than half the revenue is derived from customs. There was a public debt at the end of 1919 of £100,000.

History.—Sayyid Ali bin Hamud, the Sultan, a young man who had been educated at Harrow, who kept his court on European models and was fond of travel, abdicated in 1911 while on a visit to Europe. He died in Paris in Dec. 1918. Ali was succeeded by his brother-in-law Sayyid Khalifa ben Harud, a great nephew of Sultan Bargash. Khalifa, born at Muscat, Aug. 27 1879, had attended the coronation of George V. and was proclaimed Sultan on his return from London, Dec. 1911. He proved whole-heartedly loyal to the British, and his moderating influence did much to steady Moslem opinion in E. Central Africa during the war.

In July 1913 the control of the protectorate was transferred from the Foreign to the Colonial Office. Mr. Edward Clarke, the British Agent since 1909, had died at Zanzibar in the previous Feb. Under the Colonial Office the governor of British E. Africa (Kenya Colony) was appointed High Commissioner of Zanzibar, the local administration being in the hands of a British Resident, to which office Maj. F. B. Pearce was appointed in 1914. The Resident also took over the functions of first minister, a post which had been filled by Capt. F. R. Barton. The Sultan became president of the Protectorate Council, on which three Arab notables sat as unofficial members. The council has advisory powers only, but decrees of the Sultan are binding when countersigned by the British Resident.

During the war Zanzibar served as a base for the British naval squadron. On Sept. 20 1914, while the ancient cruiser

** These figures indicate the volume and page number of the previous article.*

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"Pegasus" was at anchor in the roadstead, undergoing repairs, it was sunk by the German cruiser "Königsberg," losing 25 killed and 80 wounded out of a crew of 240. The "Königsberg" also sank the guard ships "Cupid" and "Khalifa"—thus destroying the Zanzibar navy. About 5,000 Zanzibari served as carriers in the E. African campaign and the inhabitants contributed £70,000 to war funds.

In 1917 Sayyid Khalid, who for a brief period in 1896 had usurped the throne and had then taken refuge in German E. Africa, where he had since remained, surrendered to a British force. He was deported to St. Helena, whence in 1921 he was transferred to the Seychelles.

See F. B. Pearce, *Zanzibar, The Island Metropolis of Eastern Africa* (1920); J. E. Craster, *Pemba, The Spice Island of Zanzibar* (1913); the annual reports to the British Colonial Office.

(F. R. C.)

ZEEBRUGGE.—Among the British naval operations in the World War none created more interest than the attack on the Germans at Zeebrugge and Ostend, on the Belgian coast, in 1918. Ever since the German occupation of the Belgian coast, Zeebrugge had been a source of anxiety to the Dover Patrol. There the German torpedo craft and German submarines lay in a safe base only some 60 m. from the Straits, a danger to the Downs and a constant menace to British transports and trade in the Channel. Vice-Adml. Sir Reginald Bacon had contemplated an attack on it with monitors, but the Admiralty had disapproved, and it was not till the appointment of Rear-Adml. Sir Roger Keyes in Dec. 1917, that preparations were actually begun. The main object of the enterprise was to block the harbours of Zeebrugge and Ostend.

The actual harbour of Zeebrugge is small and is formed by a long curved mole on the western side, whose assault was an important part of the operation. This mole was 1½ m. long, connected with the shore by a viaduct built on steel pillars. On the outside the western wall rose 27 ft. 10 in. above high water, with a ledge 2 ft. 9 in. wide running along it about 12 ft. above high water. The parapet on top was some 3 ft. wide with a drop of 4 ft. to a ledge 12 ft. wide which ran 16¾ ft. above the quay. The quay on the harbour side was 27 ft. wide, equipped in the usual way with cranes and three large sheds and shelters. At the outer end was a battery of 3 5·9-in. guns, and a narrower portion ran on to the lighthouse where 6 4-in. guns, were mounted.

The general plan of operations was simple. Three old cruisers, "Iphigenia," "Thetis" and "Intrepid" (all built about 1891), filled with cement, were to enter the harbour and be sunk at the entrance to the ship canal to Bruges. The "Vindictive," supported by two auxiliary vessels "Iris II." and "Daffodil," was to assault the mole on its outer and western side and by creating an impression that this was the main operation, divert the enemy's fire from the blocking ships. As Bruges was accessible by canal from Ostend, Ostend was to be blocked at the same time by the old cruisers "Brilliant" and "Sirius." The main obstacle to the enterprise lay in the powerful batteries. On the 40 m. of coast-line there were mounted 153 guns, including 6 15-in., 4 12-in., 33 11-in., 1 9·4-in., 23 8·2-in., 73 5·9-in., 6 5-in., 11 4·7-in., and 52 4-in. The coast positively bristled with guns. Only 3 m. E. of the Zeebrugge canal stood the Kaiser Wilhelm II. battery (known at Dover as the Knocke) armed with 4 12-in. with a range of 41,000 yd. One and a quarter m. W. of Ostend was the Tirpitz battery with 4 11-in. ranging 35,000 yd., and 3 m. E. of the town was the Deutschland (old Jacobynessen) equipped with 4 15-in. ranging 43,500 yards.

The approach to the entrance of the ship canal at Zeebrugge was under the fire of the Goeben battery of 4 8·2-in. guns at 1,000 yd., and the chance of success depended largely on an effective smoke screen.

The attack on the mole was to be made by the "Vindictive" (Capt. Alfred B. Carpenter), an old cruiser of 5,750 tons, 320 ft. long, 24 ft. draught specially fitted for the occasion, assisted by the "Iris II." (Comm. Valentine Gibbs) and "Daffodil" (Lt. Harold G. Campbell), two Liverpool ferry boats of large capacity and light draught. The viaduct of the mole was to be blown up by two submarines, C1 (Lt. Aubrey Newbold) and C3 (Lt. Richard D. Sandford). A strong body of 15 destroyers was attached to the Zeebrugge force under Capt. Wilfred Tomkinson ("Phoebe," "North Star," "Trident," "Mansfield," "Whirlwind," "Myngs," "Velox," "Morris Moorsom Melpomene," "Tempest" and "Tetrarch" to escort the force and cover it to seaward; "Termagant," "Truculent" and "Manly" to screen the Zeebrugge monitors). A force of 18 coastal motor boats (55 ft. long, 3 ft. draught, 35 knots, 2 18-in. torpedoes) under Lt. Arthur E. Welman accompanied the expedition, of which 8 were allocated for the smoke screen, 5 to support the "Vindictive," and 4 to attack vessels inside the harbour. With them were 33 motor launches under Capt. Ralph Collins for smoke screens, and inshore rescue work. Out to seaward were the two monitors "Erebus" and "Terror" for bombarding the batteries. The Rear Admiral's flag flew in the destroyer "Warwick."

The three old cruisers "Thetis" (Comm. R. S. Sneyd), "Intrepid" (Lt. Stuart Bonham-Carter) and "Iphigenia" (Lt. E. W. Billyard-Leake) were to act as blocking ships. The two latter were of 3,600 tons displacement, 300 ft. long x 43½ ft. x 18½ ft., and the "Thetis" was a little smaller (3,400 tons and 17½ ft. draught).

A similar attempt was to be made at Ostend. There the blocking ships were to be the old cruisers "Brilliant" (Comm. A. E. Godsal) and "Sirius" (Lt.-Comm. H. N. Hardy) of 3,600 tons. They were to be supported by five bombarding monitors ("Marshal Soult," "Lord Clive," "Prince Eugene," "General Crawford," M24 and M26) and covered by five British destroyers ("Swift," "Faulknor," "Matchless," "Mastiff" and "Afridi"), with three British destroyers and six French torpedo boats attending on the monitors ("Mentor," "Lightfoot," "Zubian," "Lestin," "Capitaine Mehl," "Francis Garnier," "Roux," "Bouclier"). Eighteen British motor launches under Comm. Hamilton Benn and four French were attached for smoke screen, inshore and rescue work, and the whole force was under Commodore Hubert Lynes.

The object of the attack on the mole at Zeebrugge was first to seize the battery at the seaward end and prevent it firing at the block ships, and then to demolish the structures on it as far as possible. The battery was 250 yd. from the lighthouse, and to facilitate its seizure the "Vindictive" was to berth nearly abreast of it on the outer side of the wall. It was then to be stormed by three companies of bluejackets—A company under Lt.-Comm. Bayan Adams ("Princess Royal"), B under Lt. Arth. G. Chamberlain ("Neptune"), D under Lt.-Comm. G. N. Bradford; all under Lt.-Comm. Arthur Harrison ("Lion").

Some 150 yd. to shoreward of the battery and 400 yd. from the lighthouse there was a "fortified zone" of barbed wire and machine-guns. As this commanded the "Vindictive's" berth and would form a rallying point for reinforcements from landward, it was to be seized by four companies of Royal Marines—A (Chatham) under Maj. Chas. Eagles, B (Portsmouth) Capt. Ed. Bamford, C (Plymouth) Maj. Bernard Weller, and machine-guns under Capt. Chas. B. Conybeare.

The storming parties numbered 50 officers and 980 men of the Royal Navy, drawn chiefly from the Grand Fleet and the Nore, and 32 officers and 718 men of the Royal Marines. The seamen were under Capt. Henry C. Halahan and the marines under Lt.-Col. Bertram Elliot. Preparations began early in the year. The force was segregated in the Swin (Thames) and specially trained in all its various tasks. The blocking ships were stripped of all fittings and filled with rubble and concrete. The "Vindictive" in addition to her 10 6-in. guns was given a special equipment of 2 7·5-in. howitzers (1 ford. and 1 aft), 1 11-in. howitzer (aft), 16 Stokes mortars, flame throwers, 16 Lewis guns, and 4 1½-in. pompoms. The success of the attack depended largely on an effective smoke screen, and Wing-Comm. F. A. Brock and 60 ratings were lent to the Dover command, where a small factory was set up to prepare the materials for it.

The lessons of history were not very favourable to the enterprise. Naval Constructor R. P. Hobson had tried to block

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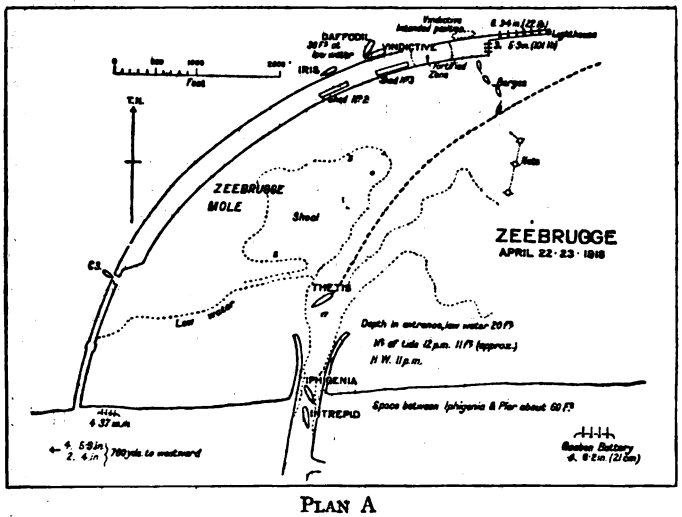
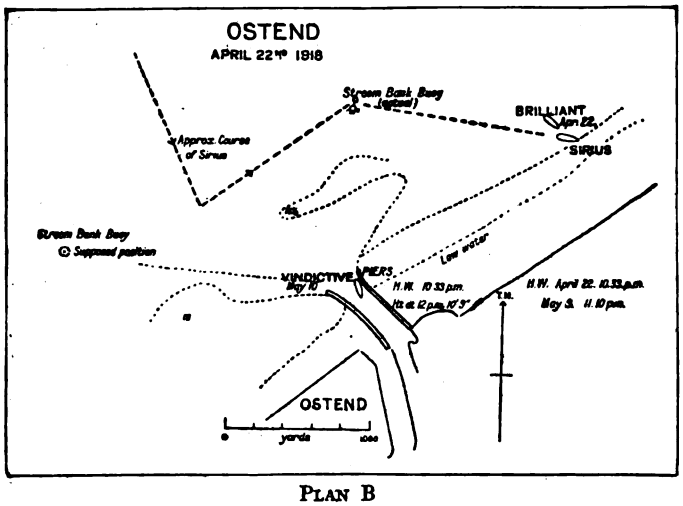
Santiago in 1898. The Japanese had thrice attempted to block Port Arthur in 1904. None of these attempts had been wholly successful. Let us glance for a moment at the conditions under which the attack was to be made. The distance from Dover to Zeebrugge was 63 miles. This meant that the expedition must start in daylight to be off the port by midnight. The night must be dark and the wind on shore.

Twice the force was assembled and twice unfavourable conditions supervened. On the night of April 11–12, it was within 13 m. of its rallying point. Finally the night of April 22–23 was fixed for the attack. The main force started at 4:53 P.M. on Monday, April 22. The bombardment was to begin at 11:20 P.M., simultaneously at Zeebrugge and Ostend. The smoke screen was to start at 11:40 P.M. The "Vindictive" was to reach the mole at midnight. The "Thetis" was to pass the end of the mole 25 minutes later. The last point of departure was at a point called G in lat. 51° 27′ N., long. 2° 50′ E. This and other points on the route were marked by buoys laid after careful triangulation by Capt. H. P. Douglas and Lt.-Comm. Francis E. Haselfoot. It was here, some 12 m. off Zeebrugge and Ostend, that the vessels took up their formation for attack. The "Vindictive," which had been towing the "Iris II." and "Daffodil," cast them off. The "Sirius" and "Brilliant" shaped course for Ostend, the "Thetis" and her companions eased down. The host of small craft dispersed for their various tasks. The night was overcast, with a light wind from the N.E., and a thick column of smoke soon began to roll down the coast, hiding everything.



PLAN A



PLAN B

As they approached the shore about 11:40 P.M. a great star shell soared into the sky, which was soon thick with them shining dimly through the eddies of the smoke. They were close to the harbour when a great disappointment overtook them. The wind, which had died away, shifted to the southward, greatly reducing the efficiency of the screen. The searchlights fastened on the vessels. At 11:56 the "Vindictive" emerged out of the smoke into the full glare of their beams. The mole could be seen 300 yd. on the port bow. Capt. Carpenter increased to full speed and approached it at an angle of 45°. A heavy fire was opened on her and she replied with her port 6-in. battery, the upper deck pompoms and the guns in the fore top. The storming parties drawn up ready to rush ashore lost both their leaders at this point. Col. Bertram Elliot, waiting to lead the Royals just abaft the bridge, was struck down by a shell which did fearful execution forward. Capt. H. C. Halahan at the head of the bluejackets amidships was killed by machine-gun fire.

At one minute past midnight, the ship came alongside the mole. It was intended to do this 300 yd. from the lighthouse abreast of the 4-in. battery, but the starboard anchor was hung up with a strong tide sluicing down the mole, and the ship was carried some 700 yd. from the lighthouse or nearly 400 yd. to landward of the intended spot. The port anchor was dropped and bowsed to with only a shackle (75 ft.) out. A further difficulty now arose. The rush of the 3-knot tide between the ship and mole created a heavy swell which threw the ship off the mole; only two of the 18 brows could reach the parapet, and the ship could not be kept into the mole. Swaying upward with the roll of the ship the two foremost brows came down scraping and grinding along the mole. The naval storming parties led by Lt.-Comm. Bryan Adams ran out along them, followed closely by the Royal Marines led by Capt. and Adj. A. R. Chater. As the seamen got to the wall they leapt down and tried to make the mole grapnels fast (for hauling the ship into the mole), but only one was got in place and a heavy roll broke it up.

This was a critical time, and it was four minutes past midnight when the little "Daffodil" came up and pushed the ship bodily into the mole. Two more brows were got into place and the landing parties got ashore. The "Vindictive's" guns had suffered heavily. The marine crew of the foremost 7·5-in. howitzer had all been killed or wounded. A naval crew from one of the 6-in. guns, which took its place, was almost entirely swept away. In the foretop the Royal Marines under Lt. Chas. Rigby had kept up a continuous fire with their pompoms and Lewis guns till two heavy shells got home on it, killing or disabling everyone there except Sergt. Norman Finch, who though severely wounded continued to fight his gun singlehanded till the top was wrecked by another shell. The "Iris II." with the Chatham company of Royal Marines and D company of seamen had suffered even more severely. She had gone alongside the mole about 150 yd. ahead of the "Vindictive." The swell broke up the scaling ladders. Lt. Claude Hawkings ("Erin"), who led the way, made a grapnel fast and was shot down on the mole. Lt.-Comm. G. N. Bradford ("Orion") got to the top of a derrick with a grapnel, leapt on to the mole, secured it and fell back shot into the water. Comm. Val. Gibbs fell, with both legs shot away. The grapnels tore away, and the "Iris II.," slipping her cable, dropped alongside the "Vindictive" to land her men across her. Here she again suffered heavily. A big shell went through the upper deck and burst just where 56 marines were waiting to charge up the gangways, killing 49 and wounding seven. Another shell in the wardroom killed 4 officers and 26 men. The heavy swell made it difficult to get alongside the "Vindictive," and only a few men had got across when the siren sounded the retire.

To return to the landing on the mole. The 400 yd. or so by which the "Vindictive" overran her position had a considerable effect on the plan. The seamen, instead of dropping down on the battery, had to go back to it 400 yd. along the mole. The "fortified zone," instead of being between the "Vindictive" and the shore, was now between the "Vindictive" and the battery on the mole, increasing the difficulty of an assault.

The seamen of A and B companies under Lt.-Comm. B. F. Adams, got ashore, and dropping on to the ledge below the parapet made their way toward the lighthouse. They came to

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a lookout station which they captured. Here an iron ladder led down on the quay and three of the party went down it. A machine-gun in the fortified zone was firing on them, and Lt.-Comm. Adams advanced towards it for some 40 yd. and after taking up a position returned to collect more men. Lieutenant-Commander Harrison, severely wounded in the head, arrived about this time and took charge. Lieutenant-Commander Adams met Maj. Weller who gave him reinforcements, but by the time he got back Lt.-Comm. Harrison had led a rush along the parapet, where he and several of his men were killed by machine-gun fire. Able seaman Mackenzie's courage here gained him a V.C., and able seaman Evans was seriously wounded and taken prisoner in trying to bring in Lt.-Comm. Harrison's body. D Company was still in the "Iris II.," but the marines were forming up on the mole to make an assault.

They had been busy at first in the other direction. The first platoon to get ashore made to the right toward the shore and silenced a party of snipers near No. 2 shed. Captain Bamford (awarded the V.C.) joined them and they reached and held a point 200 yd. toward the shore. Another party of marines dropping straight to the mole had established a strong point by No. 3 shed close to the "Vindictive." About 12:20 a terrific roar and a great sheet of flame rose high above the din. The viaduct had gone up, and the mole was secure from landward side. Major Weller now received Lt.-Comm. Adams' request for reinforcements and sent a platoon and the remains of another to help him.

They advanced toward the lighthouse and reached the lookout station, where they were held up again by machine-gun fire. Lieutenant-Commander Adams and his men were some 40 or 50 yd. ahead. Nos. 5, 7 and 8 platoons were forming up under Capt. Bamford for an assault on the fortified zone. This was the position when the signal to retire blared out.

The demolition company (C Company of seamen) had got ashore under Lt.-Comm. Dickinson, but the storming parties were too close to permit of the sheds being blown up, and an attempt to blow up the destroyers was beaten back. The danger of the attack from landward had been removed by the destruction of the viaduct. Submarine C1 had parted its tow and did not reach the scene in time. Lieutenant R. D. Sandford (awarded the V.C.) in C3 had sighted the viaduct about half a mile off, and running into the iron piers at 9½ knots had jammed the vessel with its 5½ tons of amatol hard and fast. The fuze was lighted and the crew of six were pushing off in their little motor skiff when the propellor was torn off by fouling the submarine, and they had to take to the oars. A rain of bullets fell close to them, and struck down two oarsmen in succession. They were 300 yd. away when the viaduct went up, scattering huge pieces of iron and concrete around them.

Another bullet struck Lt. Sandford, but just at that moment the picket boat with his brother (Lieut.-Comm. Francis Sandford) came up and took them off. Meanwhile, in the "Vindictive," Capt. Carpenter had seen the block ships go in. The position of the storming party and of the ship was precarious. None of the mole anchors had grappled. The ship was being held into the mole by the "Daffodil," and if she were disabled it was practically certain that the men in the mole would not get back. He decided it was time to retire. His own siren was riddled through and through, but the order was passed to the "Daffodil," and the shriek of its siren rose above the din.

It was 12:50 A.M. The parties came gradually back, the marines retiring in perfect order, bringing their wounded with them. Capt. T. M. Palmer refused to leave the shore while any of his men were there, and joined the ranks of the missing. Wing-Comm. F. A. Brock, too, never returned. He was last seen fighting on the mole.

A hawser was passed from the "Vindictive," and at 1:10 A.M. the "Daffodil" began to pull her bows off the mole. The hawser just held long enough to swing her bows round, and she got clear. The "Iris II." came under a heavy fire as she left the mole. A large shell carried away the port side of the bridge, mortally wounding Comm. V. Gibbs and Maj. Chas. Eagles, Lieutenant Spencer, though seriously wounded, continued to con the ship and got her clear. Three more shells hit the ship and caused heavy casualties in the crowded decks, but Motor Launch 558 (Lt.-Comm. Lionel Chappell, with Capt. Ralph Collins on board) came up, and throwing a smoke screen round her helped her to get away.

To return to the blocking ships. With the "Thetis" leading they had rounded the lighthouse in a storm of shot and shell. The "Thetis" propeller fouled a net laid at the entrance to the harbour and carried it with her. Both engines brought up, and she grounded 300 yd. from the pierhead. She was under heavy fire, and as she appeared to be sinking, the order was given to abandon ship and blow the charges; they detonated and the ship sank. The crew manned the remaining cutter and pulled to ML526 (Lt. Hugh Littleton) which was lying near.

The "Intrepid" astern had come under heavy shrapnel fire from the guns as she approached the mole, but after rounding it escaped their attention. She had 87 officers and men in her instead of 54, as the surplus had contrived to stay on board rather than miss the fight. She ran right into the canal, and Lt. Bonham Carter went full speed ahead with the starboard engine and full speed astern with the port to turn her round. As the ship commenced to make stern way he blew the charges, and the crews got into two cutters which were picked up by the "Whirlwind" and a motor launch. Lt. Bonham Carter with two officers and four petty officers had got on a Carley raft and floated down the canal. ML582 (Lt. Percy T. Dean, awarded the V.C.) had come right into the canal behind the "Iphigenia," and under a heavy fire picked them up and took them off. All the crew except one were saved. In the "Iphigenia," like the "Intrepid," the engine room ratings had avoided being taken off, so as to be present at the fight. She came under shrapnel fire off the mole, and as she rounded it a star shell showed up the "Intrepid" heading for the canal and the "Thetis" aground. Two shells struck the ship on the starboard side. The canal was hidden by smoke. It lifted for a moment, and the captain, seeing he was heading for the western pier, went full speed astern, then ahead with the starboard engine, and with a barge in front of him drove into the canal. There was a gap between the "Intrepid" and the eastern bank; he steered into it, collided with the "Intrepid," rang the gong to signify the imminent blowing of the charges, went astern and then ahead. She grounded on the eastern bank and the charges were fired. The crew left the ship in the only cutter left under fire. ML282 (Lt. Percy T. Dean) was waiting and took the crew on board, and then making the cutter fast to his stem went out of harbour stern first at full speed. Heavy machine-gun fire was concentrated on her; two officers were dangerously wounded and two of the launch's crew of four killed, but she got clear.

The destroyers had been lying off the harbour, and the "Warwick" now picked up four motor launches, including ML282 overloaded and full of wounded with 101 men of the "Iphigenia" and "Intrepid." ML110 (Lt.-Comm. Dawbarn Young) had come under a heavy fire while trying to show the blockships the way in. She was struck by three shells, which killed or wounded half the crew and wrecked the engines. Her captain, hit in three places and mortally wounded, gave orders to the last, but died before reaching Dover. The "Warwick," "Phoebe" and "North Star" had been cruising off the mole to screen the force from torpedo attack. The destroyer "North Star" losing her bearings in the smoke had emerged from the smoke screen and coming under a heavy fire was reduced to a sinking condition. The "Phoebe" (Lt.-Comm. Hubert Gore-Langton) attempted to tow her out, but the hawser was shot away once, and parted another time. She was therefore abandoned and sunk. By 1:30 it was all over and the force was on its way back to Dover. The "Vindictive" in terrible disarray arrived there soon after 8 A.M. on April 23. The "Iris II.," limping behind her, reached home at 2:45 P.M. Her commander had died that morning.

Meanwhile things had gone badly at Ostend. The blocking ships "Brilliant" (Comm. Alfred Godsal) and "Sirius" (Lt.-

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Comm. Henry Hardy), escorted by the Harwich destroyers "Tempest" and "Tetrarch," arrived off the coast. The motor launches under Comm. Hamilton Benn were busy laying a smoke screen, supported by the "Faulknor" (flying Commodore Hubert Lyne's broad pendant), "Lightfoot," "Mastiff," "Afridi," "Swift" and "Matchless." The wind was blowing lightly from the N.W., but about 11:50 shifted to the S.W. and blew back the smoke screen. The low clouds and drizzle made visibility difficult, and the Stroom Bank buoy could not be seen at first. Thinking that the ships were perhaps too far to the northward, Comm. Godsal continued on his course for two minutes, when he sighted the Stroom Bank buoy to the N.E. and turned to pass to northward of it. It was not, however, in its normal position (approximately 1 m. W.N.W. of the entrance), but had been shifted about a mile to the eastward. Commander Godsal steered from the buoy for the supposed direction of the harbour. As he looked anxiously out for the pierheads at Ostend, breakers suddenly loomed up on the starboard bow, and before the ship could turn she was ashore. The "Sirius" behind her grounded too. Fire had been opened from shore, and both ships were accordingly blown up where they stranded about a mile east of the piers. ML276 (Lt. Roland Bourke) took off the "Brilliant's" crew, while ML283 (Lt. Keith Hoare) rescued the men from the "Sirius." A second attempt to close Ostend was made on the night of May 9–10 by Comm. Alfred Godsal in the "Vindictive" and Lt.-Comm. Hardy in the "Sappho," an old cruiser of the same class as the "Sirius." This time there was no preliminary bombardment but aircraft were coöperating. Conditions seemed favourable for the attempt. The sea was smooth, the night dark with wind from N.W., but hardly had the ships left Dunkirk when the "Sappho" blew out a manhole joint in her boiler and had to put back.

At 1:30 A.M. the small craft went in to lay the smoke screen. News had previously come in that the Stroom Bank buoy had been removed, and Lt. W. R. Slayter went in a coastal motor boat to place a calcium flare in its old position. By 1:35 the smoke cloud was beginning to come down, and at 1:43 the order was given for the monitors to open fire. A roar of batteries answered from the shore. Two coastal motor boats, CMB24 and 30, dashed ahead and torpedoed the piers. But once again misfortune was to attend the attempt. As the "Vindictive" approached, a thick sea fog rolled up the coast, making it impossible to see anything at over 300 yd. Uncertain as to his position, Comm. Godsal steered to westward and then to eastward, and finally gave orders to CMB23 (Lt. Hon. Cecil Spencer) to light a million-candle flare. Though dimmed by the fog and drizzle, its glare revealed the entrance 200 yd. off. The "Vindictive" steered for it and the guns found her at once. The after control was demolished by a shell which killed everyone in it. The bridge was swept with bullets, and Comm. Godsal ordered everyone inside the conning tower. She was close to the eastern pier when a heavy shell burst close to the conning tower, which must have killed the commander for he was never seen again. Lt. Victor Crutchley took command and tried to turn her up the channel, but she grounded at an angle of about 25° to the pier and lay hard and fast. Engineer Lieutenant Wm. C. Bury blew the charges and she sank. The captain could not be found. ML254 (Lt. Geoff. Drummond, awarded the V.C.) came alongside under a fierce fire. His lieutenant and deck-hand were killed and he himself wounded in three places, but he managed to embark 39 officers and men, and then backing out of the entrance got clear and just managed to reach the "Warwick." Day was breaking and as the boat was badly damaged she was sunk. ML276 (Lt. Roland Bourke, awarded the V.C.) now returned to the "Vindictive," and after searching and shouting found Lt. Sir John Alleyne and two men, all badly wounded, clinging to a skiff. With three of his own crew killed or wounded Lt. Bourke managed to get out and reach the monitor "Prince Eugene" in safety.

This was the end of an enterprise for which no fewer than nine V.C.s were awarded. Its casualties amounted to a total of 637 killed, wounded and missing.

April 22–23	Killed or died of wounds	Wounded	Missing
Officers	19	29	2
Seamen	56	136	
Marines	93	205	14
"North Star"	21	13	
	189	383	16
May 9–10			
Officers	2	5	2
Men	6	25	9
	197	413	27=637

In judging what was achieved it is necessary to remember that at the end of 1917 and early in 1918 the whole efforts of the navy were directed toward one goal—to counter the submarine. The greatest losses were in the Channel where the Flanders flotilla worked, and the blow they would have received by the blocking of Zeebrugge and Ostend was well worth the risk. It was, however, only partially successful. Ostend, though the width of the entrance was reduced probably to 300 ft., was not closed, and though the ships sunk in Zeebrugge must have caused great inconvenience and delay it may be doubted whether they actually stopped the passage of submarines for more than a month. The entrance was 300 ft. wide; there was still a space of some 60 ft. between the stern of the "Iphigenia" and the pier, and by dredging along the edge and fixing up warping bollards it was made possible to warp submarines in and out at high water. The enterprise had another aspect. The navy chafed at its inactivity and looked eagerly for some outlet where it could get at grips with its enemy. The blocking of Zeebrugge and Ostend offered a good prospect of success and was within a reasonable distance of it. And if it did not wholly succeed, the work of those who took part in it sent a breath of inspiration through the navy and gave all who took part in it a lasting name. (A. C. D.)

ZEPPELIN, COUNT FERDINAND VON (1838–1917), German airship inventor, was born at Constance, Baden, July 8 1838. He was educated for the army and received a commission at the age of 20. He served, as a volunteer, in the Federal army during the American Civil War and whilst in America made his first balloon ascent. Returning to Germany, he saw active service in the Austrian war of 1866 and in the Franco-German War of 1870. In 1891 he retired from the army with the rank of general and thenceforth devoted his energies to the study of aeronautics. In 1900 he built an airship, which rose from the ground and remained in the air for 20 minutes, but was wrecked in landing. In 1906 he made two successful flights at a speed of 30 m. an hour, and in 1907 attained a speed of 36 miles. From that time onwards his airship construction made steady progress, and the success he had achieved was evidenced by the exploits of the Zeppelin airships in the World War. He died at Charlottenburg March 8 1917.

ZHILINSKY, YAKOV (1853–1918), Russian general, was born in 1853. On finishing his course at the Cavalry school in St. Petersburg in 1876 he was given a commission in the Guards cavalry, and in 1883 he was appointed on the general staff. He became in 1899 commander of a dragoon regiment, and in 1900 was promoted to the rank of general. During the Spanish-American War he was one of the foreign military attachés at the American general headquarters. In the Japanese War (1904–5) he was appointed chief of staff of the Viceroy of the Far East, Adml. Alexeyev, and in 1909, when Sukhomlinov became War Minister, Zhilinsky became head of the general staff. At the beginning of 1914 he was appointed to command the troops of the Warsaw military district, and on the declaration of war in 1914 he became commander-in-chief of the north-western front. After the defeat of Aug. and Sept. in eastern Prussia inflicted on his armies (Samsonov's and Rennenkampf's) he was recalled. In 1915 and 1916 he was the military representative of the Russian supreme commander-in-chief at the French headquarters. Zhilinsky was reported killed by the Bolsheviks in 1918.

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ZICHY, COUNT EUGEN (1837–1906), Hungarian traveller (*see* 28.979), died in 1906.

ZIEM, FÉLIX FRANÇOIS GEORGE PHILIBERT (1821–1911), French painter (*see* 28.979), died in Paris Nov. 11 1911.

ZIMMERMANN, ARTHUR (1859–), the German Foreign Secretary who, during the World War, conceived the idea of trying to inveigle Mexico into an alliance against the United States, was born May 8 1859 at Frankenstein. After having been vice-consul at Shanghai and acting consul in 1900 at Tientsin, he entered the Foreign Office in 1902 in a subordinate capacity and rose by 1910 to be director of the Political Section. In 1911 he was appointed under-secretary and in Nov. 1916 Secretary of State in succession to von Jagow. In this capacity he addressed to America the note of Jan. 31 1917 on the subject of U-boat warfare. He was also the author of the extraordinary invitation of Jan. 19 1917 to Mexico to enter into an alliance with Germany and to sound Japan as to her willingness to coöperate. For Mexico the price of this alliance was to be the American States of New Mexico, Texas and Arizona. This proposal, which was sent through the medium of the German minister to Mexico, von Eckhardt, was intercepted in America, and President Wilson was in a position to publish it on March 1 1917. With other disclosures regarding German machinations against the United States it materially contributed to rouse American national feeling, which found expression in the decisive votes of the Senate and the House of Representatives on April 5 in favour of declaring war upon Germany. Zimmermann retired on Aug. 5 1917 shortly after the resignation of Bethmann Hollweg. The German Liberals and the governmental Socialists had withdrawn their support from Bethmann Hollweg's Government at the time of the so-called "Peace Resolution" (July 19 1917), largely on the ground that it was inconceivable that the Allies and America should ever negotiate with politicians like Zimmermann and Bethmann, who had been guilty of the note to Mexico and other treacherous proceedings.

ZINOVIEV, GRIGORI [OVSEI GERSHON ARONOR] (1883–), Russian revolutionary politician, was born at Novomirgorod in 1883. He was of Jewish origin and his original name was Aronor, but he was known in early life under the names of Apfelbaum or Radomyslovsky and later adopted several designations, such as Shatski, Grigoriev, Grigori and Zinoviev, by the two last of which he is most frequently called. For many years he was an active member of the Russian Social Democratic Labour party, and attended the London Conference in 1907. The next year he was arrested on a charge of participating in the work of the printing press *Rabotnik*, sentenced to a term of solitary confinement in St. Petersburg and forbidden to reside there in future. He then made his way abroad, and in 1909 was editing the *Social Democrat*, the party's main organ. He was present at the party meeting of Nov. 1915, when a split occurred amongst the Russian Social Democratic members of the Duma, and earlier in that year had attended the Zimmerwald meeting at Berne, consisting mainly of Lenin's group, where arrangements were made to get copies of the *Social Democrat* secretly into Russia and to keep in close touch with Karl Liebknecht and Rosa Luxemburg in Germany so as to ensure the distribution of Lenin's literature to Russian prisoners of war.

After the Revolution Zinoviev returned to Russia and became a prominent member of the Petrograd Soviet, of which he became president after the murder of Uritsky in 1918. In the summer of 1917 the paper *Den* published revelations showing that he had been formerly employed by the department of police, and this statement was not refuted.

Zinoviev became a member of the Petrograd Committee and of the Central Committee of the Russian Communist party, and was first president of the Third (Communist) International. He was also president of the Petrograd Extraordinary Commission for combating counter-revolution, speculation and sabotage, and he occupied the position of president of the Soviet Government in Petrograd.

ZIONISM (*see* 28.986).—The part played by anti-Semitism in the growth of the Zionist movement has often been exaggerated. Zionism is a natural, indeed an inevitable, outcome of the instinct of self-preservation, which is as strong in the Jewish people as in any other; and the conditions which threaten the continued existence of the Jewish people in modern times are not wholly referable to anti-Semitism in any of its phases. They are equally present in countries in which anti-Semitism does not exist, or, if it exists, does not seriously affect the civic, social or economic position of the Jews. In such countries—which include, broadly speaking, all the countries of the western hemisphere except those of the old Russian and Austrian Empires and Rumania—the rapid assimilation of the Jews to the prevailing modes of life and thought is accompanied by an attenuation of the tie which binds them to their people, with the result that emancipation is a more potent enemy of Jewish solidarity and of Judaism than persecution or the milder forms of anti-Semitism. It follows that from the point of view of the Jews, which of course postulates the desirability of the continued existence of the Jewish people and of Judaism, the substitution of conditions of emancipation for conditions of persecution solves one problem only by creating another. Naturally enough, this was not foreseen by Moses Mendelssohn and the other pioneers of Jewish emancipation in Europe. They took it for granted that the Jew, having emerged from the ghetto and divested himself of the external peculiarities which cut him off from European life, would still be able to maintain his religious separateness, and to carry out a specifically religious and moral mission in the modern world. But experience has shown them to have been wrong. Judaism reduced to a set of religious beliefs and practices, or to a moral code with some superstructure of ritual, has no abiding hold on the Jew. The possibility of the continued existence of the Jewish people and of Judaism stands or falls with recognition of the fact that to be a Jew means primarily to be a member of a particular ethnic group. On that basis it is possible to build attachment to Judaism as religion or as moral teaching; without that basis the Jew is powerless to withstand through successive generations the forces of an environment which is always drawing him away from his own tradition, in its religious, ethical and intellectual aspects even more than in its ceremonial aspect. Hence a reaffirmation of the national idea in Judaism is even more readily intelligible as a reaction against the results of emancipation than against persecution.

It is not surprising, therefore, that, when the case for Jewish nationalism was first presented by a Jew in a European language, it was based on the disintegrating effects of assimilation rather than on the sufferings of the unemancipated Jews. In his *Rom und Jerusalem*, published in 1862, Moses Hess delivered a trenchant attack on the theory of German "Reform" Judaism, showed that Judaism could not live except on the basis of the national idea, and foretold a spiritual and political rebirth of the Jewish people in Palestine. Fourteen years later Jewish Nationalism was advocated on similar lines by George Eliot in *Daniel Deronda*. For both writers the essential thing is that the Jewish people should have an opportunity of taking up the broken thread of its history, and of expressing its own spirit and characteristics in a form of life shaped by itself. Considerations based on anti-Semitism are secondary.

Even in Russia, for so long the home of the great masses of Jews and the very temple of governmental anti-Semitism, Zionism was not fundamentally a product of persecution or pogroms. Until well after the middle of the 19th century, the best minds of Russian Jewry saw its hope in emancipation, not in nationalism. They thought that if the Jews of Russia discarded their distinctive language and dress, modified their religious ceremonial so as to make it compatible with European life, and sent their children to Russian schools, they would be admitted to full participation in the life of their country, like the Jews of western Europe, and all would be well. A vigorous propaganda on behalf of *Haskalah*—"enlightenment" or "modernism"—had been carried on for some decades in the Hebrew language, which was used not because of its national associations, but because the apostles of *Haskalah* disdained to write in Yiddish, and no European language was intelligible to

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those whom they wished to influence. *Haskalah* had made considerable headway against the obscurantism of those who opposed any and every change in Jewish life; and in the 'seventies of the 19th century the liberal policy of Alexander II. seemed to promise success to its efforts to modernize Russian Jewry. But already, within the modernist movement itself, another current of thought had set in. Perez Smolenskin, one of its most gifted champions, who spent the best years of his life in Vienna, had had the opportunity of seeing at close quarters what emancipation meant for Judaism. He had seen that in practice the ideal of being "a Jew at home and a man outside" did not work. Hence he became the advocate of a Jewish nationalism based on the "triple cord" of the Land (Palestine), the Law (*Torah*) and the Language (Hebrew). When, in 1880, the emancipatory tendencies of Alexander II. gave place to a wave of pogroms and a policy of systematic oppression, the seed sown by Smolenskin bore fruit. While the great majority of the Russian Jews who fled from massacre naturally made for the economically developed countries of the West, where they could be readily absorbed, a few, inspired by the ideal of a national revival, found their way to Palestine, and in the face of incredible difficulties laid the foundations of Jewish agricultural colonization. Supported by the *Chovevê Zion* (Lovers of Zion) in Russia, and later more amply by Baron Edmond de Rothschild, of Paris, these pioneers succeeded in maintaining their footing in Palestine. They were followed by a small but steady stream of immigration, which included many vigorous and self-supporting elements. Innocent of any concern with international politics, these Palestinian settlers accepted the Turkish administration as they found it, and, thanks largely to its very indifference, were able to establish little settlements with complete internal autonomy, to live in their own way, to manage their own affairs, and, not least important, to create a system of Hebrew schools, by means of which the ancient language of the Jews was revived as the speech of the younger generation of Jews in Palestine. This new Palestinian *Yishub* (settlement), strengthened in the early years of the present century by a number of young men and women who went to Palestine with the ideal of working as labourers on its soil, became the basis of the political success which Zionism achieved during the World War. The historic connexion of the Jews with Palestine would not of itself have availed to secure recognition of Jewish national aspirations, had there not been this concrete evidence of the will and the ability of the Jews to rebuild Palestine and their own national life in Palestine.

Side by side with this practical colonization work, the development of Jewish nationalist theory went on in Hebrew literature. The implications of Smolenskin's idea were worked out more thoroughly, and from a standpoint more in consonance with European thought, by Asher Ginzberg (*Achad ha-Am*), one of the early leaders of the *Chovevê Zion*, who has made his own the conception of Palestine as destined to be in the immediate future the "spiritual centre" of the Jewish people—that is to say, the home of a corporate Jewish life expressing in all its aspects the true qualities of the Jew, and serving for that reason as a point of attachment and a source of spiritual influence for the Jews of all the world, who will find in their common association with the spiritual centre a new basis of unity and a new bulwark against absorption by assimilation. This conception, though by no means universally accepted as a complete statement of the philosophy of Zionism, has had a profound effect on Zionist thought for the last 30 years, and, though it designedly leaves on one side the political implications of Zionism, has contributed materially to the final shaping of the political claims of the movement.

The reaction against anti-Semitism has, however, played an important port in Zionist history. In 1882, after the terrible outbreak of pogroms in Russia, a Russian Jew, Dr. Leo Pinsker, published a striking pamphlet, in German, under the title of *Auto-Emancipation*, in which he argued that Judeophobia was an endemic malady among the peoples of the world, analogous to the fear of ghosts, and that the only solution of the "Jewish problem" was to be found in the establishment in some suitable territory (not necessarily Palestine) of an autonomous commonwealth of Jews. While Pinsker thus took anti-Semitism as his starting point, he yet showed a certain appreciation of the historical and psychological roots of Jewish nationalism; and when his own scheme of large scale emigration to a hypothetical Jewish territory met with no support, he was nationalist enough to throw himself into the Palestinian work of the *Chovevê Zion*, whose first President he became. The later and more famous brochure of Dr. Theodor Herzl, *Der Judenstaat*[1] (1896), elaborated independently a scheme similar to that of Pinsker, based entirely on the need of a refuge from anti-Semitism, and disregarding completely the inner springs of Jewish nationalism. Herzl's argument implies throughout that all would be well if only Jews were allowed to assimilate peacefully to their surroundings; and to that extent he stood on the same ground as the assimilationist Jews of western Europe, who had for years been trying—without success—to alleviate the lot of the Jews of Russia and Rumania by bringing about diplomatic intervention with the Governments of those countries. He differed from them only in seeing the futility of their methods and the need for more radical steps. He did, however, assert the unity of the Jewish people ("we are a people, *one* people"), and the emancipated Jews of western countries, fearful of anything that might seem to cast doubt on their absolute identification with the nations among which they lived, could not accept a scheme based on such promises. With few exceptions, the Jews of the west met Herzl's appeal with indifference or hostility; it was the *Chovevê Zion* who rallied to his support with enthusiasm, less conscious of the difference between his philosophy and their own than of the value to their movement of his great personality, vision and influence. Thus there came about a fusion between the older Jewish nationalism, rooted in history and attached by its very nature to Palestine, and the newer so-called nationalism which demanded an autonomous territory in Palestine or elsewhere for those Jews who could not or would not assimilate to their European surroundings. The fusion was not effected without tears. At the first Zionist Congress (Basle, 1897) there was a struggle over the crucial question of the mention of Palestine in the programme of the movement. For Herzl's scheme of rapid mass-settlement scarcely any country could have been worse adapted than Palestine, with its restricted area, its neglected soil and its importance in international politics; but the nationalist instinct of the Russian Jews won the day, and the Zionist organization tied itself down to the aim of "establishing for the Jewish people a home in Palestine secured by public law."[2] The trouble did not end there. For the *Chovevê Zion* the gradual building up of a Hebrew life in Palestine—*Yishub Eres-Israel*—was the fundamental nationalist activity. Herzl, on the other hand, deprecated any "infiltration" into Palestine so long as the conditions necessary for full autonomy were not secured. He desired the acquisition by the Jewish people still outside Palestine of a formal charter making Palestine its preserve; immigration on a large scale would follow. The failure of his efforts to secure a charter, and his premature death in 1904, ultimately gave the victory here also to the tendency represented by the *Chovevê Zion*. Thus Zionism emerged from the seven years of Herzl's brilliant leadership with its pre-Herzlian philosophy and policy substantially unchanged, but with very

[1] The current translation "A Jewish State" is misleading. The prefix *Juden* has not the qualitative implications of "Jewish"; the German *Staat* does not connote political independence so definitely as the English "State"; and the emphasis in *Judenstaat* is on the first half of the compound, whereas in "Jewish State" it is inevitably on the second. "A Commonwealth of Jews" is a better rendering. This point is of some importance, because critics of Zionism have fastened on the term "Jewish State" as implying a desire to set up a State based on religious tests—than which nothing could be further from the idea of Herzl and of Zionists generally.

[2] *Öffentlich-rechtlich gesicherte Heimstätte* in the original German. The old translation "publicly and legally assured home" (*see* 28.988) is scarcely adequate. In article (4) of the Programme as there set out, "grants" should be replaced by "consents" (*Zustimmungen*). Zionism has never expected or asked for a financial grant from any Government.

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considerable gains in organization, in prestige, and in the number and diffusion of its adherents. The movement had become world-wide; it had been recognized by the British Government (in the abortive offer of a territory in E. Africa, 1903) as representing the Jewish people; and it had become a powerful leaven in Jewish life, stimulating interest in Palestine and the revival of the Hebrew language in every Jewish community throughout the world. The Zionist organization, though it could not of itself bring about any serious political change in Palestine, was in a position to secure that, if and when the political future of Palestine became a practical question, the claims of Jewish nationalism should not go unheard.

Meanwhile it had to be content with the up-hill work of Palestinian colonization and the education of the Jewish people in the national idea. The number of Jewish agricultural settlements in Palestine grew from about 25 in 1904 to about 45 in 1914. The Hebrew school system developed rapidly, and the project of a Hebrew university in Jerusalem was definitely launched in 1913. The membership of the organization and the capital of the Jewish National Fund grew from year to year, and unorganized sympathy with the Zionist outlook and aims became more and more widely diffused.

The entry of Turkey into the World War called for a renewal of political activity on the part of the Zionist organization, as it obviously meant that the future of Palestine would before long come up for settlement. At the same time, the position of the organization was extraordinarily difficult. With adherents in all countries, both belligerent and neutral, it could not present a united front in international political questions, and the leaders of its various groups could not even take counsel together. The last biennial Zionist Congress had met in 1913; a Congress in 1915 was obviously impossible. Emergency arrangements were made to secure the existence of the organization, but for practical purposes it had to remain in suspense throughout the unexpectedly long period of hostilities. Meanwhile, the need for obtaining express recognition of Zionist claims became more pressing as a result of the British advance into Palestine in 1917. Relations with the principal Allied Governments had already been established, mainly by Dr. Ch. Weizmann and Mr. N. Sokolow, two of the Zionist leaders. As the outcome of protracted negotiations, in which Sir (then Mr.) Herbert Samuel played an important part, the British Government issued on Nov. 2 1917 the "Balfour Declaration," stating that they "view with favour the establishment in Palestine of a National Home for the Jewish people, and will use their best endeavours to facilitate the achievement of this object," and adding provisos to safeguard the rights of existing non-Jewish communities in Palestine and the rights and political status enjoyed by Jews elsewhere. The Allied troops entered Jerusalem soon afterwards (Dec. 9 1917), and in March of the following year the Balfour Declaration had its first practical outcome in the departure for Palestine of a Zionist Commission, which was to "act as an advisory body to the British authorities in all matters relating to Jews or which may affect the establishment of a national home for the Jewish people," and was charged with certain specific tasks in relation to the Jewish population of Palestine. The Commission remained in Palestine as the representative of the Zionist organization, and there directed such Zionist work as was possible during a period of unsettlement and restricted communications. In July 1918 it laid the foundations of the future Hebrew University on Mount Scopus.

The Turks were finally expelled from Palestine in Sept. 1918, and the Zionist policy of the British Government, which had in the meantime been endorsed by all the Allied Powers and by the President of the United States, had its logical outcome in the incorporation of the Balfour Declaration in the Treaty of Sèvres and the acceptance by Great Britain of a Mandate for Palestine on behalf of the League of Nations (San Remo, April 1920). The draft Mandate as printed in a Parliamentary White Paper (Cmd. 1176), recites in its preamble the substance of the Balfour Declaration, whereby "recognition has been given to the historical connexion of the Jewish people with Palestine and to the grounds for reconstituting their national home in that country," and provides *inter alia* that the Mandatory shall be responsible for placing the country under such political administrative and economic conditions as will secure the establishment of the Jewish national home and the development of self-governing institutions (Art. 2); shall recognize an appropriate Jewish agency (provisionally the Zionist organization) as a public body for the purpose of advising and coöperating with the administration of Palestine in matters affecting the establishment of the Jewish national home (Art. 4); shall appoint a special Commission to study and regulate all questions and claims relating to the different religious communities (Art. 14); shall see that complete freedom of conscience is assured to all (Art. 15); and shall recognize Hebrew along with English and Arabic as an official language (Art. 22).

The frontiers of Palestine were defined in a separate convention between Great Britain and France dated Dec. 23 1920, and published in a White Paper (Cmd. 1195). In 1916, before either Government had come into close contact with Zionism, an Agreement (known as the Sykes-Picot Agreement) was made, dividing Palestine into a British and a French sphere of influence. This agreement needed revision in the light of subsequent developments, with due regard to both Arab and Zionist interests as well as to those of the two Powers concerned. The Convention of 1920 defines the frontiers of Palestine in such a way as to comply with the requirements of the historic phrase "from Dan to Beersheba," and to include in Palestine all the modern Jewish agricultural settlements, but not to give Palestine control of the sources of water power which are held to be necessary for its full economic development. On the other hand, the Agreement provides that Palestine is to have the use of the waters of the Upper Jordan and the Yarmuk and their tributaries, after satisfaction of the territories under the French mandate.

The draft Mandate for Palestine was attacked from three sides. Certain Palestinian Arabs, professing to speak in the name of the whole Arab population, objected absolutely to its Zionist provisions. A school of Zionists more or less in the line of the original Herzlian tradition complained that the draft Mandate gave too little to the Jewish people, and that the term "National Home" was too vague, and demanded that explicit provision should be made for the development of Palestine into a "Jewish State" within a fixed period. Lastly, some British politicians and newspapers attacked the Mandate on the grounds that it would involve the British taxpayer in expense with no corresponding return, and that it was unjust to impose a Zionist policy on the Arabs of Palestine against their wishes.

Despite these criticisms, there was every sign up to the end of 1921 that the Government intended to proceed in full accord with the spirit and the letter of the Balfour Declaration. Mr. Winston Churchill, the Secretary of State for the colonies, during his visit to Palestine in April 1921, emphatically declared that the Zionist policy of the Government remained unchanged, while assuring the Arabs with equal emphasis that their rights would be fully respected. The First High Commissioner, Sir Herbert Samuel, had won the confidence of all sections of the population by his impartiality.

AUTHORITIES.—Moses Hess, *Rom und Jerusalem*, 1862 (English translation by Meyer Waxman, 1918); Leo Pinsker, *Auto-Emancipation*, 1882 (English translation by D. S. Blondheim, 1918); Theodor Herzl, *Zionistische Schriften* (English translation of *Der Judenstaat* and of his Congress Addresses published by the Federation of American Zionists, 1917); Achad ha-Am, *Selected Essays*, translated by Leon Simon (1912); Richard Gottheil, *Zionism* (1914); Adolf Friedemann, *Das Leben Theodor Herzls* (1914); Kurt Nawratzki, *Die Jüdische Kolonisation Palästinas* (1914); *Zionism and the Jewish Future*, edited by H. Sacher (2nd ed. 1917: with bibliography); A. M. Hyamson, *Palestine: The Rebirth of an Ancient People* (1917); H. Sidebotham, *England and Palestine* (1918); Nahum Sokolow, *History of Zionism, 1600–1918* (2 vols. 1919: with bibliography); Norman Bentwich, *Palestine of the Jews* (1919); Shmarya Levin, *Out of Bondage* (1919); Leon Simon, *Studies in Jewish Nationalism* (1920); *Zionism* (Foreign Office Handbook, No. 162, 1920). There is also a voluminous periodical and pamphlet literature. *Zionism and the Future of Palestine* by Morris Jastrow, Jr. (1919) puts the "assimilationist" case against Zionism. (L. SL.)

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ZIRKEL, FERDINAND (1838–1912), German petrographer, was born at Bonn in 1838. He was educated at Bonn, where he trained as a mining engineer, but a journey he made to Iceland and the Faeroe Is., Scotland and England, and a meeting with Henry Clifton Sorby (*see* 25.431) attracted him to the study of microscopical petrography, then a comparatively new science. He became professor of mineralogy and geology successively at Lemberg (1863), Kiel (1868) and Leipzig (1870), retiring from the last-named post in 1909. He did much to develop the study of petrography, and his *Lehrbuch der Petrographie* (1866; 2nd ed. 1893–4) is a standard work on the subject. He was an hon. D.Sc. of Oxford, and also a foreign member of the Royal Society and an hon. member of the Mineralogical Society. He died at Bonn June 11 1912.

ZOBEIR RAHAMA (1830–1913), Egyptian pasha (*see* 28.992), died at Geili, near Khartum, Jan. 5 1913.

ZOÖLOGY (*see* 28.1022).—It is a sign of the vitality of a science such as zoölogy that its aspect should change from generation to generation. Paths of inquiry which are eagerly followed for one quarter of a century are sometimes almost forsaken during the next. There is change of emphasis and perspective. The reasons for this are mainly four. (1) A great discovery, such as Mendel made, opens up the possibility of conquering a territory hitherto unsubjugated, and this secures the enthusiasm of pioneers. (2) A new idea, such as that of discontinuous variations or mutations, alters the traditional outlook and is bound to affect zoölogical activity, *e.g.* taxonomy in the case mentioned; or a new scepticism, *e.g.* in regard to the transmission of exogenous somatic modifications ("acquired characters"), may prompt effort in reinterpreting facts. (3) A new contact, such as is suggested by the terms biochemistry and biophysics, biopsychology and psychobiology, always means a fresh series of formulations, making, in synthesis, for a more complete apprehension of that well-integrated unity—the Organism—which the various analytic methods seek to understand from different points of view. (4) A new method—such as section-cutting, differential staining, the use of the ultra-microscope, the utilization of statistics—may prove so rewarding that it attracts many recruits to its service, with the result that the trend of zoölogy is for a time markedly in that direction. There are other factors which change the aspect of zoölogy from generation to generation, such as the influence of great masters, like Huxley, Balfour, and Lankester; and the claims of the nation for scientific counsel, *e.g.* as regards agriculture, breeding, fisheries, and insect-pests. Moreover, the reflective intelligence of the scientific workers themselves, who have an ideal of the unity of their science, makes them tend, deliberately or subconsciously, to fill up gaps, as may be illustrated by the relatively recent development of the scientific study of animal behaviour.

For such reasons as have been indicated the aspect of zoölogy has changed considerably since the opening of the 20th century, though it may be safely said that the things that remain much the same are of more importance than most of the novelties. Of some of the significant new departures, which led to notable results in the period 1910–21, account is taken in separate articles, *e.g.* under BEHAVIOURISM, BOTANY, CYTOLOGY, ECONOMIC ENTOMOLOGY, MEDICAL ENTOMOLOGY, EMBRYOLOGY, SEX, GENETICS, MENDELISM, PROTOZOÖLOGY. What is attempted in the present article is a general survey, which may be conveniently arranged under the headings: Morphological, Physiological, Embryological and Aetiological (Evolutionary).

(A) MORPHOLOGICAL ZOÖLOGY

In its full scope morphology has to do with the static relations of organisms, with form and structure, as contrasted with physiology, which is concerned with the dynamical problems of vital activity. The two inquiries are obviously complementary and indispensable. It is a narrow view which affects to despise "purely morphological research"; as is obvious enough when any distinctively new type, like the sedentary ctenophore *Tjalfiella*, or the elusive Okapi, comes under consideration. Yet it must be admitted that zoölogical activity has in some measure turned aside from accumulating details of comparative anatomy at any and every level of analysis. As a discipline descriptive morphology is indispensable, but it is not to be persisted in too long, when there is so much else awaiting investigation. There is a widespread and not unreasonable opinion that morphological researches require some justification beyond their immediate result; they should contribute to our knowledge of affinities, of adaptations, of principles of architecture, and laws of change, as the best morphology has always done.

Causal Morphology.—The distinctive modern change has been the coming together of physiology and morphology, which developed for so long on paths that seldom even crossed. As E. S. Russell says, in his scholarly and critical *Form and Function* (1916), "Until well into the 'eighties animal morphology remained a purely descriptive science, content to state and summarize the relations between the coexistent and successive form-states of the same and of different animals. No serious attempt has been made to discover the causes which led to the production of form in the individual and in the race" (p. 314). The evolution theory offered only a formal solution, and for all practical purposes physiologists took the animal organization as given, not troubling about its mode of origin. Not a few saw the need of definitely tackling the physiology of development, notably Prof. W. His, in his well-known work, *Unsere Körperform und das Problem ihrer Entstehung* (1874), but the credit of founding a new sub-science of causal morphology (*Entwicklungsmechanik*) on an experimental basis certainly belongs to Prof. W. Roux, who has had many followers. The aim of *Entwicklungsmechanik* is defined by Roux to be "the reduction of developmental events to the fewest and simplest causal processes." Two classes of causal processes may be distinguished, as "complex components" and "simple components" of development. "The latter are directly explicable by the laws of physics and chemistry; the former, while in essence physico-chemical, are yet so very complicated that they cannot at present be reduced to physico-chemical terms. . . . They represent biological generalizations, in their way of equal validity with the generalizations of physics and chemistry" (Russell, 1916, p. 319). They are, in fact, the general properties or functions of organized matter, such as assimilation and dissimilation, growth and reproduction, heredity and self-differentiation.

Biophysics.—A special department of causal morphology may be usefully designated biophysics. As in regard to chemical processes, so in regard to physics, there is great promise in those investigations which carry up into the study of organisms the laws and lessons of the inorganic. An auspicious beginning of this difficult task has been made by Prof. D'Arcy W. Thompson, in his *Growth and Form* (1917), one of the foundations of biophysics. The aim of this inquiry is "to show that a certain mathematical aspect of morphology, to which as yet the morphologist gives little heed, is interwoven with his problems, complementary to his descriptive task, and helpful, nay, essential to his proper study and comprehension of form." Factors to be reckoned with are size, the principle of minimal areas, surface tension, equilibrium, the rate of growth in different directions, and the properties of colloids. The essay marks a big advance in the interpretation of form, whether in external structures like molluscan shells, the twisted horns of mammals and the shapes of eggs, or in internal architecture, like that of a bone, where statical and dynamical principles find fine illustration. Luminous also is Thompson's theory of transformations, in which it is shown how a single harmonious deformation may lead from one form of skull or leaf to that of a related type; and how trammels or lines of constraint may determine the action of the expansive forces of growth, now in one direction and now in another. This is more than an approach to the principles of morphogenesis.

Let us state this step of progress concretely. Exact study has shown that the thigh-bone, for instance, is in its proportions and structure mechanically correct. It has great strength with a maximum economy of material, and the internal beams are in their thickness and closeness of spacing demonstrably adjusted

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to the intensity of the stresses to be withstood. So far well; but the further step is to utilize the principles of physics in accounting, as far as may be, for the vital architecture. A guillemot lays a single top-shaped egg on a narrow shelf of a precipitous sea-cliff. Now Darwin pointed out that when an egg of this shape is roughly jostled by the wind or by the parent bird, it will rapidly rotate on its short axis, but will not roll away from the spot. The mechanical adjustment is simple and effective, but the further question is how far the adaptive result can be accounted for in terms of the physical conditions of pressure, surface-tension and the like, operative on the egg-shell while it is still in the making in the oviduct. It is for the student of biophysics to work this out.

Enough is not yet known of the possibilities of another line of physiological morphology, represented by the work of Prof. C. M. Child, *Individuality in Organisms* (1915), which seeks to interpret structural differences in terms of different rates of metabolism at the various levels or "gradients" of the axis of body-symmetry.

Homoplastic Structures.—Criticism of the concept of homology (resemblance in embryonic origin and fundamental structure) has brought into prominence the kind of resemblance which Sir Ray Lankester called "homoplasy," to which others have applied other terms, such as "convergence." It is a resemblance in types not closely related, and is due to the similar adaptation of non-homologous structures to similar conditions of life. But it is plain that the idea requires careful handling. There are cases where homologous parts become adaptively very like one another, directly or indirectly in relation to similar functioning, as in the case of the "paddles" of ichthyosaurs, turtles, penguins and cetaceans. To such cases it has been proposed to apply the term "parallelism," while Prof. Gadow (1913) has carried the analysis further, distinguishing "isotely" (hitting the same mark), *e.g.* zygodactyl feet of cuckoos, parrots, and woodpeckers, from "homaeotely" (hitting the same target, but not quite the same mark), *e.g.* the jumping foot of kangaroo, jerboa and Tarsius. Both of these have to be clearly separated from what many call true convergence, which Prof. Gadow has called "parately," where the feature has been evolved from parts and material so different that there can be little relationship, if any. The resulting resemblance is more or less superficial. Thus the bivalve shell of Brachiopods has nothing to do with that of Lamellibranchs, and the *bulla auris* of certain extinct reptiles (Pythonomorpha) is probably the quadrate, while that of the cetacea is the tympanic. Similarly, it is probable that the eye was evolved many separate times. Now the well-marked convergence or homoplasy of non-homologous structures depends on a coöperation of factors: *e.g.* (*a*) the widespread occurrence of certain similar hereditary factors which will respond much in the same way to similar environmental conditions; (*b*) the plastic power of similar functioning, operating in individual development; and (*c*) the similarity in the sifting process of natural selection. Along with (*a*) may be included the idea that the number of new departures is probably far from being unlimited; along with (*c*) may be included the idea that the biophysical conditions of stability are within relatively narrow limits; and along with (*b*) the similar moulding of similar functions may be included, as Gadow says, the subtle effects of correlation. It is probable that the continuation of the interesting study of convergence, along the lines indicated by Lankester, and more fully by Willey and Gadow, will lead to a deeper understanding of the principles of organic architecture or morphogenesis. It may also throw some light on classification, for it is worth considering whether the same congeries of characters may not arise more than once, and that not fortuitously. Prof. Gadow refers to his finding in Mexico the burrowing snake, *Typhlops braminus*, previously known from islands and countries of the Indian Ocean basin, a fact which suggests to him that the species had evolved twice. Some would say indeed that three similar domestic dogs might be traced to three different ancestors, a coyote, a jackal, and a wolf. The question also arises whether this promising study of convergence or homoplasy will not also elucidate close pattern-resemblances between forms, in regard to which it is impossible to suggest any genuine mimicry.

The Question of Species.—A huge number of new species of animals are described annually, sometimes several thousand insects in one year. When a collection has to be reported on or a new region explored, there is obvious need for the old-fashioned definition of new species, *i.e.* forms which do not conform to any previously described. To give one of these novelties a new name, if it is marked off by peculiarities of some magnitude (necessarily to some extent a matter of opinion), is practically a much more desirable procedure than the restraint which says; "*Mus n. sp.*, in the vicinity of *Mus sylvaticus*," for this makes subsequent reference intolerably tedious. But several changes may be detected in the zoölogical species-making of to-day. (1) There is no longer much enthusiasm for this line of activity in itself. It is a necessity, a useful discipline; but there is no particular hurry in completing the descriptive catalogue; there are more urgent affairs. (2) The task is now approached with a deeper sense of responsibility, for it is recognized that every peculiarity does not mean a new species. Many peculiarities are transient somatic modifications which are reimpressed on successive generations as long as the same incident factors are operative. Other peculiarities are not beyond the range of the variations which occur within the limits of one family, the progeny of one pair. It is a pious opinion that a new species should be based on numerous specimens, and that something should be known of the genetic behaviour of its peculiarities. (3) More attention is being given to the occurrence of variations and mutations, which, instead of being put in a corner as inconveniences, are now regarded as of no less interest than the rank and file of the species. Polymorphic species, like the ruff, are more interesting biologically than relatively fixed species like the pheasant. (4) But along with this increased and more analytic attention to variations, which have to be studied from the point of view of genetics, and if possible experimented with, there is an increased recognition of the other side—the discontinuity or apartness of species. It is difficult to maintain that the category *species* is univalent throughout, *e.g.* that it has the same value among micro-lepidoptera as it has among birds, but in all sound taxonomy a species is marked by its definite specificity. The tendency is toward a recognition of fixity as even more characteristic than flux. In many cases it seems safe to say that species differ in the presence or absence of unit characters, or in the arrangements of their unit characters, whose gametic factors exhibit Mendelian behaviour. (5) If species differ, like a series of organic compounds or like a series of related minerals, in their internal constitution, then it is no longer necessary to insist on the utilitarian value or adaptive significance of the specificities. That specific characters are often adaptive seems undeniable; that they need have this value is highly improbable (see Bateson, 1913).

Taxonomy Criticised.—Supposing the most satisfactory description of a new species, based on numerous specimens living in known environment, and supposing even some acquaintance with the genetics of the species, we must face the further question whether zoölogical work at this Linnaean level is worth while. It is in a way hodman work, though few do it very well. It is very quantitative work, adding leaves to inherited monographs. It tends to preoccupy the investigator, leaving him with little time or inclination for more adventurous pursuits. It leads to little in itself. Thus there is a widespread conviction that the day of the pure systematist is past, and should be declared as past.

But this is perhaps not more than a wholesome rebound from an unsatisfactory species-mongering. In any case there is another side to the criticism. If a region is to be surveyed in a business-like way, *e.g.* the Zoölogical Survey of India initiated and directed by Dr. Nelson Annandale, there must be a perfectly precise census. For practical purposes it is indispensable that there be no vagueness about the species of (say) mosquito and tick. The meticulous thoroughness, sometimes scoffed at by the impatient, may save the lives of thousands. Moreover,

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a new type with real taxonomic importance comes every now and then as the reward of drudgery. Nor can it be doubted that an evolutionary study of species, especially when it can be linked to genetic studies of the living material, may lead us nearer the main object in view—the understanding of life. Educationally, it may be doubted if the Linnaean discipline of species-making can be dispensed with without serious loss of efficiency.

Palaeontological Study.—The *differentia* of palaeontology is that it studies organisms in their time relations, in their genetic sequence from age to age. A taxonomy based only on a study of forms extant—"a horizontal section across the tree of life"—may be shrewd, but it is incomplete without the work of the palaeontologist who exposes the relations of the buried branches. It is certain that palaeontological research has done well by zoölogy in this respect, as may be well illustrated by the later work of Prof. D. M. S. Watson on the taxonomy of amphibians, reptiles and mammals, or by the magnificent history of the extinct Equidæ which has crowned the labours of Prof. H. F. Osborn.

Another achievement of the palaeontologists has been their increasingly satisfactory vindication of evolution as a historic process. Thus, to quote Dr. F. A. Bather (1920, p. 67): "if we take a chronological series of apparently related species or mutations, a^1, a^2, a^3, a^4, and if in a^4 we find that the growth-stage immediately preceding the adult resembles the adult a^3, and that the next preceding stage resembles a^2, and so on; if this applies, *mutatis mutandis*, to other species of the series; and if, further, the old age of each species foreshadows the adult character of its successor; then we are entitled to infer that the relation between the species is one of descent." This method of proving filiation is clearly illustrated by work on Ammonites. "Thus, large ammonites of the *Xipheroceras planicosta* group, beginning smooth, pass through a ribbed stage, which may be omitted, through unituberculate and bituberculate stages, back to ribbed and smooth again" (Bather, 1920, p. 68).

It is clear that taxonomic categories based on the study of existing forms must be supplemented by new categories disclosed by the palaeontologists' study of change in time. "Thus many crinoids with pinnulate arms arose from others in which the arms were non-pinnulate. We cannot place them in an order by themselves, because the ancestors belonged to two or three orders. We must keep them in the same orders as their representative ancestors, but distinguish a *Grade* Pinnata from a *Grade* Impinnata" (Bather, 1920, p. 63).

To the palaeontologists are due, we think, convincing proofs that evolutionary change may be sometimes continuous, by gradual transition rather than by saltation. In their contributions to such problems as orthogenesis, the rise and decline of species, the tempo of evolution, and the correlation of organic with cosmic changes, the palaeontologists have certainly kept pace with the "neontologists."

Animal Histology.—Without unduly trespassing on the article CYTOLOGY, we may indicate some general features of recent progress in animal histology. (*a*) The concept of the cell has become more fluid; for we recognize cells without very definite limits living in syncytia, cells with protoplasmic bridges binding them to their neighbours, cells with nuclear dust instead of a nucleus, and so on. Many zoölogists agree with Prof. Clifford Dobell that to speak of a Ciliated Infusorian (let us say) as a single cell is more misleading than useful. It is rather a non-cellular than a unicellular being; it has not entered upon the cellular line of evolution; it is a complex organism with much division of labour, and no Metazoan cell can be said to be on a par with it. Similarly, it is a suggestion of a fallacy in calling an ovum a single cell; for it has a complexity beyond imagining, it is a highly endowed implicit organism. (*b*) It is no longer easy to be satisfied with the oft-repeated comparison of a multicellular organism to a colony or regiment of cells. It has become clearer that cellular structure is largely a segregating device for the better working of that division of labour which the intricacy of vital processes demands. (*c*) If we take as a good example the recent *Introduction to Cytology* (1920) by the late Prof. Doncaster, we find that our picture of the animal cell has become extraordinarily complex. In the cell-substance or cytoplasm there are in many cases definitely formed granules or rods (mitochondria) which sometimes have to do with the formation of particular protoplasmic products; there are very frequently strands or rods of the "Golgi apparatus," the significance of which is very obscure; there are also "chromidia" which sometimes appear like migrants from the nucleus attempting to colonize the cytoplasm. In the centre of the cytoplasm floats the nucleus, microcosm within microcosm. It has its differentially permeable membrane; its chromosomes, usually definite in number for each species; its nucleolus, which may be a karyosome of chromatin or a plastosome of plastin; and the karyolymph, bathing both chromosomes and nucleoli. Then there are the centrosomes, which play an important part in organizing the process of nuclear division. But this is not nearly all, for each chromosome is like a necklace of beads threaded on a transparent ribbon of linin, and these beads or microsomes are probably the biological units of the lowest visible grade. In curiously indirect ways it seems possible (Morgan, 1919) to make a sort of map of the chromosomes of an egg-cell, and to say, for instance, that such and such hereditary factors of the fruit-fly Drosophila are located in the upper third of the second chromosome. In some cases it is possible to tell from visible peculiarities in the chromosomes of a fertilized egg-cell whether it would have developed into a male or into a female. These are but illustrations of the increasing precision. (*d*) In another direction, however, modern work has led to simplification, namely as regards cytoplasmic structure. The 19th-century histologists accepted with little question the view that the reticular, fibrillar, or other fine structure seen under high power in fixed and stained cells corresponded to a genuine architectural complexity in the living cell. But the work of Hardy (1899) and Fischer (1899) showed that the alleged structure is mainly of the nature of artefact, and that different structure is revealed according to the histological methods used. The use of the ultra-microscope has confirmed the conclusion that protoplasm in a living condition is a structureless fluid with particles and droplets in a freely movable state—a colloidal system in short. There must be arrangements which permit of the simultaneous occurrence of very different chemical processes in adjacent parts of the cell, but this is not of the nature of a visible cytoplasmic architecture, and it may be of the nature of a temporary gelation (see Bayliss, 1915, chap. i.). (*e*) Just as the early microscopists described and figured many structures under magnification without making them more significant or intelligible, so in the immense library of zoölogical histology there is a prodigious amount of meticulous description that is not very illuminating. Too much of it has been a registration of artefacts; and it may be fairly noted as characteristic of recent years that mere micrography is finding fewer devotees. The achievements of differential staining are giving place to a reasonable biochemical microscopy. For it is plain that the analytical study of minute structure does not justify itself—apart from demonstrating specificity and a succession of plasmic phases—unless it throws light on what happens in the cell-laboratory—the oxidations and reductions, the hydrations and condensations, the synthetic and analytic processes which constitute vital metabolism. These chemical reactions take place with extraordinary speed, which is conditioned by the activity of enzymes, and also with not less extraordinary orderliness, which is conditioned by some localizing (as it were insulating) arrangements of the colloidal system of the cell. But an analogy probably more fitting than that of a laboratory is that of a factory, for it seems clear that cytoplasm, nucleus, centrosomes, mitochondria and so forth are working together, and potent in their inter-relations.

Thus, to take an obvious case, there appears to be, as Richard Hertwig and others have emphasized, a definite volumetric ratio between the nucleoplasm and the cytoplasm of the cell. Interesting results have also rewarded the inquiry into the changes in this relation which occur in regenerative processes, in the growth of tumours, in the segmentation of the ovum, or when a microbe enters a cell, and disturbs its equilibrium.

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(B) Physiological Zoölogy

Along the line of comparative physiology the rate of progress during the last 20 years has not been proportionate to the importance and attractiveness of this line of investigation. There have been many individual researches of value, but there has been no adequate continuation of the broad and well-conceived work of Krukenberg 30 years ago. The difficulty is that few zoölogists are expert in biochemistry, without which many paths of physiological research are impassable, and that few biochemists are aware of the many and pressing zoölogical problems that promise great results. It may be doubted whether in the whole range of zoölogy there is any kind of investigation more likely than comparative physiology to yield new knowledge of first-rate importance. Just as the discovery of the significance of the glands of internal secretion (suprarenals, thyroid, etc.) has profoundly influenced the physiology of the vertebrates, so will a deepened physiology of the invertebrata modify the whole science.

Recent Advances.—Although we are still awaiting concerted prosecution of comparative physiology, there have been numerous advances of great interest, of which two or three illustrations must suffice. (*a*) G. H. Parker's working-out of the various grades of nervous activity exhibited by a series of animals from sea-anemone upward is a good example of a physiological inquiry of immediate interest in itself and also important in its bearing on the evolution of behaviour. (*b*) The continuation of the study of animal pigments may be illustrated by the work of Oscar Riddle, and not less interesting are such investigations as those of Gamble on the Aesop Prawn, of Sumner on the changeful patterns of flat-fish (*see* Colours of Animals), and of Minkiewicz on the apparent colour-disguises which some crabs find in the seaweed with which they mask themselves. (*c*) Also very promising is the inquiry (*e.g.* by Holmes and Schmidt) into the varied phenomena of "death-feigning." There is a prospect that it may be possible to arrange these in a series. Beginning with the sudden stoppage seen when the animal passes abruptly into a new medium we are led on to the spontaneous catalepsy of some Phasmids, and thence to "animal hypnosis," and to the subtler forms of death-feint in various birds and mammals. On another series it may be possible to arrange a succession of physiological states, such as extreme fatigue, auto-intoxication, cold-coma, sleep, hibernation, and so on to latent life. Further study of latent life is desirable.

Hormones and Chalones.—As was to be expected, the physiological discovery of the significance of the organs of internal secretion (ductless glands) has had its influence on zoölogy. The fact that stimulating hormones and quieting chalones produced by these ductless glands are distributed through the vertebrate body by the blood, and secure an integration hardly less important than that effected by the nervous system, has shed a flood of light on the functional correlation of parts. The idea of a regulative system is far-reaching. (*a*) It is of importance in connexion with growth and development, as studies of the pituitary body show. (*b*) It sheds light on the ante-natal symbiosis characteristic of mammals, for it is known that hormones pass through the placenta not only from mother to offspring, but from offspring to mother, to the great advantage of both. In such ways clues are being discovered which make it possible to understand how the uterus is prepared for the ovum, and how the milk is ready for the new-born mammal. (*c*) The whole dark subject of secondary sex-characters in animals has been illumined by the discovery of gonadial (testicular and ovarian) hormones which activate the development of the distinctive secondary characteristics of male and female. The internal secretions which pass from the ovary of a duck determine the development of feminine characters and the inhibition of masculine characters. The latter normally remain latent, but if the ovary be removed the duck becomes a more or less perfect imitation of a drake of the same race; and this assumption of masculinity may affect behaviour as well as plumage (Goodale, 1916). (*d*) When acid gastric contents reach the duodenum there is produced in the intestinal wall a hormone which the discoverers (Bayliss and Starling, 1902) called "secretin"; it is carried by the blood to the pancreas, where it provokes a greater production of digestive ferments which are carried by the pancreatic duct to the duodenum, there to discharge their appropriate function. It is for the zoölogist to discover similar automatic regulative processes; and the quest for hormones in invertebrates, suggested by the work of J. F. Gaskell (1914) on the leech, is very attractive. Such an everyday incident as the cat's hairs "standing on end" when surprised by a dog admits of obvious interpretation in terms of the hormone of the suprarenal bodies.

Ecology.—The old "natural history" cultivated a profitable field—the study of the life of organisms in its interrelations, as it is lived in wild nature. Logically classified, it was an enquiry into "the higher physiology," that interplay of organisms, where account has to be taken of more than the internal economy of the individuals concerned. For if physiology be the study of the organism in its dynamic relations it must include the serious study of the intact creature in its natural surroundings, as one of a pair and of a family, as a member of an association and of a fauna. This ecology (or "bionomics") is the oldest department of the science and it is indispensable; the question is how that of to-day differs from Réaumur's or Gilbert White's.

(*a*) Largely through Darwin's influence, there has been an increasing recognition of the complexity of interrelations amid which the organism lives and works. The recognition of the correlation of organisms has been not less profitable than the recognition of the correlations of organs within the body. It is not merely that, for completeness' sake, insects must be studied in relation to the flowers they visit, and the bird in relation to its mate and family, its "territory" and migrations—there is yet more implied in the modern insistence on the concept of "the web of life." As Darwin indicated, it deepens our understanding of natural selection in the struggle for existence. "For in the gradually evolved and ever complexified system of interrelations there is a sieve of extraordinary delicacy, which discriminates between even minute variations to the plus or minus side" (Thomson, 1919, p. 95). Moreover, part of the difficulty of understanding the frequent and general progressiveness of evolution (in the direction of increasing differentiation and integration) may be found in the gradual complexifying of the web of life, *e.g.* in the linkages between flowers and their insect-visitors. "There is established an external system of interrelations which is always becoming more intricate, and this forms the sieve by which variations are sifted. There has been an evolution of sieves which partly accounts for the progressive evolution of the sifted" (Thomson, 1919, p. 96). The importance of recognizing animate interrelations is familiar.

(*b*) Modern "natural history" has become frankly evolutionary. The "*Souvenirs Entomologiques*" of Henri Fabre must be taken as the crowning work of the older school; unquestionably an achievement of genius when we consider the patience, ingenuity, and intimacy of its observation, behind which lay an emotional sympathy, bringing, at times, even scientific reward, and yet an achievement robbed of its fruition by the observer's refusal to take Darwinism seriously, and by an unprofitable pessimism as to the possibility of any evolutionary interpretation whatsoever. A more progressive note is sounded in modern work permeated with the evolution-idea, such as Wheeler's studies on ants or Roubaud's on wasps.

(*c*) A third change, and a welcome one, is that "natural history" is becoming more analytic—which will eventually mean a fresh synthesis. Thus the study of the migration of birds, for so long rather fumbling and anecdotal, has entered on a new phase of precision. This may be illustrated by Dr. Eagle Clarke's careful analysis (1912) of enormous masses of observational material, the utilization of a new ringing method (Landsborough Thomson, 1921), and by the precise experiments of Watson and Lashley (1915) on the homing of terns at the Tortugas.

Another illustration will be found in the still incipient endeavour of the shrewder observers to take advantage of the results of the modern study of animal behaviour. The older

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naturalists read the man into the beast without let or hindrance or else reacted to the other extreme of regarding animals as automata. It is now recognized as desirable that an attempt be made to describe behaviour with reference to definite categories, of intelligence, instinct, individual habitation, association, tropisms, reflexes, and the like. To mention what may seem at first sight a small matter, Miss Frances Pitt (1920), in studying the well-known method the thrush adopts of breaking snails' shells on a stone-anvil in the wood, takes the trouble to experiment with a young thrush to see whether the behaviour is instinctive or whether it has to be learned. Her account of the bird's gradual learning, by a "trial and error" method, is of real scientific value.

Luminescence.—There is definite progress to record in the study of many animal activities which stand somewhat apart from the everyday life of the body. The inquiry into the nature of animal luminescence is a case in point (see Harvey, 1920). Luminescence is known to occur in no fewer than 36 orders of animals; it is a chemical phenomenon that may manifest itself after life has ceased (bacteria apart); it may be produced *in situ* in the cells in which the photogenic substance is produced, or there may be a luminous secretion that exudes over the surface of the body and forms a glimmering trail in the sea or on the ground; it may have its seat in more or less elaborate luminous organs which often show a remarkable convergence to eyes (the chemiphotic approaching the photochemical). The production of the animal light may be continuous or it may be periodic and even rhythmic. In "fire-flies" the light consists wholly of visible rays, with no infra-red or ultra-violet, and none of the energy is lost in the form of heat. It is practically perfect "cold light." The matter has been probed furthest in Lampyrid beetles, in the small crustacean Cypridina, and in the boring bivalve Pholas, and the result has been to confirm the contention of Raphael Dubois (1887) that a protein substance, luciferase, acts, in the presence of oxygen and water, on another substance, luciferin, which has much in common with peptones. The luciferins of different luminescent animals are different, but all luciferins have a good deal in common, and it is the same for the luciferases. It is probable that luciferase is an organic enzyme or catalyst which oxidizes luciferin, or accelerates its oxidation, with the result that light is produced. It is interesting that the chemical physiology of animal light has outrun its ecologic interpretation. In some cases the light may be no more than the byplay of some physiologically important chemical change, but a biological interpretation is demanded when there is an elaborate luminous organ or a definite arrangement of organs. Unfortunately, however, the interpretations suggested remain more or less of a speculative nature. The light may scare away intruders; it may be a lure attracting booty; it may illumine the surroundings; it may facilitate the recognition of kin; and it may serve as a sex-signal in mating. What seems a physiological byplay has thus been utilized and elaborated in quite different directions.

Tropisms.—On the inclined plane of animal behaviour tropisms occupy a place somewhat above ordinary reflex actions, and it is certain that an understanding of the ways of animals is impossible unless the role of tropisms is duly appreciated. This need not involve an attempt to coerce behaviour of a higher order (*e.g.* implying intelligent control) into categories manifestly too small—an exaggeration which sometimes seems to attend the brilliant experimental work of Jacques Loeb (1918). Yet tropisms must be taken account of, and Loeb has shown that they are obligatory or forced movements of the animal as a whole, which more or less automatically secure physiological equilibrium in relation to outside stimuli, such as light or heat, gravity or electricity, diffusing chemicals or water currents. When a moth, constitutionally adapted to nocturnal activity, but positively heliotropic none the less, comes in its flight within the sphere of influence of a lit candle, and has one eye much more illumined than the other, owing to the direction in which it happens to be flying, more intense chemical processes are set up in the more illumined eye. This means that on the illumined side there is a relative increase in the mass of certain chemical products. But stimulations are always passing from the brain of the flying moth to the contracting muscles, and if the physiological symmetry of the brain has been disturbed by the unequal illumination of the eyes, the muscles on the more illumined side are thrown into a state of stronger tonus, with the result that they respond more forcibly to nervous stimulation, and therefore turn the head and body of the moth directly toward the candle near which it is flying. "As soon as the plane of symmetry goes through the source of light, both eyes receive again equal illumination, the tension (or tonus) of symmetrical muscles becomes equal again, and the impulses for locomotion will now produce equal activity in the symmetrical muscles. As a consequence, the animal will move in a straight line to the source of light until some other asymmetrical disturbance once more changes the direction of motion" (Loeb, 1918, p. 14). When elvers go straight up stream against the current, when small crustaceans crowd to the shaded or to the warmer corner of the aquarium, when newly hatched turtles make for the sea, we have to do with tropisms. In many cases, however, even among the lower animals a higher note seems struck. For Jennings (1906) there is trial after trial of different movements, and there is a selection of that which brings relative satisfaction; an interpretation to which this observer adheres, despite criticism from Loeb.

Zoölogical Parasitology.—Progress in the study of parasites has been a very marked characteristic of the zoölogical work of recent years. This is congruent with the increased attention that has been given to the broad fact of the inter-relations between organisms, and details of the important medical results achieved will be found in the separate medical articles on this or that form of parasitic disease (*e.g.* MALARIA, SLEEPING-SICKNESS, BILHARZIOSIS, etc.). The tracking of the life-history of parasites is but a particular instance of this kind of investigation, with a special interest when the parasites affect Man and his domesticated animals and cultivated plants. Good examples are not far to seek—the malaria organism (plasmodium), and the mosquito's share in its development and dissemination; the trypanosomes that cause sleeping-sickness and other diseases, and the tsetse flies and other insects implicated in their transmission; the hookworms (*Ankylostoma* and *Necator*) which depress the vitality of enormous numbers of the inhabitants of tropical and sub-tropical countries; and the species of the formidable Bilharzia (*Schistosomum*) whose life-history, discovered by Dr. Leiper, is bound up with freshwater snails. Apart altogether from the immense practical importance of these investigations, they are full of theoretical interest. Thus, to take the two kinds of Bilharzia in Egypt, one species, *Schistosomum mansoni*, has ova with a lateral spine, is chiefly associated with the snail Planorbis, and produces intestinal bilharziosis; while the other species, *S. Haematobium*, has ova with a terminal spine, is chiefly associated with the snail Bulinus, and produces renal bilharziosis—obviously a fine instance of specificity. As several human diseases have now yielded to attack from the zoölogical side, it is not over-sanguine to consider whether there may not be a much-desired clue in the fact that cancer of the stomach of the rat is produced by a nematode whose carrying host is the American cockroach. Very interesting and somewhat surprising is the discovery (see Rennie, White, and Harvey, 1921) that the so-called "Isle of Wight disease" in hive-bees, which spread in a few years all through Britain, is causally connected with the presence of a minute mite, *Tarsonemus woodi*, in the cavity of two anterior tracheæ. More familiar is the demonstration of the fact that true pearls may have a parasitic origin.

(C) EMBRYOLOGICAL ZOÖLOGY

While descriptive morphological embryology continues on lines which require no vindication—we have only to think of recent work on the development of the marsupials and armadillos, of Dipnoi and Echinodermis—it is instructive to notice in the volumes of the *Journal of Experimental Zoölogy* how many embryological investigations sound the experimental note. There has been great activity not only as regards what is often called

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"experimental embryology" in the narrow sense, where germ-cells and developing ova are subjected to artificial stimuli, constraints, and disturbances, but also as regards later stages of embryonic life. Here might also be considered the observations of Carrel and others on the prolonged life of pieces of tissue in artificial cultures, and the important researches of Ross Harrison on the growth of a nerve fibre. It is of zoölogical as well as physiological interest that this growth should be closely comparable to the protrusion of a pseudopodium by an amœba.

Experimental Embryology.—In illustration of what may be included under the term "experimental embryology," we may take Godlewski's remarkable cases of the fertilization of an ovum with the spermatozoon of an unrelated animal. A fragment of the ovum of *Echinus*, bereft of a nucleus, was fertilized by the spermatozoon of the Crinoid *Antedon*. The segmentation, the gastrulation, and the formation of the mesenchyme followed the type of the maternal parent, which seems to show that the cytoplasm may count for much in inheritance. The ova of *Sphaerechinus* were fertilized by the spermatozoa of the Annelid *Chaetopterus*, and the union of the two nuclei was observed. But before the nucleus divided, the chromatin from the spermatozoon was ejected, as if the incompatibility was too pronounced. In another set of experiments Godlewski altered the composition of the sea water containing sea-urchin ova, and then introduced the spermatozoa of *Chaetopterus* or of the mollusc *Dentalium*. The result was development, which was followed to the Pluteus stage. The further experiment was made of adding spermatozoa of the sea-urchin to those of the worm or of the mollusc, with the result that no development occurred. Godlewski speaks of the antagonism of the unrelated spermatozoa, and Bohm (1921, p. 27) calls attention to the possible analogy with the antagonistic action of serums derived from distantly related species. Nothing, he says, is more fruitful in biology than the bringing together of two sets of facts which appear at first sight to belong to very different provinces. Enough has been said to indicate the interest of this relatively young inquiry.

Artificial Parthenogenesis.—It was discovered independently by Yves Delage and by Jacques Loeb that ova which do not normally show parthenogenetic or aspermic development may be induced to do so by very varied artificial stimulation. The prosecution of this kind of experiment has made it plain that there are usually two distinct events—the first, a stimulation which induces cleavage but is apt to lead to disintegration; the second, a counteracting or corrective influence which steadies development, acting as a life-saving brake. Thus, to take one of Loeb's methods, if the eggs of the sea-urchin are subjected for a short time to the influence of some fatty acid like butyric acid, cleavage sets in, but it is then necessary to place the ova in hypertonic sea water to keep them on lines of safety. Or, to take one of Delage's methods, the ova may be first activated by a combined application of tannin and ammonia, and then replaced in ordinary sea water. Or, to take Bataillon's method, if the eggs of the frog are first activated by pricking them with a very fine stilet of glass or platinum, and then steadied by washing them with blood, which allows of the entrance of a corpuscle, normal development may follow, and several young frogs, of both sexes, have been reared.

Experimental Teratology.—A good instance of the modern endeavour to supplement the study of form by the study of function, morphology by physiology, may be found in the development of experimental teratology. Accurate descriptions of monstrosities and abnormalities are valuable, but their significance is increased when some light can be thrown on how the peculiarities in question came about. It has been shown that defective nutrition of the embryo, especially at critical stages, may lead to "arrests of development," such as harelip in Man. It has been shown that conditions which bring about local slowing or quickening of the rate of development may result in abnormal asymmetry, coalescence, separation, and the like. But a more precise illustration may be useful. Dr. E. I. Werber (1916) subjected the developing eggs of the American minnow, *Fundulus*, to various reagents, such as butyric acid, which brought about numerous monstrosities in eyes and ears, nostrils and mouth, heart and fins. The chemical intrusion seemed to dislocate and partially dissolve the germinal material, especially toward the head end of the embryo. As one of the results of a disturbance of carbohydrate metabolism is the production of butyric acid, the theory almost suggests itself that a poisoning of a mammalian mother's constitution with butyric acid might account for histolytic monstrosities in the offspring. Werber has also shown that a breaking-up (blastolysis) of the optic club brings about the formation of many lenses. The optic club fragments exert on various parts of the skin which would not naturally form a lens a specific effect, like that of a ferment, which induces multiple lens-formation.

Sex Determination.—Without encroaching on the article SEX, we may notice the general fact that the inquiry has become wholesomely experimental along several distinct lines. (*a*) The striking work of Geoffrey Smith and Potts, following Giard's pioneer observations, has shown that the castration of a male crab by a Rhizocephelan parasite induces an expression of latent feminine and female features. The male put on abdominal limbs like those of a female, and the gonad showed ova; and Smith's theory, stated briefly, was that the parasite alters the composition of the male's blood to or toward a female condition, and that this is naturally followed by the development of latent female secondary characters, or by the regeneration of an ovary instead of a testis from the indifferent residue that remains at the end of the infection. Metabolism-stimulation activates latent sex characters. Using the terminology of *The Evolution of Sex* (Geddes and Thomson, 1889), Geoffrey Smith summed up: "This adaptive regulation consists in the production of at least a partially female condition of anabolism as opposed to a wholly male condition, the female condition being preponderantly anabolic or conservative, as opposed to the katabolic male condition, and, by this change from a katabolic to a more anabolic condition, the animal can withstand better the drain on its system increased by the parasite." (*b*) Many experiments show that latent masculine characters in a female animal, or latent feminine characters in a male, may be activated by changes in the internal secretions of the gonads. (*c*) Baltzer (1914) has shown that if the very young sexually indifferent larvæ of the worm *Bonellia*, just hatched from the eggs, happen to become attached to the proboscis of an adult female, they develop into males; whereas, if they fail to attach themselves and sink into the sand or mud, they develop slowly (almost exclusively) into females. But the story does not end here. Baltzer helped some of the very young free-swimming *Bonellias* to attach themselves to the proboscis of a full-grown female; those that he left attached for a very short time developed into almost perfect females; those that he left attached for a long time became perfect males, if such degenerate pigmies can be called perfect; while those that he left for intermediate periods showed practically all grades of inter-sex. These fine experiments point to a conception of sex as plastic, reversible, constitutional, and quantitative. (*d*) The recent work of Oscar Riddle has made it practically certain that pigeons produce two kinds of eggs which differ in the rate or intensity of their chemical processes. One kind of egg has a low storage capacity, a high oxidizing capacity, and a relatively higher intensity of metabolism; and such a type of egg develops into a male bird. The contrasted type of egg develops into a female bird, while an intermediate type of egg, produced for instance early in the season, will develop into a female bird with an admixture of masculine features. Femaleness in an egg is associated with high storage capacity, less intensity of metabolism, lower percentage of water, higher total of fat and phosphorus, and greater energy value in the yolk as determined by the calorimeter. It is of further interest to notice that analyses of the blood of adult cocks and hens show a persistence of constitutional differences analogous to those which mark the two kinds of ova. These experiments furnish a corroboration of the thesis, suggested in 1889 by Geddes and Thomson, that femaleness is associated with a relative preponderance of constructive up-building, or anabolic processes, and conversely for maleness.

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It need hardly be said that what seems to have been made very probable for the pigeon need not hold good in the same way for other animals. Thus in frogs it is probable that all the eggs are alike to begin with, but that there are two kinds of spermatozoa, one with and the other without a special sex-chromosome. If the eggs are quite normal at the time of fertilization the determination of the sex depends on whether the egg is fertilized by a sperm with the special sex-chromosome (which results, it is believed, in a female offspring), or by one without the sex-chromosome (which results, it is believed, in a male offspring). Even clearer cases have been worked out in insects by Prof. E. B. Wilson and others. It does not follow that the physiological condition of the ova is of no importance, for over-ripe frog's ova tend to develop into females. Moreover, the presence of the special sex-chromosome may be associated with certain constitutional differences in the germ-cell—an index as much as a cause.

Regenerative Capacity.—Prof. T. H. Morgan's critique (1901) of Weismann's theory of regeneration as an adaptive phenomenon—occurring in those two animals and in those parts of animals which, in the natural conditions of life, are particularly liable to non-fatal injury, has been followed by interesting experiments and observations. It seems that regeneration often follows the experimental excision of a part which could rarely, if ever, be lost in the ordinary conditions of life. In such cases it seems gratuitous to search for some far-fetched evidence of adaptiveness. It seems more reasonable to regard the regrowth of an excised portion of the body as a special exhibition of a power which is always in operation in the repair of certain tissues, such as the glandular epithelium of an intestine. On the other hand, this will not suffice when there is definite prearrangement establishing a weak breaking plane, as in a crab's claw or a lizard's tail. The fine work of Dr. J. H. Paul (1915) has shown in the case of the shore-crab (*a*) the definite prearrangements at the breaking plane; (*b*) the muscular arrangements that secure the rapid surrender of a captured or broken limb; and (*c*) the presence of a two-flapped membrane, pierced by nerve and blood-vessel, which automatically folds over the wound and prevents hæmorrhage. To this has to be added the way in which the new limb is fully formed within the scar before it is jerked out after a moult. When it is known that a breakage of a leg by a dislodged stone is a common accident among shore-crabs, the adaptiveness of the special arrangements seems more than plausible.

Senescence and Rejuvenescence.—The study of development in the widest sense includes the phenomena of senescence as well as those of adolescence, and there is no doubt that progress is marked by such studies as those of C. M. Child (1915). On an experimental basis, mostly in regard to planarian worms, Child rests the conclusion that as an organism differentiates, it ages, for there is a necessary accumulation of relatively inactive and stable constituents in the colloidal cytoplasmic substratum, and this accumulation involves a decrease in the rate of metabolism, as the flow of a stream may be slowed by what it deposits in its bed. There are indeed counteractive processes of reduction, removal, and de-differentiation, when the metabolic stream may be said to erode its bed instead of depositing more materials. Periods or it may be crises (often seasonal) of rejuvenescence alternate with periods of senescence. Sooner or later, however, rejuvenescence lags and senescence prevails. Exceptions, as Weismann and others suggested, are to be found in the Protozoa, where recuperative rejuvenescence is wellnigh so perfect that it implies bodily immortality. The question rises whether a similar evasion of natural death may not occur also in some simple Metazoa such as hydroid polyps and planarian worms.

In the same connexion may be noticed the observations of L. L. Woodruff on pure-line (all descended from one individual) cultures of the slipper-animalcule *Paramoecium*, which multiplies rapidly by fission. In 1915 he reported on a stock which had kept agoing for over eight years, 5,250 or more asexual generations. There had been no conjugation (which does not occur between members of a pure line) and no artificial stimulation; the secret of continued vitality, so different from the aging observed by Maupas, being abundant food and a thorough removal of waste products from the water. Very suggestive is the periodic, approximately monthly, occurrence of *endomixis* observed by Woodruff and Erdmann (1914), a disruption and reorganization of the nuclear apparatus, similar to that which precedes conjugation in natural conditions. It appears to serve as a process of rejuvenescence, and it serves, perhaps, like conjugation, to provoke variability.

Another correlated idea, to which the work of some palæontologists has pointed, is that one type of animal may differ from another in the relative length of the chapters in the life-history. The pre-natal chapter may be long in one, *e.g.* elephant, and very short in another, *e.g.* opossum; the larval period, long drawn out in a crab, is telescoped down in the crayfish. The young storm-petrel remains many weeks in the burrow; the young mound-bird may run or fly from its birthplace on the day it is hatched. A queen-ant or a queen-bee may live for several years as an adult, while the may-fly sometimes completes its adult life in an evening. The idea is that an arc in the curve of life may be shortened or lengthened in related types, as the adaptive outcome of "temporal" variations. In vertebrate animals it is known that changes in the activity of the glands of internal secretion may hasten or slow down processes of development as well as processes of metabolism.

(D) Aetiological Evolutionary Zoölogy

Heredity.—Prof. T. H. Morgan (1915, p. 7) calls attention to a curious situation which has begun to develop since 1900, when Mendel's law was rediscovered. "The students of heredity, calling themselves geneticists, have begun to draw away from the traditional fields of zoölogy and botany, and have concentrated their attention on the study of Mendel's principles and their later developments. The results of these investigators appear largely in special journals. Their terminology is often regarded by other zoölogists as something barbarous—outside the ordinary routine of their profession. The tendency is to regard genetics as a subject for specialists instead of an all-important theme of zoölogy and botany." It is to be hoped that this severance is only a passing phase, for its accentuation would mean much loss on both sides. "It would be as unfortunate for all biologists to remain ignorant of the modern advances in the study of heredity as it would be for geneticists to remain unconcerned as to the value for their own work of many special fields of biological inquiry." Of clear exposition by investigators like Bateson and Punnett, Castle and Morgan, there is no lack, and the advantages of a synoptic view of the fundamentals of zoölogy as a whole do not need to be enforced by argument.

Referring for due treatment to the article Mendelism, we may call attention here to three points of general interest. (*a*) In two recently published books we find two extraordinarily discrepant statements in regard to heredity. In one of them Prof. J. P. Lotsy (1916, p. 63) says: "We know absolutely nothing of heredity." In the other Prof. T. H. Morgan (1919, p. 15) speaks of the fundamental aspects of heredity having turned out "so extraordinarily simple," and he elsewhere indicates that the problem of heredity may be regarded as solved. What is the meaning of this startling divergence of statement? The first author had in mind the difficulty of conceiving how all the manifoldness of a well-endowed organism is telescoped down into a microscopic implicit individuality—the germ-cell. The second author was contemplating the precise way in which certain characters of the parents, carried by the chromosomes, are distributed among their offspring. For a large number of cases the modern theory of factors or "genes," located in linear order in the chromosomes, is convincing and clear. (*b*) The list of characters proved to exhibit Mendelian inheritance is always increasing. Many organisms consist, in part at least, of a great bundle of "unit-characters," the factors for which behave in inheritance as if they were indivisible entities. They do not blend or intergrade; they are present in a certain proportion of the progeny; they are normally either there in their entirety or completely absent. It is now recognized, indeed, that one

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factor or gene may have manifold effects and that one character may be the product of many genes, yet the general idea remains that "the germ-plasm is made up of units that are independent of each other in at least two respects, namely, in that each one may change (mutate) without the others changing, and in segregation and in crossing over each pair is separable from the others" (Morgan, 1919, p. 240). The balance of present opinion seems to be strongly in favour of interpreting all inheritance as Mendelian, but it seems to many not unscientific to say that there is another mode of inheritance which may be described as "blending." There are indeed ways of explaining away blending as due to the coöperation of multiple Mendelian factors, and we are also now being introduced to "Mendelian characters which slowly blend"; but in an article which attempts a general survey it seems just to cite the considered opinion of an experimenter and thinker like Prof. W. E. Castle (1916, p. 218), who writes: "It seems best, accordingly, to attempt neither with Galton to generalize all inheritance as blending nor with Johannsen to treat all inheritance as alternative, but frankly to recognize the existence of two categories of cases distinct in their inheritance behaviour."

Inbreeding and Outbreeding.—Attention has often been directed to the evolutionary importance of inbreeding and outbreeding (exogamy and endogamy), but it is only within recent years that firm foundations have been laid (see East and Jones, 1920). Professional breeders have recognized for a long time that close inbreeding, accompanied by the usual judicious selection and elimination, fixes desirable characters and leads toward a uniform and stable herd; and yet that it has disadvantages, being apt to lead to reduction in vigour, resisting power, fecundity, and even size. Till recently there has been no secure answer to the important question, whether the disadvantageous consequences are actually induced by the close breeding as such, or are simply brought to light and accentuated by it. Experiment has furnished the answer. It has been proved that the close inbreeding of fine stock, associated with the usual selection and elimination, may be persisted in for several generations without any undesirable consequences. Many fine breeds of animals have had very close inbreeding at their beginning; and there seems to be habitual endogamy among bees and ants. In certain forms of "isolation" there is bound to be close inbreeding. Furthermore, it has been shown that the direct result of persistent inbreeding is to segregate within the stock a number of true breeding strains of similar individuals. If there were, at a given time, in a herd, say, four distinct hereditary factors relative to a particular character, such as the colour of the pellage, then if the factors illustrated Mendelian inheritance, the automatic effect of inbreeding would be to segregate four types, pure as regards the particular character in question. But some of the characters which thus become isolated may be undesirable "recessives," seldom seen under ordinary circumstances because they are hidden by their "dominant" counteractives. Thus the undesirable character of albinism, likely to be kept out of expression in conditions of exogamy, is isolated and brought to light in endogamy. These exposed recessives have given inbreeding its bad reputation, but now that the occurrence is understood the elimination of these recessives by the practical breeder becomes a more hopeful task. When the same undesirable qualities occur on both sides of the house, inbreeding tends to their diffusion and exaggeration, yet the result of modern experimenting is clear: "Inbreeding is not in itself harmful; whatever effect it may have is due wholly to the inheritance received" (East and Jones, 1920). But there is another phenomenon, namely the increased "vigour" which often rewards outbreeding. Darwin was strongly of opinion that the gain in constitutional vigour derived from an occasional crossing was a more important biological fact than the loss that often followed close inbreeding, and modern experimenters have confirmed his shrewd judgment. The outbreeding often has advantageous results like those that reward a notable improvement in nurture. There may be an increase in "vigour," resisting power, size, and other good qualities. The reason for this frequently observed "hybrid vigour" is probably to be found in the pooling of diverse hereditary resources of good quality, not in some vague physiological stimulus to the offspring. The general aspects of this kind of inquiry are very important. Thus one of the great trends of organic evolution has been toward the securing of cross-fertilization, though the range of crossing in different cases varies within wide limits. The survival value of this cross-fertilization probably lies in the fact that it promotes variability. It brings about a greater variety of raw material on which selective agencies can work. Similarly, for the wider ranges of cross-fertilization which we call outbreeding, the suggestion arises that this is fundamentally valuable in promoting variability, both in the way of new patterns and fresh vigour. A new light is shed on the process of evolution if we consider the probability that success has rewarded the alternation of periods of exogamy with periods of endogamy. Thus there is a return to the position of Romanes, Gulick, and others, that "isolation" may count for much in evolution. Another ray of light, and a very welcome one, touches the dark problem of sterility. It is suggested by East and Jones that there are two quite different kinds of sterility of diverse origin: (1) Inbreeding tends to sort out homogeneous pure strains and in this sifting out the ability to reproduce may be lost; (2) outbreeding may bring together two germ-cells which are too incompatible, *e.g.* in their chromosomal equipment, to allow of a continuance of the process of germ-cell making. Thus, the *number* of chromosomes in the two parents (*e.g.* horse and ass) may be too discrepant.

Nature or Nurture.—There is a mounting up of evidence as to the influence of environment and function on the developing organism. Just as a certain quantity of food, oxygen, and moisture is essential if the inheritance is to be expressed, so is it with the wider environment of liberating stimuli, and so it is with functioning and exercise. Up to a certain point the chick's lung develops in virtue of the properties resident in the germinal material; beyond that point the development requires that the chick shall breathe. If the word "nurture," which Sir Francis Galton made technical, be used to include all manner of nutritional, environmental, and functional influences, it may be fairly said that modern zoölogy has been marked by an increasing appreciation of the importance of "nurture," as complementary, not antithetic, to the hereditary "nature." As Prof. T. H. Morgan says (1915): "every character is the realized result of the reaction of hereditary factors with each other and with their environment"; and again: "it is a commonplace that the environment is essential to the development of any trait, and that traits may differ according to the environment in which they develop." Gudernatsch has shown that in tadpoles fed on thyroid there is differentiation without growth, while in tadpoles fed on thymus and spleen there is growth without differentiation. Fruit-flies (*Drosophila*) with a peculiar Mendelian abnormality may appear perfectly normal if reared in a dry bottle, but the presence within them of the "factor" for the abnormal character may be demonstrated by rearing their offspring in a damp bottle (Morgan, 1915). Loeb has shown that it is easy to produce a percentage of minnow (*Fundulus*) embryos with defective eyes by adding a very minute quantity of potassium cyanide to the water, or by exposing the developing eggs to low temperature. That is to say, relatively slight environmental changes may so alter the constitution of the developing embryo that a leap is taken in the direction of blindness. Peculiarities in nurtures may enhance or depreciate the hereditary virtues of the organisms; they may induce a modification which serves as a life-saving screen until an innate variation in the same direction has time to establish itself; in cases like mammals and seed-plants the nurtural condition of the maternal parent may influence the vigour of the offspring during the ante-natal symbiosis; changes in nurture, as Tower's experiments (1906, 1918) suggest, may be variational stimuli to the germ-cells.

In regard to the prolonged discussion over the transmissibility of exogenous somatic modifications, the chief need is still for more facts. It is admitted that somatic modifications may have secondary effects on the germ-cells and on the offspring

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(especially in the case of the viviparous mammals), but this is not the same as the transmission of particular modifications as such or in any representative degree. It is probable, as Agar's experiments (1913) suggest, that long-continued, deeply saturating environmental and functional peculiarities may produce specific substances which enter into the cytoplasm of the germ-cell, or into the embryonic body, and may exert a very definite influence as long as they last; but there is as yet no convincing evidence that the resulting changes grip the constitution permanently. J. T. Cunningham (1908) and others have suggested that particular modifications of an incisive sort may liberate very specific chemical substances, like hormones, and that these may be carried to the germ-cells and accumulate there with subsequent formative (morphogenic) effects. The number of competent zoölogists who hold to some form of Lamarckism should be enough to restrain the impatient from attempting to close this important question or to dogmatize about it. As Prof. E. B. Wilson has wisely said: "In the present defective state of our knowledge we may well grant that there may be many a thing between germ-cell and body that is not yet dreamed of in our biological philosophy." It should be clearly understood that there is no depreciation of the varied importance of peculiarities in nurture on the part of those who are unable to find convincing evidence of the transmission of any exogenous somatic modification. It is incorrect to say that this scepticism leads to the view that individual experience counts for nothing racially. On the contrary, it is through individual experience that germinal variations or mutations are tried and tested.

Evolution Theory.—It would be a contradiction in terms if the Evolution Theory did not evolve. What changes are in process? (1) Some methodological progress has been made in clarifying the concept of organic evolution (see Sorley, 1909). "Organic evolution is a continuous natural process of racial change in a definite direction, whereby distinctively new individualities arise, take root, and flourish alongside of, or in place of, the originative stock" (Thomson, 1920, p. 378). We must also clearly distinguish this from (*a*) the "*genesis*" of a solar system or of a mountain or valley; (*b*) the "*development*" of an organism as an individual; and (*c*) the "*history*" of a human society. (2) Somewhat startling is the suggestion made by Bateson (1914), that we should consider "whether the course of evolution can at all reasonably be represented as an unpacking of an original complex, which contained within itself the whole range of diversity which living things present." "At first it may seem rank absurdity to suppose that the primordial form or forms of protoplasm could have contained complexity enough to produce the divers types of life. But is it easier to imagine that these powers could have been conveyed by extrinsic additions?" In so far as this view means that there is nothing evolved which was not originally in kind involved, that there is nothing of lasting value in the end which was not represented in kind in the beginning, it may be philosophically tenable; but most biologists will probably adhere to the view that organic evolution has been a process of racial epigenesis (not an *evolutio*), with a frequent outcrop of genuine novelties, a synthetic complexifying by creative inventions and by trading with time, rather than an analytic simplification through the removal of inhibitions which allowed the original richness of endowment to express itself with increasing fullness. There was a time when there were no birds or mammals; they came into being, and they were new ideas; they made a new world. (3) While there is practical unanimity among the zoölogists of to-day as to fact of organic evolution, there is a clearer apprehension than there was a generation ago of the detailed difficulties. These difficulties are chiefly of three kinds: (*a*) that little is known with certainty in regard to the pedigree of the great phyla, such as Vertebrates, and as to the way in which the biggest steps were taken, like the passage from Protozoa to Metazoa; (*b*) that there naturally remains much uncertainty in regard to the factors operative in the historic process, and as to the conditions implied in the hereditary or genetic relation between one generation and another; and (*c*) that in regard to the originative factor termed for convenience "variability," our ignorance is still immense. Bateson expressed the mood of many when he said (1913, preface): "That species have come into existence by an evolutionary process no one seriously doubts; but few who are familiar with the facts that genetic research has revealed are now inclined to speculate as to the manner by which the process has been accomplished. Our knowledge of the nature and properties of living things is far too meagre to justify any such attempts." And later in the same work (p. 97), he says: "We have not even an inkling of the steps by which a Silver Wyandotte fowl descended from *Gallus bankiva*, and we can scarcely even believe that it did." (4) It is pessimistic to say that we are no nearer an understanding of the central problem of ætiology, namely the origin of the new, *i.e.* of the variations or mutations which form the raw material of progress or the reverse. The ground has been cleared, though the problem remains unsolved. (*a*) If from the observed differences between the members of the same species there can be subtracted all the peculiarities that are associated with age and sex, and likewise all that can be reasonably interpreted as individually acquired exogenous somatic modifications (directly due to peculiarities of nurture, whether environmental, nutritional, or functional), then we get at the true variations and mutations—inborn, not acquired—endogenous, not exogenous—blastogenic, not somatogenic—expressions or outcomes, not indents or imprints. If there be no convincing evidence of the transmission of extrinsic modifications, as such, or in any representative degree, then they cannot be included, in the first instance at least, among the raw materials for evolution, which are thus confined to what is left when the modifications are subtracted from the total of observed differences. That some at least of this residue, as true variations, are very transmissible, is quite certain. This is the first clearing of the ground. (*b*) But within the large category of inborn changes it seems possible to distinguish minute continuous variations from brusque saltations (Darwin's "sports," Galton's "transilient variations," Bateson's "discontinuous variations," and of course the "mutations" of De Vries; all these being practically the same, though investigated with ever-increasing care). The minute continuous variations, on the other hand, are of the nature of "a little more or a little less," and they show intergrades. Their transmissibility has not been much studied, but has been proved in a few cases. The mutations, whether large or small, are more deserving of the title qualitative; they often show a measure of perfectness from their first appearance, they are without intergrades, they are markedly transmissible, and they are demonstrably at the origin of some new varieties of domesticated animals and cultivated plants. They correspond to, or are implicated in, those "unit characters" of species or varieties which illustrate Mendelian inheritance in their recurrence from generation to generation. Now whether we attend to the continuous or to the discontinuous variations, we can imagine them to arise in the course of the shufflings of the hereditary cards (the chromosomes and their microsomes) during the intricate processes of maturation and fertilization. The reduction or exaggeration of a quality, the dropping out of a character altogether, a "double dose" of a character, a rearranged pattern of hereditary items, may all be interpreted as due to permutations or combinations of hereditary factors or genes during the intricate manœuvres preceding the completion of the fertilization of the ovum. The evidence is very strong that the segregation of the factors of Mendelian characters takes place in the reduction divisions of the germ-cells in the process of maturation. An interesting corroboration has been furnished by the recent experiments of Prof. W. E. Agar (1920) with a parthenogenetic "clone" (pure line) of a hybrid water-flea (*Daphnia pertusa* × *Daphnia pulex*). No reduction divisions occur in a parthenogenetic lineage, and no Mendelian variations occurred. Along with the rearrangements which may be effected in the maturation of the germ-cells—rearrangements in which such phenomena of chromosomal behaviour as "crossing-over" must be taken account of—another possibility of change is afforded at the beginning of each individual life; for there, in all

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ordinary cases, two very complex systems, of dual origin, become a new unity which normally develops into a harmonious organism. Some modern evolutionists, such as Lotsy (1916), attach great importance to crossing as a cause of variations.

If it be said that such opportunities as have been mentioned could account for nothing more than rearrangements, pluses and minuses, gains and losses, but not for any distinctively novel change, the difficulty of interpretation increases. But even among Mendelians it is sometimes admitted that the factors or genes may themselves change. How this might happen is at present the subject of speculation, but this need not be unreasonable, and it is sometimes backed by the beginning of experiment. Three suggestions may be stated. First, it may be, as Weismann believed, that deeply saturating environmental influences act through the body as variational stimuli on the germ-cells, provoking them to change. It is known that changes in a cell's environment may cause disturbance of the process of cell-division, and this, as Bateson has pointed out, may be the *fons et origo* of germinal variation. Apart from demonstrable external stimuli, it is possible that the chromosomes of the germ-cells may change suddenly like mutating Bacteria, or may undergo age changes, or may exhibit periodic reorganizations, like the remarkable endomixis that occurs about once a month in a "pure line" of *Paramoecium*, or may show rejuvenescence-changes, like those which occur in some cases of regeneration and asexual multiplication. It must be borne in mind that the chromosomes are very complex living bodies, and that differences between species are sometimes the expressions of visible differences in the chromosomes, as Gates (1915) has shown in the case of *Oenothera*.

The Mendelian conception of unit-characters, whose germinal factors or genes behave like discrete unities in inheritance, neither blending nor fragmenting, has had to be corrected by fuller knowledge. Thus Prof. T. H. Morgan (1919) lays emphasis on the conclusions: first, that each gene may have manifold effects on the organism; and second, that every part of the body, and even each particular character, is the product of many genes. The phenomenon of linkage also shows that chains of genes may keep together in inheritance instead of there being free assortment of the various links in the chain. Thus from the idea of extreme particulateness which Mendelism at first suggested, there is a return toward the Darwinian idea, on which Sir E. Ray Lankester, especially, has laid emphasis, of the correlation of variations. Several apparently independent changes may be diverse outcrops due to one disturbance. A change in some particular kind of metabolism may reverberate through the whole body. Another idea of considerable importance is that of temporal variations, that is to say, alterations in the "time" or rate or rhythm of certain metabolic processes, or in the duration of particular phases in the life-cycle. Many changes of great adaptiveness are interpretable as lengthenings out or shortenings down of particular chapters in the life-history. In the influence of internal secretions in backboned animals there is a known method whereby these variations in tempo might be brought about; and it is worthy of notice that in Sebright poultry, where the cocks are hen-feathered, an endocrine secretion depends on a genetic factor inherited in the same way as are other genetic factors (see T. H. Morgan, 1919, p. 243).

Many palæontologists, with remarkable concurrence, have reached the conclusion that an evolving line often changes not by discontinuous steps (saltations or abrupt mutations), but by continuous minute steps. This is well illustrated by Dr. Rowe's study of the species of the sea-urchin *Micraster* in the chalk of S.E. England and just as well by the evolution of Mammalian teeth. Speaking of Tertiary mammals, Dr. W. D. Matthew writes (1910): "The more complete the series of specimens, the more perfect the record in successive strata, and the nearer the hypothetic centre of dispersal, the closer do we come to a phyletic series whose intergrading stages are well within the limits of observed variation of the race."

Whether the individual changes in the past were continuous and minute transitions, like those which Dr. Duerden finds occurring to-day in the ostrich, or were discontinuous and minute saltations, or both, no one can tell; and the question does not seem very important. Even in ordinary growth what seems by one mode of measurement continuous, may be shown by another and finer method to progress rhythmically, even to seeming fits and starts. But the palaeontologist tells us more; he can arrange his species in series in a time-succession. "There is not merely transition, but transition in orderly sequence, such as can be represented by a graphic curve of simple form" (Bather, 1920, p. 73). Moreover, in this seriation there may be gradual increase or decrease as in the number of spines or tubercles, or in the size of horns or digits; and this gives the palæontologist an advantage over the neontologist, inasmuch as he can point to progression or retrogression extending throughout millenia. It is for the neontologist to assist the palæontologist by pointing to determinate variation occurring in generations of living animals; for it may have been by such mode of variability that the seriations of the rock record were produced (see Bather, 1920, p. 74).

There is a growing body of evidence in support of the view that variation is often a very definite kind of organic change. This cannot be assured from the movement of a species as such; for the inferred orthogenesis might be the outcome of selection, sifting out those best adapted to a particular environment which might also be changing in a definite direction, say of increased salinity or aridity. But when large numbers of specimens are procurable, and can be studied in successive years (or centuries in strata), the non-occurrence of variations off the line is significant. If this be so, it is not necessary to look for any particular impulse from within to account for the definiteness. It may be enough to recognize that the unified organization, stereochemical in part at least, must to a certain extent predetermine what variations (other than pathological disintegrations) emerge.

Here may also be mentioned the suggestion of dichotomous variation, as between types of passive and active (anabolic and katabolic) preponderance, and as resulting in contrasts of allied forms, like bee and wasp, moth and butterfly, sheep and goat, and to larger differences as of reptile and bird, even of plant and animal, female and male. (*See* P. Geddes, VARIATION, *E.B.*, 9th ed.; and Geddes and Thomson, *Evolution*, 1911.)

Natural Selection.—The zoölogist of to-day has to face the reconciliation of two sets of facts as regards natural selection. In a few cases, such as Weldon's crabs, it has been demonstrated in actual effective operation, and Cesnola's test of the protectiveness of colouring by tethering green mantises with silk threads on brown herbage and brown variants on green herbage, gave vividly convincing results. Working with "hooded rats," Prof. W. E. Castle selected simultaneously in two opposite directions; and produced one race black all over except for a white patch of variable size underneath, and another race white all over except for the top of the head and the back of the neck, which are black. On the other hand, it has been shown by Johannsen, de Vries, Jennings, Pearl and others that selection does not count for much within pure lines or inbred stocks. Within an inbred race of guinea-pigs, for instance, a *ne plus ultra* may be reached, beyond which no amount of selection is of any avail within the period of experimentation. Abundant "fluctuations" of a quantitative sort occur, but these cannot be used as a basis for selection since they are not transmissible. They are probably for the most part of the nature of somatic modifications.

The estimate of the scope of natural selection is plainly affected by the view taken in regard to the raw materials supplied. If a new position of structural or functional equilibrium is reached by mutational abruptness, there is no need in such a case to burden natural selection with the task of gradually accumulating minutiæ. On the other hand, due attention should be given to de Vries's declaration (1909, p. 83): "Thus we see that the theory of the origin of species by means of natural selection is quite independent of the question, how the variations to be selected arise? They may arise slowly, from simple fluctuations, or suddenly, by mutations; in both cases natural selection will take hold of them, will multiply them if they are beneficial,

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and in the course of time accumulate them, so as to produce that great diversity of organic life, which we so highly admire." In the same way, if variations are in large measure definite, natural selection has not to sift out the serviceable from a large casual crop, but it still has its work to do.

The trend of recent zoölogy seems to be toward a confirmation of the central idea in Darwinism—the selection of the relatively fitter variants in the struggle for existence. Thus there is no longer serious difficulty in meeting the criticism that slight initial variations could not have survival value, or that they would be swamped by intercrossing. There is also a deeper appreciation of the fact, on which Darwin so often laid emphasis, that selection is a manifold and often subtle process of sifting. Thus lethal selection must be distinguished from reproductive selection, and the operation of selective processes at many levels, even among germ-cells, must be recognized. The ubiquitous sifting is anything but automatic, since animals often select their environments, instead of being selected by them, and may be in various ways active agents in their own evolution. Natural selection operates in reference to an intricate web of life, and thus a nuance—a shibboleth—may have survival value. There has been an evolution of the sieves as well as of the sifted, for natural selection operates, generally speaking, in relation to an ecological *Systema Naturae*—or system of interrelations—which has been increasingly elaborated through the ages; and this (along with what may be called organismal momentum) is probably part of the explanation of the *general* progressiveness of organic evolution.

Sexual Selection.—No part of Darwin's theory has met with a more critical reception than his theory of sexual selection; and yet it often has weathered the storm. (*a*) When there is forceful competition among rival males there is some evidence that the less well equipped with weapons will have fewer and less vigorous offspring, or it may be, none at all. This will operate like ordinary natural selection. (*b*) The same may be said of those masculine characters which aid males to find, pursue, and catch the female. (*c*) Sexual selection meant, for Darwin, all the processes of sifting that occur in connexion with mating and pairing, whether the female held the sieve or not; but he firmly believed that in a certain number of cases there is definite preferential mating on the female's part, the more attractive males having a reproductive advantage. While Prof. T. H. Morgan has given, in his *Evolution and Adaptation* (1903), no fewer than 24 reasons for rejecting the theory of sexual selection, many zoölogists believe that the reality of some measure of preferential mating has been placed beyond doubt by the data furnished by Darwin himself (1871) and by the Peckhams (1889), Groos (1898), Cunningham (1900), Pycraft (1913), Julian Huxley (1914), Whitman (1919) and others. It is not necessary to suppose that the female chooses "the best of the bunch" from amongst her unequally endowed suitors; it will be enough if she remains unresponsive to the solicitations of certain of the less generously endowed, who do not arouse her emotional interest to the requisite pitch. This is in agreement with Darwin's own remark about the female bird: "it is not probable that she consciously deliberates: but she is most excited or attracted by the most beautiful, or melodious, or gallant males." It is not necessary to credit the female with a capacity for appreciating slight differences in decorativeness or musical talent or lithesomeness, or with a consistency in allowing these nuances to determine her preferential mating, season after season, generation after generation. It is enough, as Lloyd Morgan says, that "the hen selects the mate which by his song or otherwise excites in greatest degree the mating impulse. Stripped of all its unnecessary æsthetic surplusage, the hypothesis of sexual selection suggests that the accepted mate is the one that most strongly evokes the pairing instinct." But this does not mean that the details do not count; it is rather that each is contributory to a general impression. Each has its effect; but synthetically, not analytically. "Even when the female seems to choose some slight improvement in colour or song or dance, the probability is that she is simply surrendering herself to the male whose *ensemble* has most successfully excited her sexual interest" (Geddes and Thomson, *Evolution*, 1911, p. 172).

It is interesting to inquire into the racial justification of the courtship habits—often so prolonged, elaborate, and exhausting. According to Groos (1898, p. 242) the coyness of the female, which has to be overcome, is an advantageous check to the impetuous violence of the sex impulse. According to Julian Huxley the elaborate ritual of the Great Crested Grebe serves to forge an emotional bond. "The courtship ceremonies serve to keep the two birds of a pair together, and to keep them constant to one another." Pycraft (1913) also insists on the need for psychological interpretation. Karl Pearson suggests that pronounced and persistent preferential mating within a species being differentiated into types may lead to a physiological and psychological "isolation" (*i.e.* narrowing of the range of intercrossing), and thus to "the relative or absolute mutual sterility of the differentiated types, *i.e.* to the origin of species" (*Grammar of Science*, 2nd ed. 1900, p. 418). Finally, it may be noted that the courtship habits must have played an important part in the evolution of sense (*e.g.* the aesthetic sense), and even of mind. This has been well illustrated by S. J. Holmes (1916) in connexion with the evolution of the voice, which began as a sex-call in amphibians, but gradually broadened out as parental summons, infantile cry, and kin-signal, until it became the means of reasoned discourse. That after the last returns the first is obvious in every serenade.

Naturalist Travellers.—From Darwin's *Voyage of the "Beagle"* (1844) and Wallace's "*Travels on the Amazon*" there has been a fine succession of the tales of naturalist travellers. This has been sustained in the last 20 years, and with increasing specialization. In the older narratives there is naturally much that is not definitely zoölogical; in many of the newer the zoölogical or biological note is dominant. We may instance such books as Alcock's *Naturalist in the Indian Ocean*, Hickson's *Naturalist in the Celebes*, Hudson's *Naturalist in La Plata*, Saville-Kent's *Naturalist in Australia*, Semon's *In the Australian Bush*, and Siedlecki's *Java*.

Faunal Evolution.—A line of zoölogical research which has had some fine expressions in recent years is that of constructive faunistic interpretation, following the lead of Wallace in his *Island Life* (1880). One of the best examples is Dr. James Ritchie's *Influence of Man on the Animal Life of Scotland* (1920). Neolithic man penetrated into a country which, after the clean sweep of the Great Ice Age, had been restocked with animal life from the south of England and from the Continent. There were then no domesticated animals, nor aliens like rabbits and rats. But there were elk and reindeer, wild cattle, wild boar, perhaps wild horses—a fauna of large animals on which lynx, brown bear, and wolves levied toll. This post-glacial fauna was the capital with which prehistoric man started, to which he added various imports from abroad, and which at times he likewise taxed heavily. With fine zoölogical scholarship Ritchie traces the changes brought about by domestication, by the destruction of beasts and birds of prey, by deliberate protection in various interests, by the intentional and unintentional introduction of new animals from other countries, and by the cutting down of forests, the spread of cultivation, and other human interferences. While more species have been introduced into Britain than have been exterminated (the fauna having substantially gained in numerical strength), there has been a falling off in what may be called faunistic quality. For many masterly creatures have been replaced by elusive vagrants, and giants by pigmies. "We have, in effect, lost more than we have gained; for how can the increase of rabbits and sparrows and earthworms and caterpillars, and the addition of millions of rats and cockroaches and crickets and bugs, ever take the place of those fine creatures round the memories of which the glamour of Scotland's past still plays—the reindeer and the elk, the wolf, the brown bear, the lynx, and the beaver, the bustard, the crane, the bumbling bittern, and many another, lost or disappearing?" (p. 497). We have singled out this book as an outstanding instance of a kind of zoölogical investigation which is inter-

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pretative as well as observational, synthetic and constructive as well as analytic. In its vivid realization of the correlation of organisms, this "study in faunal evolution" continues the tradition of Darwin.

Mechanism and Vitalism.—Coming finally to the "*Magnalia Naturae*," and the diverse attitudes of modern zoölogists to these, as in the long controversy of mechanists and vitalists, we cannot yet say that substantial conclusions have been reached. The conflicts between mechanistic and vitalistic interpretations, between the purely physiological (*i.e.* apsychic) and the psychobiological descriptions of behaviour continue with undiminished vigour. Yet there is progress in the fact that the questions at issue are being defined with increasing precision. (*a*) Everyone allows that there is a chemistry and a physics of the organism; that a chemical and physical (*i.e.* theoretically mechanical) description can be given of much that goes on in the living body; that the chemical and physical analysis of the animal has yielded very important results; and that this kind of description will certainly extend its scope. (*b*) It is widely though not unanimously held that there is little help in the hypothesis that a special form of energy ("vital" or "biotic") comes into operation in organisms, and is convertible into equivalent quantities of other forms of energy. For no one has demonstrated this specific vital energy, much less measured its intensity. As the tendency of science is to greater simplification of the forms of energy, we must agree with Bayliss (1915, p. 31) that "it seems somewhat retrograde to assume a new form of energy, especially as there is no urgent necessity for it. The resources of the known forms of energy are not altogether exhausted." (*c*) Many physiologists occupy the position of Claude Bernard: "There is in reality only one general physics, only one chemistry, and only one mechanics, in which all the phenomenal manifestations of nature are included, both those of living bodies and those of inanimate ones. In a word, all the phenomena which make their appearance in a living being obey the same laws as those outside of it" (*La Science Experimentale*, 1878, p. 116). (*d*) There is, however, a growing body who hold to what may be called methodological vitalism. Without presuming to set limits to the extent to which chemical and physical descriptions may be given of what occurs in a living animal, and without assuming that the concepts of physics and chemistry are stationary (which they certainly are not), it is urged that up to the present the chemico-physical interpretation remains inadequate. For there has not been given any exhaustive physico-chemical description of any total vital operation, such as the contraction of a muscle, still less of any complex case of animal behaviour. And as to individual development we cannot give a mechanical description of the condensation of the inheritance into a germ-cell, nor of the differentiation of the embryo, nor of the regulation phenomena observed when an embryo rights itself after the building materials of its living edifice have been seriously disarranged, nor of the way in which many developing parts seem to conspire toward one result. Similarly as regards organic evolution: we cannot offer a mechanical theory of variability; and the process of selection is much more than mechanical sifting. In short, mechanical formulæ do not fully suffice for answering biological questions. Biology requires categories of its own. (*e*) But when the critic of mechanism advances beyond this, to postulate some further vital agency associated with the organism, operating actively in certain cases, directing the chemico-physical processes so that their results are different from what they would have been apart from its intervention, he has passed to thoroughgoing vitalism. Bergson's "*élan vital*" has much of this character; but the most consistently thought out expression of this doctrine is Driesch's "Entelechy" (*The Science and Philosophy of the Organism*, 2 vols. 1908). Discussions of the problem of vitalism may be conveniently found in Johnstone's *Philosophy of Biology* (1914), and Thomson's *System of Animate Nature* (2 vols. 1920). See also J. S. Haldane (*Organism and Environment*, 1917) in which he discusses the physiology of respiration as a test case, and with suggestiveness for both sides of the controversy.

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ZUIDER (or ZUYDER) **ZEE** (*see* 28.1049).—It was after the draining of several landlocked seas and small sea-arms of the province of North Holland had been successfully completed in the early part of the 17th century that, about the middle of the next century, the idea of the shutting off and draining the entire Zuider Zee first began to be discussed. Serious objections to the initial scheme led to various proposals for the draining of parts of that sea, and eventually to a thorough investigation as to the best means of closing and draining it. This

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gave rise to a scheme put forward in 1891, the execution of which, in a modified form, was begun in 1920.

The requisite bill was introduced in 1913 and was passed almost unanimously by both Chambers of the States-General in 1918. There may perhaps be some cause for wonder that a decision of such import should have been made during wartime. The explanation is that it was just the circumstances of those days, with the shortage of food occasioned by them, which brought into prominence the importance of extending the area of arable land. Moreover, people had still fresh in their memories the severe storm of 1916, which, bursting the Zuider Zee dykes, deluged vast districts of the country.

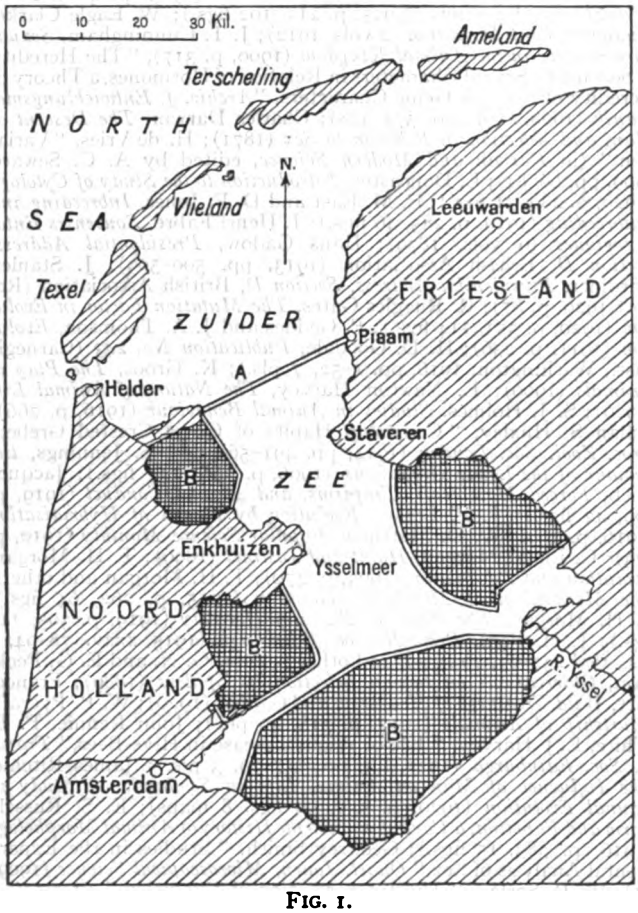

FIG. 1.

The main features of the scheme are indicated in fig. 1. They consist of (*A*) the closure and (*B*) the drainage. The closure is likewise divisible into two parts, namely, from North Holland to the Isle of Wieringen and from that island to Friesland. The combined length of the enclosing dams or barrages is nearly 19 miles. With the completion of the dams 850,000 ac. of the Zuider Zee will be shut off from the North Sea, thus creating a large lake. The dams will afford full protection to the coasts of the provinces bordering on the Zuider Zee for a distance of 152 miles. In the dam sluices Zuider Zee, and the quantity may at times be very great, since it will include the afflux of the Yssel, an arm of the Rhine. It is therefore deemed necessary to have no fewer than 30 sluices, 33 ft. wide and 13·2 ft. deep. As soon as the closure is complete various parts of the Zuider Zee can be successively dammed and drained. Four inner enclosures (*B*) are contemplated, corresponding to the character of the sea-bottom and other factors.

After deducting the dimensions of dykes, canals, and roads the enclosures will provide 500,000 ac. of land, an area equivalent to that of the cultivated districts of North Holland or of Groningen with a surface analogous in composition to the best clay soil to be found in the country. The remainder of the Zuider Zee bottom consists chiefly of sand, and will, consequently, not be reclaimed. The water covering this area is shown in the sketch under the name of Ysselmeer. Its size is about 580 sq. m., which is thrice that of the lakes of Geneva or of Constance. It will constitute a receptacle for the waters of the Yssel and some smaller rivers, and will discharge them through the sluices into the open sea during ebb tide. As a reservoir of fresh water this Ysselmeer will be able to supply the canals of the surrounding provinces in periods of drought.

The Zuider Zee project has thus a double purpose: in the first place the reclamation from the sea of new fertile provinces; secondly, the security from the encroachments of the sea and the supply of fresh water to the neighbouring provinces. In the initial stages of the work heavy clay was dredged out of the open sea and deposited along the track to be followed by the dam. The cost of the undertaking was calculated in 1914 at about £19,000,000, but it seemed likely in 1921 to be very much more. Ten years were allowed for the construction of the main dam and another 20 years for the completion of the four inner enclosures.

See *Flevo*, monthly periodical devoted to the Zuider Zee reclamation scheme; *Maandberichten betreffende de Zuyderzeewerkens* (monthly). (C. Ly.)

ZULOAGA, IGNACIO (1870–), Spanish painter (*see* 28.1049), had become by 1921 the head of a definite school of Basque and Castilian painters, whose work was marked by a realistic and decorative treatment of contemporary Spanish life, consciously based on Velazquez, El Greco and Goya. His art showed increasing emphasis on silhouette, simplification of form and use of broad masses of sombre colour relieved by splashes of more vivid tints. In his figure compositions a low horizon and a panoramic background were favourite devices for obtaining a decorative monumental effect. Women and the nude figure played an important part in Zuloaga's work. In his portraits, of which typical examples are "Lucienne Bréval in *Carmen*," "Cousin Candida," "The Duke of Alba," and "Countess Mathieu de Noailles," emphasis is on the type rather than the individual, and the combination of realism and simplification tends towards caricature. This also appears in his *genre* paintings of Spanish types, peasants, dancers, bullfighters, priests and beggars, such as "Old Castile," "The Bottleseller" and "The Witches of San Millan." His landscapes, mainly painted round Burgos, Salamanca and Segovia, have a similar bizarre, fantastic quality. His later work includes "My Uncle Daniel and his Family" (1912), "A Cardinal" (1914), "Toreadors" (1914), "Un Versolari" (1916). An important retrospective exhibition of his work was seen at the 1919 International Exhibition at Bilbao, and he was represented by three portraits in the 1920–1 Exhibition of Spanish Paintings at Burlington House.

See also: L. Bénédite, *Ignacio Zuloaga* (1912); Juan de la Encina, *El Arte de Ignacio Zuloaga* (1916).

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The Index to the New Volumes XXX., XXXI. and XXXII. of the *Encyclopædia Britannica*, has been prepared on the same system as that used in Volume XXIX. Every Index has its own principles and its own conventions. Those adopted for Volumes I. to XXVIII. need not here be recapitulated; they are sufficiently explained in the preface to Volume XXIX. and in the Rules and Abbreviations which follow it. It is only necessary to add that in this supplementary Index the volume number is not repeated before successive references from the same volume, and that measures have been taken to avoid difficulties arising from variant spellings which have different initial letters, of Arabic and Slavonic names. All abbreviations used in this supplementary Index are explained in the Key beginning on page xv. of Volume XXX.

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Rioux, isl., Mal.Arch. **31**-1095a.
Ripon, Yorks. **32**-759c.
Ripont, Fr. **30**-601a.
RISLEY, SIR HERBERT H. 32-286d.
Rissen, Johann E. B. **32**-772c.
Ritchie, Albert C. **31**-863d.
—, **ANNE ISABELLA**, Lady **32**-287a.
—, James **32**-1142d.
—, Sir Richmond **32**-287a.
— v. Wayman **32**-1044d.
Ritz-Carlton Hotel, N.Y. **31**-1119d.
Rivard, Adjutor **30**-561d.
River Brethren **30**-692b.
"River Clyde" **30**-800d.
Rivers, W. H. R. **30**-427d; **30**-148b.
River Stations (aircraft) **30**-48b.
Riviere, Briton **32**-287a.
RIVINGTON, FRANCIS H. 32-287a.
Rivière-Grosville, Fr. **30**-268 (A2).
RIVOIRA, GIOVANNI T. 32-287a.
Rixheim, Fr. **31**-156d.
Riyadh, Arab. **30**-164d.
Riza Pasha **32**-654a.
Rizzo, Luigi **31**-1084b.
R.N.A.S.: *see* Royal Naval Air Service.
Roads Act (1920) **47**a.
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Roanoake, Va. **32**-927b, 855a.
Roault, Georges **32**-6c.
Robbers, Herman **31**-379b.
Robe, Aus. **32**-76b.
ROBERT-FLEURY, TONY 32-287b.
Roberts, A. H. **32**-717a.
—, Aileen Mary, Countess **31**-287b; **32**-1062c.
—, Charles G. D. **30**-560c, 561a.
— Frederick S., Earl **30**-1004b.
—, **GEORGE HENRY 30**-1023d.
—, **JOHN 32**-287c.
—, Lloyd **30**-561a.
—, Morley **32**-101c.
—, Theodore **30**-561a, c.
Robertson (biochemist) **30**-862b, 477c.
—, A. G. **32**-772c.
—, Sir Benjamin **32**-537c, 677a.
—, C. Grant **30**-459c.
ROBERTSON, SIR GEORGE Scott 32-287d.
—, James B. A. **31**-1174a.
—, John **31**-835c.
—, John M. **30**-685d.
—, John Ross **30**-560b.
—, Sir R. **30**-590d.
—, **SIR WM. ROBERT 30**-1021d.
Robertson Co., Tenn. **32**-716b.
Robey, George **30**-857d.
Robilant, Nicolis di **31**-598b; **30**-576a.
Robin, L. **32**-99c.
Robin (bird) **30**-725c.
ROBINS, ELIZABETH 32-288b.
—, Raymond **31**-425d.
Robinson, C. W. **30**-560c.
—, Doane **32**-549b.
—, Edward **32**-9b.
—, **EDWIN ARLINGTON 32**-288b; **30**-117d.
—, Geoffrey: *see* Dawson, G.
—, Sir Harry Perry **31**-1108b.
—, Henry Russell **32**-616c.
—, J. G. **32**-227d.
—, John **30**-688a.
—, Joseph T. **30**-196c.
—, Lennox **30**-856a.
—, Paschal **32**-18b.
—, Robert **32**-223b.
—, W. Leefe **30**-96b.
—, William Sugden **31**-1106b.
ROBSON, WILLIAM S. ROBson, baron **32**-288c.
Roburite **31**-51a.
ROBY, HENRY JOHN 32-288c.
Roçadas, Alves **32**-131d.
Rochdale, George Kemp, 1st baron **30**-991b.
Rochdale, Lancs. **32**-840d.
ROCHEFORT, HENRI 32-288c.
Rochester, Minn. **31**-961d, 962b.
—, Nev. **31**-1097c.
—, N.Y. **31**-1114c, 1115a, 894d; **32**-289a, 854b.
Rochette (swindler) **31**-134d.
Rock **31**-214b; **32**-82c, 86c.
ROCKEFELLER, JOHN D. 32-288c.
—, John D. (jun.) **31**-894d; **30**-724d.
Rockefeller Foundation **32**-872b, 288c; **31**-298d, 660a, 895a; **30**-927b.
— Institute **32**-289a, 343c, 500d; **30**-585b.
Rocket **32**-492b.
Rockford, Ill. **31**-423d; **32**-854d.
Rocking Detroit furnace **30**-962a.
Rock Island, Ill. **31**-423d.
Rockland, Me. **31**-833b.
Rockport, Tex. **32**-719d.
Rock salt: *see* Salt.
Rock Springs, Wyo. **32**-1091b.
Rocky, mts., N.Am. **30**-504c; **32**-72c.
— Mountain, park, Can. **30**-109b.
— Mountain fever **30**-363c.
Roclincourt, Fr. **30**-268 (D2), 265b.
Rocquigny, Fr. **32**-516 (G3).
Rocroi, Fr. **31**-168 (A2), 166d; **32**-978b.
Rod, Edouard **32**-647c.
Rodd, Sir Rennell **30**-946a.
Rode, Helge **30**-833b.
—, Ove **30**-823b.
Rodeport, Trans. **32**-772a.
Rodern, Friedrich, count **31**-248d.
Rodger, Sir John **31**-296d.
Rodichev (politician) **31**-72d.
RODIN, FRANCOIS AUGUSTE 32-289b, 389a.
Rodosto, Gr. **31**-300d.
Rodríguez, Diaz **32**-914d.
— Marín, Francisco **32**-558c.
RODZIANKO, MICHAEL VASSILIEVITCH 32-289b, 319b.
Roe, A. V. **30**-37a.
Roehampton, Sur. **31**-901d, 904b, 1219b.
Roerich, Nicolas **32**-9a.
Roermond, Holl. **31**-374b.
Roesel, Fr. **31**-533d.
Roeux, Fr. **30**-268 (B2), 278d; **32**-519a.
Rogers, A. W. **31**-216c.
—, **BENJAMIN BICKLEY 32**-289c.
—, James Gamble **30**-187d.
—, **J. GUINNESS 32**-289c.
—, Sir Leonard **31**-672d.
—, Thorold **31**-479b.
Rogue, riv., Oreg. **31**-1216a.
Róheim, Géza **30**-154a.
Rohez, Asia M.: *see* Urfa.
Rohr, von (general) **31**-597a.
Rohrbach, Paul **32**-184c.
Rohukula, Esth. **31**-11b.
Roisel, Fr. **30**-536 (B9).
Rojas, Felipe Guevara **32**-914d.
Rojos, Liberato **32**-32c.
Rokeby "Venus" **32**-1035a.
Rokitno, marshes, Pol.: *see* Pripet.
Rolla, Mo. **31**-965c.
ROLLAND, ROMAIN 32-289d, 647b; **31**-153d.
Rolle, mt. pass, Aus. **31**-600 (C3).
Roller welding **32**-964d.
Rolling-mill **31**-592c.
Rollit, Sir Albert K. **30**-988b.
Rollken, Pol. **31**-872b.
Roll of Honour (industrial) **32**-53d.
Rollot, Fr. **32**-518c.
Rolls, C. S. **30**-16a.
Rolls-Royce engine **30**-39a (table).
Roma, Queens. **32**-76b.
"Roma" (airship) **30**-55c.
Romagne-sous-Montfaucon, Fr. **31**-932d, 932 (F4).
Romain, Jules **31**-154c.
Romaios (archaeologist) **30**-181d.
Roman Art **30**-183b.
— Catholic Church **30**-679b, 843d; Ireland **31**-572a, **30**-1022a; U.S. **30**-689d, 692b. *See also* under Countries.
Romanes lecture **32**-290c.
Romani, Egy. **32**-814c; **31**-769d.
Romanones, Count **32**-552b, 556d.
Romanovsky (general) **30**-827b.
Romarin, Fr. **31**-814b.
Rombach, Fr. **31**-593d.
Rombeaux, Egide **32**-389a.
Rome, It. **31**-615c, 400b; **30**-759b; British School **30**-366a; phytopathological conference **30**-479d, 925c.
—, N.Y. **31**-1114c.
—, Pact of (1918) **31**-625a; **32**-1117d, 1086c.
ROMER, SIR ROBERT 32-289d.
Romilly, Fr. **31**-117 (C2).
Rominten Heath, battle of **30**-897b, 888 (B5); **31**-870d.
Romorantin, Fr. **31**-117 (C2).
Romsdal, Nor. **31**-1152b.
Romsée, Belg. **30**-433d.
RONALD, LANDON 32-290a.
Ronchamp, coalfield, Fr. **31**-112d (table).
Roncq, Fr. **31**-609a.
Ronssoy, Fr. **30**-534a, 536 (C8).
Röntgen Rays **32**-1062b.
Röntgenogram: *see* Laue photograph.
Röntgen pattern: *see* Laue photograph.
— rays: *see* X-rays.
Rookwood pottery **30**-284d.
Roop, Esth. **31**-12b.
ROOSEVELT, FRANKLIN D. 32-900b.
—, Quentin **32**-219d.
—, **THEODORE, 32**-290b, 893b, 894c, 898d, 886b, 1019a; Administration **32**-879d; Conservation Policy **30**-738d; Panama Canal **32**-23a; woman suffrage **32**-1039a.
ROOT, ELIHU 32-882c, 460d; **31**-1116d.
Root (bot.) **30**-478d.
Roozeboom, Backhuis **32**-86a.
Roppe, fort, Fr. **31**-157d, 156(B3).
Rorbach, Fr. **31**-160c.
Rörd am, Valdemar **30**-833b.
Rosa, E. B. **32**-866c.
—, José Maria **30**-192c.
Rosa, It. **31**-600 (C5).
Rosalies, Belg. **31**-168b.
Rosario, Arg. **30**-191b.
Rosée, Belg. **31**-169c.
ROSCOE, SIR HENRY E. 32-293a.
Roscommon, co., Ire. **32**-841d.
Rose (botanist) **30**-478d.
—, Hans **32**-608d.
—, R. A. de B. **31**-207a.
ROSEBERY, A. P. PRIMrose, 5th earl of **32**-293a.
Rosebud Co., Mont. **31**-976d.
Rose Croix group **32**-4b; **30**-827b.
ROSEGGER, PETER 32-293b; **30**-325b.
Rosen (bacteriologist) **31**-897b.
—, Friedrich **31**-281a.
Rosenberg, dist., Ger. **30**-114a; **32**-42b.
Rosenfeld (politician) **31**-275b.
ROSENTHAL, TOBY EDWARD 32-293d.
Rosenwald, Augusta **32**-293c.
—, **JULIUS 32**-293c; **31**-1028b.
Rosewell, N.Mex. **31**-1104b.
Rosières, Fr. **32**-521b, 164 (D5).
Rosières-en-Santerre, Fr. **30**-268 (A7).
Roshi Kyocho Kai (society) **31**-648b.
Rosny, Joseph Henry **31**-153a.
ROSS, SIR GEORGE W. 32-239d; **30**-560b.
—, Norman **32**-567b.
—, **ROBERT B. 32**-293d.
—, **SIR RONALD 32**-294a; **31**-896a, 7d, 672d.
Ross, sea, Antarc. **30**-143a; **31**-932b.
Ross and Cromarty, co., Scot. **32**-841c.
— Bridge, colliery, Scot. **31**-209b.
Rossetti, D. G. **30**-282a.
Rossignol, Belg. **31**-165b; **30**-434c.
Rössing, S.W.Af. **31**-230c.
Rosso, Col del, mt., It. **30**-577d.
Ross Smith flight: *see under* Smith, Sir Ross.
ROSTAND, EDMOND 32-294b; **31**-152d; **30**-860a.
—, Jean **31**-153a.
—, Maurice **31**-153a.
"Rostock" (warship) **31**-667a.
Rostov, Russ. **30**-827b.
Roswell, N.Mex. **31**-1103d.
ROSYTH, Scot. **32**-294b, 77d.
Rota, Court of the **30**-682a.
Rotary boring **31**-958d.
— engine **30**-40a.
— repeater **32**-704c.
Rotating band: *see* Driving band.
Rotation of crops **30**-361d.
Rote Fahne, Die **31**-280c.
Roter Turm, pass, Transyl. **30**-917b.
Roth, K. F. Wilhelm **31**-791a.
Rothamsted Agricultural experimental institute; **30**-72b, 78a, 360b, 476d.
ROTHENSTEIN, WILLIAM 32-294c; **30**-282b.
Rotherham, Yorks. **32**-840d.
ROTHERMERE, HAROLD S. Harmsworth, 1st visct. **32**-294d, 926c; **31**-1146b, 1106b; **30**-1026a.
Rothschild, Edmond de, baron **32**-1130a.
—, Leopold de **32**-295c.
—, **NATHANIEL MAYER**, 1st baron, **32**-295b.
Rotogravure **31**-1113b.
Rotor (elec.) **30**-949c; **32**-1023b.
Rottenmann, Aus. **32**-600a.
Rotterdam, Holl. **31**-373a, 375c.
Rottweiler (dog) **30**-850b.
Rotumah, isl., Pac.O. **32**-2c.
Roubaix, Fr. **31**-109b (table), 114d; **32**-981a.
Rouble (coin) **31**-48a.
Rouen, Fr. **31**-117 (C2), 109b (table); **32**-975d, 160b.
Rougebancs, Fr. **30**-268 (D3), 271c.
Rougegoutte, Fr. **31**-156 (A3).
Rouge Maison, Fr. **31**-600d.
Rougemont-le-Chateau, Fr. **31**-156 (C2).
Rougiville, Fr. **31**-161d.
Roulers, Belg. **32**-1098 (G2); **30**-267a.
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Round Table movement **30**-508a.
Rousseau, Blanche **30**-446a.
—, Henri **32**-5d.
—, J. **31**-793d.
Roussel, K. X. **32**-6b.
Rout, Ettie **32**-912a.
Route Gardée **31**-991c.
Routh, Armand **32**-912a.
Rouvroy, Fr. **31**-601d; **30**-265c, 268 (C1).
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ROUVIER, MAURICE 32-296b.
Roux, Wilhelm **32**-1132c.
Rovigno, It. **31**-600 (E6).
Rovigo, It. **31**-600 (C6).
Rovno, Russ. **32**-122d.
—, **BATTLE OF 32**-296b; **31**-801a; **30**-888a, 907c.
Rovuma, riv., E.Af. **32**-676b, 131d.
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Rowing **32**-566c.
Rowlatt, Sir Sidney A. T. **31**-437b.
Rowlatt Act (1919) **31**-441a.
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Rowno, Russ. **30**-888 (J1).
Rowy, Pol. **31**-1054b.
Roxburgh, co., Scot. **32**-841c.
Roxburghe, H. J. Innes-Ker, 8th duke of **32**-381d.
Roy, Matthew Burrow **31**-351b.
—, Pierre Georges **30**-561c.
—, Raja Rammohan **32**-675c.
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— Aero Club **30**-47a.
— Aeronautical Society **30**-33c.
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— Air Force **31**-86b; **30**-47a, 854a.
— Army Clothing Department **32**-295a.
— Army Medical Corps **30**-210b, 244c; **31**-1164c; Women's Auxiliary Corps **32**-1056b.
— Army Service Corps **30**-210b foll., 245b; **31**-491b; **32**-1054d.
— Artillery **30**-209d.
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Service, etc.: *see* Mines, Civil Service, etc.
"Royal Edward" (ship) **32**-606c.
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— Flying Corps **31**-82c; **32**-295a; **30**-414a; women in **32**-1056a.
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— Horticultural Society **30**-81d.
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— Irish Constabulary **30**-1027b; **31**-576a, 579c.
— Mail Steam Packet Company **32**-1006c, 456b.
— Marine Artillery **31**-844c.
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— Red Cross, order of the **31**-891d.
— Signal Corps **30**-976d.
— Society **31**-434c; **32**-102b.
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—, Sir Thomas **32**-453a, 298a.
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Rozan, Serb. **32**-411c.
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— and Kamionka, battle of **31**-1054d.
Rozissce, Pol. **31**-802d.
Rozsnava, Czechsl. **30**-786 (map).
Rozoy, Fr. **31**-329a, 855c.
Ruanda, dist., E.Af. **30**-881c; **31**-223d.
RUBBER **32**-298a, 573c; **30**-59b; Brazil **30**-491b; Ceylon **30**-599a; deterioration **31**-836a; insect pests **30**-923c; S. America **32**-214c; Straits Settlements **32**-580d; substitutes **30**-635d; tire manufacture **32**-727b; U.S. **32**-146a.
—, tissue (med.) **31**-348a.
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Rubel bronze **31**-926a.
"Rubens" (ship) **30**-877c.
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Rudmose, mt., Spits. **32**-563b.
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—, lake, Af. **30**-68 (G4).
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Rundell, Sir Herbert **30**-593c.
Rüneberg, John Ludvig **31**-72d.
Rungwe, E.Af. **32**-677c.
Runyon, William A. **31**-1103d.
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—, **BERTRAND A. W.** **32**-308a, 95b, 394c; **31**-875c.
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—, E. S. **32**-1132c.
—, **GEORGE WILLIAM** ("A.E.") **32**-308b; **31**-2c, 4c.
—, Sir Herbert **31**-1108b.
—, H. N. **30**-297c; **32**-267a.
—, **ISRAEL COOK** **32**-308d.
—, Lee M. **31**-964b.
—, **SIR THOMAS W.** **32**-308d.
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